

## 12. Appendix

## Project name

**9471\_Nursery**

As designed

Date: Thu Jul 30 11:02:05 2026

## Administrative information

## Building Details

Address: Arborfield District Nursery, Reading, RG

## Certifier details

Name: AES Sustainability Consultants Ltd

Telephone number: Phone

Address: 4B Oaklands Court, Tiverton Way, Tiverton  
Business Park, Tiverton, EX16 6TG

## Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.31

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.31

BRUKL compliance module version: v6.1.e.1

Foundation area [m<sup>2</sup>]: 219.85The CO<sub>2</sub> emission and primary energy rates of the building must not exceed the targets

|                                                                                       |                         |
|---------------------------------------------------------------------------------------|-------------------------|
| Target CO <sub>2</sub> emission rate (TER), kgCO <sub>2</sub> /m <sup>2</sup> annum   | 7.07                    |
| Building CO <sub>2</sub> emission rate (BER), kgCO <sub>2</sub> /m <sup>2</sup> annum | 6.8                     |
| Target primary energy rate (TPER), kWh <sub>PE</sub> /m <sup>2</sup> annum            | 73.86                   |
| Building primary energy rate (BPER), kWh <sub>PE</sub> /m <sup>2</sup> annum          | 71.6                    |
| Do the building's emission and primary energy rates exceed the targets?               | BER ≤ TER   BPER ≤ TPER |

## The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

| Fabric element                       | U <sub>a-Limit</sub> | U <sub>a-Calc</sub> | U <sub>i-Calc</sub> | First surface with maximum value    |
|--------------------------------------|----------------------|---------------------|---------------------|-------------------------------------|
| Walls*                               | 0.26                 | 0.18                | 0.2                 | 1F000000:Surf[4]                    |
| Floors                               | 0.18                 | 0.18                | 0.18                | GF000000:Surf[8]                    |
| Pitched roofs                        | 0.16                 | 0.15                | 0.15                | 1F000000:Surf[1]                    |
| Flat roofs                           | 0.18                 | 0.09                | 0.19                | 1F000000:Surf[5]                    |
| Windows** and roof windows           | 1.6                  | 1.4                 | 1.4                 | GF000000:Surf[1]                    |
| Rooflights***                        | 2.2                  | 1.5                 | 1.5                 | 1F000000:Surf[0]                    |
| Personnel doors^                     | 1.6                  | -                   | -                   | No personnel doors in building      |
| Vehicle access & similar large doors | 1.3                  | -                   | -                   | No vehicle access doors in building |
| High usage entrance doors            | 3                    | 1.4                 | 1.4                 | GF000000:Surf[4]                    |

U<sub>a-Limit</sub> = Limiting area-weighted average U-values [W/(m<sup>2</sup>K)]U<sub>i-Calc</sub> = Calculated maximum individual element U-values [W/(m<sup>2</sup>K)]U<sub>a-Calc</sub> = Calculated area-weighted average U-values [W/(m<sup>2</sup>K)]

\* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

\*\* Display windows and similar glazing are excluded from the U-value check.

\*\*\* Values for rooflights refer to the horizontal position.

^ For fire doors, limiting U-value is 1.8 W/m<sup>2</sup>K

NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

| Air permeability                                                                                                                                                                                                                                | Limiting standard | This building |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|---------------|
| m <sup>3</sup> /(h.m <sup>2</sup> ) at 50 Pa                                                                                                                                                                                                    | 8                 | 15*           |
| * Buildings with less than 500 m <sup>2</sup> total useful floor area may avoid the need for a pressure test provided that the air permeability used to calculate the BER and BPER is taken as 15 m <sup>3</sup> /(h.m <sup>2</sup> ) at 50 Pa. |                   |               |

## Building services

For details on the standard values listed below, system-specific guidance, and additional regulatory requirements, refer to the Approved Documents.

|                                                                                              |      |
|----------------------------------------------------------------------------------------------|------|
| Whole building lighting automatic monitoring & targeting with alarms for out-of-range values | NO   |
| Whole building electric power factor achieved by power factor correction                     | <0.9 |

### 1- ASHP

|                                                                                               | Heating efficiency | Cooling efficiency | Radiant efficiency | SFP [W/(l/s)] | HR efficiency |
|-----------------------------------------------------------------------------------------------|--------------------|--------------------|--------------------|---------------|---------------|
| This system                                                                                   | 4.5                | -                  | 0.2                | -             | -             |
| Standard value                                                                                | 2.5*               | N/A                | N/A                | N/A           | N/A           |
| Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system     |                    |                    |                    |               | NO            |
| * Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. |                    |                    |                    |               |               |

### 1- Hot water

|                | Water heating efficiency | Storage loss factor [kWh/litre per day] |
|----------------|--------------------------|-----------------------------------------|
| This building  | 1                        | 0.046                                   |
| Standard value | 1                        | N/A                                     |

### Zone-level mechanical ventilation, exhaust, and terminal units

| ID                                                                                                                                       | System type in the Approved Documents                                 |
|------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|
| A                                                                                                                                        | Local supply or extract ventilation units                             |
| B                                                                                                                                        | Zonal supply system where the fan is remote from the zone             |
| C                                                                                                                                        | Zonal extract system where the fan is remote from the zone            |
| D                                                                                                                                        | Zonal balanced supply and extract ventilation system                  |
| E                                                                                                                                        | Local balanced supply and extract ventilation units                   |
| F                                                                                                                                        | Other local ventilation units                                         |
| G                                                                                                                                        | Fan assisted terminal variable air volume units                       |
| H                                                                                                                                        | Fan coil units                                                        |
| I                                                                                                                                        | Kitchen extract with the fan remote from the zone and a grease filter |
| NB: Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components. |                                                                       |

| Zone name       | SFP [W/(l/s)]     |     |     |     |     |   |     |     |     |   | HR efficiency |          |
|-----------------|-------------------|-----|-----|-----|-----|---|-----|-----|-----|---|---------------|----------|
|                 | ID of system type | A   | B   | C   | D   | E | F   | G   | H   | I | Zone          | Standard |
|                 | Standard value    | 0.3 | 1.1 | 0.5 | 2.3 | 2 | 0.5 | 0.5 | 0.4 | 1 |               |          |
| GF_Toilets      |                   | -   | -   | 0.3 | -   | - | -   | -   | -   | - | -             | N/A      |
| GF_WC           |                   | -   | -   | 0.3 | -   | - | -   | -   | -   | - | -             | N/A      |
| GF_Kitchen      |                   | -   | -   | 0.3 | -   | - | -   | -   | -   | - | -             | N/A      |
| 1F_WC           |                   | -   | -   | 0.3 | -   | - | -   | -   | -   | - | -             | N/A      |
| 1F_Milk Kitchen |                   | -   | -   | 0.3 | -   | - | -   | -   | -   | - | -             | N/A      |
| 1F_Kitchen      |                   | -   | -   | 0.3 | -   | - | -   | -   | -   | - | -             | N/A      |

| General lighting and display lighting |                | General luminaire | Display light source |                      |
|---------------------------------------|----------------|-------------------|----------------------|----------------------|
| Zone name                             |                | Efficacy [lm/W]   | Efficacy [lm/W]      | Power density [W/m²] |
|                                       | Standard value | 95                | 80                   | 0.3                  |
| GF_Class/Play room 2                  |                | 120               | -                    | -                    |
| GF_Class/Play room 1                  |                | 120               | -                    | -                    |
| GF_Hallway                            |                | 120               | -                    | -                    |
| GF_Toilets                            |                | 120               | -                    | -                    |

| General lighting and display lighting |                       | General luminaire | Display light source |                                   |
|---------------------------------------|-----------------------|-------------------|----------------------|-----------------------------------|
| Zone name                             |                       | Efficacy [lm/W]   | Efficacy [lm/W]      | Power density [W/m <sup>2</sup> ] |
|                                       | <b>Standard value</b> | 95                | 80                   | 0.3                               |
| GF_WC                                 |                       | 120               | -                    | -                                 |
| GF_Kitchen                            |                       | 120               | -                    | -                                 |
| GF_Staff room                         |                       | 120               | -                    | -                                 |
| GF_Entrance                           |                       | 120               | -                    | -                                 |
| GF_Office                             |                       | 120               | -                    | -                                 |
| GF_Store 1                            |                       | 120               | -                    | -                                 |
| GF_Store 2                            |                       | 120               | -                    | -                                 |
| GF_Class/Play room 3                  |                       | 120               | -                    | -                                 |
| GF_Store 3                            |                       | 120               | -                    | -                                 |
| 1F_Training Suite                     |                       | 120               | -                    | -                                 |
| 1F_WC                                 |                       | 120               | -                    | -                                 |
| 1F_Milk Kitchen                       |                       | 120               | -                    | -                                 |
| 1F_Nappy                              |                       | 120               | -                    | -                                 |
| 1F_Cot room                           |                       | 120               | -                    | -                                 |
| 1F_0-12 Month Class Room              |                       | 120               | -                    | -                                 |
| 1F_Hall                               |                       | 120               | -                    | -                                 |
| 1F_Kitchen                            |                       | 120               | -                    | -                                 |

**The spaces in the building should have appropriate passive control measures to limit solar gains in summer**

| Zone                     | Solar gain limit exceeded? (%) | Internal blinds used? |
|--------------------------|--------------------------------|-----------------------|
| GF_Class/Play room 2     | NO (-71%)                      | NO                    |
| GF_Class/Play room 1     | NO (-71%)                      | NO                    |
| GF_Staff room            | NO (-54.3%)                    | NO                    |
| GF_Office                | N/A                            | N/A                   |
| GF_Class/Play room 3     | NO (-44.3%)                    | NO                    |
| 1F_Training Suite        | NO (-88.7%)                    | NO                    |
| 1F_Nappy                 | N/A                            | N/A                   |
| 1F_Cot room              | NO (-90.5%)                    | NO                    |
| 1F_0-12 Month Class Room | NO (-88.6%)                    | NO                    |

## **Regulation 25A: Consideration of high efficiency alternative energy systems**

|                                                                                               |            |
|-----------------------------------------------------------------------------------------------|------------|
| <b>Were alternative energy systems considered and analysed as part of the design process?</b> | <b>YES</b> |
| Is evidence of such assessment available as a separate submission?                            | YES        |
| Are any such measures included in the proposed design?                                        | YES        |

# Technical Data Sheet (Actual vs. Notional Building)

## Building Global Parameters

|                                                       | Actual | Notional |
|-------------------------------------------------------|--------|----------|
| Floor area [m <sup>2</sup> ]                          | 439.7  | 439.7    |
| External area [m <sup>2</sup> ]                       | 957.9  | 957.9    |
| Weather                                               | SWI    | SWI      |
| Infiltration [m <sup>3</sup> /hm <sup>2</sup> @ 50Pa] | 15     | 3        |
| Average conductance [W/K]                             | 224.36 | 317.4    |
| Average U-value [W/m <sup>2</sup> K]                  | 0.23   | 0.33     |
| Alpha value* [%]                                      | 25.75  | 10       |

\* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

## Building Use

### % Area Building Type

Retail/Financial and Professional Services  
 Restaurants and Cafes/Drinking Establishments/Takeaways  
 Offices and Workshop Businesses  
 General Industrial and Special Industrial Groups  
 Storage or Distribution  
 Hotels  
 Residential Institutions: Hospitals and Care Homes  
 Residential Institutions: Residential Schools  
 Residential Institutions: Universities and Colleges  
 Secure Residential Institutions  
 Residential Spaces  
 Non-residential Institutions: Community/Day Centre  
 Non-residential Institutions: Libraries, Museums, and Galleries

100

### Non-residential Institutions: Education

Non-residential Institutions: Primary Health Care Building  
 Non-residential Institutions: Crown and County Courts  
 General Assembly and Leisure, Night Clubs, and Theatres  
 Others: Passenger Terminals  
 Others: Emergency Services  
 Others: Miscellaneous 24hr Activities  
 Others: Car Parks 24 hrs  
 Others: Stand Alone Utility Block

## Energy Consumption by End Use [kWh/m<sup>2</sup>]

|                 | Actual       | Notional     |
|-----------------|--------------|--------------|
| Heating         | 23.75        | 30.97        |
| Cooling         | 0            | 0            |
| Auxiliary       | 1.77         | 3.21         |
| Lighting        | 8.29         | 6            |
| Hot water       | 12.63        | 8.75         |
| Equipment*      | 16.73        | 16.73        |
| <b>TOTAL **</b> | <b>46.44</b> | <b>48.94</b> |

\* Energy used by equipment does not count towards the total for consumption or calculating emissions.

\*\* Total is net of any electrical energy displaced by CHP generators, if applicable.

## Energy Production by Technology [kWh/m<sup>2</sup>]

|                              | Actual   | Notional |
|------------------------------|----------|----------|
| Photovoltaic systems         | 0        | 0        |
| Wind turbines                | 0        | 0        |
| CHP generators               | 0        | 0        |
| Solar thermal systems        | 0        | 0        |
| <i>Displaced electricity</i> | <i>0</i> | <i>0</i> |

## Energy & CO<sub>2</sub> Emissions Summary

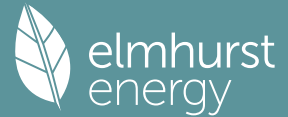
|                                                     | Actual | Notional |
|-----------------------------------------------------|--------|----------|
| Heating + cooling demand [MJ/m <sup>2</sup> ]       | 343.26 | 309.87   |
| Primary energy [kWh <sub>PE</sub> /m <sup>2</sup> ] | 71.6   | 73.86    |
| Total emissions [kg/m <sup>2</sup> ]                | 6.8    | 7.07     |

| HVAC Systems Performance                                                                         |                   |                   |                    |                    |                   |               |               |                  |                  |      |
|--------------------------------------------------------------------------------------------------|-------------------|-------------------|--------------------|--------------------|-------------------|---------------|---------------|------------------|------------------|------|
| System Type                                                                                      | Heat dem<br>MJ/m2 | Cool dem<br>MJ/m2 | Heat con<br>kWh/m2 | Cool con<br>kWh/m2 | Aux con<br>kWh/m2 | Heat<br>SSEFF | Cool<br>SSEER | Heat gen<br>SEFF | Cool gen<br>SEER |      |
| [ST] Central heating using water: floor heating, [HS] ASHP, [HFT] Electricity, [CFT] Electricity |                   |                   |                    |                    |                   |               |               |                  |                  |      |
|                                                                                                  | Actual            | 343.3             | 0                  | 23.7               | 0                 | 1.8           | 4.02          | 0                | 4.5              | 0    |
|                                                                                                  | Notional          | 309.9             | 0                  | 31                 | 0                 | 1             | 2.78          | 0                | ----             | ---- |

Key to terms

- Heat dem [MJ/m2] = Heating energy demand
- Cool dem [MJ/m2] = Cooling energy demand
- Heat con [kWh/m2] = Heating energy consumption
- Cool con [kWh/m2] = Cooling energy consumption
- Aux con [kWh/m2] = Auxiliary energy consumption
- Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
- Cool SSEER = Cooling system seasonal energy efficiency ratio
- Heat gen SSEFF = Heating generator seasonal efficiency
- Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
- ST = System type
- HS = Heat source
- HFT = Heating fuel type
- CFT = Cooling fuel type

# Full SAP Calculation Printout



|                                    |                                                          |  |               |               |                |            |       |  |
|------------------------------------|----------------------------------------------------------|--|---------------|---------------|----------------|------------|-------|--|
| Plot Reference                     | 4907-R823-9471-001                                       |  |               |               | Issued on Date | 21/07/2026 |       |  |
| Assessment Reference               | Plot 1                                                   |  |               | Plot Type Ref | Bosworth-Semi  |            |       |  |
| Plot Address                       | Plot 1, Bosworth-Semi, K, WC, B, ES, 1012                |  |               |               | SAP Version    | 10.2       |       |  |
|                                    |                                                          |  |               |               |                |            |       |  |
| SAP Rating                         | 90 B                                                     |  | DER           | 11.90         |                | TER        | 12.24 |  |
| Environmental                      | 90 B                                                     |  | % DER < TER   |               |                |            | 2.78  |  |
| CO <sub>2</sub> Emissions (t/year) | 0.99                                                     |  | DFEE          | 40.21         |                | TFEE       | 42.82 |  |
| Compliance Check                   | See BREL                                                 |  | % DFEE < TFEE |               |                |            | 6.10  |  |
| % DPER < TPER                      | 0.56                                                     |  | DPER          | 63.73         |                | TPER       | 64.09 |  |
|                                    |                                                          |  |               |               |                |            |       |  |
| Assessor Details                   | Mr. Daniel Harris                                        |  |               |               | Assessor ID    | R823-0001  |       |  |
| Client                             | Crest Nicholson Head Office, Crest Nicholson Head Office |  |               |               |                |            |       |  |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)            | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Main dwelling                                          |                           |                                 |                             |
| Ground floor                                           | 47.4100 (1b)              | x 2.4600 (2b)                   | = 116.6286 (1b) - (3b)      |
| First floor                                            | 47.4100 (1c)              | x 2.7600 (2c)                   | = 130.8516 (1c) - (3c)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 94.8200                   |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 247.4802 (5)              |

## 2. Ventilation rate

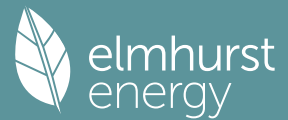
|                                                                                                    | m <sup>3</sup> per hour                 |
|----------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                    |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                    |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                    |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                    |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                    |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                    |
| Number of intermittent extract fans                                                                | 0 * 10 = 0.0000 (7a)                    |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)                    |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 0.0000 / (5) = 0.0000 (8)               |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 4.5000 (17)                             |
| Infiltration rate                                                                                  | 0.2250 (18)                             |
| Number of sides sheltered                                                                          | 2 (19)                                  |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 0.8500 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.1913 (21)        |

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor                                                                                             | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate                                                                                         | 0.2438 | 0.2391 | 0.2343 | 0.2104 | 0.2056 | 0.1817 | 0.1817 | 0.1769 | 0.1913 | 0.2056 | 0.2152 | 0.2247 (22b) |
| Mechanical extract ventilation - decentralised                                                          |        |        |        |        |        |        |        |        |        |        |        |              |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 (25)  |

## 3. Heat losses and heat loss parameter

| Element                                                      | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K   |
|--------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|-----------------|
| Main dwelling                                                |                         |                            |                           |                               |              |                                |                 |
| Front Door                                                   |                         |                            | 2.2300                    | 1.2000                        | 2.6760       |                                | (26)            |
| Windows                                                      |                         |                            | 10.7600                   | 1.2357                        | 13.2966      |                                | (27)            |
| French Doors                                                 |                         |                            | 5.2200                    | 1.2357                        | 6.4506       |                                | (27)            |
| GF SPVL 125TS P/A                                            |                         |                            | 47.4100                   | 0.1300                        | 6.1633       | 75.0000                        | 3555.7500 (28a) |
| EW Brick AAC011                                              | 151.6400                | 18.2100                    | 133.4300                  | 0.1800                        | 24.0174      | 60.0000                        | 8005.8000 (29a) |
| PR 500mm MW044                                               | 47.4100                 |                            | 47.4100                   | 0.0900                        | 4.2669       | 9.0000                         | 426.6900 (30)   |
| Total net area of external elements Aum (A, m <sup>2</sup> ) |                         |                            | 246.4600                  |                               |              |                                | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                          |                         |                            |                           | (26)...(30) + (32) =          | 56.8707      |                                | (33)            |
| Main dwelling                                                |                         |                            |                           |                               |              |                                |                 |
| Timber - GF                                                  |                         |                            | 24.2600                   |                               |              | 9.0000                         | 218.3400 (32c)  |
| Timber - FF                                                  |                         |                            | 140.7000                  |                               |              | 9.0000                         | 1266.3000 (32c) |
| Masonry GF                                                   |                         |                            | 51.5100                   |                               |              | 100.0000                       | 5151.0000 (32c) |
| Internal Floor FF                                            |                         |                            | 47.4100                   |                               |              | 18.0000                        | 853.3800 (32d)  |
| Internal Ceiling GF                                          |                         |                            | 47.4100                   |                               |              | 9.0000                         | 426.6900 (32e)  |

# Full SAP Calculation Printout



Heat capacity Cm = Sum(A x k)  
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K  
List of Thermal Bridges

(28)...(30) + (32) + (32a)...(32e) = 19903.9500 (34)  
209.9130 (35)

|                                                                  |         |           |         |
|------------------------------------------------------------------|---------|-----------|---------|
| K1 Element                                                       | Length  | Psi-value | Total   |
| E2 Other lintels (including other steel lintels)                 | 11.9100 | 0.0410    | 0.4883  |
| E3 Sill                                                          | 9.4200  | 0.0220    | 0.2072  |
| E4 Jamb                                                          | 22.0500 | 0.0190    | 0.4189  |
| E5 Ground floor (normal)                                         | 12.0200 | 0.0928    | 1.1155  |
| E6 Intermediate floor within a dwelling                          | 29.0500 | 0.0020    | 0.0581  |
| E10 Eaves (insulation at ceiling level)                          | 9.1500  | 0.0390    | 0.3569  |
| E18 Party wall between dwellings                                 | 0.0000  | 0.0300    | 0.0000  |
| E4 Jamb                                                          | 4.2000  | 0.1000    | 0.4200  |
| E2 Other lintels (including other steel lintels)                 | 1.0600  | 0.0410    | 0.0435  |
| P1 Party wall - Ground floor                                     | 0.0000  | 0.1000    | 0.0000  |
| P2 Party wall - Intermediate floor within a dwelling             | 0.0000  | 0.0000    | 0.0000  |
| P4 Party wall - Roof (insulation at ceiling level)               | 0.0000  | 0.0350    | 0.0000  |
| E5 Ground floor (normal)                                         | 17.0300 | 0.0980    | 1.6689  |
| E12 Gable (insulation at ceiling level)                          | 19.9000 | 0.0870    | 1.7313  |
| E16 Corner (normal)                                              | 26.1000 | 0.0420    | 1.0962  |
| E17 Corner (inverted - internal area greater than external area) | 5.2200  | -0.0820   | -0.4280 |

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.1768 (36)  
Point Thermal bridges (36a) = 0.0000  
Total fabric heat loss (33) + (36) + (36a) = 64.0475 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

|                           | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |
|---------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| (38)m                     | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  |
| Heat transfer coeff       | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 |
| Average = Sum(39)m / 12 = |          |          |          |          |          |          |          |          |          |          |          |          |

|               | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| HLP           | 1.1061 | 1.1061 | 1.1061 | 1.1061 | 1.1061 | 1.1061 | 1.1061 | 1.1061 | 1.1061 | 1.1061 | 1.1061 | 1.1061 |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        |        |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31     |

## 4. Water heating energy requirements (kWh/year)

|                                                                 |          |          |          |          |          |          |          |                                        |          |                    |          |           |               |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------------------------------------|----------|--------------------|----------|-----------|---------------|
| Assumed occupancy                                               |          |          |          |          |          |          |          |                                        |          |                    |          |           | 2.6861 (42)   |
| Hot water usage for mixer showers                               | 69.2572  | 68.2164  | 66.6997  | 63.7979  | 61.6564  | 59.2683  | 57.9108  | 59.4160                                | 61.0660  | 63.6301            | 66.5943  | 68.9918   | (42a)         |
| Hot water usage for baths                                       | 29.9061  | 29.4619  | 28.8365  | 27.6833  | 26.8197  | 25.8622  | 25.3450  | 25.9661                                | 26.6424  | 27.6669            | 28.8439  | 29.8050   | (42b)         |
| Hot water usage for other uses                                  | 42.1386  | 40.6063  | 39.0739  | 37.5416  | 36.0093  | 34.4770  | 34.4770  | 36.0093                                | 37.5416  | 39.0739            | 40.6063  | 42.1386   | (42c)         |
| Average daily hot water use (litres/day)                        |          |          |          |          |          |          |          |                                        |          |                    |          |           | 129.8883 (43) |
| Daily hot water use                                             | 141.3019 | 138.2846 | 134.6102 | 129.0228 | 124.4855 | 119.6075 | 117.7329 | 121.3914                               | 125.2500 | 130.3710           | 136.0444 | 140.9354  | (44)          |
| Energy conte                                                    | 223.7876 | 196.9154 | 206.8908 | 176.6258 | 167.5814 | 147.0714 | 142.3877 | 150.3080                               | 154.4457 | 176.9122           | 193.8202 | 220.6708  | (45)          |
| Energy content (annual)                                         |          |          |          |          |          |          |          |                                        |          | Total = Sum(45)m = |          | 2157.4171 | (45)          |
| Distribution loss (46)m = 0.15 x (45)m                          | 33.5681  | 29.5373  | 31.0336  | 26.4939  | 25.1372  | 22.0607  | 21.3582  | 22.5462                                | 23.1669  | 26.5368            | 29.0730  | 33.1006   | (46)          |
| Water storage loss (or HIU loss):                               |          |          |          |          |          |          |          |                                        |          |                    |          |           |               |
| Total storage loss                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000             | 0.0000   | 0.0000    | (56)          |
| If cylinder contains dedicated solar storage                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000             | 0.0000   | 0.0000    | (57)          |
| Primary loss                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000             | 0.0000   | 0.0000    | (59)          |
| Combi loss                                                      | 12.0010  | 10.8287  | 11.9655  | 11.5300  | 11.8830  | 11.4679  | 11.8301  | 11.8467                                | 11.4834  | 11.9026            | 11.5661  | 11.9945   | (61)          |
| Total heat required for water heating calculated for each month | 235.7886 | 207.7441 | 218.8564 | 188.1558 | 179.4644 | 158.5393 | 154.2178 | 162.1547                               | 165.9291 | 188.8148           | 205.3864 | 232.6653  | (62)          |
| WWHRS                                                           | -30.8360 | -27.2716 | -28.5573 | -23.6466 | -22.0378 | -18.8579 | -17.6762 | -18.7969                               | -19.5111 | -23.0014           | -26.0578 | -30.2650  | (63a)         |
| PV diverter                                                     | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000                                | -0.0000  | -0.0000            | -0.0000  | -0.0000   | (63b)         |
| Solar input                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000             | 0.0000   | 0.0000    | (63c)         |
| FGHRS                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000             | 0.0000   | 0.0000    | (63d)         |
| Output from w/h                                                 | 204.9526 | 180.4725 | 190.2991 | 164.5092 | 157.4266 | 139.6815 | 136.5416 | 143.3578                               | 146.4181 | 165.8134           | 179.3286 | 202.4003  | (64)          |
| 12Total per year (kWh/year)                                     |          |          |          |          |          |          |          | Total per year (kWh/year) = Sum(64)m = |          |                    |          | 2011.2011 | (64)          |
| Electric shower(s)                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000             | 0.0000   | 0.0000    | (64a)         |
|                                                                 |          |          |          |          |          |          |          |                                        |          |                    |          | 0.0000    | (64a)         |
| Heat gains from water heating, kWh/month                        | 77.4096  | 68.1815  | 71.7826  | 61.6106  | 58.6916  | 51.7682  | 50.3014  | 52.9391                                | 54.2241  | 61.7990            | 67.3368  | 76.3717   | (65)          |

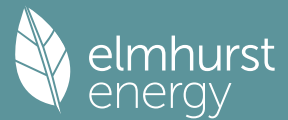
## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |           |           |           |           |           |           |           |           |           |           |           |           |      |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------|
| Metabolic gains (Table 5), Watts                                                    |           |           |           |           |           |           |           |           |           |           |           |           |      |
| (66)m                                                                               | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 129.0440  | 142.8702  | 129.0440  | 133.3455  | 129.0440  | 133.3455  | 129.0440  | 129.0440  | 133.3455  | 129.0440  | 133.3455  | 129.0440  | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 247.6715  | 250.2415  | 243.7651  | 229.9774  | 212.5731  | 196.2154  | 185.2875  | 182.7174  | 189.1939  | 202.9815  | 220.3859  | 236.7435  | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | (69) |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 3.0000    | 3.0000    | 3.0000    | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | (71) |
| Water heating gains (Table 5)                                                       | 104.0452  | 101.4606  | 96.4820   | 85.5702   | 78.8865   | 71.9003   | 67.6095   | 71.1547   | 75.3112   | 83.0631   | 93.5233   | 102.6501  | (72) |
| Total internal gains                                                                | 547.0525  | 560.8642  | 535.5829  | 515.1850  | 486.7955  | 464.7531  | 445.2328  | 446.2080  | 461.1424  | 481.3805  | 513.5465  | 534.7295  | (73) |

## 6. Solar gains

| [Jan] | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W |
|-------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|------------|
|-------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|------------|

# Full SAP Calculation Printout



|       |        |         |        |        |        |              |
|-------|--------|---------|--------|--------|--------|--------------|
| North | 1.3900 | 10.6334 | 0.4500 | 0.0000 | 0.7700 | 5.1214 (74)  |
| East  | 4.1200 | 19.6403 | 0.4500 | 0.0000 | 0.7700 | 28.0380 (76) |
| West  | 5.2500 | 19.6403 | 0.4500 | 0.0000 | 0.7700 | 35.7281 (80) |
| East  | 5.2200 | 19.6403 | 0.4500 | 0.0000 | 0.7700 | 35.5239 (76) |

|             |          |          |          |           |           |           |           |          |          |          |          |               |
|-------------|----------|----------|----------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|---------------|
| Solar gains | 104.4115 | 204.0197 | 336.5042 | 493.2296  | 607.7185  | 623.7941  | 593.1680  | 507.1627 | 392.0216 | 242.1237 | 130.1210 | 85.9208 (83)  |
| Total gains | 651.4640 | 764.8839 | 872.0871 | 1008.4146 | 1094.5140 | 1088.5471 | 1038.4009 | 953.3707 | 853.1640 | 723.5041 | 643.6675 | 620.6503 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |         |         |         |              |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| tau                                                                         | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153      |
| alpha                                                                       | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144       |
| util living area                                                            | 0.9927  | 0.9845  | 0.9637  | 0.8988  | 0.7686  | 0.5880  | 0.4380  | 0.4942  | 0.7456  | 0.9411  | 0.9859  | 0.9942 (86)  |
| MIT                                                                         | 19.3730 | 19.6222 | 19.9980 | 20.4658 | 20.8024 | 20.9541 | 20.9902 | 20.9834 | 20.8710 | 20.3964 | 19.7876 | 19.3138 (87) |
| Th 2                                                                        | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 (88) |
| util rest of house                                                          | 0.9907  | 0.9803  | 0.9537  | 0.8720  | 0.7144  | 0.5065  | 0.3412  | 0.3919  | 0.6686  | 0.9195  | 0.9813  | 0.9925 (89)  |
| MIT 2                                                                       | 18.3179 | 18.5984 | 19.0171 | 19.5190 | 19.8480 | 19.9714 | 19.9927 | 19.9900 | 19.9155 | 19.4590 | 18.7872 | 18.2510 (90) |
| Living area fraction                                                        | 18.5162 | 18.7908 | 19.2014 | 19.6969 | 20.0273 | 20.1561 | 20.1802 | 20.1767 | 20.0951 | 19.6351 | 18.9752 | 18.4508 (91) |
| MIT                                                                         | 18.5162 | 18.7908 | 19.2014 | 19.6969 | 20.0273 | 20.1561 | 20.1802 | 20.1767 | 20.0951 | 19.6351 | 18.9752 | 18.4508 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT                                                                | 18.5162 | 18.7908 | 19.2014 | 19.6969 | 20.0273 | 20.1561 | 20.1802 | 20.1767 | 20.0951 | 19.6351 | 18.9752 | 18.4508 (93) |

## 8. Space heating requirement

|                                                                                |           |           |           |           |          |          |          |          |          |               |           |                |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|---------------|-----------|----------------|
|                                                                                | Jan       | Feb       | Mar       | Apr       | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov       | Dec            |
| Utilisation                                                                    | 0.9865    | 0.9733    | 0.9435    | 0.8627    | 0.7162   | 0.5200   | 0.3593   | 0.4108   | 0.6770   | 0.9096        | 0.9748    | 0.9888 (94)    |
| Useful gains                                                                   | 642.6400  | 744.4837  | 822.8400  | 869.9498  | 783.9067 | 566.0755 | 373.0560 | 391.6799 | 577.5549 | 658.1335      | 627.4430  | 613.7295 (95)  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000    | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000    | 4.2000 (96)    |
| Heat loss rate W                                                               | 1491.0219 | 1456.8937 | 1332.1476 | 1132.4011 | 873.3856 | 582.7321 | 375.4939 | 396.1063 | 628.7741 | 947.6209      | 1245.4934 | 1494.6444 (97) |
| Space heating kWh                                                              | 631.1961  | 478.7395  | 378.9248  | 188.9650  | 66.5723  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 215.3786      | 444.9962  | 655.4007 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |          |          |          |          |          |               |           | 3060.1733      |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |           |          |          |          |          |          |               |           | 0.0000         |
| Space heating kWh                                                              | 631.1961  | 478.7395  | 378.9248  | 188.9650  | 66.5723  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 215.3786      | 444.9962  | 655.4007 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |          |          |          |          |          |               |           | 3060.1733      |
| Space heating per m2                                                           |           |           |           |           |          |          |          |          |          | (98c) / (4) = |           | 32.2735 (99)   |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                                                      |          |          |          |          |          |          |          |          |          |          |          |                 |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (201)    |
| Fraction of space heat from main system(s)                                                           |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (202)    |
| Efficiency of main space heating system 1 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 91.7000 (206)   |
| Efficiency of main space heating system 2 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)    |
| Efficiency of secondary/supplementary heating system, %                                              |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)    |
|                                                                                                      | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec             |
| Space heating requirement                                                                            | 631.1961 | 478.7395 | 378.9248 | 188.9650 | 66.5723  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 215.3786 | 444.9962 | 655.4007 (98)   |
| Space heating efficiency (main heating system 1)                                                     | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 91.7000  | 91.7000  | 91.7000 (210)   |
| Space heating fuel (main heating system)                                                             | 688.3273 | 522.0715 | 413.2223 | 206.0686 | 72.5979  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 234.8730 | 485.2740 | 714.7227 (211)  |
| Space heating efficiency (main heating system 2)                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)    |
| Space heating fuel (main heating system 2)                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)    |
| Space heating fuel (secondary)                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)    |
| Water heating                                                                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| Water heating requirement                                                                            | 204.9526 | 180.4725 | 190.2991 | 164.5092 | 157.4266 | 139.6815 | 136.5416 | 143.3578 | 146.4181 | 165.8134 | 179.3286 | 202.4003 (64)   |
| Efficiency of water heater (217)m                                                                    | 88.2759  | 88.2150  | 88.0867  | 87.8101  | 87.3137  | 86.7000  | 86.7000  | 86.7000  | 86.7000  | 87.8742  | 88.1865  | 86.7000 (216)   |
| Fuel for water heating, kWh/month                                                                    | 232.1727 | 204.5824 | 216.0361 | 187.3465 | 180.3001 | 161.1090 | 157.4874 | 165.3492 | 168.8790 | 188.6941 | 203.3516 | 229.2309 (219)  |
| Space cooling fuel requirement                                                                       |          |          |          |          |          |          |          |          |          |          |          |                 |
| (221)m                                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)    |
| Pumps and Fa                                                                                         | 11.2600  | 10.1703  | 11.2600  | 10.8967  | 11.2600  | 10.8967  | 11.2600  | 11.2600  | 10.8967  | 11.2600  | 10.8967  | 11.2600 (231)   |
| Lighting                                                                                             | 24.7371  | 19.8450  | 17.8683  | 13.0911  | 10.1119  | 8.2615   | 9.2244   | 11.9903  | 15.5742  | 20.4341  | 23.0803  | 25.4247 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | -13.8577 | -22.9196 | -39.1412 | -51.1890 | -60.7330 | -58.6935 | -57.5786 | -51.1723 | -40.7967 | -28.6393 | -16.1851 | -11.5083 (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | -3.5626  | -8.8909  | -21.7125 | -39.0614 | -57.5840 | -60.2478 | -58.6981 | -46.0086 | -29.1122 | -13.8994 | -5.0330  | -2.6869 (233b)  |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234b)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235d)   |
| Annual totals kWh/year                                                                               |          |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating fuel - main system 1                                                                   |          |          |          |          |          |          |          |          |          |          |          | 3337.1573 (211) |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)    |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)    |

# Full SAP Calculation Printout



|                                                                                         |                 |  |
|-----------------------------------------------------------------------------------------|-----------------|--|
| Efficiency of water heater                                                              | 86.7000         |  |
| Water heating fuel used                                                                 | 2294.5390 (219) |  |
| Space cooling fuel                                                                      | 0.0000 (221)    |  |
| Electricity for pumps and fans:                                                         |                 |  |
| (MEVDecentralised, Database: total watage = 6.9420, total flow = 45.0000, SFP = 0.1543) |                 |  |
| mechanical ventilation fans (SFP = 0.1543)                                              | 46.5771 (230a)  |  |
| central heating pump                                                                    | 41.0000 (230c)  |  |
| main heating flue fan                                                                   | 45.0000 (230e)  |  |
| Total electricity for the above, kWh/year                                               | 132.5771 (231)  |  |
| Electricity for lighting (calculated in Appendix L)                                     | 199.6429 (232)  |  |
| Energy saving/generation technologies (Appendices M ,N and Q)                           |                 |  |
| PV generation                                                                           | -798.9117 (233) |  |
| Wind generation                                                                         | 0.0000 (234)    |  |
| Hydro-electric generation (Appendix N)                                                  | 0.0000 (235a)   |  |
| Electricity generated - Micro CHP (Appendix N)                                          | 0.0000 (235)    |  |
| Appendix Q - special features                                                           |                 |  |
| Energy saved or generated                                                               | -0.0000 (236)   |  |
| Energy used                                                                             | 0.0000 (237)    |  |
| Total delivered energy for all uses                                                     | 5165.0046 (238) |  |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                                 | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|-------------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1                   | 3337.1573          | 0.2100                        | 700.8030 (261)           |
| Total CO2 associated with community systems     |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                      | 2294.5390          | 0.2100                        | 481.8532 (264)           |
| Space and water heating                         |                    |                               | 1182.6562 (265)          |
| Pumps, fans and electric keep-hot               | 132.5771           | 0.1387                        | 18.3901 (267)            |
| Energy for lighting                             | 199.6429           | 0.1443                        | 28.8146 (268)            |
| Energy saving/generation technologies           |                    |                               |                          |
| PV Unit electricity used in dwelling            | -452.4142          | 0.1318                        | -59.6090                 |
| PV Unit electricity exported                    | -346.4975          | 0.1217                        | -42.1576                 |
| Total                                           |                    |                               | -101.7666 (269)          |
| Total CO2, kg/year                              |                    |                               | 1128.0943 (272)          |
| EPC Dwelling Carbon Dioxide Emission Rate (DER) |                    |                               | 11.9000 (273)            |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1               | 3337.1573          | 1.1300                              | 3770.9878 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 2294.5390          | 1.1300                              | 2592.8291 (278)            |
| Space and water heating                     |                    |                                     | 6363.8169 (279)            |
| Pumps, fans and electric keep-hot           | 132.5771           | 1.5128                              | 200.5626 (281)             |
| Energy for lighting                         | 199.6429           | 1.5338                              | 306.2189 (282)             |
| Energy saving/generation technologies       |                    |                                     |                            |
| PV Unit electricity used in dwelling        | -452.4142          | 1.4868                              | -672.6467                  |
| PV Unit electricity exported                | -346.4975          | 0.4464                              | -154.6730                  |
| Total                                       |                    |                                     | -827.3197 (283)            |
| Total Primary energy kWh/year               |                    |                                     | 6043.2787 (286)            |
| Dwelling Primary energy Rate (DPER)         |                    |                                     | 63.7300 (287)              |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF TARGET EMISSIONS

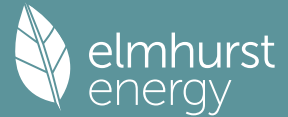
## 1. Overall dwelling characteristics

|                                                        | Area<br>(m2) | Storey height<br>(m)              | Volume<br>(m3)         |
|--------------------------------------------------------|--------------|-----------------------------------|------------------------|
| Main dwelling                                          |              |                                   |                        |
| Ground floor                                           | 47.4100 (1b) | x 2.4600 (2b)                     | = 116.6286 (1b) - (3b) |
| First floor                                            | 47.4100 (1c) | x 2.7600 (2c)                     | = 130.8516 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 94.8200      |                                   | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 247.4802 (5)           |

## 2. Ventilation rate

|                                                                                                    | m3 per hour                |
|----------------------------------------------------------------------------------------------------|----------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)       |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)       |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)       |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)       |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)       |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)       |
| Number of intermittent extract fans                                                                | 3 * 10 = 30.0000 (7a)      |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)       |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)       |
| Air changes per hour                                                                               |                            |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 30.0000 / (5) = 0.1212 (8) |
| Pressure test                                                                                      | Yes                        |
| Pressure Test Method                                                                               | Blower Door                |
| Measured/design AP50                                                                               | 5.0000 (17)                |
| Infiltration rate                                                                                  | 0.3712 (18)                |

# Full SAP Calculation Printout



Number of sides sheltered

2 (19)

Shelter factor

$$(20) = 1 - [0.075 \times (19)] = 0.8500 \quad (20)$$

Infiltration rate adjusted to include shelter factor

$$(21) = (18) \times (20) = 0.3155 \quad (21)$$

|                 | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |       |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|
| Wind speed      | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 | (22)  |
| Wind factor     | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 | (22a) |
| Adj infilt rate |        |        |        |        |        |        |        |        |        |        |        |        |       |
| Effective ac    | 0.4023 | 0.3944 | 0.3865 | 0.3471 | 0.3392 | 0.2998 | 0.2998 | 0.2919 | 0.3155 | 0.3392 | 0.3550 | 0.3708 | (22b) |
|                 | 0.5809 | 0.5778 | 0.5747 | 0.5602 | 0.5575 | 0.5449 | 0.5449 | 0.5426 | 0.5498 | 0.5575 | 0.5630 | 0.5687 | (25)  |

## 3. Heat losses and heat loss parameter

| Element                                        | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K | A x U<br>W/K         | K-value<br>kJ/m2K | A x K<br>kJ/K |       |
|------------------------------------------------|-------------|----------------|---------------|------------------|----------------------|-------------------|---------------|-------|
| Main dwelling                                  |             |                |               |                  |                      |                   |               |       |
| TER Opaque door                                |             |                | 2.2300        | 1.0000           | 2.2300               |                   |               | (26)  |
| TER Opening Type                               |             |                | 15.9800       | 1.1450           | 18.2977              |                   |               | (27)  |
| GF SPVL 125TS P/A                              |             |                | 47.4100       | 0.1300           | 6.1633               |                   |               | (28a) |
| EW Brick AAC011                                | 151.6400    | 18.2100        | 133.4300      | 0.1800           | 24.0174              |                   |               | (29a) |
| PR 500mm MW044                                 | 47.4100     |                | 47.4100       | 0.1100           | 5.2151               |                   |               | (30)  |
| Total net area of external elements Aum(A, m2) |             |                | 246.4600      |                  |                      |                   |               | (31)  |
| Fabric heat loss, W/K = Sum (A x U)            |             |                |               |                  | (26)...(30) + (32) = | 55.9235           |               | (33)  |

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

209.9130 (35)

List of Thermal Bridges

| K1 Element                                                       | Length  | Psi-value | Total   |  |
|------------------------------------------------------------------|---------|-----------|---------|--|
| E2 Other lintels (including other steel lintels)                 | 11.9100 | 0.0500    | 0.5955  |  |
| E3 Sill                                                          | 9.4200  | 0.0500    | 0.4710  |  |
| E4 Jamb                                                          | 22.0500 | 0.0500    | 1.1025  |  |
| E5 Ground floor (normal)                                         | 12.0200 | 0.1600    | 1.9232  |  |
| E6 Intermediate floor within a dwelling                          | 29.0500 | 0.0000    | 0.0000  |  |
| E10 Eaves (insulation at ceiling level)                          | 9.1500  | 0.0600    | 0.5490  |  |
| E18 Party wall between dwellings                                 | 0.0000  | 0.0600    | 0.0000  |  |
| E4 Jamb                                                          | 4.2000  | 0.0500    | 0.2100  |  |
| E2 Other lintels (including other steel lintels)                 | 1.0600  | 0.0500    | 0.0530  |  |
| P1 Party wall - Ground floor                                     | 0.0000  | 0.0800    | 0.0000  |  |
| P2 Party wall - Intermediate floor within a dwelling             | 0.0000  | 0.0000    | 0.0000  |  |
| P4 Party wall - Roof (insulation at ceiling level)               | 0.0000  | 0.1200    | 0.0000  |  |
| E5 Ground floor (normal)                                         | 17.0300 | 0.1600    | 2.7248  |  |
| E12 Gable (insulation at ceiling level)                          | 19.9000 | 0.0600    | 1.1940  |  |
| E16 Corner (normal)                                              | 26.1000 | 0.0900    | 2.3490  |  |
| E17 Corner (inverted - internal area greater than external area) | 5.2200  | -0.0900   | -0.4698 |  |

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

10.7022 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

$$(33) + (36) + (36a) = 66.6257 \quad (37)$$

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

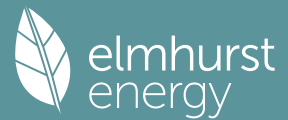
|                           | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |      |
|---------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| (38)m                     | 47.4434  | 47.1868  | 46.9352  | 45.7537  | 45.5326  | 44.5035  | 44.5035  | 44.3129  | 44.8999  | 45.5326  | 45.9798  | 46.4474  | (38) |
| Heat transfer coeff       | 114.0692 | 113.8125 | 113.5609 | 112.3794 | 112.1583 | 111.1292 | 111.1292 | 110.9386 | 111.5256 | 112.1583 | 112.6055 | 113.0731 | (39) |
| Average = Sum(39)m / 12 = |          |          |          |          |          |          |          |          |          |          |          | 112.3783 |      |

|               | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |      |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| HLP           | 1.2030 | 1.2003 | 1.1976 | 1.1852 | 1.1829 | 1.1720 | 1.1720 | 1.1700 | 1.1762 | 1.1829 | 1.1876 | 1.1925 | (40) |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 1.1852 |      |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31     |      |

## 4. Water heating energy requirements (kWh/year)

|                                                                                |          |          |          |          |          |          |          |          |          |          |          |           |             |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-------------|
| Assumed occupancy                                                              |          |          |          |          |          |          |          |          |          |          |          |           | 2.6861 (42) |
| Hot water usage for mixer showers                                              |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 69.2572                                                                        | 68.2164  | 66.6997  | 63.7979  | 61.6564  | 59.2683  | 57.9108  | 59.4160  | 61.0660  | 63.6301  | 66.5943  | 68.9918  | 68.9918   | (42a)       |
| Hot water usage for baths                                                      |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 29.9061                                                                        | 29.4619  | 28.8365  | 27.6833  | 26.8197  | 25.8622  | 25.3450  | 25.9661  | 26.6424  | 27.6669  | 28.8439  | 29.8050  | 29.8050   | (42b)       |
| Hot water usage for other uses                                                 |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 42.1386                                                                        | 40.6063  | 39.0739  | 37.5416  | 36.0093  | 34.4770  | 34.4770  | 36.0093  | 37.5416  | 39.0739  | 40.6063  | 42.1386  | 42.1386   | (42c)       |
| Average daily hot water use (litres/day)                                       |          |          |          |          |          |          |          |          |          |          |          | 129.8883  | (43)        |
| Daily hot water use                                                            |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 141.3019                                                                       | 138.2846 | 134.6102 | 129.0228 | 124.4855 | 119.6075 | 117.7329 | 121.3914 | 125.2500 | 130.3710 | 136.0444 | 140.9354 | 140.9354  | (44)        |
| Energy conte                                                                   | 223.7876 | 196.9154 | 206.8908 | 176.6258 | 167.5814 | 147.0714 | 142.3877 | 150.3080 | 154.4457 | 176.9122 | 193.8202 | 220.6708  | (45)        |
| Energy content (annual)                                                        |          |          |          |          |          |          |          |          |          |          |          |           |             |
| Distribution loss (46)m = 0.15 x (45)m                                         |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 33.5681                                                                        | 29.5373  | 31.0336  | 26.4939  | 25.1372  | 22.0607  | 21.3582  | 22.5462  | 23.1669  | 26.5368  | 29.0730  | 33.1006  | 33.1006   | (46)        |
| Water storage loss (or HIU loss):                                              |          |          |          |          |          |          |          |          |          |          |          |           |             |
| Total storage loss                                                             |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (56)        |
| If cylinder contains dedicated solar storage                                   |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (57)        |
| Primary loss                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (59)        |
| Combi loss                                                                     | 50.9589  | 46.0274  | 50.9589  | 49.3151  | 50.9589  | 49.3151  | 50.9589  | 50.9589  | 49.3151  | 50.9589  | 49.3151  | 50.9589   | (61)        |
| Total heat required for water heating calculated for each month                |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 274.7465                                                                       | 242.9428 | 257.8497 | 225.9408 | 218.5403 | 196.3865 | 193.3466 | 201.2669 | 203.7608 | 227.8711 | 243.1353 | 271.6297 | 271.6297  | (62)        |
| WWHRS                                                                          | -31.6615 | -28.0017 | -29.3218 | -24.2796 | -22.6277 | -19.3627 | -18.1494 | -19.3001 | -20.0334 | -23.6171 | -26.7553 | -31.0752  | (63a)       |
| PV diverter                                                                    | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000   | (63b)       |
| Solar input                                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (63c)       |
| FGHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (63d)       |
| Output from w/h                                                                |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 243.0850                                                                       | 214.9411 | 228.5280 | 201.6613 | 195.9126 | 177.0238 | 175.1972 | 181.9668 | 183.7274 | 204.2540 | 216.3800 | 240.5545 | 240.5545  | (64)        |
| 12Total per year (kWh/year)                                                    |          |          |          |          |          |          |          |          |          |          |          | 2463.2317 | (64)        |
| Electric shower(s)                                                             |          |          |          |          |          |          |          |          |          |          |          | 2463      | (64)        |
| 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (64a)       |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (64a)       |
| Heat gains from water heating, kWh/month                                       |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 87.1491                                                                        | 76.9812  | 81.5309  | 71.0568  | 68.4605  | 61.2300  | 60.0836  | 62.7171  | 63.6820  | 71.5630  | 76.7740  | 86.1128  | 86.1128   | (65)        |

# Full SAP Calculation Printout



## 5. Internal gains (see Table 5 and 5a)

| Metabolic gains (Table 5), Watts                                                    |           |           |           |           |           |           |           |           |           |           |           |                |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
|                                                                                     | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec            |
| (66)m                                                                               | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 129.0440  | 142.8702  | 129.0440  | 133.3455  | 129.0440  | 133.3455  | 129.0440  | 129.0440  | 133.3455  | 129.0440  | 133.3455  | 129.0440 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 247.6715  | 250.2415  | 243.7651  | 229.9774  | 212.5731  | 196.2154  | 185.2875  | 182.7174  | 189.1939  | 202.9815  | 220.3859  | 236.7435 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306 (69)   |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 3.0000    | 3.0000    | 3.0000 (70)    |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 (71) |
| Water heating gains (Table 5)                                                       | 117.1359  | 114.5554  | 109.5846  | 98.6901   | 92.0169   | 85.0417   | 80.7576   | 84.2972   | 88.4472   | 96.1869   | 106.6306  | 115.7430 (72)  |
| Total internal gains                                                                | 560.1432  | 573.9589  | 548.6855  | 528.3048  | 499.9258  | 477.8944  | 458.3809  | 459.3505  | 474.2784  | 494.5042  | 526.6538  | 547.8224 (73)  |

## 6. Solar gains

| [Jan]       | Area<br>m2 |          | Solar flux<br>Table 6a<br>W/m2 |          | Specific data<br>or Table 6b |           | Specific data<br>or Table 6c |          | Access<br>factor<br>Table 6d |          | Gains<br>W   |               |
|-------------|------------|----------|--------------------------------|----------|------------------------------|-----------|------------------------------|----------|------------------------------|----------|--------------|---------------|
| North       | 1.3900     |          | 10.6334                        |          | 0.6300                       |           | 0.7000                       |          | 0.7700                       |          | 4.5171 (74)  |               |
| East        | 9.3400     |          | 19.6403                        |          | 0.6300                       |           | 0.7000                       |          | 0.7700                       |          | 56.0617 (76) |               |
| West        | 5.2500     |          | 19.6403                        |          | 0.6300                       |           | 0.7000                       |          | 0.7700                       |          | 31.5122 (80) |               |
| Solar gains | 92.0909    | 179.9454 | 296.7967                       | 435.0285 | 536.0078                     | 550.1864  | 523.1742                     | 447.3175 | 345.7630                     | 213.5531 | 114.7667     | 75.7821 (83)  |
| Total gains | 652.2342   | 753.9043 | 845.4822                       | 963.3333 | 1035.9336                    | 1028.0808 | 981.5552                     | 906.6680 | 820.0414                     | 708.0573 | 641.4205     | 623.6045 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |         |         |         |              |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| tau                                                                         | 48.4695 | 48.5788 | 48.6864 | 49.1983 | 49.2953 | 49.7518 | 49.7518 | 49.8372 | 49.5749 | 49.2953 | 49.0995 | 48.8965      |
| alpha                                                                       | 4.2313  | 4.2386  | 4.2458  | 4.2799  | 4.2864  | 4.3168  | 4.3168  | 4.3225  | 4.3050  | 4.2864  | 4.2733  | 4.2598       |
| util living area                                                            | 0.9929  | 0.9862  | 0.9704  | 0.9204  | 0.8136  | 0.6412  | 0.4855  | 0.5413  | 0.7848  | 0.9502  | 0.9868  | 0.9941 (86)  |
| MIT                                                                         | 19.3900 | 19.6049 | 19.9409 | 20.3919 | 20.7425 | 20.9330 | 20.9840 | 20.9748 | 20.8379 | 20.3652 | 19.8025 | 19.3578 (87) |
| Th 2                                                                        | 19.9176 | 19.9198 | 19.9219 | 19.9319 | 19.9337 | 19.9425 | 19.9425 | 19.9441 | 19.9391 | 19.9337 | 19.9300 | 19.9260 (88) |
| util rest of house                                                          | 0.9909  | 0.9824  | 0.9618  | 0.8971  | 0.7616  | 0.5534  | 0.3749  | 0.4269  | 0.7082  | 0.9307  | 0.9825  | 0.9925 (89)  |
| MIT 2                                                                       | 18.0524 | 18.3270 | 18.7523 | 19.3125 | 19.7117 | 19.9015 | 19.9367 | 19.9340 | 19.8227 | 19.2937 | 18.5873 | 18.0171 (90) |
| Living area fraction                                                        | 18.3038 | 18.5672 | 18.9757 | 19.5154 | 19.9055 | 20.0953 | 20.1335 | 20.1296 | 20.0135 | 19.4951 | 18.8157 | 18.2690 (91) |
| MIT                                                                         | 18.3038 | 18.5672 | 18.9757 | 19.5154 | 19.9055 | 20.0953 | 20.1335 | 20.1296 | 20.0135 | 19.4951 | 18.8157 | 18.2690 (92) |
| Temperature adjustment                                                      | 18.3038 | 18.5672 | 18.9757 | 19.5154 | 19.9055 | 20.0953 | 20.1335 | 20.1296 | 20.0135 | 19.4951 | 18.8157 | 18.2690 (93) |
| adjusted MIT                                                                | 18.3038 | 18.5672 | 18.9757 | 19.5154 | 19.9055 | 20.0953 | 20.1335 | 20.1296 | 20.0135 | 19.4951 | 18.8157 | 18.2690 (93) |

## 8. Space heating requirement

|                                                                                |           |           |           |           |          |          |          |          |          |               |           |                |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|---------------|-----------|----------------|
|                                                                                | Jan       | Feb       | Mar       | Apr       | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov       | Dec            |
| Utilisation                                                                    | 0.9865    | 0.9755    | 0.9517    | 0.8861    | 0.7600   | 0.5669   | 0.3954   | 0.4479   | 0.7143   | 0.9202        | 0.9759    | 0.9887 (94)    |
| Useful gains                                                                   | 643.4337  | 735.4530  | 804.6723  | 853.5646  | 787.3204 | 582.7679 | 388.1262 | 406.0655 | 585.7470 | 651.5661      | 625.9534  | 616.5337 (95)  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000    | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000    | 4.2000 (96)    |
| Heat loss rate W                                                               | 1597.3991 | 1555.4938 | 1416.7504 | 1192.9499 | 920.3098 | 610.6922 | 392.6753 | 413.7589 | 659.5076 | 997.6608      | 1319.2475 | 1590.8306 (97) |
| Space heating kWh                                                              | 709.7502  | 551.0674  | 455.3861  | 244.3574  | 98.9441  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 257.4944      | 499.1717  | 724.8769 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |          |          |          |          |          |               |           | 3541.0483      |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |           |          |          |          |          |          |               |           | 0.0000         |
| Space heating kWh                                                              | 709.7502  | 551.0674  | 455.3861  | 244.3574  | 98.9441  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 257.4944      | 499.1717  | 724.8769 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |          |          |          |          |          |               |           | 3541.0483      |
| Space heating per m2                                                           |           |           |           |           |          |          |          |          |          | (98c) / (4) = |           | 37.3450 (99)   |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                       |          |          |          |          |          |          |          |          |          |          |          |                |
|-----------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| Fraction of space heat from secondary/supplementary system (Table 11) |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (201)   |
| Fraction of space heat from main system(s)                            |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (202)   |
| Efficiency of main space heating system 1 (in %)                      |          |          |          |          |          |          |          |          |          |          |          | 92.4000 (206)  |
| Efficiency of main space heating system 2 (in %)                      |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)   |
| Efficiency of secondary/supplementary heating system, %               |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)   |
|                                                                       | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec            |
| Space heating requirement                                             | 709.7502 | 551.0674 | 455.3861 | 244.3574 | 98.9441  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 257.4944 | 499.1717 | 724.8769 (98)  |
| Space heating efficiency (main heating system 1)                      | 92.4000  | 92.4000  | 92.4000  | 92.4000  | 92.4000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 92.4000  | 92.4000  | 92.4000 (210)  |
| Space heating fuel (main heating system)                              | 768.1280 | 596.3933 | 492.8421 | 264.4561 | 107.0823 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 278.6736 | 540.2292 | 784.4988 (211) |
| Space heating efficiency (main heating system 2)                      | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)   |
| Space heating fuel (main heating system 2)                            | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)   |
| Space heating fuel (secondary)                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)   |
| Water heating                                                         |          |          |          |          |          |          |          |          |          |          |          |                |
| Water heating requirement                                             | 243.0850 | 214.9411 | 228.5280 | 201.6613 | 195.9126 | 177.0238 | 175.1972 | 181.9668 | 183.7274 | 204.2540 | 216.3800 | 240.5545 (64)  |
| Efficiency of water heater                                            |          |          |          |          |          |          |          |          |          |          |          | 80.3000 (216)  |

# Full SAP Calculation Printout



|                                                                                                      |          |          |           |           |           |           |           |           |           |          |          |            |        |
|------------------------------------------------------------------------------------------------------|----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|----------|------------|--------|
| (217)m                                                                                               | 86.5356  | 86.3063  | 85.8285   | 84.7940   | 82.9942   | 80.3000   | 80.3000   | 80.3000   | 80.3000   | 84.8789  | 86.1112  | 86.5893    | (217)  |
| Fuel for water heating, kWh/month                                                                    | 280.9075 | 249.0444 | 266.2612  | 237.8249  | 236.0559  | 220.4530  | 218.1783  | 226.6087  | 228.8013  | 240.6417 | 251.2797 | 277.8108   | (219)  |
| Space cooling fuel requirement                                                                       |          |          |           |           |           |           |           |           |           |          |          |            |        |
| (221)m                                                                                               | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (221)  |
| Pumps and Fa                                                                                         | 7.3041   | 6.5973   | 7.3041    | 7.0685    | 7.3041    | 7.0685    | 7.3041    | 7.0685    | 7.3041    | 7.0685   | 7.3041   | 7.0685     | (231)  |
| Lighting                                                                                             | 26.8128  | 21.5102  | 19.3676   | 14.1895   | 10.9604   | 8.9547    | 9.9984    | 12.9963   | 16.8810   | 22.1487  | 25.0169  | 27.5580    | (232)  |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |           |           |           |           |           |           |           |          |          |            |        |
| (233a)m                                                                                              | -43.5998 | -61.0812 | -87.2451  | -97.4418  | -104.5021 | -97.3059  | -96.0664  | -90.9480  | -81.8609  | -69.5024 | -47.7811 | -37.7370   | (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |           |           |           |           |           |           |           |          |          |            |        |
| (234a)m                                                                                              | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (234a) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |           |           |           |           |           |           |           |          |          |            |        |
| (235a)m                                                                                              | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (235a) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |           |           |           |           |           |           |           |          |          |            |        |
| (235c)m                                                                                              | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (235c) |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |           |           |           |           |           |           |           |          |          |            |        |
| (233b)m                                                                                              | -25.8178 | -54.1746 | -107.4389 | -161.0389 | -212.6397 | -213.5772 | -211.0977 | -178.8993 | -131.3221 | -77.4059 | -34.4448 | -20.4294   | (233b) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |           |           |           |           |           |           |           |          |          |            |        |
| (234b)m                                                                                              | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (234b) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |           |           |           |           |           |           |           |          |          |            |        |
| (235b)m                                                                                              | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (235b) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |           |           |           |           |           |           |           |          |          |            |        |
| (235d)m                                                                                              | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (235d) |
| Annual totals kWh/year                                                                               |          |          |           |           |           |           |           |           |           |          |          |            |        |
| Space heating fuel - main system 1                                                                   |          |          |           |           |           |           |           |           |           |          |          | 3832.3034  | (211)  |
| Space heating fuel - main system 2                                                                   |          |          |           |           |           |           |           |           |           |          |          | 0.0000     | (213)  |
| Space heating fuel - secondary                                                                       |          |          |           |           |           |           |           |           |           |          |          | 0.0000     | (215)  |
| Efficiency of water heater                                                                           |          |          |           |           |           |           |           |           |           |          |          | 80.3000    |        |
| Water heating fuel used                                                                              |          |          |           |           |           |           |           |           |           |          |          | 2933.8675  | (219)  |
| Space cooling fuel                                                                                   |          |          |           |           |           |           |           |           |           |          |          | 0.0000     | (221)  |
| Electricity for pumps and fans:                                                                      |          |          |           |           |           |           |           |           |           |          |          |            |        |
| Total electricity for the above, kWh/year                                                            |          |          |           |           |           |           |           |           |           |          |          | 86.0000    | (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |          |          |           |           |           |           |           |           |           |          |          | 216.3947   | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |          |           |           |           |           |           |           |           |          |          |            |        |
| PV generation                                                                                        |          |          |           |           |           |           |           |           |           |          |          | -2343.3580 | (233)  |
| Wind generation                                                                                      |          |          |           |           |           |           |           |           |           |          |          | 0.0000     | (234)  |
| Hydro-electric generation (Appendix N)                                                               |          |          |           |           |           |           |           |           |           |          |          | 0.0000     | (235a) |
| Electricity generated - Micro CHP (Appendix N)                                                       |          |          |           |           |           |           |           |           |           |          |          | 0.0000     | (235)  |
| Appendix Q - special features                                                                        |          |          |           |           |           |           |           |           |           |          |          |            |        |
| Energy saved or generated                                                                            |          |          |           |           |           |           |           |           |           |          |          | -0.0000    | (236)  |
| Energy used                                                                                          |          |          |           |           |           |           |           |           |           |          |          | 0.0000     | (237)  |
| Total delivered energy for all uses                                                                  |          |          |           |           |           |           |           |           |           |          |          | 4725.2075  | (238)  |

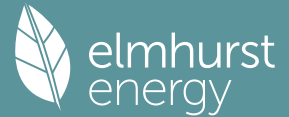
## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                               | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|-----------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1                 | 3832.3034          | 0.2100                        | 804.7837 (261)           |
| Total CO2 associated with community systems   |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                    | 2933.8675          | 0.2100                        | 616.1122 (264)           |
| Space and water heating                       |                    |                               | 1420.8959 (265)          |
| Pumps, fans and electric keep-hot             | 86.0000            | 0.1387                        | 11.9293 (267)            |
| Energy for lighting                           | 216.3947           | 0.1443                        | 31.2324 (268)            |
| Energy saving/generation technologies         |                    |                               |                          |
| PV Unit electricity used in dwelling          | -915.0717          | 0.1347                        | -123.2884                |
| PV Unit electricity exported                  | -1428.2863         | 0.1260                        | -179.8958                |
| Total                                         |                    |                               | -303.1842 (269)          |
| Total CO2, kg/year                            |                    |                               | 1160.8734 (272)          |
| EPC Target Carbon Dioxide Emission Rate (TER) |                    |                               | 12.2400 (273)            |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1               | 3832.3034          | 1.1300                              | 4330.5028 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 2933.8675          | 1.1300                              | 3315.2703 (278)            |
| Space and water heating                     |                    |                                     | 7645.7731 (279)            |
| Pumps, fans and electric keep-hot           | 86.0000            | 1.5128                              | 130.1008 (281)             |
| Energy for lighting                         | 216.3947           | 1.5338                              | 331.9134 (282)             |
| Energy saving/generation technologies       |                    |                                     |                            |
| PV Unit electricity used in dwelling        | -915.0717          | 1.4980                              | -1370.7323                 |
| PV Unit electricity exported                | -1428.2863         | 0.4623                              | -660.3444                  |
| Total                                       |                    |                                     | -2031.0766 (283)           |
| Total Primary energy kWh/year               |                    |                                     | 6076.7106 (286)            |
| Target Primary Energy Rate (TPER)           |                    |                                     | 64.0900 (287)              |

# Full SAP Calculation Printout



|                                    |                                                          |               |       |               |                |            |
|------------------------------------|----------------------------------------------------------|---------------|-------|---------------|----------------|------------|
| Plot Reference                     | 4907-R823-9471-001                                       |               |       |               | Issued on Date | 21/07/2026 |
| Assessment Reference               | Plot 1                                                   | Plot Type Ref |       | Bosworth-Semi |                |            |
| Plot Address                       | Plot 1, Bosworth-Semi, K, WC, B, ES, 1012                |               |       |               | SAP Version    | 10.2       |
|                                    |                                                          |               |       |               |                |            |
| SAP Rating                         | 90 B                                                     | DER           | 11.90 | TER           | 12.24          |            |
| Environmental                      | 90 B                                                     | % DER < TER   |       |               |                | 2.78       |
| CO <sub>2</sub> Emissions (t/year) | 0.99                                                     | DFEE          | 40.21 | TFEE          | 42.82          |            |
| Compliance Check                   | See BREL                                                 | % DFEE < TFEE |       |               |                | 6.10       |
| % DPER < TPER                      | 0.56                                                     | DPER          | 63.73 | TPER          | 64.09          |            |
|                                    |                                                          |               |       |               |                |            |
| Assessor Details                   | Mr. Daniel Harris                                        |               |       |               | Assessor ID    | R823-0001  |
| Client                             | Crest Nicholson Head Office, Crest Nicholson Head Office |               |       |               |                |            |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF FABRIC ENERGY EFFICIENCY

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)            | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Main dwelling                                          |                           |                                 |                             |
| Ground floor                                           | 47.4100 (1b)              | x 2.4600 (2b)                   | = 116.6286 (1b) - (3b)      |
| First floor                                            | 47.4100 (1c)              | x 2.7600 (2c)                   | = 130.8516 (1c) - (3c)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 94.8200                   |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 247.4802 (5)              |

## 2. Ventilation rate

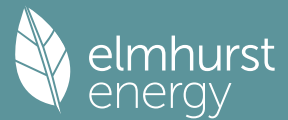
|                                                                                                    | m <sup>3</sup> per hour                            |
|----------------------------------------------------------------------------------------------------|----------------------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                               |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                               |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                               |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                               |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                               |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                               |
| Number of intermittent extract fans                                                                | 3 * 10 = 30.0000 (7a)                              |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)                               |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)                               |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | Air changes per hour<br>30.0000 / (5) = 0.1212 (8) |
| Pressure test                                                                                      | Yes                                                |
| Pressure Test Method                                                                               | Blower Door                                        |
| Measured/design AP50                                                                               | 4.5000 (17)                                        |
| Infiltration rate                                                                                  | 0.3462 (18)                                        |
| Number of sides sheltered                                                                          | 2 (19)                                             |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 0.8500 (20)            |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.2943 (21)                   |

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor                                                                                             | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate                                                                                         | 0.3752 | 0.3679 | 0.3605 | 0.3237 | 0.3164 | 0.2796 | 0.2796 | 0.2722 | 0.2943 | 0.3164 | 0.3311 | 0.3458 (22b) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.0000 (23b) |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =            |        |        |        |        |        |        |        |        |        |        |        | 0.0000 (23c) |
| Effective ac                                                                                            | 0.5704 | 0.5677 | 0.5650 | 0.5524 | 0.5500 | 0.5391 | 0.5391 | 0.5371 | 0.5433 | 0.5500 | 0.5548 | 0.5598 (25)  |

## 3. Heat losses and heat loss parameter

| Element                                                        | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K         | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K                                        |
|----------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|----------------------|--------------------------------|------------------------------------------------------|
| Main dwelling                                                  |                         |                            |                           |                               |                      |                                |                                                      |
| Front Door                                                     |                         |                            | 2.2300                    | 1.2000                        | 2.6760               |                                | (26)                                                 |
| Windows                                                        |                         |                            | 10.7600                   | 1.2357                        | 13.2966              |                                | (27)                                                 |
| French Doors                                                   |                         |                            | 5.2200                    | 1.2357                        | 6.4506               |                                | (27)                                                 |
| GF SPVL 125TS P/A                                              |                         |                            | 47.4100                   | 0.1300                        | 6.1633               | 75.0000                        | 3555.7500 (28a)                                      |
| EW Brick AAC011                                                | 151.6400                | 18.2100                    | 133.4300                  | 0.1800                        | 24.0174              | 60.0000                        | 8005.8000 (29a)                                      |
| PR 500mm MW044                                                 | 47.4100                 |                            | 47.4100                   | 0.0900                        | 4.2669               | 9.0000                         | 426.6900 (30)                                        |
| Total net area of external elements Aum(A, m <sup>2</sup> )    |                         |                            | 246.4600                  |                               |                      |                                | (31)                                                 |
| Fabric heat loss, W/K = Sum (A x U)                            |                         |                            |                           |                               | (26)...(30) + (32) = | 56.8707                        | (33)                                                 |
| Main dwelling                                                  |                         |                            |                           |                               |                      |                                |                                                      |
| Timber - GF                                                    |                         |                            | 24.2600                   |                               |                      | 9.0000                         | 218.3400 (32c)                                       |
| Timber - FF                                                    |                         |                            | 140.7000                  |                               |                      | 9.0000                         | 1266.3000 (32c)                                      |
| Masonry GF                                                     |                         |                            | 51.5100                   |                               |                      | 100.0000                       | 5151.0000 (32c)                                      |
| Internal Floor FF                                              |                         |                            | 47.4100                   |                               |                      | 18.0000                        | 853.3800 (32d)                                       |
| Internal Ceiling GF                                            |                         |                            | 47.4100                   |                               |                      | 9.0000                         | 426.6900 (32e)                                       |
| Heat capacity Cm = Sum(A x k)                                  |                         |                            |                           |                               |                      |                                | (28)...(30) + (32) + (32a)...(32e) = 19903.9500 (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K |                         |                            |                           |                               |                      |                                | 209.9130 (35)                                        |

# Full SAP Calculation Printout



## List of Thermal Bridges

|                                                                  | Length  | Psi-value | Total                              |
|------------------------------------------------------------------|---------|-----------|------------------------------------|
| K1 Element                                                       |         |           |                                    |
| E2 Other lintels (including other steel lintels)                 | 11.9100 | 0.0410    | 0.4883                             |
| E3 Sill                                                          | 9.4200  | 0.0220    | 0.2072                             |
| E4 Jamb                                                          | 22.0500 | 0.0190    | 0.4189                             |
| E5 Ground floor (normal)                                         | 12.0200 | 0.0928    | 1.1155                             |
| E6 Intermediate floor within a dwelling                          | 29.0500 | 0.0020    | 0.0581                             |
| E10 Eaves (insulation at ceiling level)                          | 9.1500  | 0.0390    | 0.3569                             |
| E18 Party wall between dwellings                                 | 0.0000  | 0.0300    | 0.0000                             |
| E4 Jamb                                                          | 4.2000  | 0.1000    | 0.4200                             |
| E2 Other lintels (including other steel lintels)                 | 1.0600  | 0.0410    | 0.0435                             |
| P1 Party wall - Ground floor                                     | 0.0000  | 0.1000    | 0.0000                             |
| P2 Party wall - Intermediate floor within a dwelling             | 0.0000  | 0.0000    | 0.0000                             |
| P4 Party wall - Roof (insulation at ceiling level)               | 0.0000  | 0.0350    | 0.0000                             |
| E5 Ground floor (normal)                                         | 17.0300 | 0.0980    | 1.6689                             |
| E12 Gable (insulation at ceiling level)                          | 19.9000 | 0.0870    | 1.7313                             |
| E16 Corner (normal)                                              | 26.1000 | 0.0420    | 1.0962                             |
| E17 Corner (inverted - internal area greater than external area) | 5.2200  | -0.0820   | -0.4280                            |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)       |         |           | 7.1768 (36)                        |
| Point Thermal bridges                                            |         |           | (36a) = 0.0000                     |
| Total fabric heat loss                                           |         |           | (33) + (36) + (36a) = 64.0475 (37) |

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

|                           | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
|---------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| (38)m                     | 46.5832  | 46.3600  | 46.1412  | 45.1134  | 44.9211  | 44.0259  | 44.0259  | 43.8601  | 44.3707  | 44.9211  | 45.3101  | 45.7168 (38)  |
| Heat transfer coeff       | 110.6307 | 110.4075 | 110.1887 | 109.1609 | 108.9686 | 108.0734 | 108.0734 | 107.9076 | 108.4182 | 108.9686 | 109.3576 | 109.7643 (39) |
| Average = Sum(39)m / 12 = |          |          |          |          |          |          |          |          |          |          |          | 109.1600      |
| HLP                       | 1.1667   | 1.1644   | 1.1621   | 1.1512   | 1.1492   | 1.1398   | 1.1398   | 1.1380   | 1.1434   | 1.1492   | 1.1533   | 1.1576 (40)   |
| HLP (average)             |          |          |          |          |          |          |          |          |          |          |          | 1.1512        |
| Days in mont              | 31       | 28       | 31       | 30       | 31       | 30       | 31       | 31       | 30       | 31       | 30       | 31            |

## 4. Water heating energy requirements (kWh/year)

|                                                                 |          |         |          |         |         |         |         |         |         |                                        |         |               |
|-----------------------------------------------------------------|----------|---------|----------|---------|---------|---------|---------|---------|---------|----------------------------------------|---------|---------------|
| Assumed occupancy                                               |          |         |          |         |         |         |         |         |         |                                        |         | 2.6861 (42)   |
| Hot water usage for mixer showers                               |          |         |          |         |         |         |         |         |         |                                        |         |               |
| 0.0000                                                          | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000 (42a)  |
| Hot water usage for baths                                       | 29.9061  | 29.4619 | 28.8365  | 27.6833 | 26.8197 | 25.8622 | 25.3450 | 25.9661 | 26.6424 | 27.6669                                | 28.8439 | 29.8050 (42b) |
| Hot water usage for other uses                                  | 42.1386  | 40.6063 | 39.0739  | 37.5416 | 36.0093 | 34.4770 | 34.4770 | 36.0093 | 37.5416 | 39.0739                                | 40.6063 | 42.1386 (42c) |
| Average daily hot water use (litres/day)                        |          |         |          |         |         |         |         |         |         |                                        |         | 66.0354 (43)  |
| Daily hot water use                                             | 72.0447  | 70.0682 | 67.9104  | 65.2249 | 62.8291 | 60.3393 | 59.8221 | 61.9754 | 64.1840 | 66.7409                                | 69.4502 | 71.9436 (44)  |
| Energy conte                                                    | 114.1011 | 99.7762 | 104.3758 | 89.2896 | 84.5800 | 74.1941 | 72.3496 | 76.7385 | 79.1453 | 90.5667                                | 98.9445 | 112.6462 (45) |
| Energy content (annual)                                         |          |         |          |         |         |         |         |         |         | Total = Sum(45)m =                     |         | 1096.7078     |
| Distribution loss (46)m = 0.15 x (45)m                          | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000 (46)   |
| Water storage loss (or HIU loss):                               |          |         |          |         |         |         |         |         |         |                                        |         |               |
| Total storage loss                                              | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000 (56)   |
| If cylinder contains dedicated solar storage                    | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000 (57)   |
| Primary loss                                                    | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000 (59)   |
| Combi loss                                                      | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000 (61)   |
| Total heat required for water heating calculated for each month | 96.9860  | 84.8098 | 88.7194  | 75.8962 | 71.8930 | 63.0650 | 61.4972 | 65.2278 | 67.2735 | 76.9817                                | 84.1028 | 95.7493 (62)  |
| WWHRS                                                           | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000 (63a)  |
| PV diverter                                                     | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000 (63b)  |
| Solar input                                                     | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000 (63c)  |
| FGHRS                                                           | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000 (63d)  |
| Output from w/h                                                 | 96.9860  | 84.8098 | 88.7194  | 75.8962 | 71.8930 | 63.0650 | 61.4972 | 65.2278 | 67.2735 | 76.9817                                | 84.1028 | 95.7493 (64)  |
| 12Total per year (kWh/year)                                     |          |         |          |         |         |         |         |         |         | Total per year (kWh/year) = Sum(64)m = |         | 932.2016 (64) |
| Electric shower(s)                                              | 55.4635  | 49.4184 | 53.9630  | 51.4962 | 52.4626 | 50.0442 | 51.7123 | 52.4626 | 51.4962 | 53.9630                                | 52.9483 | 55.4635 (64a) |
| Heat gains from water heating, kWh/month                        | 38.1124  | 33.5570 | 35.6706  | 31.8481 | 31.0889 | 28.2773 | 28.3024 | 29.4226 | 29.6924 | 32.7362                                | 34.2628 | 37.8032 (65)  |

## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |           |           |           |           |           |           |           |           |           |           |           |                |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
| Metabolic gains (Table 5), Watts                                                    |           |           |           |           |           |           |           |           |           |           |           |                |
| (66)m                                                                               | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 129.0440  | 142.8702  | 129.0440  | 133.3455  | 129.0440  | 133.3455  | 129.0440  | 129.0440  | 133.3455  | 129.0440  | 133.3455  | 129.0440 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 247.6715  | 250.2415  | 243.7651  | 229.9774  | 212.5731  | 196.2154  | 185.2875  | 182.7174  | 189.1939  | 202.9815  | 220.3859  | 236.7435 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306 (69)   |
| Pumps, fans                                                                         | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000 (70)    |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 (71) |
| Water heating gains (Table 5)                                                       | 51.2263   | 49.9361   | 47.9444   | 44.2335   | 41.7861   | 39.2740   | 38.0408   | 39.5465   | 41.2395   | 44.0002   | 47.5872   | 50.8107 (72)   |
| Total internal gains                                                                | 491.2336  | 506.3396  | 484.0453  | 470.8483  | 446.6951  | 432.1268  | 415.6642  | 414.5998  | 427.0707  | 439.3176  | 464.6104  | 479.8901 (73)  |

## 6. Solar gains

| [Jan] | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W  |
|-------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|-------------|
| North | 1.3900     | 10.6334                        | 0.4500                            | 0.0000                             | 0.7700                       | 5.1214 (74) |

# Full SAP Calculation Printout



|      |        |         |        |        |        |              |
|------|--------|---------|--------|--------|--------|--------------|
| East | 4.1200 | 19.6403 | 0.4500 | 0.0000 | 0.7700 | 28.0380 (76) |
| West | 5.2500 | 19.6403 | 0.4500 | 0.0000 | 0.7700 | 35.7281 (80) |
| East | 5.2200 | 19.6403 | 0.4500 | 0.0000 | 0.7700 | 35.5239 (76) |

|             |          |          |          |          |           |           |           |          |          |          |          |               |
|-------------|----------|----------|----------|----------|-----------|-----------|-----------|----------|----------|----------|----------|---------------|
| Solar gains | 104.4115 | 204.0197 | 336.5042 | 493.2296 | 607.7185  | 623.7941  | 593.1680  | 507.1627 | 392.0216 | 242.1237 | 130.1210 | 85.9208 (83)  |
| Total gains | 595.6451 | 710.3593 | 820.5495 | 964.0779 | 1054.4136 | 1055.9208 | 1008.8322 | 921.7625 | 819.0923 | 681.4413 | 594.7314 | 565.8109 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |                           |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |                           |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |                           |         |         |         |         |         |         |         |         |         |         |              |
|                                                                             | Jan                       | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| tau                                                                         | 49.9759                   | 50.0770 | 50.1764 | 50.6489 | 50.7382 | 51.1585 | 51.1585 | 51.2371 | 50.9958 | 50.7382 | 50.5578 | 50.3704      |
| alpha                                                                       | 4.3317                    | 4.3385  | 4.3451  | 4.3766  | 4.3825  | 4.4106  | 4.4106  | 4.4158  | 4.3997  | 4.3825  | 4.3705  | 4.3580       |
| util living area                                                            | 0.9950                    | 0.9887  | 0.9723  | 0.9166  | 0.7977  | 0.6161  | 0.4622  | 0.5218  | 0.7761  | 0.9541  | 0.9899  | 0.9960 (86)  |
| MIT                                                                         | 19.3810                   | 19.6121 | 19.9670 | 20.4341 | 20.7769 | 20.9467 | 20.9880 | 20.9800 | 20.8543 | 20.3745 | 19.7950 | 19.3448 (87) |
| Th 2                                                                        | 19.9467                   | 19.9486 | 19.9505 | 19.9592 | 19.9608 | 19.9685 | 19.9685 | 19.9699 | 19.9655 | 19.9608 | 19.9575 | 19.9541 (88) |
| util rest of house                                                          | 0.9935                    | 0.9855  | 0.9643  | 0.8927  | 0.7448  | 0.5311  | 0.3583  | 0.4127  | 0.6999  | 0.9360  | 0.9864  | 0.9948 (89)  |
| MIT 2                                                                       | 18.4769                   | 18.7076 | 19.0583 | 19.5106 | 19.8121 | 19.9433 | 19.9651 | 19.9637 | 19.8843 | 19.4660 | 18.8974 | 18.4464 (90) |
| Living area fraction                                                        | fLA = Living area / (4) = |         |         |         |         |         |         |         |         |         |         | 0.1879 (91)  |
| MIT                                                                         | 18.6469                   | 18.8776 | 19.2291 | 19.6842 | 19.9934 | 20.1319 | 20.1573 | 20.1547 | 20.0666 | 19.6367 | 19.0661 | 18.6153 (92) |
| Temperature adjustment                                                      | 0.0000                    |         |         |         |         |         |         |         |         |         |         |              |
| adjusted MIT                                                                | 18.6469                   | 18.8776 | 19.2291 | 19.6842 | 19.9934 | 20.1319 | 20.1573 | 20.1547 | 20.0666 | 19.6367 | 19.0661 | 18.6153 (93) |

## 8. Space heating requirement

|                                                                                |                            |           |           |           |          |          |          |          |          |          |           |                |
|--------------------------------------------------------------------------------|----------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|-----------|----------------|
|                                                                                | Jan                        | Feb       | Mar       | Apr       | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov       | Dec            |
| Utilisation                                                                    | 0.9910                     | 0.9811    | 0.9572    | 0.8853    | 0.7466   | 0.5452   | 0.3777   | 0.4329   | 0.7082   | 0.9288   | 0.9824    | 0.9927 (94)    |
| Useful gains                                                                   | 590.2842                   | 696.9093  | 785.3990  | 853.4566  | 787.2244 | 575.7299 | 381.0577 | 399.0642 | 580.0575 | 632.9484 | 584.2446  | 561.6815 (95)  |
| Ext temp.                                                                      | 4.3000                     | 4.9000    | 6.5000    | 8.9000    | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000  | 7.1000    | 4.2000 (96)    |
| Heat loss rate W                                                               | 1587.2031                  | 1543.2328 | 1402.6014 | 1177.2106 | 903.7216 | 597.8503 | 384.4533 | 405.1572 | 646.8862 | 984.7179 | 1308.5863 | 1582.2831 (97) |
| Space heating kWh                                                              | 741.7077                   | 568.7294  | 459.1986  | 233.1029  | 86.6739  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 261.7165 | 521.5260  | 759.3276 (98a) |
| Space heating requirement - total per year (kWh/year)                          | 3631.9826                  |           |           |           |          |          |          |          |          |          |           |                |
| Solar heating kWh                                                              | 0.0000                     | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         | 0.0000                     |           |           |           |          |          |          |          |          |          |           |                |
| Space heating kWh                                                              | 741.7077                   | 568.7294  | 459.1986  | 233.1029  | 86.6739  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 261.7165 | 521.5260  | 759.3276 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) | 3631.9826                  |           |           |           |          |          |          |          |          |          |           |                |
| Space heating per m2                                                           | (98c) / (4) = 38.3040 (99) |           |           |           |          |          |          |          |          |          |           |                |

## 8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

|                                  |                                       |        |        |        |         |           |           |           |         |         |        |              |
|----------------------------------|---------------------------------------|--------|--------|--------|---------|-----------|-----------|-----------|---------|---------|--------|--------------|
|                                  | Jan                                   | Feb    | Mar    | Apr    | May     | Jun       | Jul       | Aug       | Sep     | Oct     | Nov    | Dec          |
| Ext. temp.                       | 4.3000                                | 4.9000 | 6.5000 | 8.9000 | 11.7000 | 14.6000   | 16.6000   | 16.4000   | 14.1000 | 10.6000 | 7.1000 | 4.2000       |
| Heat loss rate W                 | 0.0000                                | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 1015.8901 | 799.7433  | 820.0981  | 0.0000  | 0.0000  | 0.0000 | 0.0000 (100) |
| Utilisation                      | 0.0000                                | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 0.8706    | 0.9243    | 0.8945    | 0.0000  | 0.0000  | 0.0000 | 0.0000 (101) |
| Useful loss                      | 0.0000                                | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 884.4530  | 739.2156  | 733.5597  | 0.0000  | 0.0000  | 0.0000 | 0.0000 (102) |
| Total gains                      | 0.0000                                | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 1180.0589 | 1127.6280 | 1028.4301 | 0.0000  | 0.0000  | 0.0000 | 0.0000 (103) |
| Space cooling kWh                | 0.0000                                | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 212.8363  | 288.9788  | 219.3836  | 0.0000  | 0.0000  | 0.0000 | 0.0000 (104) |
| Cooled fraction                  | fc = cooled area / (4) = 1.0000 (105) |        |        |        |         |           |           |           |         |         |        |              |
| Intermittency factor (Table 10b) | 0.2500                                | 0.2500 | 0.2500 | 0.2500 | 0.2500  | 0.2500    | 0.2500    | 0.2500    | 0.2500  | 0.2500  | 0.2500 | 0.2500 (106) |
| Space cooling kWh                | 0.0000                                | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 53.2091   | 72.2447   | 54.8459   | 0.0000  | 0.0000  | 0.0000 | 0.0000 (107) |
| Space cooling requirement        | 180.2997 (107)                        |        |        |        |         |           |           |           |         |         |        |              |
| Energy for space heating         | 38.3040 (99)                          |        |        |        |         |           |           |           |         |         |        |              |
| Energy for space cooling         | 1.9015 (108)                          |        |        |        |         |           |           |           |         |         |        |              |
| Total                            | 40.2055 (109)                         |        |        |        |         |           |           |           |         |         |        |              |
| Fabric Energy Efficiency (DFEE)  | 40.2 (109)                            |        |        |        |         |           |           |           |         |         |        |              |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

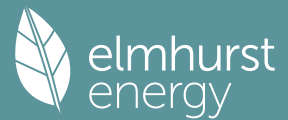
## 1. Overall dwelling characteristics

|                                                         |              |                                    |                        |
|---------------------------------------------------------|--------------|------------------------------------|------------------------|
| Main dwelling                                           | Area (m2)    | Storey height (m)                  | Volume (m3)            |
| Ground floor                                            | 47.4100 (1b) | x 2.4600 (2b)                      | = 116.6286 (1b) - (3b) |
| First floor                                             | 47.4100 (1c) | x 2.7600 (2c)                      | = 130.8516 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)... (1n) | 94.8200      |                                    | (4)                    |
| Dwelling volume                                         |              | (3a)+(3b)+(3c)+(3d)+(3e)... (3n) = | 247.4802 (5)           |

## 2. Ventilation rate

m3 per hour

# Full SAP Calculation Printout



|                                                    |          |              |
|----------------------------------------------------|----------|--------------|
| Number of open chimneys                            | 0 * 80 = | 0.0000 (6a)  |
| Number of open flues                               | 0 * 20 = | 0.0000 (6b)  |
| Number of chimneys / flues attached to closed fire | 0 * 10 = | 0.0000 (6c)  |
| Number of flues attached to solid fuel boiler      | 0 * 20 = | 0.0000 (6d)  |
| Number of flues attached to other heater           | 0 * 35 = | 0.0000 (6e)  |
| Number of blocked chimneys                         | 0 * 20 = | 0.0000 (6f)  |
| Number of intermittent extract fans                | 3 * 10 = | 30.0000 (7a) |
| Number of passive vents                            | 0 * 10 = | 0.0000 (7b)  |
| Number of flueless gas fires                       | 0 * 40 = | 0.0000 (7c)  |

|                                                      |                                                       |         |                      |            |
|------------------------------------------------------|-------------------------------------------------------|---------|----------------------|------------|
| Infiltration due to chimneys, flues and fans         | = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 30.0000 | Air changes per hour | 0.1212 (8) |
| Pressure test                                        |                                                       |         | Yes                  |            |
| Pressure Test Method                                 |                                                       |         | Blower Door          |            |
| Measured/design AP50                                 |                                                       |         | 5.0000               | (17)       |
| Infiltration rate                                    |                                                       |         | 0.3712               | (18)       |
| Number of sides sheltered                            |                                                       |         | 2                    | (19)       |
| Shelter factor                                       | (20) = 1 - [0.075 x (19)] =                           | 0.8500  |                      | (20)       |
| Infiltration rate adjusted to include shelter factor | (21) = (18) x (20) =                                  | 0.3155  |                      | (21)       |

|                                                                                                         |        |        |        |        |        |        |        |        |        |        |        |        |       |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|
| Wind speed                                                                                              | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |       |
| Wind factor                                                                                             | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 | (22)  |
| Adj infilt rate                                                                                         | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 | (22a) |
|                                                                                                         | 0.4023 | 0.3944 | 0.3865 | 0.3471 | 0.3392 | 0.2998 | 0.2998 | 0.2919 | 0.3155 | 0.3392 | 0.3550 | 0.3708 | (22b) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.0000 | (23b) |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =            |        |        |        |        |        |        |        |        |        |        |        | 0.0000 | (23c) |
| Effective ac                                                                                            | 0.5809 | 0.5778 | 0.5747 | 0.5602 | 0.5575 | 0.5449 | 0.5449 | 0.5426 | 0.5498 | 0.5575 | 0.5630 | 0.5687 | (25)  |

### 3. Heat losses and heat loss parameter

| Element                                        | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K | A x U<br>W/K | K-value<br>kJ/m2K | A x K<br>kJ/K |
|------------------------------------------------|-------------|----------------|---------------|------------------|--------------|-------------------|---------------|
| Main dwelling                                  |             |                |               |                  |              |                   |               |
| TER Opaque door                                |             |                | 2.2300        | 1.0000           | 2.2300       |                   | (26)          |
| TER Opening Type                               |             |                | 15.9800       | 1.1450           | 18.2977      |                   | (27)          |
| GF SPVL 125TS P/A                              |             |                | 47.4100       | 0.1300           | 6.1633       |                   | (28a)         |
| EW Brick AAC011                                | 151.6400    | 18.2100        | 133.4300      | 0.1800           | 24.0174      |                   | (29a)         |
| PR 500mm MW044                                 | 47.4100     |                | 47.4100       | 0.1100           | 5.2151       |                   | (30)          |
| Total net area of external elements Aum(A, m2) |             |                | 246.4600      |                  |              |                   | (31)          |
| Fabric heat loss, W/K = Sum (A x U)            |             |                |               |                  | 55.9235      |                   | (33)          |

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 209.9130 (35)

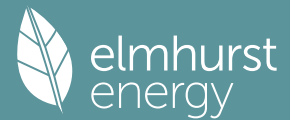
| List of Thermal Bridges                                          | Length  | Psi-value | Total        |
|------------------------------------------------------------------|---------|-----------|--------------|
| K1 Element                                                       | 11.9100 | 0.0500    | 0.5955       |
| E2 Other lintels (including other steel lintels)                 | 9.4200  | 0.0500    | 0.4710       |
| E3 Sill                                                          | 22.0500 | 0.0500    | 1.1025       |
| E4 Jamb                                                          | 12.0200 | 0.1600    | 1.9232       |
| E5 Ground floor (normal)                                         | 29.0500 | 0.0000    | 0.0000       |
| E6 Intermediate floor within a dwelling                          | 9.1500  | 0.0600    | 0.5490       |
| E10 Eaves (insulation at ceiling level)                          | 0.0000  | 0.0600    | 0.0000       |
| E18 Party wall between dwellings                                 | 4.2000  | 0.0500    | 0.2100       |
| E4 Jamb                                                          | 1.0600  | 0.0500    | 0.0530       |
| E2 Other lintels (including other steel lintels)                 | 0.0000  | 0.0800    | 0.0000       |
| P1 Party wall - Ground floor                                     | 0.0000  | 0.0000    | 0.0000       |
| P2 Party wall - Intermediate floor within a dwelling             | 0.0000  | 0.1200    | 0.0000       |
| P4 Party wall - Roof (insulation at ceiling level)               | 17.0300 | 0.1600    | 2.7248       |
| E5 Ground floor (normal)                                         | 19.9000 | 0.0600    | 1.1940       |
| E12 Gable (insulation at ceiling level)                          | 26.1000 | 0.0900    | 2.3490       |
| E16 Corner (normal)                                              | 5.2200  | -0.0900   | -0.4698      |
| E17 Corner (inverted - internal area greater than external area) |         |           |              |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)       |         |           | 10.7022 (36) |
| Point Thermal Bridges                                            |         |           | 0.0000 (36a) |
| Total fabric heat loss                                           |         |           | 66.6257 (37) |

|                                                                     |          |          |          |          |          |          |          |          |          |          |          |          |      |
|---------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) |          |          |          |          |          |          |          |          |          |          |          |          |      |
| (38)m                                                               | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |      |
| Heat transfer coeff                                                 | 47.4434  | 47.1868  | 46.9352  | 45.7537  | 45.5326  | 44.5035  | 44.5035  | 44.3129  | 44.8999  | 45.5326  | 45.9798  | 46.4474  | (38) |
| Average = Sum(39)m / 12 =                                           | 114.0692 | 113.8125 | 113.5609 | 112.3794 | 112.1583 | 111.1292 | 111.1292 | 110.9386 | 111.5256 | 112.1583 | 112.6055 | 113.0731 | (39) |
|                                                                     |          |          |          |          |          |          |          |          |          |          |          | 112.3783 |      |
| HLP                                                                 | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |      |
| HLP (average)                                                       | 1.2030   | 1.2003   | 1.1976   | 1.1852   | 1.1829   | 1.1720   | 1.1720   | 1.1700   | 1.1762   | 1.1829   | 1.1876   | 1.1925   | (40) |
| Days in mont                                                        | 31       | 28       | 31       | 30       | 31       | 30       | 31       | 31       | 30       | 31       | 30       | 31       |      |

### 4. Water heating energy requirements (kWh/year)

|                                                                 |          |         |          |         |         |         |         |         |         |         |         |          |             |
|-----------------------------------------------------------------|----------|---------|----------|---------|---------|---------|---------|---------|---------|---------|---------|----------|-------------|
| Assumed occupancy                                               |          |         |          |         |         |         |         |         |         |         |         |          | 2.6861 (42) |
| Hot water usage for mixer showers                               | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000   | (42a)       |
| Hot water usage for baths                                       | 29.9061  | 29.4619 | 28.8365  | 27.6833 | 26.8197 | 25.8622 | 25.3450 | 25.9661 | 26.6424 | 27.6669 | 28.8439 | 29.8050  | (42b)       |
| Hot water usage for other uses                                  | 42.1386  | 40.6063 | 39.0739  | 37.5416 | 36.0093 | 34.4770 | 34.4770 | 36.0093 | 37.5416 | 39.0739 | 40.6063 | 42.1386  | (42c)       |
| Average daily hot water use (litres/day)                        |          |         |          |         |         |         |         |         |         |         |         | 66.0354  | (43)        |
| Daily hot water use                                             | Jan      | Feb     | Mar      | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec      |             |
| Energy conte                                                    | 72.0447  | 70.0682 | 67.9104  | 65.2249 | 62.8291 | 60.3393 | 59.8221 | 61.9754 | 64.1840 | 66.7409 | 69.4502 | 71.9436  | (44)        |
| Energy content (annual)                                         | 114.1011 | 99.7762 | 104.3758 | 89.2896 | 84.5800 | 74.1941 | 72.3496 | 76.7385 | 79.1453 | 90.5667 | 98.9445 | 112.6462 | (45)        |
| Distribution loss (46)m = 0.15 x (45)m                          | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000   | (46)        |
| Water storage loss (or HIU loss):                               | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000   | (46)        |
| Total storage loss                                              | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000   | (56)        |
| If cylinder contains dedicated solar storage                    | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000   | (57)        |
| Primary loss                                                    | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000   | (59)        |
| Combi loss                                                      | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000   | (61)        |
| Total heat required for water heating calculated for each month |          |         |          |         |         |         |         |         |         |         |         |          |             |

# Full SAP Calculation Printout



|                                                                                |         |         |         |         |         |         |         |         |         |         |               |                |
|--------------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------------|----------------|
| WWHRS                                                                          | 96.9860 | 84.8098 | 88.7194 | 75.8962 | 71.8930 | 63.0650 | 61.4972 | 65.2278 | 67.2735 | 76.9817 | 84.1028       | 95.7493 (62)   |
| PV diverter                                                                    | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000        | 0.0000 (63a)   |
| Solar input                                                                    | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000        | 0.0000 (63b)   |
| FGHRS                                                                          | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000        | 0.0000 (63c)   |
| Output from w/h                                                                | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000        | 0.0000 (63d)   |
| 12Total per year (kWh/year)                                                    | 96.9860 | 84.8098 | 88.7194 | 75.8962 | 71.8930 | 63.0650 | 61.4972 | 65.2278 | 67.2735 | 76.9817 | 84.1028       | 95.7493 (64)   |
| Electric shower(s)                                                             |         |         |         |         |         |         |         |         |         |         |               | 932.2016 (64)  |
|                                                                                |         |         |         |         |         |         |         |         |         |         |               | 932 (64)       |
| 55.4635                                                                        | 49.4184 | 53.9630 | 51.4962 | 52.4626 | 50.0442 | 51.7123 | 52.4626 | 51.4962 | 53.9630 | 52.9483 | 55.4635 (64a) | 630.8938 (64a) |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |         |         |         |         |         |         |         |         |         |         |               |                |
| Heat gains from water heating, kWh/month                                       | 38.1124 | 33.5570 | 35.6706 | 31.8481 | 31.0889 | 28.2773 | 28.3024 | 29.4226 | 29.6924 | 32.7362 | 34.2628       | 37.8032 (65)   |

## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |           |           |           |           |           |           |           |           |           |           |           |           |      |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------|
| Metabolic gains (Table 5), Watts                                                    | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec       |      |
| (66)m                                                                               | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 129.0440  | 142.8702  | 129.0440  | 133.3455  | 129.0440  | 133.3455  | 129.0440  | 129.0440  | 133.3455  | 129.0440  | 133.3455  | 129.0440  | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 247.6715  | 250.2415  | 243.7651  | 229.9774  | 212.5731  | 196.2154  | 185.2875  | 182.7174  | 189.1939  | 202.9815  | 220.3859  | 236.7435  | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | (69) |
| Pumps, fans                                                                         | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | (71) |
| Water heating gains (Table 5)                                                       | 51.2263   | 49.9361   | 47.9444   | 44.2335   | 41.7861   | 39.2740   | 38.0408   | 39.5465   | 41.2395   | 44.0002   | 47.5872   | 50.8107   | (72) |
| Total internal gains                                                                | 491.2336  | 506.3396  | 484.0453  | 470.8483  | 446.6951  | 432.1268  | 415.6642  | 414.5998  | 427.0707  | 439.3176  | 464.6104  | 479.8901  | (73) |

## 6. Solar gains

| [Jan]       |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 |          | g<br>Specific data<br>or Table 6b |          | FF<br>Specific data<br>or Table 6c |          | Access<br>factor<br>Table 6d |  | Gains<br>W    |
|-------------|----------|----------|----------|------------|--------------------------------|----------|-----------------------------------|----------|------------------------------------|----------|------------------------------|--|---------------|
| North       |          |          |          | 1.3900     | 10.6334                        |          | 0.6300                            |          | 0.7000                             |          | 0.7700                       |  | 4.5171 (74)   |
| East        |          |          |          | 9.3400     | 19.6403                        |          | 0.6300                            |          | 0.7000                             |          | 0.7700                       |  | 56.0617 (76)  |
| West        |          |          |          | 5.2500     | 19.6403                        |          | 0.6300                            |          | 0.7000                             |          | 0.7700                       |  | 31.5122 (80)  |
| Solar gains | 92.0909  | 179.9454 | 296.7967 | 435.0285   | 536.0078                       | 550.1864 | 523.1742                          | 447.3175 | 345.7630                           | 213.5531 | 114.7667                     |  | 75.7821 (83)  |
| Total gains | 583.3245 | 686.2850 | 780.8420 | 905.8768   | 982.7028                       | 982.3131 | 938.8384                          | 861.9173 | 772.8338                           | 652.8707 | 579.3771                     |  | 555.6723 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |                           |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |                           |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |                           |         |         |              |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep                       | Oct     | Nov     | Dec          |
| tau                                                                         | 48.4695 | 48.5788 | 48.6864 | 49.1983 | 49.2953 | 49.7518 | 49.7518 | 49.8372 | 49.5749                   | 49.2953 | 49.0995 | 48.8965      |
| alpha                                                                       | 4.2313  | 4.2386  | 4.2458  | 4.2799  | 4.2864  | 4.3168  | 4.3168  | 4.3225  | 4.3050                    | 4.2864  | 4.2733  | 4.2598       |
| util living area                                                            | 0.9954  | 0.9902  | 0.9774  | 0.9335  | 0.8342  | 0.6636  | 0.5054  | 0.5654  | 0.8098                    | 0.9616  | 0.9909  | 0.9962 (86)  |
| MIT                                                                         | 19.3042 | 19.5230 | 19.8675 | 20.3392 | 20.7129 | 20.9235 | 20.9813 | 20.9703 | 20.8149                   | 20.3074 | 19.7269 | 19.2727 (87) |
| Th 2                                                                        | 19.9176 | 19.9198 | 19.9219 | 19.9319 | 19.9337 | 19.9425 | 19.9425 | 19.9441 | 19.9391                   | 19.9337 | 19.9300 | 19.9260 (88) |
| util rest of house                                                          | 0.9940  | 0.9874  | 0.9706  | 0.9131  | 0.7848  | 0.5752  | 0.3912  | 0.4477  | 0.7363                    | 0.9458  | 0.9878  | 0.9951 (89)  |
| MIT 2                                                                       | 18.3789 | 18.5978 | 18.9396 | 19.4016 | 19.7380 | 19.9055 | 19.9371 | 19.9347 | 19.8333                   | 19.3816 | 18.8093 | 18.3537 (90) |
| Living area fraction                                                        |         |         |         |         |         |         |         |         | fLA = Living area / (4) = |         |         | 0.1879 (91)  |
| MIT                                                                         | 18.5528 | 18.7717 | 19.1140 | 19.5778 | 19.9212 | 20.0968 | 20.1334 | 20.1293 | 20.0178                   | 19.5556 | 18.9817 | 18.5264 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |                           |         |         | 0.0000       |
| adjusted MIT                                                                | 18.5528 | 18.7717 | 19.1140 | 19.5778 | 19.9212 | 20.0968 | 20.1334 | 20.1293 | 20.0178                   | 19.5556 | 18.9817 | 18.5264 (93) |

## 8. Space heating requirement

|                                                                                | Jan       | Feb       | Mar       | Apr       | May      | Jun      | Jul      | Aug      | Sep      | Oct       | Nov       | Dec       |               |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|-----------|-----------|-----------|---------------|
| Utilisation                                                                    | 0.9916    | 0.9832    | 0.9639    | 0.9049    | 0.7842   | 0.5890   | 0.4125   | 0.4693   | 0.7425   | 0.9385    | 0.9839    | 0.9931    | (94)          |
| Useful gains                                                                   | 578.4115  | 674.7832  | 752.6561  | 819.6939  | 770.5923 | 578.5554 | 387.3068 | 404.5254 | 573.8608 | 612.6980  | 570.0755  | 551.8307  | (95)          |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000    | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000   | 7.1000    | 4.2000    | (96)          |
| Heat loss rate W                                                               | 1625.8038 | 1578.7713 | 1432.4530 | 1199.9665 | 922.0752 | 610.8558 | 392.6621 | 413.7240 | 659.9854 | 1004.4479 | 1337.9497 | 1619.9330 | (97)          |
| Space heating kWh                                                              | 779.2599  | 607.4800  | 505.7689  | 273.7962  | 112.7032 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 291.4619  | 552.8694  | 794.6681  | (98a)         |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |          |          |          |          |          |           |           | 3918.0077 |               |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | (98b)         |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |           |          |          |          |          |          |           |           | 0.0000    |               |
| Space heating kWh                                                              | 779.2599  | 607.4800  | 505.7689  | 273.7962  | 112.7032 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 291.4619  | 552.8694  | 794.6681  | (98c)         |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |          |          |          |          |          |           |           | 3918.0077 |               |
| Space heating per m2                                                           |           |           |           |           |          |          |          |          |          |           |           |           | (98c) / (4) = |
|                                                                                |           |           |           |           |          |          |          |          |          |           |           | 41.3205   | (99)          |

## 8c. Space cooling requirement

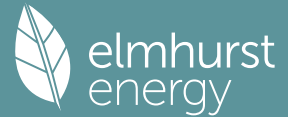
|                                                     |        |        |        |        |         |           |          |          |         |         |        |              |
|-----------------------------------------------------|--------|--------|--------|--------|---------|-----------|----------|----------|---------|---------|--------|--------------|
| Calculated for June, July and August. See Table 10b |        |        |        |        |         |           |          |          |         |         |        |              |
|                                                     | Jan    | Feb    | Mar    | Apr    | May     | Jun       | Jul      | Aug      | Sep     | Oct     | Nov    | Dec          |
| Ext. temp.                                          | 4.3000 | 4.9000 | 6.5000 | 8.9000 | 11.7000 | 14.6000   | 16.6000  | 16.4000  | 14.1000 | 10.6000 | 7.1000 | 4.2000       |
| Heat loss rate W                                    | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 1044.6143 | 822.3560 | 843.1334 | 0.0000  | 0.0000  | 0.0000 | 0.0000 (100) |
| Utilisation                                         | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 0.8302    | 0.8951   | 0.8602   | 0.0000  | 0.0000  | 0.0000 | 0.0000 (101) |

# Full SAP Calculation Printout



|                                  |        |        |        |        |        |           |           |          |                          |        |        |                |
|----------------------------------|--------|--------|--------|--------|--------|-----------|-----------|----------|--------------------------|--------|--------|----------------|
| Useful loss                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 867.2229  | 736.0654  | 725.2834 | 0.0000                   | 0.0000 | 0.0000 | 0.0000 (102)   |
| Total gains                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1094.0240 | 1045.8171 | 958.4812 | 0.0000                   | 0.0000 | 0.0000 | 0.0000 (103)   |
| Space cooling kWh                |        |        |        |        |        |           |           |          |                          |        |        |                |
|                                  | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 163.2968  | 230.4552  | 173.4992 | 0.0000                   | 0.0000 | 0.0000 | 0.0000 (104)   |
| Cooled fraction                  |        |        |        |        |        |           |           |          | fC = cooled area / (4) = |        |        | 1.0000 (105)   |
| Intermittency factor (Table 10b) |        |        |        |        |        |           |           |          |                          |        |        |                |
|                                  | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500    | 0.2500    | 0.2500   | 0.2500                   | 0.2500 | 0.2500 | 0.2500 (106)   |
| Space cooling kWh                |        |        |        |        |        |           |           |          |                          |        |        |                |
|                                  | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 40.8242   | 57.6138   | 43.3748  | 0.0000                   | 0.0000 | 0.0000 | 0.0000 (107)   |
| Space cooling requirement        |        |        |        |        |        |           |           |          |                          |        |        | 141.8128 (107) |
| Energy for space heating         |        |        |        |        |        |           |           |          |                          |        |        | 41.3205 (99)   |
| Energy for space cooling         |        |        |        |        |        |           |           |          |                          |        |        | 1.4956 (108)   |
| Total                            |        |        |        |        |        |           |           |          |                          |        |        | 42.8161 (109)  |
| Fabric Energy Efficiency (TFEE)  |        |        |        |        |        |           |           |          |                          |        |        | 42.8 (109)     |

# Full SAP Calculation Printout



|                                    |                                                          |               |       |               |                |            |
|------------------------------------|----------------------------------------------------------|---------------|-------|---------------|----------------|------------|
| Plot Reference                     | 4907-R823-9471-001                                       |               |       |               | Issued on Date | 21/07/2026 |
| Assessment Reference               | Plot 1                                                   | Plot Type Ref |       | Bosworth-Semi |                |            |
| Plot Address                       | Plot 1, Bosworth-Semi, K, WC, B, ES, 1012                |               |       |               | SAP Version    | 10.2       |
|                                    |                                                          |               |       |               |                |            |
| SAP Rating                         | 90 B                                                     | DER           | 11.90 | TER           | 12.24          |            |
| Environmental                      | 90 B                                                     | % DER < TER   |       |               |                | 2.78       |
| CO <sub>2</sub> Emissions (t/year) | 0.99                                                     | DFEE          | 40.21 | TFEE          | 42.82          |            |
| Compliance Check                   | See BREL                                                 | % DFEE < TFEE |       |               |                | 6.10       |
| % DPER < TPER                      | 0.56                                                     | DPER          | 63.73 | TPER          | 64.09          |            |
|                                    |                                                          |               |       |               |                |            |
| Assessor Details                   | Mr. Daniel Harris                                        |               |       |               | Assessor ID    | R823-0001  |
| Client                             | Crest Nicholson Head Office, Crest Nicholson Head Office |               |       |               |                |            |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)            | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Main dwelling                                          |                           |                                 |                             |
| Ground floor                                           | 47.4100 (1b)              | x 2.4600 (2b)                   | = 116.6286 (1b) - (3b)      |
| First floor                                            | 47.4100 (1c)              | x 2.7600 (2c)                   | = 130.8516 (1c) - (3c)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 94.8200                   |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 247.4802 (5)              |

## 2. Ventilation rate

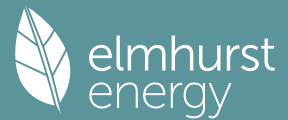
|                                                                                                    | m <sup>3</sup> per hour                 |
|----------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                    |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                    |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                    |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                    |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                    |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                    |
| Number of intermittent extract fans                                                                | 0 * 10 = 0.0000 (7a)                    |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)                    |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 0.0000 / (5) = 0.0000 (8)               |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 4.5000 (17)                             |
| Infiltration rate                                                                                  | 0.2250 (18)                             |
| Number of sides sheltered                                                                          | 2 (19)                                  |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 0.8500 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.1913 (21)        |

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor                                                                                             | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate                                                                                         | 0.2438 | 0.2391 | 0.2343 | 0.2104 | 0.2056 | 0.1817 | 0.1817 | 0.1769 | 0.1913 | 0.2056 | 0.2152 | 0.2247 (22b) |
| Mechanical extract ventilation - decentralised                                                          |        |        |        |        |        |        |        |        |        |        |        |              |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 (25)  |

## 3. Heat losses and heat loss parameter

| Element                                                      | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K   |
|--------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|-----------------|
| Main dwelling                                                |                         |                            |                           |                               |              |                                |                 |
| Front Door                                                   |                         |                            | 2.2300                    | 1.2000                        | 2.6760       |                                | (26)            |
| Windows                                                      |                         |                            | 10.7600                   | 1.2357                        | 13.2966      |                                | (27)            |
| French Doors                                                 |                         |                            | 5.2200                    | 1.2357                        | 6.4506       |                                | (27)            |
| GF SPVL 125TS P/A                                            |                         |                            | 47.4100                   | 0.1300                        | 6.1633       | 75.0000                        | 3555.7500 (28a) |
| EW Brick AAC011                                              | 151.6400                | 18.2100                    | 133.4300                  | 0.1800                        | 24.0174      | 60.0000                        | 8005.8000 (29a) |
| PR 500mm MW044                                               | 47.4100                 |                            | 47.4100                   | 0.0900                        | 4.2669       | 9.0000                         | 426.6900 (30)   |
| Total net area of external elements Aum (A, m <sup>2</sup> ) |                         |                            | 246.4600                  |                               |              |                                | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                          |                         |                            |                           | (26)...(30) + (32) =          | 56.8707      |                                | (33)            |
| Main dwelling                                                |                         |                            |                           |                               |              |                                |                 |
| Timber - GF                                                  |                         |                            | 24.2600                   |                               |              | 9.0000                         | 218.3400 (32c)  |
| Timber - FF                                                  |                         |                            | 140.7000                  |                               |              | 9.0000                         | 1266.3000 (32c) |
| Masonry GF                                                   |                         |                            | 51.5100                   |                               |              | 100.0000                       | 5151.0000 (32c) |
| Internal Floor FF                                            |                         |                            | 47.4100                   |                               |              | 18.0000                        | 853.3800 (32d)  |
| Internal Ceiling GF                                          |                         |                            | 47.4100                   |                               |              | 9.0000                         | 426.6900 (32e)  |

# Full SAP Calculation Printout



Heat capacity Cm = Sum(A x k)  
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K  
List of Thermal Bridges

(28)...(30) + (32) + (32a)...(32e) = 19903.9500 (34)  
209.9130 (35)

|                                                                  |         |           |         |
|------------------------------------------------------------------|---------|-----------|---------|
| K1 Element                                                       | Length  | Psi-value | Total   |
| E2 Other lintels (including other steel lintels)                 | 11.9100 | 0.0410    | 0.4883  |
| E3 Sill                                                          | 9.4200  | 0.0220    | 0.2072  |
| E4 Jamb                                                          | 22.0500 | 0.0190    | 0.4189  |
| E5 Ground floor (normal)                                         | 12.0200 | 0.0928    | 1.1155  |
| E6 Intermediate floor within a dwelling                          | 29.0500 | 0.0020    | 0.0581  |
| E10 Eaves (insulation at ceiling level)                          | 9.1500  | 0.0390    | 0.3569  |
| E18 Party wall between dwellings                                 | 0.0000  | 0.0300    | 0.0000  |
| E4 Jamb                                                          | 4.2000  | 0.1000    | 0.4200  |
| E2 Other lintels (including other steel lintels)                 | 1.0600  | 0.0410    | 0.0435  |
| P1 Party wall - Ground floor                                     | 0.0000  | 0.1000    | 0.0000  |
| P2 Party wall - Intermediate floor within a dwelling             | 0.0000  | 0.0000    | 0.0000  |
| P4 Party wall - Roof (insulation at ceiling level)               | 0.0000  | 0.0350    | 0.0000  |
| E5 Ground floor (normal)                                         | 17.0300 | 0.0980    | 1.6689  |
| E12 Gable (insulation at ceiling level)                          | 19.9000 | 0.0870    | 1.7313  |
| E16 Corner (normal)                                              | 26.1000 | 0.0420    | 1.0962  |
| E17 Corner (inverted - internal area greater than external area) | 5.2200  | -0.0820   | -0.4280 |

Thermal bridges (Sum(L x Psi) calculated using Appendix K)  
Point Thermal bridges  
Total fabric heat loss

(33) + (36) + (36a) = 64.0475 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

|                           |          |          |          |          |          |          |          |          |          |          |          |          |
|---------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| (38)m                     | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |
| Heat transfer coeff       | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  |
| Average = Sum(39)m / 12 = | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 |

|               |        |        |        |        |        |        |        |        |        |        |        |        |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| HLP           | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |
| HLP (average) | 1.1061 | 1.1061 | 1.1061 | 1.1061 | 1.1061 | 1.1061 | 1.1061 | 1.1061 | 1.1061 | 1.1061 | 1.1061 | 1.1061 |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31     |

## 4. Water heating energy requirements (kWh/year)

|                                                                 |                |          |          |          |          |          |          |          |          |          |          |          |
|-----------------------------------------------------------------|----------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| Assumed occupancy                                               | 2.6861 (42)    |          |          |          |          |          |          |          |          |          |          |          |
| Hot water usage for mixer showers                               | 69.2572        | 68.2164  | 66.6997  | 63.7979  | 61.6564  | 59.2683  | 57.9108  | 59.4160  | 61.0660  | 63.6301  | 66.5943  | 68.9918  |
| Hot water usage for baths                                       | 29.9061        | 29.4619  | 28.8365  | 27.6833  | 26.8197  | 25.8622  | 25.3450  | 25.9661  | 26.6424  | 27.6669  | 28.8439  | 29.8050  |
| Hot water usage for other uses                                  | 42.1386        | 40.6063  | 39.0739  | 37.5416  | 36.0093  | 34.4770  | 34.4770  | 36.0093  | 37.5416  | 39.0739  | 40.6063  | 42.1386  |
| Average daily hot water use (litres/day)                        | 129.8883 (43)  |          |          |          |          |          |          |          |          |          |          |          |
| Daily hot water use                                             | Jan            | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |
| Energy conte                                                    | 141.3019       | 138.2846 | 134.6102 | 129.0228 | 124.4855 | 119.6075 | 117.7329 | 121.3914 | 125.2500 | 130.3710 | 136.0444 | 140.9354 |
| Energy content (annual)                                         | 223.7876       | 196.9154 | 206.8908 | 176.6258 | 167.5814 | 147.0714 | 142.3877 | 150.3080 | 154.4457 | 176.9122 | 193.8202 | 220.6708 |
| Distribution loss (46)m = 0.15 x (45)m                          | 33.5681        | 29.5373  | 31.0336  | 26.4939  | 25.1372  | 22.0607  | 21.3582  | 22.5462  | 23.1669  | 26.5368  | 29.0730  | 33.1006  |
| Water storage loss (or HIU loss):                               | 0.0000         |          |          |          |          |          |          |          |          |          |          |          |
| Total storage loss                                              | 0.0000         |          |          |          |          |          |          |          |          |          |          |          |
| If cylinder contains dedicated solar storage                    | 0.0000         |          |          |          |          |          |          |          |          |          |          |          |
| Primary loss                                                    | 0.0000         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   |
| Combi loss                                                      | 12.0010        | 10.8287  | 11.9655  | 11.5300  | 11.8830  | 11.4679  | 11.8301  | 11.8467  | 11.4834  | 11.9026  | 11.5661  | 11.9945  |
| Total heat required for water heating calculated for each month | 235.7886       | 207.7441 | 218.8564 | 188.1558 | 179.4644 | 158.5393 | 154.2178 | 162.1547 | 165.9291 | 188.8148 | 205.3864 | 232.6653 |
| WWHRS                                                           | -30.8360       | -27.2716 | -28.5573 | -23.6466 | -22.0378 | -18.8579 | -17.6762 | -18.7969 | -19.5111 | -23.0014 | -26.0578 | -30.2650 |
| PV diverter                                                     | -0.0000        | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  |
| Solar input                                                     | 0.0000         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   |
| FGHRS                                                           | 0.0000         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   |
| Output from w/h                                                 | 204.9526       | 180.4725 | 190.2991 | 164.5092 | 157.4266 | 139.6815 | 136.5416 | 143.3578 | 146.4181 | 165.8134 | 179.3286 | 202.4003 |
| 12Total per year (kWh/year)                                     | 2011.2011 (64) |          |          |          |          |          |          |          |          |          |          |          |
| Electric shower(s)                                              | 0.0000         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   |
| Heat gains from water heating, kWh/month                        | 77.4096        | 68.1815  | 71.7826  | 61.6106  | 58.6916  | 51.7682  | 50.3014  | 52.9391  | 54.2241  | 61.7990  | 67.3368  | 76.3717  |

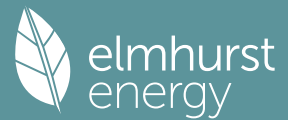
## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |           |           |           |           |           |           |           |           |           |           |           |           |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| Metabolic gains (Table 5), Watts                                                    | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec       |
| (66)m                                                                               | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 129.0440  | 142.8702  | 129.0440  | 133.3455  | 129.0440  | 133.3455  | 129.0440  | 129.0440  | 133.3455  | 129.0440  | 133.3455  | 129.0440  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 247.6715  | 250.2415  | 243.7651  | 229.9774  | 212.5731  | 196.2154  | 185.2875  | 182.7174  | 189.1939  | 202.9815  | 220.3859  | 236.7435  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 3.0000    | 3.0000    | 3.0000    |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 |
| Water heating gains (Table 5)                                                       | 104.0452  | 101.4606  | 96.4820   | 85.5702   | 78.8865   | 71.9003   | 67.6095   | 71.1547   | 75.3112   | 83.0631   | 93.5233   | 102.6501  |
| Total internal gains                                                                | 547.0525  | 560.8642  | 535.5829  | 515.1850  | 486.7955  | 464.7531  | 445.2328  | 446.2080  | 461.1424  | 481.3805  | 513.5465  | 534.7295  |

## 6. Solar gains

|       |      |            |               |               |          |       |
|-------|------|------------|---------------|---------------|----------|-------|
| [Jan] | Area | Solar flux | g             | FF            | Access   | Gains |
|       | m2   | Table 6a   | Specific data | Specific data | factor   | W     |
|       |      | W/m2       | or Table 6b   | or Table 6c   | Table 6d |       |

# Full SAP Calculation Printout



|       |        |         |        |        |        |              |
|-------|--------|---------|--------|--------|--------|--------------|
| North | 1.3900 | 10.6334 | 0.4500 | 0.0000 | 0.7700 | 5.1214 (74)  |
| East  | 4.1200 | 19.6403 | 0.4500 | 0.0000 | 0.7700 | 28.0380 (76) |
| West  | 5.2500 | 19.6403 | 0.4500 | 0.0000 | 0.7700 | 35.7281 (80) |
| East  | 5.2200 | 19.6403 | 0.4500 | 0.0000 | 0.7700 | 35.5239 (76) |

|             |          |          |          |           |           |           |           |          |          |          |          |               |
|-------------|----------|----------|----------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|---------------|
| Solar gains | 104.4115 | 204.0197 | 336.5042 | 493.2296  | 607.7185  | 623.7941  | 593.1680  | 507.1627 | 392.0216 | 242.1237 | 130.1210 | 85.9208 (83)  |
| Total gains | 651.4640 | 764.8839 | 872.0871 | 1008.4146 | 1094.5140 | 1088.5471 | 1038.4009 | 953.3707 | 853.1640 | 723.5041 | 643.6675 | 620.6503 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |         |         |         |              |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| tau                                                                         | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153      |
| alpha                                                                       | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144       |
| util living area                                                            | 0.9927  | 0.9845  | 0.9637  | 0.8988  | 0.7686  | 0.5880  | 0.4380  | 0.4942  | 0.7456  | 0.9411  | 0.9859  | 0.9942 (86)  |
| MIT                                                                         | 19.3730 | 19.6222 | 19.9980 | 20.4658 | 20.8024 | 20.9541 | 20.9902 | 20.9834 | 20.8710 | 20.3964 | 19.7876 | 19.3138 (87) |
| Th 2                                                                        | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 (88) |
| util rest of house                                                          | 0.9907  | 0.9803  | 0.9537  | 0.8720  | 0.7144  | 0.5065  | 0.3412  | 0.3919  | 0.6686  | 0.9195  | 0.9813  | 0.9925 (89)  |
| MIT 2                                                                       | 18.3179 | 18.5984 | 19.0171 | 19.5190 | 19.8480 | 19.9714 | 19.9927 | 19.9900 | 19.9155 | 19.4590 | 18.7872 | 18.2510 (90) |
| Living area fraction                                                        | 18.5162 | 18.7908 | 19.2014 | 19.6969 | 20.0273 | 20.1561 | 20.1802 | 20.1767 | 20.0951 | 19.6351 | 18.9752 | 18.4508 (91) |
| MIT                                                                         | 18.5162 | 18.7908 | 19.2014 | 19.6969 | 20.0273 | 20.1561 | 20.1802 | 20.1767 | 20.0951 | 19.6351 | 18.9752 | 18.4508 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT                                                                | 18.5162 | 18.7908 | 19.2014 | 19.6969 | 20.0273 | 20.1561 | 20.1802 | 20.1767 | 20.0951 | 19.6351 | 18.9752 | 18.4508 (93) |

## 8. Space heating requirement

|                                                                                |           |           |           |           |          |          |          |          |          |               |           |                |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|---------------|-----------|----------------|
|                                                                                | Jan       | Feb       | Mar       | Apr       | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov       | Dec            |
| Utilisation                                                                    | 0.9865    | 0.9733    | 0.9435    | 0.8627    | 0.7162   | 0.5200   | 0.3593   | 0.4108   | 0.6770   | 0.9096        | 0.9748    | 0.9888 (94)    |
| Useful gains                                                                   | 642.6400  | 744.4837  | 822.8400  | 869.9498  | 783.9067 | 566.0755 | 373.0560 | 391.6799 | 577.5549 | 658.1335      | 627.4430  | 613.7295 (95)  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000    | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000    | 4.2000 (96)    |
| Heat loss rate W                                                               | 1491.0219 | 1456.8937 | 1332.1476 | 1132.4011 | 873.3856 | 582.7321 | 375.4939 | 396.1063 | 628.7741 | 947.6209      | 1245.4934 | 1494.6444 (97) |
| Space heating kWh                                                              | 631.1961  | 478.7395  | 378.9248  | 188.9650  | 66.5723  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 215.3786      | 444.9962  | 655.4007 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |          |          |          |          |          |               |           | 3060.1733      |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |           |          |          |          |          |          |               |           | 0.0000         |
| Space heating kWh                                                              | 631.1961  | 478.7395  | 378.9248  | 188.9650  | 66.5723  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 215.3786      | 444.9962  | 655.4007 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |          |          |          |          |          |               |           | 3060.1733      |
| Space heating per m2                                                           |           |           |           |           |          |          |          |          |          | (98c) / (4) = |           | 32.2735 (99)   |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                                                      |          |          |          |          |          |          |          |          |          |          |          |                 |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (201)    |
| Fraction of space heat from main system(s)                                                           |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (202)    |
| Efficiency of main space heating system 1 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 91.7000 (206)   |
| Efficiency of main space heating system 2 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)    |
| Efficiency of secondary/supplementary heating system, %                                              |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)    |
|                                                                                                      | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec             |
| Space heating requirement                                                                            | 631.1961 | 478.7395 | 378.9248 | 188.9650 | 66.5723  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 215.3786 | 444.9962 | 655.4007 (98)   |
| Space heating efficiency (main heating system 1)                                                     | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 91.7000  | 91.7000  | 91.7000 (210)   |
| Space heating fuel (main heating system)                                                             | 688.3273 | 522.0715 | 413.2223 | 206.0686 | 72.5979  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 234.8730 | 485.2740 | 714.7227 (211)  |
| Space heating efficiency (main heating system 2)                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)    |
| Space heating fuel (main heating system 2)                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)    |
| Space heating fuel (secondary)                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)    |
| Water heating                                                                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| Water heating requirement                                                                            | 204.9526 | 180.4725 | 190.2991 | 164.5092 | 157.4266 | 139.6815 | 136.5416 | 143.3578 | 146.4181 | 165.8134 | 179.3286 | 202.4003 (64)   |
| Efficiency of water heater (217)m                                                                    | 88.2759  | 88.2150  | 88.0867  | 87.8101  | 87.3137  | 86.7000  | 86.7000  | 86.7000  | 86.7000  | 87.8742  | 88.1865  | 86.7000 (216)   |
| Fuel for water heating, kWh/month                                                                    | 232.1727 | 204.5824 | 216.0361 | 187.3465 | 180.3001 | 161.1090 | 157.4874 | 165.3492 | 168.8790 | 188.6941 | 203.3516 | 229.2309 (219)  |
| Space cooling fuel requirement                                                                       |          |          |          |          |          |          |          |          |          |          |          |                 |
| (221)m                                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)    |
| Pumps and Fa                                                                                         | 11.2600  | 10.1703  | 11.2600  | 10.8967  | 11.2600  | 10.8967  | 11.2600  | 11.2600  | 10.8967  | 11.2600  | 10.8967  | 11.2600 (231)   |
| Lighting                                                                                             | 24.7371  | 19.8450  | 17.8683  | 13.0911  | 10.1119  | 8.2615   | 9.2244   | 11.9903  | 15.5742  | 20.4341  | 23.0803  | 25.4247 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | -13.8577 | -22.9196 | -39.1412 | -51.1890 | -60.7330 | -58.6935 | -57.5786 | -51.1723 | -40.7967 | -28.6393 | -16.1851 | -11.5083 (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | -3.5626  | -8.8909  | -21.7125 | -39.0614 | -57.5840 | -60.2478 | -58.6981 | -46.0086 | -29.1122 | -13.8994 | -5.0330  | -2.6869 (233b)  |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234b)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235d)   |
| Annual totals kWh/year                                                                               |          |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating fuel - main system 1                                                                   |          |          |          |          |          |          |          |          |          |          |          | 3337.1573 (211) |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)    |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)    |

# Full SAP Calculation Printout



|                                                                                         |                 |  |
|-----------------------------------------------------------------------------------------|-----------------|--|
| Efficiency of water heater                                                              | 86.7000         |  |
| Water heating fuel used                                                                 | 2294.5390 (219) |  |
| Space cooling fuel                                                                      | 0.0000 (221)    |  |
| Electricity for pumps and fans:                                                         |                 |  |
| (MEVDecentralised, Database: total watage = 6.9420, total flow = 45.0000, SFP = 0.1543) |                 |  |
| mechanical ventilation fans (SFP = 0.1543)                                              | 46.5771 (230a)  |  |
| central heating pump                                                                    | 41.0000 (230c)  |  |
| main heating flue fan                                                                   | 45.0000 (230e)  |  |
| Total electricity for the above, kWh/year                                               | 132.5771 (231)  |  |
| Electricity for lighting (calculated in Appendix L)                                     | 199.6429 (232)  |  |
| Energy saving/generation technologies (Appendices M ,N and Q)                           |                 |  |
| PV generation                                                                           | -798.9117 (233) |  |
| Wind generation                                                                         | 0.0000 (234)    |  |
| Hydro-electric generation (Appendix N)                                                  | 0.0000 (235a)   |  |
| Electricity generated - Micro CHP (Appendix N)                                          | 0.0000 (235)    |  |
| Appendix Q - special features                                                           |                 |  |
| Energy saved or generated                                                               | -0.0000 (236)   |  |
| Energy used                                                                             | 0.0000 (237)    |  |
| Total delivered energy for all uses                                                     | 5165.0046 (238) |  |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                                 | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|-------------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1                   | 3337.1573          | 0.2100                        | 700.8030 (261)           |
| Total CO2 associated with community systems     |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                      | 2294.5390          | 0.2100                        | 481.8532 (264)           |
| Space and water heating                         |                    |                               | 1182.6562 (265)          |
| Pumps, fans and electric keep-hot               | 132.5771           | 0.1387                        | 18.3901 (267)            |
| Energy for lighting                             | 199.6429           | 0.1443                        | 28.8146 (268)            |
| Energy saving/generation technologies           |                    |                               |                          |
| PV Unit electricity used in dwelling            | -452.4142          | 0.1318                        | -59.6090                 |
| PV Unit electricity exported                    | -346.4975          | 0.1217                        | -42.1576                 |
| Total                                           |                    |                               | -101.7666 (269)          |
| Total CO2, kg/year                              |                    |                               | 1128.0943 (272)          |
| EPC Dwelling Carbon Dioxide Emission Rate (DER) |                    |                               | 11.9000 (273)            |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1               | 3337.1573          | 1.1300                              | 3770.9878 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 2294.5390          | 1.1300                              | 2592.8291 (278)            |
| Space and water heating                     |                    |                                     | 6363.8169 (279)            |
| Pumps, fans and electric keep-hot           | 132.5771           | 1.5128                              | 200.5626 (281)             |
| Energy for lighting                         | 199.6429           | 1.5338                              | 306.2189 (282)             |
| Energy saving/generation technologies       |                    |                                     |                            |
| PV Unit electricity used in dwelling        | -452.4142          | 1.4868                              | -672.6467                  |
| PV Unit electricity exported                | -346.4975          | 0.4464                              | -154.6730                  |
| Total                                       |                    |                                     | -827.3197 (283)            |
| Total Primary energy kWh/year               |                    |                                     | 6043.2787 (286)            |
| Dwelling Primary energy Rate (DPER)         |                    |                                     | 63.7300 (287)              |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF TARGET EMISSIONS

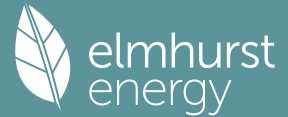
## 1. Overall dwelling characteristics

|                                                        | Area<br>(m2) | Storey height<br>(m)              | Volume<br>(m3)         |
|--------------------------------------------------------|--------------|-----------------------------------|------------------------|
| Main dwelling                                          |              |                                   |                        |
| Ground floor                                           | 47.4100 (1b) | x 2.4600 (2b)                     | = 116.6286 (1b) - (3b) |
| First floor                                            | 47.4100 (1c) | x 2.7600 (2c)                     | = 130.8516 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 94.8200      |                                   | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 247.4802 (5)           |

## 2. Ventilation rate

|                                                                                                    | m3 per hour                |
|----------------------------------------------------------------------------------------------------|----------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)       |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)       |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)       |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)       |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)       |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)       |
| Number of intermittent extract fans                                                                | 3 * 10 = 30.0000 (7a)      |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)       |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)       |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 30.0000 / (5) = 0.1212 (8) |
| Pressure test                                                                                      | Yes                        |
| Pressure Test Method                                                                               | Blower Door                |
| Measured/design AP50                                                                               | 5.0000 (17)                |
| Infiltration rate                                                                                  | 0.3712 (18)                |

# Full SAP Calculation Printout



Number of sides sheltered

2 (19)

Shelter factor

$$(20) = 1 - [0.075 \times (19)] = 0.8500 \quad (20)$$

Infiltration rate adjusted to include shelter factor

$$(21) = (18) \times (20) = 0.3155 \quad (21)$$

|                 | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |       |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|
| Wind speed      | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 | (22)  |
| Wind factor     | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 | (22a) |
| Adj infilt rate |        |        |        |        |        |        |        |        |        |        |        |        |       |
| Effective ac    | 0.4023 | 0.3944 | 0.3865 | 0.3471 | 0.3392 | 0.2998 | 0.2998 | 0.2919 | 0.3155 | 0.3392 | 0.3550 | 0.3708 | (22b) |
|                 | 0.5809 | 0.5778 | 0.5747 | 0.5602 | 0.5575 | 0.5449 | 0.5449 | 0.5426 | 0.5498 | 0.5575 | 0.5630 | 0.5687 | (25)  |

## 3. Heat losses and heat loss parameter

| Element                                        | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K | A x U<br>W/K         | K-value<br>kJ/m2K | A x K<br>kJ/K |       |
|------------------------------------------------|-------------|----------------|---------------|------------------|----------------------|-------------------|---------------|-------|
| Main dwelling                                  |             |                |               |                  |                      |                   |               |       |
| TER Opaque door                                |             |                | 2.2300        | 1.0000           | 2.2300               |                   |               | (26)  |
| TER Opening Type                               |             |                | 15.9800       | 1.1450           | 18.2977              |                   |               | (27)  |
| GF SPVL 125TS P/A                              |             |                | 47.4100       | 0.1300           | 6.1633               |                   |               | (28a) |
| EW Brick AAC011                                | 151.6400    | 18.2100        | 133.4300      | 0.1800           | 24.0174              |                   |               | (29a) |
| PR 500mm MW044                                 | 47.4100     |                | 47.4100       | 0.1100           | 5.2151               |                   |               | (30)  |
| Total net area of external elements Aum(A, m2) |             |                | 246.4600      |                  |                      |                   |               | (31)  |
| Fabric heat loss, W/K = Sum (A x U)            |             |                |               |                  | (26)...(30) + (32) = | 55.9235           |               | (33)  |

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

209.9130 (35)

List of Thermal Bridges

| K1 Element                                                       | Length  | Psi-value | Total   |  |
|------------------------------------------------------------------|---------|-----------|---------|--|
| E2 Other lintels (including other steel lintels)                 | 11.9100 | 0.0500    | 0.5955  |  |
| E3 Sill                                                          | 9.4200  | 0.0500    | 0.4710  |  |
| E4 Jamb                                                          | 22.0500 | 0.0500    | 1.1025  |  |
| E5 Ground floor (normal)                                         | 12.0200 | 0.1600    | 1.9232  |  |
| E6 Intermediate floor within a dwelling                          | 29.0500 | 0.0000    | 0.0000  |  |
| E10 Eaves (insulation at ceiling level)                          | 9.1500  | 0.0600    | 0.5490  |  |
| E18 Party wall between dwellings                                 | 0.0000  | 0.0600    | 0.0000  |  |
| E4 Jamb                                                          | 4.2000  | 0.0500    | 0.2100  |  |
| E2 Other lintels (including other steel lintels)                 | 1.0600  | 0.0500    | 0.0530  |  |
| P1 Party wall - Ground floor                                     | 0.0000  | 0.0800    | 0.0000  |  |
| P2 Party wall - Intermediate floor within a dwelling             | 0.0000  | 0.0000    | 0.0000  |  |
| P4 Party wall - Roof (insulation at ceiling level)               | 0.0000  | 0.1200    | 0.0000  |  |
| E5 Ground floor (normal)                                         | 17.0300 | 0.1600    | 2.7248  |  |
| E12 Gable (insulation at ceiling level)                          | 19.9000 | 0.0600    | 1.1940  |  |
| E16 Corner (normal)                                              | 26.1000 | 0.0900    | 2.3490  |  |
| E17 Corner (inverted - internal area greater than external area) | 5.2200  | -0.0900   | -0.4698 |  |

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

10.7022 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

$$(33) + (36) + (36a) = 66.6257 \quad (37)$$

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

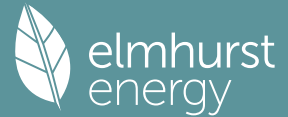
|                           | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |      |
|---------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| (38)m                     | 47.4434  | 47.1868  | 46.9352  | 45.7537  | 45.5326  | 44.5035  | 44.5035  | 44.3129  | 44.8999  | 45.5326  | 45.9798  | 46.4474  | (38) |
| Heat transfer coeff       | 114.0692 | 113.8125 | 113.5609 | 112.3794 | 112.1583 | 111.1292 | 111.1292 | 110.9386 | 111.5256 | 112.1583 | 112.6055 | 113.0731 | (39) |
| Average = Sum(39)m / 12 = |          |          |          |          |          |          |          |          |          |          |          | 112.3783 |      |

|               | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |      |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| HLP           | 1.2030 | 1.2003 | 1.1976 | 1.1852 | 1.1829 | 1.1720 | 1.1720 | 1.1700 | 1.1762 | 1.1829 | 1.1876 | 1.1925 | (40) |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 1.1852 |      |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31     |      |

## 4. Water heating energy requirements (kWh/year)

|                                                                                |          |          |          |          |          |          |          |          |          |          |          |           |             |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-------------|
| Assumed occupancy                                                              |          |          |          |          |          |          |          |          |          |          |          |           | 2.6861 (42) |
| Hot water usage for mixer showers                                              |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 69.2572                                                                        | 68.2164  | 66.6997  | 63.7979  | 61.6564  | 59.2683  | 57.9108  | 59.4160  | 61.0660  | 63.6301  | 66.5943  | 68.9918  | 68.9918   | (42a)       |
| Hot water usage for baths                                                      |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 29.9061                                                                        | 29.4619  | 28.8365  | 27.6833  | 26.8197  | 25.8622  | 25.3450  | 25.9661  | 26.6424  | 27.6669  | 28.8439  | 29.8050  | 29.8050   | (42b)       |
| Hot water usage for other uses                                                 |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 42.1386                                                                        | 40.6063  | 39.0739  | 37.5416  | 36.0093  | 34.4770  | 34.4770  | 36.0093  | 37.5416  | 39.0739  | 40.6063  | 42.1386  | 42.1386   | (42c)       |
| Average daily hot water use (litres/day)                                       |          |          |          |          |          |          |          |          |          |          |          | 129.8883  | (43)        |
| Daily hot water use                                                            |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 141.3019                                                                       | 138.2846 | 134.6102 | 129.0228 | 124.4855 | 119.6075 | 117.7329 | 121.3914 | 125.2500 | 130.3710 | 136.0444 | 140.9354 | 140.9354  | (44)        |
| Energy conte                                                                   | 223.7876 | 196.9154 | 206.8908 | 176.6258 | 167.5814 | 147.0714 | 142.3877 | 150.3080 | 154.4457 | 176.9122 | 193.8202 | 220.6708  | (45)        |
| Energy content (annual)                                                        |          |          |          |          |          |          |          |          |          |          |          |           |             |
| Distribution loss (46)m = 0.15 x (45)m                                         |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 33.5681                                                                        | 29.5373  | 31.0336  | 26.4939  | 25.1372  | 22.0607  | 21.3582  | 22.5462  | 23.1669  | 26.5368  | 29.0730  | 33.1006  | 33.1006   | (46)        |
| Water storage loss (or HIU loss):                                              |          |          |          |          |          |          |          |          |          |          |          |           |             |
| Total storage loss                                                             |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (56)        |
| If cylinder contains dedicated solar storage                                   |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (57)        |
| Primary loss                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (59)        |
| Combi loss                                                                     | 50.9589  | 46.0274  | 50.9589  | 49.3151  | 50.9589  | 49.3151  | 50.9589  | 50.9589  | 49.3151  | 50.9589  | 49.3151  | 50.9589   | (61)        |
| Total heat required for water heating calculated for each month                |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 274.7465                                                                       | 242.9428 | 257.8497 | 225.9408 | 218.5403 | 196.3865 | 193.3466 | 201.2669 | 203.7608 | 227.8711 | 243.1353 | 271.6297 | 271.6297  | (62)        |
| WWHRS                                                                          | -31.6615 | -28.0017 | -29.3218 | -24.2796 | -22.6277 | -19.3627 | -18.1494 | -19.3001 | -20.0334 | -23.6171 | -26.7553 | -31.0752  | (63a)       |
| PV diverter                                                                    | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000   | (63b)       |
| Solar input                                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (63c)       |
| FGHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (63d)       |
| Output from w/h                                                                |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 243.0850                                                                       | 214.9411 | 228.5280 | 201.6613 | 195.9126 | 177.0238 | 175.1972 | 181.9668 | 183.7274 | 204.2540 | 216.3800 | 240.5545 | 240.5545  | (64)        |
| Total per year (kWh/year)                                                      |          |          |          |          |          |          |          |          |          |          |          | 2463.2317 | (64)        |
| Electric shower(s)                                                             |          |          |          |          |          |          |          |          |          |          |          | 2463      | (64)        |
| 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (64a)       |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (64a)       |
| Heat gains from water heating, kWh/month                                       |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 87.1491                                                                        | 76.9812  | 81.5309  | 71.0568  | 68.4605  | 61.2300  | 60.0836  | 62.7171  | 63.6820  | 71.5630  | 76.7740  | 86.1128  | 86.1128   | (65)        |

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## 5. Internal gains (see Table 5 and 5a)

| Metabolic gains (Table 5), Watts                                                    |           |           |           |           |           |           |           |           |           |           |           |                |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
|                                                                                     | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec            |
| (66)m                                                                               | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 129.0440  | 142.8702  | 129.0440  | 133.3455  | 129.0440  | 133.3455  | 129.0440  | 129.0440  | 133.3455  | 129.0440  | 133.3455  | 129.0440 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 247.6715  | 250.2415  | 243.7651  | 229.9774  | 212.5731  | 196.2154  | 185.2875  | 182.7174  | 189.1939  | 202.9815  | 220.3859  | 236.7435 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306 (69)   |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 3.0000    | 3.0000    | 3.0000 (70)    |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 (71) |
| Water heating gains (Table 5)                                                       | 117.1359  | 114.5554  | 109.5846  | 98.6901   | 92.0169   | 85.0417   | 80.7576   | 84.2972   | 88.4472   | 96.1869   | 106.6306  | 115.7430 (72)  |
| Total internal gains                                                                | 560.1432  | 573.9589  | 548.6855  | 528.3048  | 499.9258  | 477.8944  | 458.3809  | 459.3505  | 474.2784  | 494.5042  | 526.6538  | 547.8224 (73)  |

## 6. Solar gains

| [Jan]       | Area<br>m2 |          | Solar flux<br>Table 6a<br>W/m2 |          | Specific data<br>or Table 6b |           | Specific data<br>or Table 6c |          | Access<br>factor<br>Table 6d |          | Gains<br>W   |               |
|-------------|------------|----------|--------------------------------|----------|------------------------------|-----------|------------------------------|----------|------------------------------|----------|--------------|---------------|
| North       | 1.3900     |          | 10.6334                        |          | 0.6300                       |           | 0.7000                       |          | 0.7700                       |          | 4.5171 (74)  |               |
| East        | 9.3400     |          | 19.6403                        |          | 0.6300                       |           | 0.7000                       |          | 0.7700                       |          | 56.0617 (76) |               |
| West        | 5.2500     |          | 19.6403                        |          | 0.6300                       |           | 0.7000                       |          | 0.7700                       |          | 31.5122 (80) |               |
| Solar gains | 92.0909    | 179.9454 | 296.7967                       | 435.0285 | 536.0078                     | 550.1864  | 523.1742                     | 447.3175 | 345.7630                     | 213.5531 | 114.7667     | 75.7821 (83)  |
| Total gains | 652.2342   | 753.9043 | 845.4822                       | 963.3333 | 1035.9336                    | 1028.0808 | 981.5552                     | 906.6680 | 820.0414                     | 708.0573 | 641.4205     | 623.6045 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |                           |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |                           |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |                           |         |         |         |         |         |         |         |         |         |         |              |
|                                                                             | Jan                       | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| tau                                                                         | 48.4695                   | 48.5788 | 48.6864 | 49.1983 | 49.2953 | 49.7518 | 49.7518 | 49.8372 | 49.5749 | 49.2953 | 49.0995 | 48.8965      |
| alpha                                                                       | 4.2313                    | 4.2386  | 4.2458  | 4.2799  | 4.2864  | 4.3168  | 4.3168  | 4.3225  | 4.3050  | 4.2864  | 4.2733  | 4.2598       |
| util living area                                                            | 0.9929                    | 0.9862  | 0.9704  | 0.9204  | 0.8136  | 0.6412  | 0.4855  | 0.5413  | 0.7848  | 0.9502  | 0.9868  | 0.9941 (86)  |
| MIT                                                                         | 19.3900                   | 19.6049 | 19.9409 | 20.3919 | 20.7425 | 20.9330 | 20.9840 | 20.9748 | 20.8379 | 20.3652 | 19.8025 | 19.3578 (87) |
| Th 2                                                                        | 19.9176                   | 19.9198 | 19.9219 | 19.9319 | 19.9337 | 19.9425 | 19.9425 | 19.9441 | 19.9391 | 19.9337 | 19.9300 | 19.9260 (88) |
| util rest of house                                                          | 0.9909                    | 0.9824  | 0.9618  | 0.8971  | 0.7616  | 0.5534  | 0.3749  | 0.4269  | 0.7082  | 0.9307  | 0.9825  | 0.9925 (89)  |
| MIT 2                                                                       | 18.0524                   | 18.3270 | 18.7523 | 19.3125 | 19.7117 | 19.9015 | 19.9367 | 19.9340 | 19.8227 | 19.2937 | 18.5873 | 18.0171 (90) |
| Living area fraction                                                        | fLA = Living area / (4) = |         |         |         |         |         |         |         |         |         |         |              |
| MIT                                                                         | 18.3038                   | 18.5672 | 18.9757 | 19.5154 | 19.9055 | 20.0953 | 20.1335 | 20.1296 | 20.0135 | 19.4951 | 18.8157 | 18.2690 (92) |
| Temperature adjustment                                                      | 0.0000                    |         |         |         |         |         |         |         |         |         |         |              |
| adjusted MIT                                                                | 18.3038                   | 18.5672 | 18.9757 | 19.5154 | 19.9055 | 20.0953 | 20.1335 | 20.1296 | 20.0135 | 19.4951 | 18.8157 | 18.2690 (93) |

## 8. Space heating requirement

|                                                                                |           |           |           |           |          |          |          |          |          |          |           |                            |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|-----------|----------------------------|
|                                                                                | Jan       | Feb       | Mar       | Apr       | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov       | Dec                        |
| Utilisation                                                                    | 0.9865    | 0.9755    | 0.9517    | 0.8861    | 0.7600   | 0.5669   | 0.3954   | 0.4479   | 0.7143   | 0.9202   | 0.9759    | 0.9887 (94)                |
| Useful gains                                                                   | 643.4337  | 735.4530  | 804.6723  | 853.5646  | 787.3204 | 582.7679 | 388.1262 | 406.0655 | 585.7470 | 651.5661 | 625.9534  | 616.5337 (95)              |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000    | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000  | 7.1000    | 4.2000 (96)                |
| Heat loss rate W                                                               | 1597.3991 | 1555.4938 | 1416.7504 | 1192.9499 | 920.3098 | 610.6922 | 392.6753 | 413.7589 | 659.5076 | 997.6608 | 1319.2475 | 1590.8306 (97)             |
| Space heating kWh                                                              | 709.7502  | 551.0674  | 455.3861  | 244.3574  | 98.9441  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 257.4944 | 499.1717  | 724.8769 (98a)             |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |          |          |          |          |          |          |           | 3541.0483                  |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000 (98b)               |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |           |          |          |          |          |          |          |           | 0.0000                     |
| Space heating kWh                                                              | 709.7502  | 551.0674  | 455.3861  | 244.3574  | 98.9441  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 257.4944 | 499.1717  | 724.8769 (98c)             |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |          |          |          |          |          |          |           | 3541.0483                  |
| Space heating per m2                                                           |           |           |           |           |          |          |          |          |          |          |           | (98c) / (4) = 37.3450 (99) |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                       |          |          |          |          |          |          |          |          |          |          |          |                |
|-----------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| Fraction of space heat from secondary/supplementary system (Table 11) |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (201)   |
| Fraction of space heat from main system(s)                            |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (202)   |
| Efficiency of main space heating system 1 (in %)                      |          |          |          |          |          |          |          |          |          |          |          | 92.4000 (206)  |
| Efficiency of main space heating system 2 (in %)                      |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)   |
| Efficiency of secondary/supplementary heating system, %               |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)   |
|                                                                       | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec            |
| Space heating requirement                                             | 709.7502 | 551.0674 | 455.3861 | 244.3574 | 98.9441  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 257.4944 | 499.1717 | 724.8769 (98)  |
| Space heating efficiency (main heating system 1)                      | 92.4000  | 92.4000  | 92.4000  | 92.4000  | 92.4000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 92.4000  | 92.4000  | 92.4000 (210)  |
| Space heating fuel (main heating system)                              | 768.1280 | 596.3933 | 492.8421 | 264.4561 | 107.0823 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 278.6736 | 540.2292 | 784.4988 (211) |
| Space heating efficiency (main heating system 2)                      | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)   |
| Space heating fuel (main heating system 2)                            | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)   |
| Space heating fuel (secondary)                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)   |
| Water heating                                                         |          |          |          |          |          |          |          |          |          |          |          |                |
| Water heating requirement                                             | 243.0850 | 214.9411 | 228.5280 | 201.6613 | 195.9126 | 177.0238 | 175.1972 | 181.9668 | 183.7274 | 204.2540 | 216.3800 | 240.5545 (64)  |
| Efficiency of water heater                                            |          |          |          |          |          |          |          |          |          |          |          | 80.3000 (216)  |

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|                                                                                                      |          |          |           |           |           |           |           |           |           |          |          |            |        |
|------------------------------------------------------------------------------------------------------|----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|----------|------------|--------|
| (217)m                                                                                               | 86.5356  | 86.3063  | 85.8285   | 84.7940   | 82.9942   | 80.3000   | 80.3000   | 80.3000   | 80.3000   | 84.8789  | 86.1112  | 86.5893    | (217)  |
| Fuel for water heating, kWh/month                                                                    | 280.9075 | 249.0444 | 266.2612  | 237.8249  | 236.0559  | 220.4530  | 218.1783  | 226.6087  | 228.8013  | 240.6417 | 251.2797 | 277.8108   | (219)  |
| Space cooling fuel requirement                                                                       |          |          |           |           |           |           |           |           |           |          |          |            |        |
| (221)m                                                                                               | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (221)  |
| Pumps and Fa                                                                                         | 7.3041   | 6.5973   | 7.3041    | 7.0685    | 7.3041    | 7.0685    | 7.3041    | 7.0685    | 7.3041    | 7.0685   | 7.3041   | 7.0685     | (231)  |
| Lighting                                                                                             | 26.8128  | 21.5102  | 19.3676   | 14.1895   | 10.9604   | 8.9547    | 9.9984    | 12.9963   | 16.8810   | 22.1487  | 25.0169  | 27.5580    | (232)  |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |           |           |           |           |           |           |           |          |          |            |        |
| (233a)m                                                                                              | -43.5998 | -61.0812 | -87.2451  | -97.4418  | -104.5021 | -97.3059  | -96.0664  | -90.9480  | -81.8609  | -69.5024 | -47.7811 | -37.7370   | (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |           |           |           |           |           |           |           |          |          |            |        |
| (234a)m                                                                                              | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (234a) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |           |           |           |           |           |           |           |          |          |            |        |
| (235a)m                                                                                              | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (235a) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |           |           |           |           |           |           |           |          |          |            |        |
| (235c)m                                                                                              | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (235c) |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |           |           |           |           |           |           |           |          |          |            |        |
| (233b)m                                                                                              | -25.8178 | -54.1746 | -107.4389 | -161.0389 | -212.6397 | -213.5772 | -211.0977 | -178.8993 | -131.3221 | -77.4059 | -34.4448 | -20.4294   | (233b) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |           |           |           |           |           |           |           |          |          |            |        |
| (234b)m                                                                                              | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (234b) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |           |           |           |           |           |           |           |          |          |            |        |
| (235b)m                                                                                              | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (235b) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |           |           |           |           |           |           |           |          |          |            |        |
| (235d)m                                                                                              | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (235d) |
| Annual totals kWh/year                                                                               |          |          |           |           |           |           |           |           |           |          |          |            |        |
| Space heating fuel - main system 1                                                                   |          |          |           |           |           |           |           |           |           |          |          | 3832.3034  | (211)  |
| Space heating fuel - main system 2                                                                   |          |          |           |           |           |           |           |           |           |          |          | 0.0000     | (213)  |
| Space heating fuel - secondary                                                                       |          |          |           |           |           |           |           |           |           |          |          | 0.0000     | (215)  |
| Efficiency of water heater                                                                           |          |          |           |           |           |           |           |           |           |          |          | 80.3000    |        |
| Water heating fuel used                                                                              |          |          |           |           |           |           |           |           |           |          |          | 2933.8675  | (219)  |
| Space cooling fuel                                                                                   |          |          |           |           |           |           |           |           |           |          |          | 0.0000     | (221)  |
| Electricity for pumps and fans:                                                                      |          |          |           |           |           |           |           |           |           |          |          |            |        |
| Total electricity for the above, kWh/year                                                            |          |          |           |           |           |           |           |           |           |          |          | 86.0000    | (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |          |          |           |           |           |           |           |           |           |          |          | 216.3947   | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |          |           |           |           |           |           |           |           |          |          |            |        |
| PV generation                                                                                        |          |          |           |           |           |           |           |           |           |          |          | -2343.3580 | (233)  |
| Wind generation                                                                                      |          |          |           |           |           |           |           |           |           |          |          | 0.0000     | (234)  |
| Hydro-electric generation (Appendix N)                                                               |          |          |           |           |           |           |           |           |           |          |          | 0.0000     | (235a) |
| Electricity generated - Micro CHP (Appendix N)                                                       |          |          |           |           |           |           |           |           |           |          |          | 0.0000     | (235)  |
| Appendix Q - special features                                                                        |          |          |           |           |           |           |           |           |           |          |          |            |        |
| Energy saved or generated                                                                            |          |          |           |           |           |           |           |           |           |          |          | -0.0000    | (236)  |
| Energy used                                                                                          |          |          |           |           |           |           |           |           |           |          |          | 0.0000     | (237)  |
| Total delivered energy for all uses                                                                  |          |          |           |           |           |           |           |           |           |          |          | 4725.2075  | (238)  |

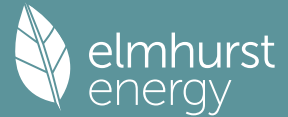
## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                               | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|-----------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1                 | 3832.3034          | 0.2100                        | 804.7837 (261)           |
| Total CO2 associated with community systems   |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                    | 2933.8675          | 0.2100                        | 616.1122 (264)           |
| Space and water heating                       |                    |                               | 1420.8959 (265)          |
| Pumps, fans and electric keep-hot             | 86.0000            | 0.1387                        | 11.9293 (267)            |
| Energy for lighting                           | 216.3947           | 0.1443                        | 31.2324 (268)            |
| Energy saving/generation technologies         |                    |                               |                          |
| PV Unit electricity used in dwelling          | -915.0717          | 0.1347                        | -123.2884                |
| PV Unit electricity exported                  | -1428.2863         | 0.1260                        | -179.8958                |
| Total                                         |                    |                               | -303.1842 (269)          |
| Total CO2, kg/year                            |                    |                               | 1160.8734 (272)          |
| EPC Target Carbon Dioxide Emission Rate (TER) |                    |                               | 12.2400 (273)            |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1               | 3832.3034          | 1.1300                              | 4330.5028 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 2933.8675          | 1.1300                              | 3315.2703 (278)            |
| Space and water heating                     |                    |                                     | 7645.7731 (279)            |
| Pumps, fans and electric keep-hot           | 86.0000            | 1.5128                              | 130.1008 (281)             |
| Energy for lighting                         | 216.3947           | 1.5338                              | 331.9134 (282)             |
| Energy saving/generation technologies       |                    |                                     |                            |
| PV Unit electricity used in dwelling        | -915.0717          | 1.4980                              | -1370.7323                 |
| PV Unit electricity exported                | -1428.2863         | 0.4623                              | -660.3444                  |
| Total                                       |                    |                                     | -2031.0766 (283)           |
| Total Primary energy kWh/year               |                    |                                     | 6076.7106 (286)            |
| Target Primary Energy Rate (TPER)           |                    |                                     | 64.0900 (287)              |

# Full SAP Calculation Printout



|                                    |                                                          |               |               |                |            |
|------------------------------------|----------------------------------------------------------|---------------|---------------|----------------|------------|
| Plot Reference                     | 4907-R823-9471-001                                       |               |               | Issued on Date | 21/07/2026 |
| Assessment Reference               | Plot 1                                                   | Plot Type Ref | Bosworth-Semi |                |            |
| Plot Address                       | Plot 1, Bosworth-Semi, K, WC, B, ES, 1012                |               |               | SAP Version    | 10.2       |
| SAP Rating                         | 90 B                                                     | DER           | 11.90         | TER            | 12.24      |
| Environmental                      | 90 B                                                     | % DER < TER   |               | 2.78           |            |
| CO <sub>2</sub> Emissions (t/year) | 0.99                                                     | DFEE          | 40.21         | TFEE           | 42.82      |
| Compliance Check                   | See BREL                                                 | % DFEE < TFEE |               | 6.10           |            |
| % DPER < TPER                      | 0.56                                                     | DPER          | 63.73         | TPER           | 64.09      |
| Assessor Details                   | Mr. Daniel Harris                                        |               |               | Assessor ID    | R823-0001  |
| Client                             | Crest Nicholson Head Office, Crest Nicholson Head Office |               |               |                |            |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF ENERGY RATING

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)            | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Main dwelling                                          |                           |                                 |                             |
| Ground floor                                           | 47.4100 (1b)              | x 2.4600 (2b)                   | = 116.6286 (1b) - (3b)      |
| First floor                                            | 47.4100 (1c)              | x 2.7600 (2c)                   | = 130.8516 (1c) - (3c)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 94.8200                   |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 247.4802 (5)              |

## 2. Ventilation rate

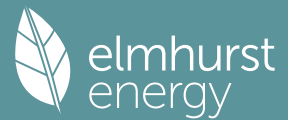
|                                                                                                    | m <sup>3</sup> per hour                 |
|----------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                    |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                    |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                    |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                    |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                    |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                    |
| Number of intermittent extract fans                                                                | 0 * 10 = 0.0000 (7a)                    |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)                    |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 0.0000 / (5) = 0.0000 (8)               |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 4.5000 (17)                             |
| Infiltration rate                                                                                  | 0.2250 (18)                             |
| Number of sides sheltered                                                                          | 2 (19)                                  |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 0.8500 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.1913 (21)        |

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor                                                                                             | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate                                                                                         | 0.2438 | 0.2391 | 0.2343 | 0.2104 | 0.2056 | 0.1817 | 0.1817 | 0.1769 | 0.1913 | 0.2056 | 0.2152 | 0.2247 (22b) |
| Mechanical extract ventilation - decentralised                                                          |        |        |        |        |        |        |        |        |        |        |        |              |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 (25)  |

## 3. Heat losses and heat loss parameter

| Element                                                      | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K   |
|--------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|-----------------|
| Main dwelling                                                |                         |                            |                           |                               |              |                                |                 |
| Front Door                                                   |                         |                            | 2.2300                    | 1.2000                        | 2.6760       |                                | (26)            |
| Windows                                                      |                         |                            | 10.7600                   | 1.2357                        | 13.2966      |                                | (27)            |
| French Doors                                                 |                         |                            | 5.2200                    | 1.2357                        | 6.4506       |                                | (27)            |
| GF SPVL 125TS P/A                                            |                         |                            | 47.4100                   | 0.1300                        | 6.1633       | 75.0000                        | 3555.7500 (28a) |
| EW Brick AAC011                                              | 151.6400                | 18.2100                    | 133.4300                  | 0.1800                        | 24.0174      | 60.0000                        | 8005.8000 (29a) |
| PR 500mm MW044                                               | 47.4100                 |                            | 47.4100                   | 0.0900                        | 4.2669       | 9.0000                         | 426.6900 (30)   |
| Total net area of external elements Aum (A, m <sup>2</sup> ) |                         |                            | 246.4600                  |                               |              |                                | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                          |                         |                            |                           | (26)...(30) + (32) =          | 56.8707      |                                | (33)            |
| Main dwelling                                                |                         |                            |                           |                               |              |                                |                 |
| Timber - GF                                                  |                         |                            | 24.2600                   |                               |              | 9.0000                         | 218.3400 (32c)  |
| Timber - FF                                                  |                         |                            | 140.7000                  |                               |              | 9.0000                         | 1266.3000 (32c) |
| Masonry GF                                                   |                         |                            | 51.5100                   |                               |              | 100.0000                       | 5151.0000 (32c) |
| Internal Floor FF                                            |                         |                            | 47.4100                   |                               |              | 18.0000                        | 853.3800 (32d)  |
| Internal Ceiling GF                                          |                         |                            | 47.4100                   |                               |              | 9.0000                         | 426.6900 (32e)  |

# Full SAP Calculation Printout



Heat capacity  $C_m = \text{Sum}(A \times k)$   
Thermal mass parameter (TMP =  $C_m / \text{TFA}$ ) in  $\text{kJ/m}^2\text{K}$  (28)...(30) + (32) + (32a)...(32e) = 19903.9500 (34)  
List of Thermal Bridges 209.9130 (35)

|                                                                  | Length  | Psi-value | Total   |
|------------------------------------------------------------------|---------|-----------|---------|
| K1 Element                                                       |         |           |         |
| E2 Other lintels (including other steel lintels)                 | 11.9100 | 0.0410    | 0.4883  |
| E3 Sill                                                          | 9.4200  | 0.0220    | 0.2072  |
| E4 Jamb                                                          | 22.0500 | 0.0190    | 0.4189  |
| E5 Ground floor (normal)                                         | 12.0200 | 0.0928    | 1.1155  |
| E6 Intermediate floor within a dwelling                          | 29.0500 | 0.0020    | 0.0581  |
| E10 Eaves (insulation at ceiling level)                          | 9.1500  | 0.0390    | 0.3569  |
| E18 Party wall between dwellings                                 | 0.0000  | 0.0300    | 0.0000  |
| E4 Jamb                                                          | 4.2000  | 0.1000    | 0.4200  |
| E2 Other lintels (including other steel lintels)                 | 1.0600  | 0.0410    | 0.0435  |
| P1 Party wall - Ground floor                                     | 0.0000  | 0.1000    | 0.0000  |
| P2 Party wall - Intermediate floor within a dwelling             | 0.0000  | 0.0000    | 0.0000  |
| P4 Party wall - Roof (insulation at ceiling level)               | 0.0000  | 0.0350    | 0.0000  |
| E5 Ground floor (normal)                                         | 17.0300 | 0.0980    | 1.6689  |
| E12 Gable (insulation at ceiling level)                          | 19.9000 | 0.0870    | 1.7313  |
| E16 Corner (normal)                                              | 26.1000 | 0.0420    | 1.0962  |
| E17 Corner (inverted - internal area greater than external area) | 5.2200  | -0.0820   | -0.4280 |

Thermal bridges ( $\text{Sum}(L \times \text{Psi})$ ) calculated using Appendix K) 7.1768 (36)  
Point Thermal bridges (36a) = 0.0000  
Total fabric heat loss (33) + (36) + (36a) = 64.0475 (37)

|                                                                                        |          |          |          |          |          |          |          |          |          |          |          |          |
|----------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)\text{m} \times (5)$ |          |          |          |          |          |          |          |          |          |          |          |          |
| (38)m                                                                                  | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |
| Heat transfer coeff                                                                    | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  |
| Average = $\text{Sum}(39)\text{m} / 12 =$                                              | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 |
| HLP                                                                                    | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   |
| HLP (average)                                                                          |          |          |          |          |          |          |          |          |          |          |          |          |
| Days in mont                                                                           | 31       | 28       | 31       | 30       | 31       | 30       | 31       | 31       | 30       | 31       | 30       | 31       |

## 4. Water heating energy requirements (kWh/year)

|                                                                                                |          |          |          |          |          |          |          |          |          |          |          |          |               |
|------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Assumed occupancy                                                                              |          |          |          |          |          |          |          |          |          |          |          |          | 2.6861 (42)   |
| Hot water usage for mixer showers                                                              | 69.2572  | 68.2164  | 66.6997  | 63.7979  | 61.6564  | 59.2683  | 57.9108  | 59.4160  | 61.0660  | 63.6301  | 66.5943  | 68.9918  | (42a)         |
| Hot water usage for baths                                                                      | 29.9061  | 29.4619  | 28.8365  | 27.6833  | 26.8197  | 25.8622  | 25.3450  | 25.9661  | 26.6424  | 27.6669  | 28.8439  | 29.8050  | (42b)         |
| Hot water usage for other uses                                                                 | 42.1386  | 40.6063  | 39.0739  | 37.5416  | 36.0093  | 34.4770  | 34.4770  | 36.0093  | 37.5416  | 39.0739  | 40.6063  | 42.1386  | (42c)         |
| Average daily hot water use (litres/day)                                                       |          |          |          |          |          |          |          |          |          |          |          |          | 129.8883 (43) |
| Daily hot water use                                                                            | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |               |
| Energy conte                                                                                   | 141.3019 | 138.2846 | 134.6102 | 129.0228 | 124.4855 | 119.6075 | 117.7329 | 121.3914 | 125.2500 | 130.3710 | 136.0444 | 140.9354 | (44)          |
| Energy content (annual)                                                                        | 223.7876 | 196.9154 | 206.8908 | 176.6258 | 167.5814 | 147.0714 | 142.3877 | 150.3080 | 154.4457 | 176.9122 | 193.8202 | 220.6708 | (45)          |
| Distribution loss (46)m = $0.15 \times (45)\text{m}$                                           | 33.5681  | 29.5373  | 31.0336  | 26.4939  | 25.1372  | 22.0607  | 21.3582  | 22.5462  | 23.1669  | 26.5368  | 29.0730  | 33.1006  | (46)          |
| Water storage loss (or HIU loss):                                                              |          |          |          |          |          |          |          |          |          |          |          |          |               |
| Total storage loss                                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (56)          |
| If cylinder contains dedicated solar storage                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (57)          |
| Primary loss                                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (59)          |
| Combi loss                                                                                     | 12.0010  | 10.8287  | 11.9655  | 11.5300  | 11.8830  | 11.4679  | 11.8301  | 11.8467  | 11.4834  | 11.9026  | 11.5661  | 11.9945  | (61)          |
| Total heat required for water heating calculated for each month                                | 235.7886 | 207.7441 | 218.8564 | 188.1558 | 179.4644 | 158.5393 | 154.2178 | 162.1547 | 165.9291 | 188.8148 | 205.3864 | 232.6653 | (62)          |
| WWHRS                                                                                          | -30.8360 | -27.2716 | -28.5573 | -23.6466 | -22.0378 | -18.8579 | -17.6762 | -18.7969 | -19.5111 | -23.0014 | -26.0578 | -30.2650 | (63a)         |
| PV diverter                                                                                    | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | (63b)         |
| Solar input                                                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (63c)         |
| FGHRS                                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (63d)         |
| Output from w/h                                                                                | 204.9526 | 180.4725 | 190.2991 | 164.5092 | 157.4266 | 139.6815 | 136.5416 | 143.3578 | 146.4181 | 165.8134 | 179.3286 | 202.4003 | (64)          |
| Electric shower(s)                                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (64a)         |
| Heat gains from water heating, kWh/month                                                       | 77.4096  | 68.1815  | 71.7826  | 61.6106  | 58.6916  | 51.7682  | 50.3014  | 52.9391  | 54.2241  | 61.7990  | 67.3368  | 76.3717  | (65)          |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = $\text{Sum}(64a)\text{m} =$ |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (64a)  |

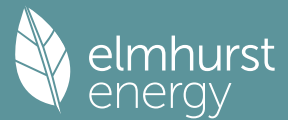
## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |           |           |           |           |           |           |           |           |           |           |           |           |      |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------|
| Metabolic gains (Table 5), Watts                                                    | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec       |      |
| (66)m                                                                               | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 28.2615   | 25.1016   | 20.4140   | 15.4547   | 11.5526   | 9.7532    | 10.5387   | 13.6985   | 18.3862   | 23.3454   | 27.2476   | 29.0470   | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 369.6589  | 373.4948  | 363.8284  | 343.2499  | 317.2732  | 292.8588  | 276.5485  | 272.7126  | 282.3789  | 302.9575  | 328.9341  | 353.3486  | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | (69) |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 3.0000    | 3.0000    | 3.0000    | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | (71) |
| Water heating gains (Table 5)                                                       | 104.0452  | 101.4606  | 96.4820   | 85.5702   | 78.8865   | 71.9003   | 67.6095   | 71.1547   | 75.3112   | 83.0631   | 93.5233   | 102.6501  | (72) |
| Total internal gains                                                                | 612.4909  | 610.5823  | 591.2497  | 554.8002  | 518.2376  | 482.0376  | 462.2219  | 465.0911  | 483.6016  | 519.8913  | 560.2303  | 595.5709  | (73) |

## 6. Solar gains

| [Jan] | Area<br>m <sup>2</sup> | Solar flux<br>Table 6a<br>W/m <sup>2</sup> | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W |
|-------|------------------------|--------------------------------------------|-----------------------------------|------------------------------------|------------------------------|------------|
|-------|------------------------|--------------------------------------------|-----------------------------------|------------------------------------|------------------------------|------------|

# Full SAP Calculation Printout



|       |  |  |        |  |         |  |        |  |        |  |        |  |              |
|-------|--|--|--------|--|---------|--|--------|--|--------|--|--------|--|--------------|
| North |  |  | 1.3900 |  | 10.6334 |  | 0.4500 |  | 0.0000 |  | 0.7700 |  | 5.1214 (74)  |
| East  |  |  | 4.1200 |  | 19.6403 |  | 0.4500 |  | 0.0000 |  | 0.7700 |  | 28.0380 (76) |
| West  |  |  | 5.2500 |  | 19.6403 |  | 0.4500 |  | 0.0000 |  | 0.7700 |  | 35.7281 (80) |
| East  |  |  | 5.2200 |  | 19.6403 |  | 0.4500 |  | 0.0000 |  | 0.7700 |  | 35.5239 (76) |

|             |          |          |          |           |           |           |           |          |          |          |          |  |               |
|-------------|----------|----------|----------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|--|---------------|
| Solar gains | 104.4115 | 204.0197 | 336.5042 | 493.2296  | 607.7185  | 623.7941  | 593.1680  | 507.1627 | 392.0216 | 242.1237 | 130.1210 |  | 85.9208 (83)  |
| Total gains | 716.9024 | 814.6021 | 927.7539 | 1048.0298 | 1125.9562 | 1105.8317 | 1055.3899 | 972.2538 | 875.6232 | 762.0150 | 690.3513 |  | 681.4917 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |         |                           |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |                           |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |         |                           |         |         |              |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct                       | Nov     | Dec     |              |
| tau                                                                         | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153                   | 52.7153 | 52.7153 |              |
| alpha                                                                       | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144                    | 4.5144  | 4.5144  |              |
| util living area                                                            | 0.9895  | 0.9804  | 0.9552  | 0.8874  | 0.7555  | 0.5802  | 0.4313  | 0.4854  | 0.7332  | 0.9307                    | 0.9817  | 0.9915  | (86)         |
| MIT                                                                         | 19.4652 | 19.6894 | 20.0654 | 20.5007 | 20.8163 | 20.9564 | 20.9908 | 20.9845 | 20.8797 | 20.4381                   | 19.8511 | 19.4003 | (87)         |
| Th 2                                                                        | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958                   | 19.9958 | 19.9958 | (88)         |
| util rest of house                                                          | 0.9866  | 0.9752  | 0.9433  | 0.8587  | 0.7005  | 0.4993  | 0.3358  | 0.3846  | 0.6556  | 0.9063                    | 0.9759  | 0.9892  | (89)         |
| MIT 2                                                                       | 18.4217 | 18.6732 | 19.0900 | 19.5536 | 19.8594 | 19.9728 | 19.9929 | 19.9904 | 19.9216 | 19.5015                   | 18.8577 | 18.3485 | (90)         |
| Living area fraction                                                        |         |         |         |         |         |         |         |         |         | FLA = Living area / (4) = |         | 0.1879  | (91)         |
| MIT                                                                         | 18.6178 | 18.8642 | 19.2733 | 19.7316 | 20.0392 | 20.1576 | 20.1804 | 20.1773 | 20.1017 | 19.6775                   | 19.0444 | 18.5462 | (92)         |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |                           |         | 0.0000  |              |
| adjusted MIT                                                                | 18.6178 | 18.8642 | 19.2733 | 19.7316 | 20.0392 | 20.1576 | 20.1804 | 20.1773 | 20.1017 | 19.6775                   | 19.0444 | 18.5462 | (93)         |

## 8. Space heating requirement

|                                                                                |           |           |           |           |          |          |          |          |          |               |           |           |       |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|---------------|-----------|-----------|-------|
|                                                                                | Jan       | Feb       | Mar       | Apr       | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov       | Dec       |       |
| Utilisation                                                                    | 0.9811    | 0.9673    | 0.9326    | 0.8500    | 0.7030   | 0.5128   | 0.3536   | 0.4032   | 0.6645   | 0.8967        | 0.9683    | 0.9845    | (94)  |
| Useful gains                                                                   | 703.3685  | 787.9669  | 865.1927  | 890.8556  | 791.5842 | 567.1238 | 373.2358 | 392.0586 | 581.8743 | 683.2845      | 668.4980  | 670.9181  | (95)  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000    | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000    | 4.2000    | (96)  |
| Heat loss rate W                                                               | 1501.6754 | 1464.5859 | 1339.6839 | 1136.0369 | 874.6314 | 582.8930 | 375.5223 | 396.1655 | 629.4641 | 952.0649      | 1252.7501 | 1504.6519 | (97)  |
| Space heating kWh                                                              | 593.9403  | 454.6880  | 353.0214  | 176.5305  | 61.7871  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 199.9726      | 420.6615  | 620.2980  | (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |          |          |          |          |          |               |           | 2880.8994 |       |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | 0.0000    | (98b) |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |           |          |          |          |          |          |               |           | 0.0000    |       |
| Space heating kWh                                                              | 593.9403  | 454.6880  | 353.0214  | 176.5305  | 61.7871  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 199.9726      | 420.6615  | 620.2980  | (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |          |          |          |          |          |               |           | 2880.8994 |       |
| Space heating per m2                                                           |           |           |           |           |          |          |          |          |          | (98c) / (4) = |           | 30.3828   | (99)  |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                                                              |          |          |          |          |          |          |          |          |          |          |          |           |               |
|--------------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|---------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                        |          |          |          |          |          |          |          |          |          |          |          |           | 0.0000 (201)  |
| Fraction of space heat from main system(s)                                                                   |          |          |          |          |          |          |          |          |          |          |          |           | 1.0000 (202)  |
| Efficiency of main space heating system 1 (in %)                                                             |          |          |          |          |          |          |          |          |          |          |          |           | 91.7000 (206) |
| Efficiency of main space heating system 2 (in %)                                                             |          |          |          |          |          |          |          |          |          |          |          |           | 0.0000 (207)  |
| Efficiency of secondary/supplementary heating system, %                                                      |          |          |          |          |          |          |          |          |          |          |          |           | 0.0000 (208)  |
|                                                                                                              | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec       |               |
| Space heating requirement                                                                                    | 593.9403 | 454.6880 | 353.0214 | 176.5305 | 61.7871  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 199.9726 | 420.6615 | 620.2980  | (98)          |
| Space heating efficiency (main heating system 1)                                                             | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 91.7000  | 91.7000  | 91.7000   | (210)         |
| Space heating fuel (main heating system)                                                                     | 647.6994 | 495.8430 | 384.9743 | 192.5088 | 67.3796  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 218.0726 | 458.7366 | 676.4427  | (211)         |
| Space heating efficiency (main heating system 2)                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (212)         |
| Space heating fuel (main heating system 2)                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (213)         |
| Space heating fuel (secondary)                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (215)         |
| Water heating                                                                                                |          |          |          |          |          |          |          |          |          |          |          |           |               |
| Water heating requirement                                                                                    | 204.9526 | 180.4725 | 190.2991 | 164.5092 | 157.4266 | 139.6815 | 136.5416 | 143.3578 | 146.4181 | 165.8134 | 179.3286 | 202.4003  | (64)          |
| Efficiency of water heater (217)m                                                                            | 88.2516  | 88.1930  | 88.0530  | 87.7745  | 87.2818  | 86.7000  | 86.7000  | 86.7000  | 86.7000  | 87.8356  | 88.1618  | 88.2740   | (216)         |
| Fuel for water heating, kWh/month                                                                            | 232.2367 | 204.6335 | 216.1188 | 187.4227 | 180.3660 | 161.1090 | 157.4874 | 165.3492 | 168.8790 | 188.7770 | 203.4086 | 229.2864  | (219)         |
| Space cooling fuel requirement (221)m                                                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (221)         |
| Pumps and Fa                                                                                                 | 11.2600  | 10.1703  | 11.2600  | 10.8967  | 11.2600  | 10.8967  | 11.2600  | 11.2600  | 10.8967  | 11.2600  | 10.8967  | 11.2600   | (231)         |
| Lighting                                                                                                     | 24.7371  | 19.8450  | 17.8683  | 13.0911  | 10.1119  | 8.2615   | 9.2244   | 11.9903  | 15.5742  | 20.4341  | 23.0803  | 25.4247   | (232)         |
| Electricity generated by PVs (Appendix M) (negative quantity) (233a)m                                        | -13.8577 | -22.9196 | -39.1412 | -51.1890 | -60.7330 | -58.6935 | -57.5786 | -51.1723 | -40.7967 | -28.6393 | -16.1851 | -11.5083  | (233a)        |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (234a)        |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235a)        |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235c)        |
| Electricity generated by PVs (Appendix M) (negative quantity) (233b)m                                        | -3.5626  | -8.8909  | -21.7125 | -39.0614 | -57.5840 | -60.2478 | -58.6981 | -46.0086 | -29.1122 | -13.8994 | -5.0330  | -2.6869   | (233b)        |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (234b)        |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235b)        |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235d)        |
| Annual totals kWh/year                                                                                       |          |          |          |          |          |          |          |          |          |          |          |           |               |
| Space heating fuel - main system 1                                                                           |          |          |          |          |          |          |          |          |          |          |          | 3141.6570 | (211)         |
| Space heating fuel - main system 2                                                                           |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (213)         |
| Space heating fuel - secondary                                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (215)         |
| Efficiency of water heater                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 86.7000   |               |

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|                                                                                         |                 |
|-----------------------------------------------------------------------------------------|-----------------|
| Water heating fuel used                                                                 | 2295.0741 (219) |
| Space cooling fuel                                                                      | 0.0000 (221)    |
| Electricity for pumps and fans:                                                         |                 |
| (MEVDecentralised, Database: total watage = 6.9420, total flow = 45.0000, SFP = 0.1543) |                 |
| mechanical ventilation fans (SFP = 0.1543)                                              | 46.5771 (230a)  |
| central heating pump                                                                    | 41.0000 (230c)  |
| main heating flue fan                                                                   | 45.0000 (230e)  |
| Total electricity for the above, kWh/year                                               | 132.5771 (231)  |
| Electricity for lighting (calculated in Appendix L)                                     | 199.6429 (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                           |                 |
| PV generation                                                                           | -798.9117 (233) |
| Wind generation                                                                         | 0.0000 (234)    |
| Hydro-electric generation (Appendix N)                                                  | 0.0000 (235a)   |
| Electricity generated - Micro CHP (Appendix N)                                          | 0.0000 (235)    |
| Appendix Q - special features                                                           |                 |
| Energy saved or generated                                                               | -0.0000 (236)   |
| Energy used                                                                             | 0.0000 (237)    |
| Total delivered energy for all uses                                                     | 4970.0393 (238) |

## 10a. Fuel costs - using Table 12 prices

|                                             | Fuel<br>kWh/year | Fuel price<br>p/kWh | Fuel cost<br>£/year |
|---------------------------------------------|------------------|---------------------|---------------------|
| Space heating - main system 1               | 3141.6570        | 3.6400              | 114.3563 (240)      |
| Total CO2 associated with community systems |                  |                     | 0.0000 (473)        |
| Water heating (other fuel)                  | 2295.0741        | 3.6400              | 83.5407 (247)       |
| Energy for instantaneous electric shower(s) | 0.0000           | 16.4900             | 0.0000 (247a)       |
| Pumps, fans and electric keep-hot           | 132.5771         | 16.4900             | 21.8620 (249)       |
| Energy for lighting                         | 199.6429         | 16.4900             | 32.9211 (250)       |
| Additional standing charges                 |                  |                     | 92.0000 (251)       |
| Energy saving/generation technologies       |                  |                     |                     |
| PV Unit electricity used in dwelling        | -452.4142        | 16.4900             | -74.6031            |
| PV Unit electricity exported                | -346.4975        | 5.5900              | -19.3692            |
| Total                                       |                  |                     | -93.9723 (252)      |
| Total energy cost                           |                  |                     | 250.7078 (255)      |

## 11a. SAP rating - Individual heating systems

|                                  |              |
|----------------------------------|--------------|
| Energy cost deflator (Table 12): | 0.3600 (256) |
| Energy cost factor (ECF)         | 0.6455 (257) |
| SAP value                        | 89.5363      |
| SAP rating (Section 12)          | 90 (258)     |
| SAP band                         | B            |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|---------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1               | 3141.6570          | 0.2100                        | 659.7480 (261)           |
| Total CO2 associated with community systems |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                  | 2295.0741          | 0.2100                        | 481.9656 (264)           |
| Space and water heating                     |                    |                               | 1141.7135 (265)          |
| Pumps, fans and electric keep-hot           | 132.5771           | 0.1387                        | 18.3901 (267)            |
| Energy for lighting                         | 199.6429           | 0.1443                        | 28.8146 (268)            |
| Energy saving/generation technologies       |                    |                               |                          |
| PV Unit electricity used in dwelling        | -452.4142          | 0.1318                        | -59.6090                 |
| PV Unit electricity exported                | -346.4975          | 0.1217                        | -42.1576                 |
| Total                                       |                    |                               | -101.7666 (269)          |
| Total CO2, kg/year                          |                    |                               | 1087.1516 (272)          |
| CO2 emissions per m2                        |                    |                               | 11.4700 (273)            |
| EI value                                    |                    |                               | 89.5810                  |
| EI rating                                   |                    |                               | 90 (274)                 |
| EI band                                     |                    |                               | B                        |

## SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

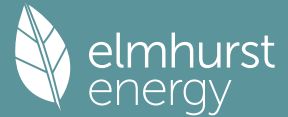
### 1. Overall dwelling characteristics

|                                                        | Area<br>(m2) | Storey height<br>(m)            | Volume<br>(m3)         |
|--------------------------------------------------------|--------------|---------------------------------|------------------------|
| Main dwelling                                          |              |                                 |                        |
| Ground floor                                           | 47.4100 (1b) | x 2.4600 (2b)                   | = 116.6286 (1b) - (3b) |
| First floor                                            | 47.4100 (1c) | x 2.7600 (2c)                   | = 130.8516 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 94.8200      |                                 | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 247.4802 (5)         |

### 2. Ventilation rate

|                         | m3 per hour          |
|-------------------------|----------------------|
| Number of open chimneys | 0 * 80 = 0.0000 (6a) |
| Number of open flues    | 0 * 20 = 0.0000 (6b) |

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|                                                    |          |             |
|----------------------------------------------------|----------|-------------|
| Number of chimneys / flues attached to closed fire | 0 * 10 = | 0.0000 (6c) |
| Number of flues attached to solid fuel boiler      | 0 * 20 = | 0.0000 (6d) |
| Number of flues attached to other heater           | 0 * 35 = | 0.0000 (6e) |
| Number of blocked chimneys                         | 0 * 20 = | 0.0000 (6f) |
| Number of intermittent extract fans                | 0 * 10 = | 0.0000 (7a) |
| Number of passive vents                            | 0 * 10 = | 0.0000 (7b) |
| Number of flueless gas fires                       | 0 * 40 = | 0.0000 (7c) |

|                                                      |                                                       |                |            |
|------------------------------------------------------|-------------------------------------------------------|----------------|------------|
| Infiltration due to chimneys, flues and fans         | = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 0.0000 / (5) = | 0.0000 (8) |
| Pressure test                                        |                                                       | Yes            |            |
| Pressure Test Method                                 |                                                       | Blower Door    |            |
| Measured/design AP50                                 |                                                       | 4.5000         | (17)       |
| Infiltration rate                                    |                                                       | 0.2250         | (18)       |
| Number of sides sheltered                            |                                                       | 2              | (19)       |
| Shelter factor                                       | (20) = 1 - [0.075 x (19)] =                           | 0.8500         | (20)       |
| Infiltration rate adjusted to include shelter factor | (21) = (18) x (20) =                                  | 0.1913         | (21)       |

|                                                                                                         |        |        |        |        |        |        |        |        |        |        |        |        |       |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|
| Wind speed                                                                                              | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |       |
|                                                                                                         | 4.2000 | 4.0000 | 4.0000 | 3.7000 | 3.7000 | 3.3000 | 3.4000 | 3.2000 | 3.3000 | 3.5000 | 3.5000 | 3.8000 | (22)  |
| Wind factor                                                                                             | 1.0500 | 1.0000 | 1.0000 | 0.9250 | 0.9250 | 0.8250 | 0.8500 | 0.8000 | 0.8250 | 0.8750 | 0.8750 | 0.9500 | (22a) |
| Adj infilt rate                                                                                         |        |        |        |        |        |        |        |        |        |        |        |        |       |
|                                                                                                         | 0.2008 | 0.1913 | 0.1913 | 0.1769 | 0.1769 | 0.1578 | 0.1626 | 0.1530 | 0.1578 | 0.1673 | 0.1673 | 0.1817 | (22b) |
| Mechanical extract ventilation - decentralised                                                          |        |        |        |        |        |        |        |        |        |        |        |        |       |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.5000 | (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.5000 | (23b) |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | (25)  |

## 3. Heat losses and heat loss parameter

| Element                                        | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K     | A x U<br>W/K | K-value<br>kJ/m2K | A x K<br>kJ/K |       |
|------------------------------------------------|-------------|----------------|---------------|----------------------|--------------|-------------------|---------------|-------|
| Main dwelling                                  |             |                |               |                      |              |                   |               |       |
| Front Door                                     |             |                | 2.2300        | 1.2000               | 2.6760       |                   |               | (26)  |
| Windows                                        |             |                | 10.7600       | 1.2357               | 13.2966      |                   |               | (27)  |
| French Doors                                   |             |                | 5.2200        | 1.2357               | 6.4506       |                   |               | (27)  |
| GF SPVL 125TS P/A                              |             |                | 47.4100       | 0.1300               | 6.1633       | 75.0000           | 3555.7500     | (28a) |
| EW Brick AAC011                                | 151.6400    | 18.2100        | 133.4300      | 0.1800               | 24.0174      | 60.0000           | 8005.8000     | (29a) |
| PR 500mm MW044                                 | 47.4100     |                | 47.4100       | 0.0900               | 4.2669       | 9.0000            | 426.6900      | (30)  |
| Total net area of external elements Aum(A, m2) |             |                | 246.4600      |                      |              |                   |               | (31)  |
| Fabric heat loss, W/K = Sum (A x U)            |             |                |               | (26)...(30) + (32) = | 56.8707      |                   |               | (33)  |
| Main dwelling                                  |             |                |               |                      |              |                   |               |       |
| Timber - GF                                    |             |                | 24.2600       |                      |              | 9.0000            | 218.3400      | (32c) |
| Timber - FF                                    |             |                | 140.7000      |                      |              | 9.0000            | 1266.3000     | (32c) |
| Masonry GF                                     |             |                | 51.5100       |                      |              | 100.0000          | 5151.0000     | (32c) |
| Internal Floor FF                              |             |                | 47.4100       |                      |              | 18.0000           | 853.3800      | (32d) |
| Internal Ceiling GF                            |             |                | 47.4100       |                      |              | 9.0000            | 426.6900      | (32e) |

|                                                   |                                      |            |      |
|---------------------------------------------------|--------------------------------------|------------|------|
| Heat capacity Cm = Sum(A x k)                     | (28)...(30) + (32) + (32a)...(32e) = | 19903.9500 | (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K |                                      | 209.9130   | (35) |

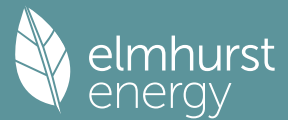
| List of Thermal Bridges                                          | Length  | Psi-value | Total                 |              |
|------------------------------------------------------------------|---------|-----------|-----------------------|--------------|
| K1 Element                                                       | 11.9100 | 0.0410    | 0.4883                |              |
| E2 Other lintels (including other steel lintels)                 | 9.4200  | 0.0220    | 0.2072                |              |
| E3 Sill                                                          | 22.0500 | 0.0190    | 0.4189                |              |
| E4 Jamb                                                          | 12.0200 | 0.0928    | 1.1155                |              |
| E5 Ground floor (normal)                                         | 29.0500 | 0.0020    | 0.0581                |              |
| E6 Intermediate floor within a dwelling                          | 9.1500  | 0.0390    | 0.3569                |              |
| E10 Eaves (insulation at ceiling level)                          | 0.0000  | 0.0300    | 0.0000                |              |
| E18 Party wall between dwellings                                 | 4.2000  | 0.1000    | 0.4200                |              |
| E4 Jamb                                                          | 1.0600  | 0.0410    | 0.0435                |              |
| E2 Other lintels (including other steel lintels)                 | 0.0000  | 0.1000    | 0.0000                |              |
| P1 Party wall - Ground floor                                     | 0.0000  | 0.0000    | 0.0000                |              |
| P2 Party wall - Intermediate floor within a dwelling             | 0.0000  | 0.0000    | 0.0000                |              |
| P4 Party wall - Roof (insulation at ceiling level)               | 0.0000  | 0.0350    | 0.0000                |              |
| E5 Ground floor (normal)                                         | 17.0300 | 0.0980    | 1.6689                |              |
| E12 Gable (insulation at ceiling level)                          | 19.9000 | 0.0870    | 1.7313                |              |
| E16 Corner (normal)                                              | 26.1000 | 0.0420    | 1.0962                |              |
| E17 Corner (inverted - internal area greater than external area) | 5.2200  | -0.0820   | -0.4280               |              |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)       |         |           | 7.1768                | (36)         |
| Point Thermal bridges                                            |         |           | (36a) =               | 0.0000       |
| Total fabric heat loss                                           |         |           | (33) + (36) + (36a) = | 64.0475 (37) |

|                                                                     |          |          |          |          |          |          |          |          |          |          |          |          |      |
|---------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) |          |          |          |          |          |          |          |          |          |          |          |          |      |
| (38)m                                                               | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |      |
|                                                                     | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | (38) |
| Heat transfer coeff                                                 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | (39) |
| Average = Sum(39)m / 12 =                                           |          |          |          |          |          |          |          |          |          |          |          | 104.8817 |      |
| HLP                                                                 | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |      |
| HLP (average)                                                       | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | (40) |
| Days in mont                                                        | 31       | 28       | 31       | 30       | 31       | 30       | 31       | 31       | 30       | 31       | 30       | 31       |      |

## 4. Water heating energy requirements (kWh/year)

|                                          |          |          |          |          |          |          |          |          |          |                    |          |           |             |
|------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------------------|----------|-----------|-------------|
| Assumed occupancy                        |          |          |          |          |          |          |          |          |          |                    |          |           | 2.6861 (42) |
| Hot water usage for mixer showers        |          |          |          |          |          |          |          |          |          |                    |          |           |             |
|                                          | 69.2572  | 68.2164  | 66.6997  | 63.7979  | 61.6564  | 59.2683  | 57.9108  | 59.4160  | 61.0660  | 63.6301            | 66.5943  | 68.9918   | (42a)       |
| Hot water usage for baths                |          |          |          |          |          |          |          |          |          |                    |          |           |             |
|                                          | 29.9061  | 29.4619  | 28.8365  | 27.6833  | 26.8197  | 25.8622  | 25.3450  | 25.9661  | 26.6424  | 27.6669            | 28.8439  | 29.8050   | (42b)       |
| Hot water usage for other uses           |          |          |          |          |          |          |          |          |          |                    |          |           |             |
|                                          | 42.1386  | 40.6063  | 39.0739  | 37.5416  | 36.0093  | 34.4770  | 34.4770  | 36.0093  | 37.5416  | 39.0739            | 40.6063  | 42.1386   | (42c)       |
| Average daily hot water use (litres/day) |          |          |          |          |          |          |          |          |          |                    |          | 129.8883  | (43)        |
| Daily hot water use                      | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct                | Nov      | Dec       |             |
|                                          | 141.3019 | 138.2846 | 134.6102 | 129.0228 | 124.4855 | 119.6075 | 117.7329 | 121.3914 | 125.2500 | 130.3710           | 136.0444 | 140.9354  | (44)        |
| Energy conte                             | 223.7876 | 196.9154 | 206.8908 | 176.6258 | 167.5814 | 147.0714 | 142.3877 | 150.3080 | 154.4457 | 176.9122           | 193.8202 | 220.6708  | (45)        |
| Energy content (annual)                  |          |          |          |          |          |          |          |          |          | Total = Sum(45)m = |          | 2157.4171 |             |
| Distribution loss (46)m = 0.15 x (45)m   |          |          |          |          |          |          |          |          |          |                    |          |           |             |
|                                          | 33.5681  | 29.5373  | 31.0336  | 26.4939  | 25.1372  | 22.0607  | 21.3582  | 22.5462  | 23.1669  | 26.5368            | 29.0730  | 33.1006   | (46)        |

# Full SAP Calculation Printout



|                                                                                |          |          |          |          |          |          |          |          |          |          |                |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| Water storage loss (or HIU loss):                                              |          |          |          |          |          |          |          |          |          |          |                |
| Total storage loss                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (56)    |
| If cylinder contains dedicated solar storage                                   |          |          |          |          |          |          |          |          |          |          |                |
| Primary loss                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (57)    |
| Combi loss                                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (59)    |
| Total heat required for water heating calculated for each month                | 12.0010  | 10.8287  | 11.9655  | 11.5300  | 11.8830  | 11.4679  | 11.8301  | 11.8467  | 11.4834  | 11.9026  | 11.5661 (61)   |
| WWHRS                                                                          | 235.7886 | 207.7441 | 218.8564 | 188.1558 | 179.4644 | 158.5393 | 154.2178 | 162.1547 | 165.9291 | 188.8148 | 205.3864 (62)  |
| PV diverter                                                                    | -30.8360 | -27.2716 | -28.5573 | -23.6466 | -22.0378 | -18.8579 | -17.6762 | -18.7969 | -19.5111 | -23.0014 | -26.0578 (63a) |
| Solar input                                                                    | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000 (63b)  |
| FGHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63c)   |
| Output from w/h                                                                | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63d)   |
| Total per year (kWh/year) = Sum(64)m =                                         | 204.9526 | 180.4725 | 190.2991 | 164.5092 | 157.4266 | 139.6815 | 136.5416 | 143.3578 | 146.4181 | 165.8134 | 179.3286 (64)  |
| Electric shower(s)                                                             | 204.9526 | 180.4725 | 190.2991 | 164.5092 | 157.4266 | 139.6815 | 136.5416 | 143.3578 | 146.4181 | 165.8134 | 202.4003 (64)  |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (64a)   |
| Heat gains from water heating, kWh/month                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (64a)   |
|                                                                                | 77.4096  | 68.1815  | 71.7826  | 61.6106  | 58.6916  | 51.7682  | 50.3014  | 52.9391  | 54.2241  | 61.7990  | 76.3717 (65)   |

## 5. Internal gains (see Table 5 and 5a)

| Metabolic gains (Table 5), Watts                                                    |           |           |           |           |           |           |           |           |           |           |           |                |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
|                                                                                     | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec            |
| (66)m                                                                               | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 28.2615   | 25.1016   | 20.4140   | 15.4547   | 11.5526   | 9.7532    | 10.5387   | 13.6985   | 18.3862   | 23.3454   | 27.2476   | 29.0470 (67)   |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 369.6589  | 373.4948  | 363.8284  | 343.2499  | 317.2732  | 292.8588  | 276.5485  | 272.7126  | 282.3789  | 302.9575  | 328.9341  | 353.3486 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029 (69)   |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 3.0000    | 3.0000    | 3.0000 (70)    |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 (71) |
| Water heating gains (Table 5)                                                       | 104.0452  | 101.4606  | 96.4820   | 85.5702   | 78.8865   | 71.9003   | 67.6095   | 71.1547   | 75.3112   | 83.0631   | 93.5233   | 102.6501 (72)  |
| Total internal gains                                                                | 612.4909  | 610.5823  | 591.2497  | 554.8002  | 518.2376  | 482.0376  | 462.2219  | 465.0911  | 483.6016  | 519.8913  | 560.2303  | 595.5709 (73)  |

## 6. Solar gains

| [Jan]       |          |          |          |           | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 |           | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d |          | Gains<br>W    |
|-------------|----------|----------|----------|-----------|------------|--------------------------------|-----------|-----------------------------------|------------------------------------|------------------------------|----------|---------------|
| North       |          |          |          |           | 1.3900     | 11.9814                        |           | 0.4500                            | 0.0000                             | 0.7700                       |          | 5.7707 (74)   |
| East        |          |          |          |           | 4.1200     | 22.3313                        |           | 0.4500                            | 0.0000                             | 0.7700                       |          | 31.8797 (76)  |
| West        |          |          |          |           | 5.2500     | 22.3313                        |           | 0.4500                            | 0.0000                             | 0.7700                       |          | 40.6235 (80)  |
| East        |          |          |          |           | 5.2200     | 22.3313                        |           | 0.4500                            | 0.0000                             | 0.7700                       |          | 40.3913 (76)  |
| <hr/>       |          |          |          |           |            |                                |           |                                   |                                    |                              |          |               |
| Solar gains | 118.6652 | 208.6660 | 339.5574 | 511.6799  | 613.0465   | 672.9016                       | 633.1510  | 554.4153                          | 428.4009                           | 264.3288                     | 151.5207 | 96.6906 (83)  |
| Total gains | 731.1561 | 819.2483 | 930.8072 | 1066.4801 | 1131.2842  | 1154.9392                      | 1095.3729 | 1019.5064                         | 912.0025                           | 784.2201                     | 711.7510 | 692.2615 (84) |

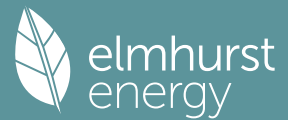
## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |         |         |         |              |
| tau                                                                         | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| alpha                                                                       | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153      |
| util living area                                                            | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144       |
|                                                                             | 0.9863  | 0.9764  | 0.9441  | 0.8526  | 0.6801  | 0.4469  | 0.2960  | 0.3277  | 0.6270  | 0.8985  | 0.9739  | 0.9889 (86)  |
| MIT                                                                         | 19.6061 | 19.7994 | 20.1936 | 20.6246 | 20.8974 | 20.9879 | 20.9986 | 20.9978 | 20.9463 | 20.5857 | 20.0129 | 19.5523 (87) |
| Th 2                                                                        | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 (88) |
| util rest of house                                                          | 0.9825  | 0.9700  | 0.9289  | 0.8157  | 0.6130  | 0.3605  | 0.2006  | 0.2257  | 0.5340  | 0.8627  | 0.9653  | 0.9857 (89)  |
| MIT 2                                                                       | 18.5808 | 18.7968 | 19.2305 | 19.6791 | 19.9284 | 19.9912 | 19.9956 | 19.9955 | 19.9691 | 19.6537 | 19.0384 | 18.5205 (90) |
| Living area fraction                                                        | 18.7735 | 18.9852 | 19.4115 | 19.8568 | 20.1105 | 20.1785 | 20.1841 | 20.1839 | 20.1527 | 19.8289 | 19.2215 | 18.7144 (91) |
| MIT                                                                         | 18.7735 | 18.9852 | 19.4115 | 19.8568 | 20.1105 | 20.1785 | 20.1841 | 20.1839 | 20.1527 | 19.8289 | 19.2215 | 18.7144 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT                                                                | 18.7735 | 18.9852 | 19.4115 | 19.8568 | 20.1105 | 20.1785 | 20.1841 | 20.1839 | 20.1527 | 19.8289 | 19.2215 | 18.7144 (93) |

## 8. Space heating requirement

|                                                                                |           |           |           |           |          |          |          |          |          |          |           |                |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|-----------|----------------|
| Utilisation                                                                    | Jan       | Feb       | Mar       | Apr       | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov       | Dec            |
| Useful gains                                                                   | 0.9760    | 0.9614    | 0.9179    | 0.8099    | 0.6212   | 0.3765   | 0.2185   | 0.2449   | 0.5493   | 0.8555   | 0.9565    | 0.9800 (94)    |
| Ext temp.                                                                      | 713.6053  | 787.6341  | 854.4125  | 863.7867  | 702.7023 | 434.8098 | 239.3672 | 249.6911 | 501.0070 | 670.9366 | 680.7650  | 678.4296 (95)  |
| Heat loss rate W                                                               | 5.1000    | 5.6000    | 7.4000    | 9.9000    | 13.0000  | 16.0000  | 17.9000  | 17.8000  | 15.2000  | 11.6000  | 8.0000    | 5.1000 (96)    |
| Space heating kWh                                                              | 1434.1030 | 1403.8641 | 1259.7883 | 1044.2844 | 745.7652 | 438.2515 | 239.5632 | 250.0225 | 519.4504 | 863.0595 | 1176.9311 | 1427.9061 (97) |
| Space heating requirement - total per year (kWh/year)                          | 536.0503  | 414.1066  | 301.5996  | 129.9584  | 32.0388  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 142.9395 | 357.2396  | 557.6105 (98a) |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         | 536.0503  | 414.1066  | 301.5996  | 129.9584  | 32.0388  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 142.9395 | 357.2396  | 557.6105 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |          |          |          |          |          |          |           | 2471.5431      |
| Space heating per m2                                                           |           |           |           |           |          |          |          |          |          |          |           | 26.0656 (99)   |

# Full SAP Calculation Printout



## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                                                      |          |          |          |          |          |          |          |          |          |          |          |                 |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (201)    |
| Fraction of space heat from main system(s)                                                           |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (202)    |
| Efficiency of main space heating system 1 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 91.7000 (206)   |
| Efficiency of main space heating system 2 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)    |
| Efficiency of secondary/supplementary heating system, %                                              |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)    |
|                                                                                                      | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec             |
| Space heating requirement                                                                            | 536.0503 | 414.1066 | 301.5996 | 129.9584 | 32.0388  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 142.9395 | 357.2396 | 557.6105 (98)   |
| Space heating efficiency (main heating system 1)                                                     | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 91.7000  | 91.7000  | 91.7000 (210)   |
| Space heating fuel (main heating system)                                                             | 584.5695 | 451.5884 | 328.8981 | 141.7212 | 34.9387  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 155.8773 | 389.5742 | 608.0813 (211)  |
| Space heating efficiency (main heating system 2)                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)    |
| Space heating fuel (main heating system 2)                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)    |
| Space heating fuel (secondary)                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)    |
| Water heating                                                                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| Water heating requirement                                                                            | 204.9526 | 180.4725 | 190.2991 | 164.5092 | 157.4266 | 139.6815 | 136.5416 | 143.3578 | 146.4181 | 165.8134 | 179.3286 | 202.4003 (64)   |
| Efficiency of water heater                                                                           | 88.2091  | 88.1519  | 87.9756  | 87.6144  | 87.0481  | 86.7000  | 86.7000  | 86.7000  | 86.7000  | 87.6597  | 88.0869  | 86.7000 (216)   |
| Fuel for water heating, kWh/month                                                                    | 232.3487 | 204.7289 | 216.3089 | 187.7650 | 180.8502 | 161.1090 | 157.4874 | 165.3492 | 168.8790 | 189.1557 | 203.5814 | 229.3985 (217)  |
| Space cooling fuel requirement                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)    |
| Pumps and Fa                                                                                         | 11.2600  | 10.1703  | 11.2600  | 10.8967  | 11.2600  | 10.8967  | 11.2600  | 11.2600  | 10.8967  | 11.2600  | 10.8967  | 11.2600 (231)   |
| Lighting                                                                                             | 24.7371  | 19.8450  | 17.8683  | 13.0911  | 10.1119  | 8.2615   | 9.2244   | 11.9903  | 15.5742  | 20.4341  | 23.0803  | 25.4247 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | -15.6190 | -23.5119 | -39.6513 | -52.7819 | -61.3023 | -61.7585 | -60.2056 | -54.5131 | -43.7099 | -30.8996 | -18.5675 | -12.8750 (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | -4.3417  | -9.2903  | -22.2296 | -41.4662 | -58.7043 | -67.1664 | -64.5439 | -52.3765 | -33.2487 | -15.9167 | -6.3436  | -3.2295 (233b)  |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234b)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235d)   |
| Annual totals kWh/year                                                                               |          |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating fuel - main system 1                                                                   |          |          |          |          |          |          |          |          |          |          |          | 2695.2488 (211) |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)    |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)    |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          | 86.7000         |
| Water heating fuel used                                                                              |          |          |          |          |          |          |          |          |          |          |          | 2296.9618 (219) |
| Space cooling fuel                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (221)    |
| Electricity for pumps and fans:                                                                      |          |          |          |          |          |          |          |          |          |          |          |                 |
| (MEV)Decentralised, Database: total watage = 6.9420, total flow = 45.0000, SFP = 0.1543)             |          |          |          |          |          |          |          |          |          |          |          |                 |
| mechanical ventilation fans (SFP = 0.1543)                                                           |          |          |          |          |          |          |          |          |          |          |          | 46.5771 (230a)  |
| central heating pump                                                                                 |          |          |          |          |          |          |          |          |          |          |          | 41.0000 (230c)  |
| main heating flue fan                                                                                |          |          |          |          |          |          |          |          |          |          |          | 45.0000 (230e)  |
| Total electricity for the above, kWh/year                                                            |          |          |          |          |          |          |          |          |          |          |          | 132.5771 (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |          |          |          |          |          |          |          |          |          |          |          | 199.6429 (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| PV generation                                                                                        |          |          |          |          |          |          |          |          |          |          |          | -854.2531 (233) |
| Wind generation                                                                                      |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (234)    |
| Hydro-electric generation (Appendix N)                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (235a)   |
| Electricity generated - Micro CHP (Appendix N)                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (235)    |
| Appendix Q - special features                                                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| Energy saved or generated                                                                            |          |          |          |          |          |          |          |          |          |          |          | -0.0000 (236)   |
| Energy used                                                                                          |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (237)    |
| Total delivered energy for all uses                                                                  |          |          |          |          |          |          |          |          |          |          |          | 4470.1774 (238) |

## 10a. Fuel costs - using BEDF prices (596)

|                                             | Fuel<br>kWh/year | Fuel price<br>p/kWh | Fuel cost<br>£/year |
|---------------------------------------------|------------------|---------------------|---------------------|
| Space heating - main system 1               | 2695.2488        | 7.3200              | 197.2922 (240)      |
| Total CO2 associated with community systems |                  |                     | 0.0000 (473)        |
| Water heating (other fuel)                  | 2296.9618        | 7.3200              | 168.1376 (247)      |
| Energy for instantaneous electric shower(s) | 0.0000           | 27.6700             | 0.0000 (247a)       |
| Pumps, fans and electric keep-hot           | 132.5771         | 27.6700             | 36.6841 (249)       |
| Energy for lighting                         | 199.6429         | 27.6700             | 55.2412 (250)       |
| Additional standing charges                 |                  |                     | 108.0000 (251)      |
| Energy saving/generation technologies       |                  |                     |                     |
| PV Unit electricity used in dwelling        | -475.3956        | 27.6700             | -131.5419           |
| PV Unit electricity exported                | -378.8575        | 5.8100              | -22.0116            |
| Total                                       |                  |                     | -153.5536 (252)     |
| Total energy cost                           |                  |                     | 411.8015 (255)      |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|---------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1               | 2695.2488          | 0.2100                        | 566.0022 (261)           |
| Total CO2 associated with community systems |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                  | 2296.9618          | 0.2100                        | 482.3620 (264)           |
| Space and water heating                     |                    |                               | 1048.3642 (265)          |
| Pumps, fans and electric keep-hot           | 132.5771           | 0.1387                        | 18.3901 (267)            |
| Energy for lighting                         | 199.6429           | 0.1443                        | 28.8146 (268)            |
| Energy saving/generation technologies       |                    |                               |                          |

# Full SAP Calculation Printout



|                                      |           |        |                 |
|--------------------------------------|-----------|--------|-----------------|
| PV Unit electricity used in dwelling | -475.3956 | 0.1318 | -62.6507        |
| PV Unit electricity exported         | -378.8575 | 0.1212 | -45.9143        |
| Total                                |           |        | -108.5651 (269) |
| Total CO2, kg/year                   |           |        | 987.0038 (272)  |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy kWh/year | Primary energy factor kg CO2/kWh | Primary energy kWh/year |
|---------------------------------------------|-----------------|----------------------------------|-------------------------|
| Space heating - main system 1               | 2695.2488       | 1.1300                           | 3045.6311 (275)         |
| Total CO2 associated with community systems |                 |                                  | 0.0000 (473)            |
| Water heating (other fuel)                  | 2296.9618       | 1.1300                           | 2595.5668 (278)         |
| Space and water heating                     |                 |                                  | 5641.1979 (279)         |
| Pumps, fans and electric keep-hot           | 132.5771        | 1.5128                           | 200.5626 (281)          |
| Energy for lighting                         | 199.6429        | 1.5338                           | 306.2189 (282)          |
| Energy saving/generation technologies       |                 |                                  |                         |
| PV Unit electricity used in dwelling        | -475.3956       | 1.4869                           | -706.8613               |
| PV Unit electricity exported                | -378.8575       | 0.4445                           | -168.4174               |
| Total                                       |                 |                                  | -875.2787 (283)         |
| Total Primary energy kWh/year               |                 |                                  | 5272.7008 (286)         |

## SAP 10 EPC IMPROVEMENTS

### Plot 1

|                                      |      |
|--------------------------------------|------|
| Current energy efficiency rating:    | B 90 |
| Current environmental impact rating: | B 90 |

|                             |                        |
|-----------------------------|------------------------|
| N Solar water heating       | SAP increase too small |
| U Solar photovoltaic panels | Already installed      |
| V2 Wind turbine             | Not applicable         |

| Recommended measures: | SAP change | Cost change | CO2 change |
|-----------------------|------------|-------------|------------|
| (none)                |            |             |            |

|                                                         |                             |
|---------------------------------------------------------|-----------------------------|
| Measures omitted - SAP change or cost saving too small: |                             |
| N Solar water heating                                   | + 0.5 -£ 32 -141 kg (14.3%) |

| Recommended measures | Typical annual savings | Energy efficiency | Environmental impact |
|----------------------|------------------------|-------------------|----------------------|
| (none)               |                        |                   |                      |
| Total Savings        | £0                     | 0.00 kg/m²        |                      |

|                                        |      |
|----------------------------------------|------|
| Potential energy efficiency rating:    | B 90 |
| Potential environmental impact rating: | B 90 |

Fuel prices for cost data on this page from database revision number 596 TEST (30 Jun 2026)  
Recommendation texts revision number 6.1 (11 Jun 2019)

### Typical heating and lighting costs of this home (per year, Thames Valley):

|                          | Current    | Potential  | Saving     |
|--------------------------|------------|------------|------------|
| Electricity              | £92        | £92        | £0         |
| Mains gas                | £473       | £473       | £0         |
| Space heating            | £342       | £342       | £0         |
| Water heating            | £168       | £168       | £0         |
| Lighting                 | £55        | £55        | £0         |
| Generated (PV)           | -£154      | -£154      | £0         |
| Total cost of fuels      | £411       | £411       | £0         |
| Total cost of uses       | £411       | £411       | £0         |
| Delivered energy         | 47 kWh/m²  | 47 kWh/m²  | 0 kWh/m²   |
| Carbon dioxide emissions | 1.0 tonnes | 1.0 tonnes | 0.0 tonnes |
| CO2 emissions per m²     | 10 kg/m²   | 10 kg/m²   | 0 kg/m²    |
| Primary energy           | 56 kWh/m²  | 56 kWh/m²  | 0 kWh/m²   |

## SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

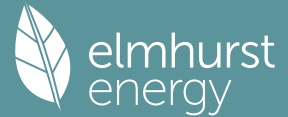
### 1. Overall dwelling characteristics

| Main dwelling                                           | Area (m2)    | Storey height (m)                | Volume (m3)            |
|---------------------------------------------------------|--------------|----------------------------------|------------------------|
| Ground floor                                            | 47.4100 (1b) | x 2.4600 (2b)                    | = 116.6286 (1b) - (3b) |
| First floor                                             | 47.4100 (1c) | x 2.7600 (2c)                    | = 130.8516 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)... (1n) | 94.8200      |                                  | (4)                    |
| Dwelling volume                                         |              | (3a)+(3b)+(3c)+(3d)+(3e)... (3n) | = 247.4802 (5)         |

### 2. Ventilation rate

m3 per hour

# Full SAP Calculation Printout



|                                                    |          |             |
|----------------------------------------------------|----------|-------------|
| Number of open chimneys                            | 0 * 80 = | 0.0000 (6a) |
| Number of open flues                               | 0 * 20 = | 0.0000 (6b) |
| Number of chimneys / flues attached to closed fire | 0 * 10 = | 0.0000 (6c) |
| Number of flues attached to solid fuel boiler      | 0 * 20 = | 0.0000 (6d) |
| Number of flues attached to other heater           | 0 * 35 = | 0.0000 (6e) |
| Number of blocked chimneys                         | 0 * 20 = | 0.0000 (6f) |
| Number of intermittent extract fans                | 0 * 10 = | 0.0000 (7a) |
| Number of passive vents                            | 0 * 10 = | 0.0000 (7b) |
| Number of flueless gas fires                       | 0 * 40 = | 0.0000 (7c) |

|                                                      |                                                       |        |                      |            |
|------------------------------------------------------|-------------------------------------------------------|--------|----------------------|------------|
| Infiltration due to chimneys, flues and fans         | = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 0.0000 | Air changes per hour | 0.0000 (8) |
| Pressure test                                        |                                                       |        | Yes                  |            |
| Pressure Test Method                                 |                                                       |        | Blower Door          |            |
| Measured/design AP50                                 |                                                       |        | 4.5000               | (17)       |
| Infiltration rate                                    |                                                       |        | 0.2250               | (18)       |
| Number of sides sheltered                            |                                                       |        | 2                    | (19)       |
| Shelter factor                                       | (20) = 1 - [0.075 x (19)] =                           | 0.8500 |                      | (20)       |
| Infiltration rate adjusted to include shelter factor | (21) = (18) x (20) =                                  | 0.1913 |                      | (21)       |

|                                                                                                         |        |        |        |        |        |        |        |        |        |        |        |        |              |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |              |
| Wind factor                                                                                             | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 | (22)         |
| Adj infilt rate                                                                                         | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 | (22a)        |
|                                                                                                         | 0.2438 | 0.2391 | 0.2343 | 0.2104 | 0.2056 | 0.1817 | 0.1817 | 0.1769 | 0.1913 | 0.2056 | 0.2152 | 0.2247 | (22b)        |
| Mechanical extract ventilation - decentralised                                                          |        |        |        |        |        |        |        |        |        |        |        |        |              |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | (25)         |

### 3. Heat losses and heat loss parameter

| Element                                        | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K     | A x U<br>W/K | K-value<br>kJ/m2K | A x K<br>kJ/K |       |
|------------------------------------------------|-------------|----------------|---------------|----------------------|--------------|-------------------|---------------|-------|
| Main dwelling                                  |             |                |               |                      |              |                   |               |       |
| Front Door                                     |             |                | 2.2300        | 1.2000               | 2.6760       |                   |               | (26)  |
| Windows                                        |             |                | 10.7600       | 1.2357               | 13.2966      |                   |               | (27)  |
| French Doors                                   |             |                | 5.2200        | 1.2357               | 6.4506       |                   |               | (27)  |
| GF SPVL 125TS P/A                              |             |                | 47.4100       | 0.1300               | 6.1633       | 75.0000           | 3555.7500     | (28a) |
| EW Brick AAC011                                | 151.6400    | 18.2100        | 133.4300      | 0.1800               | 24.0174      | 60.0000           | 8005.8000     | (29a) |
| PR 500mm MW044                                 | 47.4100     |                | 47.4100       | 0.0900               | 4.2669       | 9.0000            | 426.6900      | (30)  |
| Total net area of external elements Aum(A, m2) |             |                | 246.4600      |                      |              |                   |               | (31)  |
| Fabric heat loss, W/K = Sum (A x U)            |             |                |               | (26)...(30) + (32) = | 56.8707      |                   |               | (33)  |
| Main dwelling                                  |             |                |               |                      |              |                   |               |       |
| Timber - GF                                    |             |                | 24.2600       |                      |              | 9.0000            | 218.3400      | (32c) |
| Timber - FF                                    |             |                | 140.7000      |                      |              | 9.0000            | 1266.3000     | (32c) |
| Masonry GF                                     |             |                | 51.5100       |                      |              | 100.0000          | 5151.0000     | (32c) |
| Internal Floor FF                              |             |                | 47.4100       |                      |              | 18.0000           | 853.3800      | (32d) |
| Internal Ceiling GF                            |             |                | 47.4100       |                      |              | 9.0000            | 426.6900      | (32e) |

|                                                   |                                      |                 |
|---------------------------------------------------|--------------------------------------|-----------------|
| Heat capacity Cm = Sum(A x k)                     | (28)...(30) + (32) + (32a)...(32e) = | 19903.9500 (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K |                                      | 209.9130 (35)   |

### List of Thermal Bridges

| K1 Element                                                       | Length  | Psi-value | Total   |  |
|------------------------------------------------------------------|---------|-----------|---------|--|
| E2 Other lintels (including other steel lintels)                 | 11.9100 | 0.0410    | 0.4883  |  |
| E3 Sill                                                          | 9.4200  | 0.0220    | 0.2072  |  |
| E4 Jamb                                                          | 22.0500 | 0.0190    | 0.4189  |  |
| E5 Ground floor (normal)                                         | 12.0200 | 0.0928    | 1.1155  |  |
| E6 Intermediate floor within a dwelling                          | 29.0500 | 0.0020    | 0.0581  |  |
| E10 Eaves (insulation at ceiling level)                          | 9.1500  | 0.0390    | 0.3569  |  |
| E18 Party wall between dwellings                                 | 0.0000  | 0.0300    | 0.0000  |  |
| E4 Jamb                                                          | 4.2000  | 0.1000    | 0.4200  |  |
| E2 Other lintels (including other steel lintels)                 | 1.0600  | 0.0410    | 0.0435  |  |
| P1 Party wall - Ground floor                                     | 0.0000  | 0.1000    | 0.0000  |  |
| P2 Party wall - Intermediate floor within a dwelling             | 0.0000  | 0.0000    | 0.0000  |  |
| P4 Party wall - Roof (insulation at ceiling level)               | 0.0000  | 0.0350    | 0.0000  |  |
| E5 Ground floor (normal)                                         | 17.0300 | 0.0980    | 1.6689  |  |
| E12 Gable (insulation at ceiling level)                          | 19.9000 | 0.0870    | 1.7313  |  |
| E16 Corner (normal)                                              | 26.1000 | 0.0420    | 1.0962  |  |
| E17 Corner (inverted - internal area greater than external area) | 5.2200  | -0.0820   | -0.4280 |  |

|                                                            |                       |              |
|------------------------------------------------------------|-----------------------|--------------|
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |                       | 7.1768 (36)  |
| Point Thermal bridges                                      | (36a) =               | 0.0000       |
| Total fabric heat loss                                     | (33) + (36) + (36a) = | 64.0475 (37) |

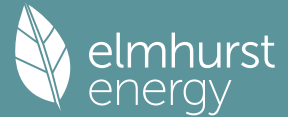
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

|                           |          |          |          |          |          |          |          |          |          |          |          |          |        |
|---------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------|
| (38)m                     | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |        |
| Heat transfer coeff       | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | (38)   |
| Average = Sum(39)m / 12 = | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | (39)   |
| HLP                       | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | (40)   |
| HLP (average)             |          |          |          |          |          |          |          |          |          |          |          |          | 1.1061 |
| Days in mont              | 31       | 28       | 31       | 30       | 31       | 30       | 31       | 31       | 30       | 31       | 30       | 31       |        |

### 4. Water heating energy requirements (kWh/year)

|                                          |          |          |          |          |          |          |          |          |          |          |          |          |                              |
|------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------------------------------|
| Assumed occupancy                        |          |          |          |          |          |          |          |          |          |          |          |          | 2.6861 (42)                  |
| Hot water usage for mixer showers        |          |          |          |          |          |          |          |          |          |          |          |          |                              |
| 69.2572                                  | 68.2164  | 66.6997  | 63.7979  | 61.6564  | 59.2683  | 57.9108  | 59.4160  | 61.0660  | 63.6301  | 66.5943  | 68.9918  |          | (42a)                        |
| Hot water usage for baths                |          |          |          |          |          |          |          |          |          |          |          |          |                              |
| 29.9061                                  | 29.4619  | 28.8365  | 27.6833  | 26.8197  | 25.8622  | 25.3450  | 25.9661  | 26.6424  | 27.6669  | 28.8439  | 29.8050  |          | (42b)                        |
| Hot water usage for other uses           |          |          |          |          |          |          |          |          |          |          |          |          |                              |
| 42.1386                                  | 40.6063  | 39.0739  | 37.5416  | 36.0093  | 34.4770  | 34.4770  | 36.0093  | 37.5416  | 39.0739  | 40.6063  | 42.1386  |          | (42c)                        |
| Average daily hot water use (litres/day) |          |          |          |          |          |          |          |          |          |          |          |          | 129.8883 (43)                |
| Daily hot water use                      | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |                              |
| 141.3019                                 | 138.2846 | 134.6102 | 129.0228 | 124.4855 | 119.6075 | 117.7329 | 121.3914 | 125.2500 | 130.3710 | 136.0444 | 140.9354 |          | (44)                         |
| Energy conte                             | 223.7876 | 196.9154 | 206.8908 | 176.6258 | 167.5814 | 147.0714 | 142.3877 | 150.3080 | 154.4457 | 176.9122 | 193.8202 | 220.6708 | (45)                         |
| Energy content (annual)                  |          |          |          |          |          |          |          |          |          |          |          |          | Total = Sum(45)m = 2157.4171 |

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|                                                                 |                                                                                |          |          |          |          |          |          |          |          |          |          |                |
|-----------------------------------------------------------------|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| Distribution loss (46)m = 0.15 x (45)m                          | 33.5681                                                                        | 29.5373  | 31.0336  | 26.4939  | 25.1372  | 22.0607  | 21.3582  | 22.5462  | 23.1669  | 26.5368  | 29.0730  | 33.1006 (46)   |
| Water storage loss (or HIU loss):                               |                                                                                |          |          |          |          |          |          |          |          |          |          |                |
| Total storage loss                                              | 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (56)    |
| If cylinder contains dedicated solar storage                    | 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (57)    |
| Primary loss                                                    | 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (59)    |
| Combi loss                                                      | 12.0010                                                                        | 10.8287  | 11.9655  | 11.5300  | 11.8830  | 11.4679  | 11.8301  | 11.8467  | 11.4834  | 11.9026  | 11.5661  | 11.9945 (61)   |
| Total heat required for water heating calculated for each month | 235.7886                                                                       | 207.7441 | 218.8564 | 188.1558 | 179.4644 | 158.5393 | 154.2178 | 162.1547 | 165.9291 | 188.8148 | 205.3864 | 232.6653 (62)  |
| WWHRS                                                           | -30.8360                                                                       | -27.2716 | -28.5573 | -23.6466 | -22.0378 | -18.8579 | -17.6762 | -18.7969 | -19.5111 | -23.0014 | -26.0578 | -30.2650 (63a) |
| PV diverter                                                     | -0.0000                                                                        | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000 (63b)  |
| Solar input                                                     | 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63c)   |
| FGHRS                                                           | 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63d)   |
| Output from w/h                                                 | 204.9526                                                                       | 180.4725 | 190.2991 | 164.5092 | 157.4266 | 139.6815 | 136.5416 | 143.3578 | 146.4181 | 165.8134 | 179.3286 | 202.4003 (64)  |
|                                                                 | Total per year (kWh/year) = Sum(64)m =                                         |          |          |          |          |          |          |          |          |          |          | 2011.2011 (64) |
| Electric shower(s)                                              | 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (64a)   |
|                                                                 | Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |          |          |          |          |          |          |          | 0.0000 (64a)   |
| Heat gains from water heating, kWh/month                        | 77.4096                                                                        | 68.1815  | 71.7826  | 61.6106  | 58.6916  | 51.7682  | 50.3014  | 52.9391  | 54.2241  | 61.7990  | 67.3368  | 76.3717 (65)   |

## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |           |           |           |           |           |           |           |           |           |           |           |                |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
| Metabolic gains (Table 5), Watts                                                    | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec            |
| (66)m                                                                               | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 28.2615   | 25.1016   | 20.4140   | 15.4547   | 11.5526   | 9.7532    | 10.5387   | 13.6985   | 18.3862   | 23.3454   | 27.2476   | 29.0470 (67)   |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 369.6589  | 373.4948  | 363.8284  | 343.2499  | 317.2732  | 292.8588  | 276.5485  | 272.7126  | 282.3789  | 302.9575  | 328.9341  | 353.3486 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029 (69)   |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 3.0000    | 3.0000    | 3.0000 (70)    |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 (71) |
| Water heating gains (Table 5)                                                       | 104.0452  | 101.4606  | 96.4820   | 85.5702   | 78.8865   | 71.9003   | 67.6095   | 71.1547   | 75.3112   | 83.0631   | 93.5233   | 102.6501 (72)  |
| Total internal gains                                                                | 612.4909  | 610.5823  | 591.2497  | 554.8002  | 518.2376  | 482.0376  | 462.2219  | 465.0911  | 483.6016  | 519.8913  | 560.2303  | 595.5709 (73)  |

## 6. Solar gains

| [Jan]       |          |          |          |           | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W   |          |               |
|-------------|----------|----------|----------|-----------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|--------------|----------|---------------|
| <hr/>       |          |          |          |           |            |                                |                                   |                                    |                              |              |          |               |
| North       |          |          |          |           | 1.3900     | 10.6334                        | 0.4500                            | 0.0000                             | 0.7700                       | 5.1214 (74)  |          |               |
| East        |          |          |          |           | 4.1200     | 19.6403                        | 0.4500                            | 0.0000                             | 0.7700                       | 28.0380 (76) |          |               |
| West        |          |          |          |           | 5.2500     | 19.6403                        | 0.4500                            | 0.0000                             | 0.7700                       | 35.7281 (80) |          |               |
| East        |          |          |          |           | 5.2200     | 19.6403                        | 0.4500                            | 0.0000                             | 0.7700                       | 35.5239 (76) |          |               |
| <hr/>       |          |          |          |           |            |                                |                                   |                                    |                              |              |          |               |
| Solar gains | 104.4115 | 204.0197 | 336.5042 | 493.2296  | 607.7185   | 623.7941                       | 593.1680                          | 507.1627                           | 392.0216                     | 242.1237     | 130.1210 | 85.9208 (83)  |
| Total gains | 716.9024 | 814.6021 | 927.7539 | 1048.0298 | 1125.9562  | 1105.8317                      | 1055.3899                         | 972.2538                           | 875.6232                     | 762.0150     | 690.3513 | 681.4917 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| tau                                                                         | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153      |
| alpha                                                                       | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144       |
| util living area                                                            | 0.9895  | 0.9804  | 0.9552  | 0.8874  | 0.7555  | 0.5802  | 0.4313  | 0.4854  | 0.7332  | 0.9307  | 0.9817  | 0.9915 (86)  |
| MIT                                                                         | 19.4652 | 19.6894 | 20.0654 | 20.5007 | 20.8163 | 20.9564 | 20.9908 | 20.9845 | 20.8797 | 20.4381 | 19.8511 | 19.4003 (87) |
| Th 2                                                                        | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 (88) |
| util rest of house                                                          | 0.9866  | 0.9752  | 0.9433  | 0.8587  | 0.7005  | 0.4993  | 0.3358  | 0.3846  | 0.6556  | 0.9063  | 0.9759  | 0.9892 (89)  |
| MIT 2                                                                       | 18.4217 | 18.6732 | 19.0900 | 19.5536 | 19.8594 | 19.9728 | 19.9929 | 19.9904 | 19.9216 | 19.5015 | 18.8577 | 18.3485 (90) |
| Living area fraction                                                        | 18.6178 | 18.8642 | 19.2733 | 19.7316 | 20.0392 | 20.1576 | 20.1804 | 20.1773 | 20.1017 | 19.6775 | 19.0444 | 18.5462 (92) |
| MIT                                                                         | 18.6178 | 18.8642 | 19.2733 | 19.7316 | 20.0392 | 20.1576 | 20.1804 | 20.1773 | 20.1017 | 19.6775 | 19.0444 | 18.5462 (93) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT                                                                | 18.6178 | 18.8642 | 19.2733 | 19.7316 | 20.0392 | 20.1576 | 20.1804 | 20.1773 | 20.1017 | 19.6775 | 19.0444 | 18.5462 (93) |

## 8. Space heating requirement

|                                                                                |           |           |           |           |          |          |          |          |          |          |           |                |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|-----------|----------------|
| Utilisation                                                                    | Jan       | Feb       | Mar       | Apr       | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov       | Dec            |
| Useful gains                                                                   | 703.3685  | 787.9669  | 865.1927  | 890.8556  | 791.5842 | 567.1238 | 373.2358 | 392.0586 | 581.8743 | 683.2845 | 668.4980  | 670.9181 (95)  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000    | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000  | 7.1000    | 4.2000 (96)    |
| Heat loss rate W                                                               | 1501.6754 | 1464.5859 | 1339.6839 | 1136.0369 | 874.6314 | 582.8930 | 375.5223 | 396.1655 | 629.4641 | 952.0649 | 1252.7501 | 1504.6519 (97) |
| Space heating kWh                                                              | 593.9403  | 454.6880  | 353.0214  | 176.5305  | 61.7871  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 199.9726 | 420.6615  | 620.2980 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |          |          |          |          |          |          |           | 2880.8994      |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |           |          |          |          |          |          |          |           | 0.0000         |
| Space heating kWh                                                              | 593.9403  | 454.6880  | 353.0214  | 176.5305  | 61.7871  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 199.9726 | 420.6615  | 620.2980 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |          |          |          |          |          |          |           | 2880.8994      |
| Space heating per m2                                                           |           |           |           |           |          |          |          |          |          |          |           | 30.3828 (99)   |

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## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                                                              |          |          |          |          |          |          |          |          |          |          |          |                 |
|--------------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                        |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (201)    |
| Fraction of space heat from main system(s)                                                                   |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (202)    |
| Efficiency of main space heating system 1 (in %)                                                             |          |          |          |          |          |          |          |          |          |          |          | 91.7000 (206)   |
| Efficiency of main space heating system 2 (in %)                                                             |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)    |
| Efficiency of secondary/supplementary heating system, %                                                      |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)    |
|                                                                                                              | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec             |
| Space heating requirement                                                                                    | 593.9403 | 454.6880 | 353.0214 | 176.5305 | 61.7871  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 199.9726 | 420.6615 | 620.2980 (98)   |
| Space heating efficiency (main heating system 1)                                                             | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 91.7000  | 91.7000  | 91.7000 (210)   |
| Space heating fuel (main heating system)                                                                     | 647.6994 | 495.8430 | 384.9743 | 192.5088 | 67.3796  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 218.0726 | 458.7366 | 676.4427 (211)  |
| Space heating efficiency (main heating system 2)                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)    |
| Space heating fuel (main heating system 2)                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)    |
| Space heating fuel (secondary)                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)    |
| Water heating                                                                                                |          |          |          |          |          |          |          |          |          |          |          |                 |
| Water heating requirement                                                                                    | 204.9526 | 180.4725 | 190.2991 | 164.5092 | 157.4266 | 139.6815 | 136.5416 | 143.3578 | 146.4181 | 165.8134 | 179.3286 | 202.4003 (64)   |
| Efficiency of water heater (217)m                                                                            | 88.2516  | 88.1930  | 88.0530  | 87.7745  | 87.2818  | 86.7000  | 86.7000  | 86.7000  | 86.7000  | 87.8356  | 88.1618  | 88.2740 (217)   |
| Fuel for water heating, kWh/month                                                                            | 232.2367 | 204.6335 | 216.1188 | 187.4227 | 180.3660 | 161.1090 | 157.4874 | 165.3492 | 168.8790 | 188.7770 | 203.4086 | 229.2864 (219)  |
| Space cooling fuel requirement (221)m                                                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)    |
| Pumps and Fa                                                                                                 | 11.2600  | 10.1703  | 11.2600  | 10.8967  | 11.2600  | 10.8967  | 11.2600  | 11.2600  | 10.8967  | 11.2600  | 10.8967  | 11.2600 (231)   |
| Lighting                                                                                                     | 24.7371  | 19.8450  | 17.8683  | 13.0911  | 10.1119  | 8.2615   | 9.2244   | 11.9903  | 15.5742  | 20.4341  | 23.0803  | 25.4247 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity) (233a)m                                        | -13.8577 | -22.9196 | -39.1412 | -51.1890 | -60.7330 | -58.6935 | -57.5786 | -51.1723 | -40.7967 | -28.6393 | -16.1851 | -11.5083 (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)   |
| Electricity generated by PVs (Appendix M) (negative quantity) (233b)m                                        | -3.5626  | -8.8909  | -21.7125 | -39.0614 | -57.5840 | -60.2478 | -58.6981 | -46.0086 | -29.1122 | -13.8994 | -5.0330  | -2.6869 (233b)  |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234b)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235d)   |
| Annual totals kWh/year                                                                                       |          |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating fuel - main system 1                                                                           |          |          |          |          |          |          |          |          |          |          |          | 3141.6570 (211) |
| Space heating fuel - main system 2                                                                           |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)    |
| Space heating fuel - secondary                                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)    |
| Efficiency of water heater                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 86.7000         |
| Water heating fuel used                                                                                      |          |          |          |          |          |          |          |          |          |          |          | 2295.0741 (219) |
| Space cooling fuel                                                                                           |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (221)    |
| Electricity for pumps and fans:                                                                              |          |          |          |          |          |          |          |          |          |          |          |                 |
| (MEV)Decentralised, Database: total watage = 6.9420, total flow = 45.0000, SFP = 0.1543)                     |          |          |          |          |          |          |          |          |          |          |          |                 |
| mechanical ventilation fans (SFP = 0.1543)                                                                   |          |          |          |          |          |          |          |          |          |          |          | 46.5771 (230a)  |
| central heating pump                                                                                         |          |          |          |          |          |          |          |          |          |          |          | 41.0000 (230c)  |
| main heating flue fan                                                                                        |          |          |          |          |          |          |          |          |          |          |          | 45.0000 (230e)  |
| Total electricity for the above, kWh/year                                                                    |          |          |          |          |          |          |          |          |          |          |          | 132.5771 (231)  |
| Electricity for lighting (calculated in Appendix L)                                                          |          |          |          |          |          |          |          |          |          |          |          | 199.6429 (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                                |          |          |          |          |          |          |          |          |          |          |          |                 |
| PV generation                                                                                                |          |          |          |          |          |          |          |          |          |          |          | -798.9117 (233) |
| Wind generation                                                                                              |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (234)    |
| Hydro-electric generation (Appendix N)                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (235a)   |
| Electricity generated - Micro CHP (Appendix N)                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (235)    |
| Appendix Q - special features                                                                                |          |          |          |          |          |          |          |          |          |          |          |                 |
| Energy saved or generated                                                                                    |          |          |          |          |          |          |          |          |          |          |          | -0.0000 (236)   |
| Energy used                                                                                                  |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (237)    |
| Total delivered energy for all uses                                                                          |          |          |          |          |          |          |          |          |          |          |          | 4970.0393 (238) |

## 10a. Fuel costs - using Table 12 prices

|                                             | Fuel kWh/year | Fuel price p/kWh | Fuel cost £/year |
|---------------------------------------------|---------------|------------------|------------------|
| Space heating - main system 1               | 3141.6570     | 3.6400           | 114.3563 (240)   |
| Total CO2 associated with community systems |               |                  | 0.0000 (473)     |
| Water heating (other fuel)                  | 2295.0741     | 3.6400           | 83.5407 (247)    |
| Energy for instantaneous electric shower(s) | 0.0000        | 16.4900          | 0.0000 (247a)    |
| Pumps, fans and electric keep-hot           | 132.5771      | 16.4900          | 21.8620 (249)    |
| Energy for lighting                         | 199.6429      | 16.4900          | 32.9211 (250)    |
| Additional standing charges                 |               |                  | 92.0000 (251)    |
| Energy saving/generation technologies       |               |                  |                  |
| PV Unit electricity used in dwelling        | -452.4142     | 16.4900          | -74.6031         |
| PV Unit electricity exported                | -346.4975     | 5.5900           | -19.3692         |
| Total                                       |               |                  | -93.9723 (252)   |
| Total energy cost                           |               |                  | 250.7078 (255)   |

## 11a. SAP rating - Individual heating systems

|                                  |  |              |
|----------------------------------|--|--------------|
| Energy cost deflator (Table 12): |  | 0.3600 (256) |
| Energy cost factor (ECF)         |  | 0.6455 (257) |
| SAP value                        |  | 89.5363      |
| SAP rating (Section 12)          |  | 90 (258)     |
| SAP band                         |  | B            |

$$[(255) \times (256)] / [(4) + 45.0] =$$

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## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|---------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1               | 3141.6570          | 0.2100                        | 659.7480 (261)           |
| Total CO2 associated with community systems |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                  | 2295.0741          | 0.2100                        | 481.9656 (264)           |
| Space and water heating                     |                    |                               | 1141.7135 (265)          |
| Pumps, fans and electric keep-hot           | 132.5771           | 0.1387                        | 18.3901 (267)            |
| Energy for lighting                         | 199.6429           | 0.1443                        | 28.8146 (268)            |
| Energy saving/generation technologies       |                    |                               |                          |
| PV Unit electricity used in dwelling        | -452.4142          | 0.1318                        | -59.6090                 |
| PV Unit electricity exported                | -346.4975          | 0.1217                        | -42.1576                 |
| Total                                       |                    |                               | -101.7666 (269)          |
| Total CO2, kg/year                          |                    |                               | 1087.1516 (272)          |
| CO2 emissions per m2                        |                    |                               | 11.4700 (273)            |
| EI value                                    |                    |                               | 89.5810                  |
| EI rating                                   |                    |                               | 90 (274)                 |
| EI band                                     |                    |                               | B                        |

## SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

### 1. Overall dwelling characteristics

|                                                        | Area<br>(m2) | Storey height<br>(m)              | Volume<br>(m3)         |
|--------------------------------------------------------|--------------|-----------------------------------|------------------------|
| Main dwelling                                          |              |                                   |                        |
| Ground floor                                           | 47.4100 (1b) | x 2.4600 (2b)                     | = 116.6286 (1b) - (3b) |
| First floor                                            | 47.4100 (1c) | x 2.7600 (2c)                     | = 130.8516 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 94.8200      |                                   | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 247.4802 (5)           |

### 2. Ventilation rate

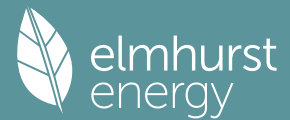
|                                                                                                    | m3 per hour                             |
|----------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                    |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                    |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                    |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                    |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                    |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                    |
| Number of intermittent extract fans                                                                | 0 * 10 = 0.0000 (7a)                    |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)                    |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 0.0000 / (5) = 0.0000 (8)               |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 4.5000 (17)                             |
| Infiltration rate                                                                                  | 0.2250 (18)                             |
| Number of sides sheltered                                                                          | 2 (19)                                  |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 0.8500 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.1913 (21)        |

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | 4.2000 | 4.0000 | 4.0000 | 3.7000 | 3.7000 | 3.3000 | 3.4000 | 3.2000 | 3.3000 | 3.5000 | 3.5000 | 3.8000 (22)  |
| Wind factor                                                                                             | 1.0500 | 1.0000 | 1.0000 | 0.9250 | 0.9250 | 0.8250 | 0.8500 | 0.8000 | 0.8250 | 0.8750 | 0.8750 | 0.9500 (22a) |
| Adj infilt rate                                                                                         | 0.2008 | 0.1913 | 0.1913 | 0.1769 | 0.1769 | 0.1578 | 0.1626 | 0.1530 | 0.1578 | 0.1673 | 0.1673 | 0.1817 (22b) |
| Mechanical extract ventilation - decentralised                                                          |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        |              |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 (25)  |

### 3. Heat losses and heat loss parameter

| Element                                           | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K | A x U<br>W/K         | K-value<br>kJ/m2K | A x K<br>kJ/K                                        |
|---------------------------------------------------|-------------|----------------|---------------|------------------|----------------------|-------------------|------------------------------------------------------|
| Main dwelling                                     |             |                |               |                  |                      |                   |                                                      |
| Front Door                                        |             |                | 2.2300        | 1.2000           | 2.6760               |                   | (26)                                                 |
| Windows                                           |             |                | 10.7600       | 1.2357           | 13.2966              |                   | (27)                                                 |
| French Doors                                      |             |                | 5.2200        | 1.2357           | 6.4506               |                   | (27)                                                 |
| GF SPVL 125TS P/A                                 |             |                | 47.4100       | 0.1300           | 6.1633               | 75.0000           | 3555.7500 (28a)                                      |
| EW Brick AAC011                                   | 151.6400    | 18.2100        | 133.4300      | 0.1800           | 24.0174              | 60.0000           | 8005.8000 (29a)                                      |
| PR 500mm MW044                                    | 47.4100     |                | 47.4100       | 0.0900           | 4.2669               | 9.0000            | 426.6900 (30)                                        |
| Total net area of external elements Aum(A, m2)    |             |                | 246.4600      |                  |                      |                   | (31)                                                 |
| Fabric heat loss, W/K = Sum (A x U)               |             |                |               |                  | (26)...(30) + (32) = | 56.8707           | (33)                                                 |
| Main dwelling                                     |             |                |               |                  |                      |                   |                                                      |
| Timber - GF                                       |             |                | 24.2600       |                  |                      | 9.0000            | 218.3400 (32c)                                       |
| Timber - FF                                       |             |                | 140.7000      |                  |                      | 9.0000            | 1266.3000 (32c)                                      |
| Masonry GF                                        |             |                | 51.5100       |                  |                      | 100.0000          | 5151.0000 (32c)                                      |
| Internal Floor FF                                 |             |                | 47.4100       |                  |                      | 18.0000           | 853.3800 (32d)                                       |
| Internal Ceiling GF                               |             |                | 47.4100       |                  |                      | 9.0000            | 426.6900 (32e)                                       |
| Heat capacity Cm = Sum(A x k)                     |             |                |               |                  |                      |                   | (28)...(30) + (32) + (32a)...(32e) = 19903.9500 (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K |             |                |               |                  |                      |                   | 209.9130 (35)                                        |

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## List of Thermal Bridges

|                                                                  | Length  | Psi-value             | Total          |
|------------------------------------------------------------------|---------|-----------------------|----------------|
| K1 Element                                                       |         |                       |                |
| E2 Other lintels (including other steel lintels)                 | 11.9100 | 0.0410                | 0.4883         |
| E3 Sill                                                          | 9.4200  | 0.0220                | 0.2072         |
| E4 Jamb                                                          | 22.0500 | 0.0190                | 0.4189         |
| E5 Ground floor (normal)                                         | 12.0200 | 0.0928                | 1.1155         |
| E6 Intermediate floor within a dwelling                          | 29.0500 | 0.0020                | 0.0581         |
| E10 Eaves (insulation at ceiling level)                          | 9.1500  | 0.0390                | 0.3569         |
| E18 Party wall between dwellings                                 | 0.0000  | 0.0300                | 0.0000         |
| E4 Jamb                                                          | 4.2000  | 0.1000                | 0.4200         |
| E2 Other lintels (including other steel lintels)                 | 1.0600  | 0.0410                | 0.0435         |
| P1 Party wall - Ground floor                                     | 0.0000  | 0.1000                | 0.0000         |
| P2 Party wall - Intermediate floor within a dwelling             | 0.0000  | 0.0000                | 0.0000         |
| P4 Party wall - Roof (insulation at ceiling level)               | 0.0000  | 0.0350                | 0.0000         |
| E5 Ground floor (normal)                                         | 17.0300 | 0.0980                | 1.6689         |
| E12 Gable (insulation at ceiling level)                          | 19.9000 | 0.0870                | 1.7313         |
| E16 Corner (normal)                                              | 26.1000 | 0.0420                | 1.0962         |
| E17 Corner (inverted - internal area greater than external area) | 5.2200  | -0.0820               | -0.4280        |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)       |         |                       | 7.1768 (36)    |
| Point Thermal bridges                                            |         |                       | (36a) = 0.0000 |
| Total fabric heat loss                                           |         | (33) + (36) + (36a) = | 64.0475 (37)   |

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

|                           | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |          |
|---------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| (38)m                     | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | (38)     |
| Heat transfer coeff       | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | (39)     |
| Average = Sum(39)m / 12 = |          |          |          |          |          |          |          |          |          |          |          |          | 104.8817 |
| HLP                       | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | (40)     |
| HLP (average)             |          |          |          |          |          |          |          |          |          |          |          |          | 1.1061   |
| Days in mont              | 31       | 28       | 31       | 30       | 31       | 30       | 31       | 31       | 30       | 31       | 30       | 31       |          |

## 4. Water heating energy requirements (kWh/year)

|                                                                                |          |          |          |          |          |          |          |          |          |          |          |          |               |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Assumed occupancy                                                              |          |          |          |          |          |          |          |          |          |          |          |          | 2.6861 (42)   |
| Hot water usage for mixer showers                                              |          |          |          |          |          |          |          |          |          |          |          |          |               |
| 69.2572                                                                        | 68.2164  | 66.6997  | 63.7979  | 61.6564  | 59.2683  | 57.9108  | 59.4160  | 61.0660  | 63.6301  | 66.5943  | 68.9918  | 68.9918  | (42a)         |
| Hot water usage for baths                                                      |          |          |          |          |          |          |          |          |          |          |          |          |               |
| 29.9061                                                                        | 29.4619  | 28.8365  | 27.6833  | 26.8197  | 25.8622  | 25.3450  | 25.9661  | 26.6424  | 27.6669  | 28.8439  | 29.8050  | 29.8050  | (42b)         |
| Hot water usage for other uses                                                 |          |          |          |          |          |          |          |          |          |          |          |          |               |
| 42.1386                                                                        | 40.6063  | 39.0739  | 37.5416  | 36.0093  | 34.4770  | 34.4770  | 36.0093  | 37.5416  | 39.0739  | 40.6063  | 42.1386  | 42.1386  | (42c)         |
| Average daily hot water use (litres/day)                                       |          |          |          |          |          |          |          |          |          |          |          |          | 129.8883 (43) |
| Daily hot water use                                                            |          |          |          |          |          |          |          |          |          |          |          |          |               |
| 141.3019                                                                       | 138.2846 | 134.6102 | 129.0228 | 124.4855 | 119.6075 | 117.7329 | 121.3914 | 125.2500 | 130.3710 | 136.0444 | 140.9354 | 140.9354 | (44)          |
| Energy conte                                                                   | 223.7876 | 196.9154 | 206.8908 | 176.6258 | 167.5814 | 147.0714 | 150.3080 | 154.4457 | 176.9122 | 193.8202 | 220.6708 | 220.6708 | (45)          |
| Energy content (annual)                                                        |          |          |          |          |          |          |          |          |          |          |          |          |               |
| Distribution loss (46)m = 0.15 x (45)m                                         |          |          |          |          |          |          |          |          |          |          |          |          |               |
| 33.5681                                                                        | 29.5373  | 31.0336  | 26.4939  | 25.1372  | 22.0607  | 21.3582  | 22.5462  | 23.1669  | 26.5368  | 29.0730  | 33.1006  | 33.1006  | (46)          |
| Water storage loss (or HIU loss):                                              |          |          |          |          |          |          |          |          |          |          |          |          |               |
| Total storage loss                                                             |          |          |          |          |          |          |          |          |          |          |          |          |               |
| 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (56)          |
| If cylinder contains dedicated solar storage                                   |          |          |          |          |          |          |          |          |          |          |          |          |               |
| 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (57)          |
| Primary loss                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (59)          |
| Combi loss                                                                     | 12.0010  | 10.8287  | 11.9655  | 11.5300  | 11.8830  | 11.4679  | 11.8301  | 11.8467  | 11.4834  | 11.9026  | 11.5661  | 11.9945  | (61)          |
| Total heat required for water heating calculated for each month                |          |          |          |          |          |          |          |          |          |          |          |          |               |
| 235.7886                                                                       | 207.7441 | 218.8564 | 188.1558 | 179.4644 | 158.5393 | 154.2178 | 162.1547 | 165.9291 | 188.8148 | 205.3864 | 232.6653 | 232.6653 | (62)          |
| WWHRS                                                                          | -30.8360 | -27.2716 | -28.5573 | -23.6466 | -22.0378 | -18.8579 | -17.6762 | -18.7969 | -19.5111 | -23.0014 | -26.0578 | -30.2650 | (63a)         |
| PV diverter                                                                    | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | (63b)         |
| Solar input                                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (63c)         |
| FGHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (63d)         |
| Output from w/h                                                                |          |          |          |          |          |          |          |          |          |          |          |          |               |
| 204.9526                                                                       | 180.4725 | 190.2991 | 164.5092 | 157.4266 | 139.6815 | 136.5416 | 143.3578 | 146.4181 | 165.8134 | 179.3286 | 202.4003 | 202.4003 | (64)          |
| Electric shower(s)                                                             |          |          |          |          |          |          |          |          |          |          |          |          |               |
| 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (64a)         |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (64a)  |
| Heat gains from water heating, kWh/month                                       |          |          |          |          |          |          |          |          |          |          |          |          |               |
| 77.4096                                                                        | 68.1815  | 71.7826  | 61.6106  | 58.6916  | 51.7682  | 50.3014  | 52.9391  | 54.2241  | 61.7990  | 67.3368  | 76.3717  | 76.3717  | (65)          |

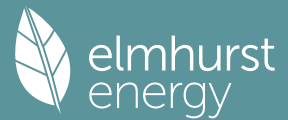
## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |           |           |           |           |           |           |           |           |           |           |           |           |      |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------|
| Metabolic gains (Table 5), Watts                                                    |           |           |           |           |           |           |           |           |           |           |           |           |      |
| (66)m                                                                               | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     |           |           |           |           |           |           |           |           |           |           |           |           |      |
| 28.2615                                                                             | 25.1016   | 20.4140   | 15.4547   | 11.5526   | 9.7532    | 10.5387   | 13.6985   | 18.3862   | 23.3454   | 27.2476   | 29.0470   | 29.0470   | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 |           |           |           |           |           |           |           |           |           |           |           |           |      |
| 369.6589                                                                            | 373.4948  | 363.8284  | 343.2499  | 317.2732  | 292.8588  | 276.5485  | 272.7126  | 282.3789  | 302.9575  | 328.9341  | 353.3486  | 353.3486  | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    |           |           |           |           |           |           |           |           |           |           |           |           |      |
| 53.8029                                                                             | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | (69) |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 3.0000    | 3.0000    | 3.0000    | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 |           |           |           |           |           |           |           |           |           |           |           |           |      |
| -107.4449                                                                           | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | (71) |
| Water heating gains (Table 5)                                                       |           |           |           |           |           |           |           |           |           |           |           |           |      |
| 104.0452                                                                            | 101.4606  | 96.4820   | 85.5702   | 78.8865   | 71.9003   | 67.6095   | 71.1547   | 75.3112   | 83.0631   | 93.5233   | 102.6501  | 102.6501  | (72) |
| Total internal gains                                                                | 612.4909  | 610.5823  | 591.2497  | 554.8002  | 518.2376  | 482.0376  | 462.2219  | 465.0911  | 483.6016  | 519.8913  | 560.2303  | 595.5709  | (73) |

## 6. Solar gains

| [Jan] | Area<br>m <sup>2</sup> | Solar flux<br>Table 6a<br>W/m <sup>2</sup> | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W   |
|-------|------------------------|--------------------------------------------|-----------------------------------|------------------------------------|------------------------------|--------------|
| North | 1.3900                 | 11.9814                                    | 0.4500                            | 0.0000                             | 0.7700                       | 5.7707 (74)  |
| East  | 4.1200                 | 22.3313                                    | 0.4500                            | 0.0000                             | 0.7700                       | 31.8797 (76) |

# Full SAP Calculation Printout



|      |        |         |        |        |        |              |
|------|--------|---------|--------|--------|--------|--------------|
| West | 5.2500 | 22.3313 | 0.4500 | 0.0000 | 0.7700 | 40.6235 (80) |
| East | 5.2200 | 22.3313 | 0.4500 | 0.0000 | 0.7700 | 40.3913 (76) |

|             |          |          |          |           |           |           |           |           |          |          |          |               |
|-------------|----------|----------|----------|-----------|-----------|-----------|-----------|-----------|----------|----------|----------|---------------|
| Solar gains | 118.6652 | 208.6660 | 339.5574 | 511.6799  | 613.0465  | 672.9016  | 633.1510  | 554.4153  | 428.4009 | 264.3288 | 151.5207 | 96.6906 (83)  |
| Total gains | 731.1561 | 819.2483 | 930.8072 | 1066.4801 | 1131.2842 | 1154.9392 | 1095.3729 | 1019.5064 | 912.0025 | 784.2201 | 711.7510 | 692.2615 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |                           |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |                           |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |                           |         |         |              |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep                       | Oct     | Nov     | Dec          |
| tau                                                                         | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153                   | 52.7153 | 52.7153 | 52.7153      |
| alpha                                                                       | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144                    | 4.5144  | 4.5144  | 4.5144       |
| util living area                                                            | 0.9863  | 0.9764  | 0.9441  | 0.8526  | 0.6801  | 0.4469  | 0.2960  | 0.3277  | 0.6270                    | 0.8985  | 0.9739  | 0.9889 (86)  |
| MIT                                                                         | 19.6061 | 19.7994 | 20.1936 | 20.6246 | 20.8974 | 20.9879 | 20.9986 | 20.9978 | 20.9463                   | 20.5857 | 20.0129 | 19.5523 (87) |
| Th 2                                                                        | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958                   | 19.9958 | 19.9958 | 19.9958 (88) |
| util rest of house                                                          | 0.9825  | 0.9700  | 0.9289  | 0.8157  | 0.6130  | 0.3605  | 0.2006  | 0.2257  | 0.5340                    | 0.8627  | 0.9653  | 0.9857 (89)  |
| MIT 2                                                                       | 18.5808 | 18.7968 | 19.2305 | 19.6791 | 19.9284 | 19.9912 | 19.9956 | 19.9955 | 19.9691                   | 19.6537 | 19.0384 | 18.5205 (90) |
| Living area fraction                                                        |         |         |         |         |         |         |         |         | fLA = Living area / (4) = |         |         | 0.1879 (91)  |
| MIT                                                                         | 18.7735 | 18.9852 | 19.4115 | 19.8568 | 20.1105 | 20.1785 | 20.1841 | 20.1839 | 20.1527                   | 19.8289 | 19.2215 | 18.7144 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |                           |         |         | 0.0000       |
| adjusted MIT                                                                | 18.7735 | 18.9852 | 19.4115 | 19.8568 | 20.1105 | 20.1785 | 20.1841 | 20.1839 | 20.1527                   | 19.8289 | 19.2215 | 18.7144 (93) |

## 8. Space heating requirement

|                                                                                |           |           |           |           |          |          |          |          |          |               |           |                 |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|---------------|-----------|-----------------|
| Utilisation                                                                    | 0.9760    | 0.9614    | 0.9179    | 0.8099    | 0.6212   | 0.3765   | 0.2185   | 0.2449   | 0.5493   | 0.8555        | 0.9565    | Dec 0.9800 (94) |
| Useful gains                                                                   | 713.6053  | 787.6341  | 854.4125  | 863.7867  | 702.7023 | 434.8098 | 239.3672 | 249.6911 | 501.0070 | 670.9366      | 680.7650  | 678.4296 (95)   |
| Ext temp.                                                                      | 5.1000    | 5.6000    | 7.4000    | 9.9000    | 13.0000  | 16.0000  | 17.9000  | 17.8000  | 15.2000  | 11.6000       | 8.0000    | 5.1000 (96)     |
| Heat loss rate W                                                               | 1434.1030 | 1403.8641 | 1259.7883 | 1044.2844 | 745.7652 | 438.2515 | 239.5632 | 250.0225 | 519.4504 | 863.0595      | 1176.9311 | 1427.9061 (97)  |
| Space heating kWh                                                              | 536.0503  | 414.1066  | 301.5996  | 129.9584  | 32.0388  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 142.9395      | 357.2396  | 557.6105 (98a)  |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |          |          |          |          |          |               |           | 2471.5431       |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | 0.0000 (98b)    |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |           |          |          |          |          |          |               |           | 0.0000          |
| Space heating kWh                                                              | 536.0503  | 414.1066  | 301.5996  | 129.9584  | 32.0388  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 142.9395      | 357.2396  | 557.6105 (98c)  |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |          |          |          |          |          |               |           | 2471.5431       |
| Space heating per m2                                                           |           |           |           |           |          |          |          |          |          | (98c) / (4) = |           | 26.0656 (99)    |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                                                      |          |          |          |          |          |          |          |          |          |          |          |                 |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (201)    |
| Fraction of space heat from main system(s)                                                           |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (202)    |
| Efficiency of main space heating system 1 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 91.7000 (206)   |
| Efficiency of main space heating system 2 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)    |
| Efficiency of secondary/supplementary heating system, %                                              |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)    |
|                                                                                                      | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec             |
| Space heating requirement                                                                            | 536.0503 | 414.1066 | 301.5996 | 129.9584 | 32.0388  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 142.9395 | 357.2396 | 557.6105 (98)   |
| Space heating efficiency (main heating system 1)                                                     | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 91.7000  | 91.7000  | 91.7000 (210)   |
| Space heating fuel (main heating system)                                                             | 584.5695 | 451.5884 | 328.8981 | 141.7212 | 34.9387  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 155.8773 | 389.5742 | 608.0813 (211)  |
| Space heating efficiency (main heating system 2)                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)    |
| Space heating fuel (main heating system 2)                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)    |
| Space heating fuel (secondary)                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)    |
| Water heating requirement                                                                            | 204.9526 | 180.4725 | 190.2991 | 164.5092 | 157.4266 | 139.6815 | 136.5416 | 143.3578 | 146.4181 | 165.8134 | 179.3286 | 202.4003 (64)   |
| Efficiency of water heater (217)m                                                                    | 88.2091  | 88.1519  | 87.9756  | 87.6144  | 87.0481  | 86.7000  | 86.7000  | 86.7000  | 86.7000  | 87.6597  | 88.0869  | 86.7000 (216)   |
| Fuel for water heating, kWh/month                                                                    | 232.3487 | 204.7289 | 216.3089 | 187.7650 | 180.8502 | 161.1090 | 157.4874 | 165.3492 | 168.8790 | 189.1557 | 203.5814 | 229.3985 (219)  |
| Space cooling fuel requirement (221)m                                                                | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)    |
| Pumps and Fa                                                                                         | 11.2600  | 10.1703  | 11.2600  | 10.8967  | 11.2600  | 10.8967  | 11.2600  | 11.2600  | 10.8967  | 11.2600  | 10.8967  | 11.2600 (231)   |
| Lighting                                                                                             | 24.7371  | 19.8450  | 17.8683  | 13.0911  | 10.1119  | 8.2615   | 9.2244   | 11.9903  | 15.5742  | 20.4341  | 23.0803  | 25.4247 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| (233a)m                                                                                              | -15.6190 | -23.5119 | -39.6513 | -52.7819 | -61.3023 | -61.7585 | -60.2056 | -54.5131 | -43.7099 | -30.8996 | -18.5675 | -12.8750 (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |          |          |          |          |          |          |          |          |                 |
| (234a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |          |          |          |          |          |          |          |          |                 |
| (235a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |          |          |          |          |          |          |          |          |                 |
| (235c)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| (233b)m                                                                                              | -4.3417  | -9.2903  | -22.2296 | -41.4662 | -58.7043 | -67.1664 | -64.5439 | -52.3765 | -33.2487 | -15.9167 | -6.3436  | -3.2295 (233b)  |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |          |          |          |          |          |          |          |          |                 |
| (234b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234b)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |          |          |          |          |          |          |          |          |                 |
| (235b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |          |          |          |          |          |          |          |          |                 |
| (235d)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235d)   |
| Annual totals kWh/year                                                                               |          |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating fuel - main system 1                                                                   |          |          |          |          |          |          |          |          |          |          |          | 2695.2488 (211) |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)    |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)    |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          | 86.7000         |
| Water heating fuel used                                                                              |          |          |          |          |          |          |          |          |          |          |          | 2296.9618 (219) |
| Space cooling fuel                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (221)    |

# Full SAP Calculation Printout



|                                                                                         |           |        |
|-----------------------------------------------------------------------------------------|-----------|--------|
| Electricity for pumps and fans:                                                         |           |        |
| (MEVDecentralised, Database: total watage = 6.9420, total flow = 45.0000, SFP = 0.1543) |           |        |
| mechanical ventilation fans (SFP = 0.1543)                                              | 46.5771   | (230a) |
| central heating pump                                                                    | 41.0000   | (230c) |
| main heating flue fan                                                                   | 45.0000   | (230e) |
| Total electricity for the above, kWh/year                                               | 132.5771  | (231)  |
| Electricity for lighting (calculated in Appendix L)                                     | 199.6429  | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                           |           |        |
| PV generation                                                                           | -854.2531 | (233)  |
| Wind generation                                                                         | 0.0000    | (234)  |
| Hydro-electric generation (Appendix N)                                                  | 0.0000    | (235a) |
| Electricity generated - Micro CHP (Appendix N)                                          | 0.0000    | (235)  |
| Appendix Q - special features                                                           |           |        |
| Energy saved or generated                                                               | -0.0000   | (236)  |
| Energy used                                                                             | 0.0000    | (237)  |
| Total delivered energy for all uses                                                     | 4470.1774 | (238)  |

|                                             |           |            |                 |
|---------------------------------------------|-----------|------------|-----------------|
| -----                                       |           |            |                 |
| 10a. Fuel costs - using BEDF prices (596)   |           |            |                 |
| -----                                       |           |            |                 |
|                                             | Fuel      | Fuel price | Fuel cost       |
|                                             | kWh/year  | p/kWh      | £/year          |
| Space heating - main system 1               | 2695.2488 | 7.3200     | 197.2922 (240)  |
| Total CO2 associated with community systems |           |            | 0.0000 (473)    |
| Water heating (other fuel)                  | 2296.9618 | 7.3200     | 168.1376 (247)  |
| Energy for instantaneous electric shower(s) | 0.0000    | 27.6700    | 0.0000 (247a)   |
| Pumps, fans and electric keep-hot           | 132.5771  | 27.6700    | 36.6841 (249)   |
| Energy for lighting                         | 199.6429  | 27.6700    | 55.2412 (250)   |
| Additional standing charges                 |           |            | 108.0000 (251)  |
| Energy saving/generation technologies       |           |            |                 |
| PV Unit electricity used in dwelling        | -475.3956 | 27.6700    | -131.5419       |
| PV Unit electricity exported                | -378.8575 | 5.8100     | -22.0116        |
| Total                                       |           |            | -153.5536 (252) |
| Total energy cost                           |           |            | 411.8015 (255)  |

|                                                                                |           |                 |                 |
|--------------------------------------------------------------------------------|-----------|-----------------|-----------------|
| -----                                                                          |           |                 |                 |
| 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP |           |                 |                 |
| -----                                                                          |           |                 |                 |
|                                                                                | Energy    | Emission factor | Emissions       |
|                                                                                | kWh/year  | kg CO2/kWh      | kg CO2/year     |
| Space heating - main system 1                                                  | 2695.2488 | 0.2100          | 566.0022 (261)  |
| Total CO2 associated with community systems                                    |           |                 | 0.0000 (373)    |
| Water heating (other fuel)                                                     | 2296.9618 | 0.2100          | 482.3620 (264)  |
| Space and water heating                                                        |           |                 | 1048.3642 (265) |
| Pumps, fans and electric keep-hot                                              | 132.5771  | 0.1387          | 18.3901 (267)   |
| Energy for lighting                                                            | 199.6429  | 0.1443          | 28.8146 (268)   |
| Energy saving/generation technologies                                          |           |                 |                 |
| PV Unit electricity used in dwelling                                           | -475.3956 | 0.1318          | -62.6507        |
| PV Unit electricity exported                                                   | -378.8575 | 0.1212          | -45.9143        |
| Total                                                                          |           |                 | -108.5651 (269) |
| Total CO2, kg/year                                                             |           |                 | 987.0038 (272)  |

|                                                                      |           |                       |                 |
|----------------------------------------------------------------------|-----------|-----------------------|-----------------|
| -----                                                                |           |                       |                 |
| 13a. Primary energy - Individual heating systems including micro-CHP |           |                       |                 |
| -----                                                                |           |                       |                 |
|                                                                      | Energy    | Primary energy factor | Primary energy  |
|                                                                      | kWh/year  | kg CO2/kWh            | kWh/year        |
| Space heating - main system 1                                        | 2695.2488 | 1.1300                | 3045.6311 (275) |
| Total CO2 associated with community systems                          |           |                       | 0.0000 (473)    |
| Water heating (other fuel)                                           | 2296.9618 | 1.1300                | 2595.5668 (278) |
| Space and water heating                                              |           |                       | 5641.1979 (279) |
| Pumps, fans and electric keep-hot                                    | 132.5771  | 1.5128                | 200.5626 (281)  |
| Energy for lighting                                                  | 199.6429  | 1.5338                | 306.2189 (282)  |
| Energy saving/generation technologies                                |           |                       |                 |
| PV Unit electricity used in dwelling                                 | -475.3956 | 1.4869                | -706.8613       |
| PV Unit electricity exported                                         | -378.8575 | 0.4445                | -168.4174       |
| Total                                                                |           |                       | -875.2787 (283) |
| Total Primary energy kWh/year                                        |           |                       | 5272.7008 (286) |

# Full SAP Calculation Printout



|                                    |                                                          |               |        |                |            |
|------------------------------------|----------------------------------------------------------|---------------|--------|----------------|------------|
| Plot Reference                     | 4907-R823-9471-002                                       |               |        | Issued on Date | 21/07/2026 |
| Assessment Reference               | Plot 2                                                   | Plot Type Ref | Plot 2 |                |            |
| Plot Address                       | Plot 2, Beaconsfield-Semi, K, WC, B, ES, 1012            |               |        | SAP Version    | 10.2       |
| SAP Rating                         | 90 B                                                     | DER           | 11.23  | TER            | 11.61      |
| Environmental                      | 90 B                                                     | % DER < TER   |        | 3.27           |            |
| CO <sub>2</sub> Emissions (t/year) | 0.86                                                     | DFEE          | 35.32  | TFEE           | 37.71      |
| Compliance Check                   | See BREL                                                 | % DFEE < TFEE |        | 6.34           |            |
| % DPER < TPER                      | 0.39                                                     | DPER          | 60.42  | TPER           | 60.66      |
| Assessor Details                   | Mr. Daniel Harris                                        |               |        | Assessor ID    | R823-0001  |
| Client                             | Crest Nicholson Head Office, Crest Nicholson Head Office |               |        |                |            |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)            | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Main dwelling                                          |                           |                                 |                             |
| Ground floor                                           | 42.9900 (1b)              | x 2.4600 (2b)                   | = 105.7554 (1b) - (3b)      |
| First floor                                            | 42.9900 (1c)              | x 2.7600 (2c)                   | = 118.6524 (1c) - (3c)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 85.9800                   |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 224.4078 (5)              |

## 2. Ventilation rate

|                                                                                                    | m <sup>3</sup> per hour                 |
|----------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                    |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                    |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                    |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                    |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                    |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                    |
| Number of intermittent extract fans                                                                | 0 * 10 = 0.0000 (7a)                    |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)                    |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 0.0000 / (5) = 0.0000 (8)               |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 4.5000 (17)                             |
| Infiltration rate                                                                                  | 0.2250 (18)                             |
| Number of sides sheltered                                                                          | 2 (19)                                  |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 0.8500 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.1913 (21)        |

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor                                                                                             | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate                                                                                         | 0.2438 | 0.2391 | 0.2343 | 0.2104 | 0.2056 | 0.1817 | 0.1817 | 0.1769 | 0.1913 | 0.2056 | 0.2152 | 0.2247 (22b) |
| Mechanical extract ventilation - decentralised                                                          |        |        |        |        |        |        |        |        |        |        |        |              |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 (25)  |

## 3. Heat losses and heat loss parameter

| Element                                                      | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K   |
|--------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|-----------------|
| Main dwelling                                                |                         |                            |                           |                               |              |                                |                 |
| Front Door                                                   |                         |                            | 2.5500                    | 1.2000                        | 3.0600       |                                | (26)            |
| Windows                                                      |                         |                            | 10.2500                   | 1.2357                        | 12.6663      |                                | (27)            |
| French Doors                                                 |                         |                            | 3.3300                    | 1.2357                        | 4.1150       |                                | (27)            |
| GF SPVL 125TS P/A                                            |                         |                            | 42.9900                   | 0.1300                        | 5.5887       | 75.0000                        | 3224.2500 (28a) |
| EW Brick AAC011                                              | 97.2486                 | 16.1300                    | 81.1186                   | 0.1800                        | 14.6013      | 60.0000                        | 4867.1160 (29a) |
| PR 500mm MW044                                               | 42.9900                 |                            | 42.9900                   | 0.0900                        | 3.8691       | 9.0000                         | 386.9100 (30)   |
| Total net area of external elements Aum (A, m <sup>2</sup> ) |                         |                            | 183.2286                  |                               |              |                                | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                          |                         |                            | (26)...(30) + (32) =      |                               | 43.9005      |                                | (33)            |
| Main dwelling                                                |                         |                            |                           |                               |              |                                |                 |
| E-WM-30                                                      |                         |                            | 43.8000                   | 0.0000                        | 0.0000       | 45.0000                        | 1971.0000 (32)  |
| Timber - GF                                                  |                         |                            | 88.6100                   |                               |              | 9.0000                         | 797.4900 (32c)  |
| Timber - FF                                                  |                         |                            | 126.9000                  |                               |              | 9.0000                         | 1142.1000 (32c) |
| Internal Floor FF                                            |                         |                            | 42.9900                   |                               |              | 18.0000                        | 773.8200 (32d)  |
| Internal Ceiling GF                                          |                         |                            | 42.9900                   |                               |              | 9.0000                         | 386.9100 (32e)  |

# Full SAP Calculation Printout



Heat capacity  $C_m = \text{Sum}(A \times k)$   
Thermal mass parameter (TMP) =  $C_m / \text{TFA}$  in  $\text{kJ/m}^2\text{K}$   
List of Thermal Bridges

|                                                      | Length  | Psi-value | Total  |
|------------------------------------------------------|---------|-----------|--------|
| K1 Element                                           |         |           |        |
| E2 Other lintels (including other steel lintels)     | 10.7800 | 0.0410    | 0.4420 |
| E3 Sill                                              | 9.2000  | 0.0220    | 0.2024 |
| E4 Jamb                                              | 21.1500 | 0.0190    | 0.4018 |
| E5 Ground floor (normal)                             | 10.2300 | 0.0928    | 0.9493 |
| E6 Intermediate floor within a dwelling              | 18.6300 | 0.0020    | 0.0373 |
| E10 Eaves (insulation at ceiling level)              | 10.2500 | 0.0390    | 0.3997 |
| E18 Party wall between dwellings                     | 10.4400 | 0.0330    | 0.3445 |
| E4 Jamb                                              | 4.8000  | 0.1000    | 0.4800 |
| E2 Other lintels (including other steel lintels)     | 1.0600  | 0.0410    | 0.0435 |
| P1 Party wall - Ground floor                         | 8.3900  | 0.1000    | 0.8390 |
| P2 Party wall - Intermediate floor within a dwelling | 8.3900  | 0.0000    | 0.0000 |
| P4 Party wall - Roof (insulation at ceiling level)   | 8.3900  | 0.0350    | 0.2937 |
| E5 Ground floor (normal)                             | 8.3900  | 0.0980    | 0.8222 |
| E12 Gable (insulation at ceiling level)              | 8.3900  | 0.0870    | 0.7299 |
| E16 Corner (normal)                                  | 10.4400 | 0.0420    | 0.4385 |

Thermal bridges (Sum(L x Psi) calculated using Appendix K)  
Point Thermal bridges (36a) = 6.4238 (36)  
Total fabric heat loss (33) + (36) + (36a) = 50.3244 (37)

|                                                                                        |         |         |         |         |         |         |         |         |         |         |         |         |      |
|----------------------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)\text{m} \times (5)$ | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |      |
| (38)m                                                                                  | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | (38) |
| Heat transfer coeff                                                                    | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | (39) |
| Average = Sum(39)m / 12 =                                                              |         |         |         |         |         |         |         |         |         |         |         | 87.3516 | (39) |
| HLP                                                                                    | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |      |
| HLP (average)                                                                          | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | (40) |
| Days in mont                                                                           | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31      |      |

## 4. Water heating energy requirements (kWh/year)

|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------------|-----------|-------------|
| Assumed occupancy                                               |          |          |          |          |          |          |          |          |          |          |            |           | 2.5666 (42) |
| Hot water usage for mixer showers                               |          |          |          |          |          |          |          |          |          |          |            |           |             |
| 67.2533                                                         | 66.2426  | 64.7698  | 61.9519  | 59.8724  | 57.5533  | 56.2352  | 57.6968  | 59.2990  | 61.7890  | 64.6674  | 66.9956    | (42a)     |             |
| Hot water usage for baths                                       |          |          |          |          |          |          |          |          |          |          |            |           |             |
| 29.0443                                                         | 28.6130  | 28.0055  | 26.8856  | 26.0469  | 25.1170  | 24.6147  | 25.2179  | 25.8746  | 26.8697  | 28.0127  | 28.9461    | (42b)     |             |
| Hot water usage for other uses                                  |          |          |          |          |          |          |          |          |          |          |            |           |             |
| 40.9146                                                         | 39.4268  | 37.9390  | 36.4512  | 34.9634  | 33.4756  | 33.4756  | 34.9634  | 36.4512  | 37.9390  | 39.4268  | 40.9146    | (42c)     |             |
| Average daily hot water use (litres/day)                        |          |          |          |          |          |          |          |          |          |          |            | 126.1290  | (43)        |
| Daily hot water use                                             | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov        | Dec       |             |
| 137.2122                                                        | 134.2823 | 130.7143 | 125.2887 | 120.8827 | 116.1459 | 114.3255 | 117.8781 | 121.6248 | 126.5977 | 132.1069 | 136.8563   | (44)      |             |
| Energy conte                                                    | 217.3105 | 191.2162 | 200.9030 | 171.5139 | 162.7313 | 142.8150 | 138.2667 | 145.9577 | 149.9756 | 171.7918 | 188.2105   | 214.2839  | (45)        |
| Energy content (annual)                                         |          |          |          |          |          |          |          |          |          | Total =  | Sum(45)m = | 2094.9763 |             |
| Distribution loss (46)m = 0.15 x (45)m                          |          |          |          |          |          |          |          |          |          |          |            |           |             |
| 32.5966                                                         | 28.6824  | 30.1355  | 25.7271  | 24.4097  | 21.4222  | 20.7400  | 21.8937  | 22.4963  | 25.7688  | 28.2316  | 32.1426    | (46)      |             |
| Water storage loss (or HIU loss):                               |          |          |          |          |          |          |          |          |          |          |            |           |             |
| Total storage loss                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | 0.0000    | (56)        |
| If cylinder contains dedicated solar storage                    |          |          |          |          |          |          |          |          |          |          |            |           |             |
| 0.0000                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | 0.0000    | (57)        |
| Primary loss                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | 0.0000    | (59)        |
| Combi loss                                                      | 11.9874  | 10.8167  | 11.9530  | 11.5193  | 11.8728  | 11.4590  | 11.8214  | 11.8376  | 11.4740  | 11.8918  | 11.5543    | 11.9811   | (61)        |
| Total heat required for water heating calculated for each month |          |          |          |          |          |          |          |          |          |          |            |           |             |
| 229.2979                                                        | 202.0330 | 212.8560 | 183.0332 | 174.6042 | 154.2740 | 150.0882 | 157.7953 | 161.4496 | 183.6836 | 199.7649 | 226.2650   | (62)      |             |
| WWHRS                                                           | -29.9438 | -26.4825 | -27.7310 | -22.9624 | -21.4001 | -18.3122 | -17.1648 | -18.2530 | -18.9465 | -22.3359 | -25.3038   | -29.3893  | (63a)       |
| PV diverter                                                     | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000    | -0.0000   | (63b)       |
| Solar input                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | 0.0000    | (63c)       |
| FGHRS                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | 0.0000    | (63d)       |
| Output from w/h                                                 | 199.3541 | 175.5504 | 185.1250 | 160.0708 | 153.2041 | 135.9618 | 132.9234 | 139.5422 | 142.5031 | 161.3478 | 174.4610   | 196.8757  | (64)        |
| 12Total per year (kWh/year)                                     |          |          |          |          |          |          |          |          |          |          |            |           |             |
| Electric shower(s)                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | 0.0000    | (64a)       |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |

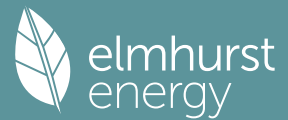
## 5. Internal gains (see Table 5 and 5a)

| Metabolic gains (Table 5), Watts                                                    |           |           |           |           |           |           |           |           |           |           |           |                |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
|                                                                                     | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec            |
| (66)m                                                                               | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 122.1242  | 135.2090  | 122.1242  | 126.1950  | 122.1242  | 126.1950  | 122.1242  | 122.1242  | 126.1950  | 122.1242  | 126.1950  | 122.1242 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 231.4847  | 233.8867  | 227.8336  | 214.9471  | 198.6802  | 183.3916  | 173.1779  | 170.7758  | 176.8289  | 189.7154  | 205.9823  | 221.2709 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330 (69)   |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 3.0000    | 3.0000    | 3.0000 (70)    |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 (71) |
| Water heating gains (Table 5)                                                       | 101.1460  | 98.6363   | 93.8018   | 83.2058   | 76.7156   | 69.9316   | 65.7649   | 69.2074   | 73.2436   | 80.7712   | 90.9286   | 99.7912 (72)   |
| Total internal gains                                                                | 519.2539  | 532.2311  | 508.2586  | 488.8470  | 462.0190  | 441.0172  | 422.5660  | 423.6065  | 437.7667  | 457.1099  | 487.6050  | 507.6854 (73)  |

## 6. Solar gains

| [Jan] | Area<br>m <sup>2</sup> | Solar flux<br>Table 6a<br>W/m <sup>2</sup> | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W |
|-------|------------------------|--------------------------------------------|-----------------------------------|------------------------------------|------------------------------|------------|
|-------|------------------------|--------------------------------------------|-----------------------------------|------------------------------------|------------------------------|------------|

# Full SAP Calculation Printout



|       |  |  |        |  |         |  |        |  |        |  |        |  |              |
|-------|--|--|--------|--|---------|--|--------|--|--------|--|--------|--|--------------|
| North |  |  | 0.5200 |  | 10.6334 |  | 0.4500 |  | 0.0000 |  | 0.7700 |  | 1.9159 (74)  |
| East  |  |  | 4.1200 |  | 19.6403 |  | 0.4500 |  | 0.0000 |  | 0.7700 |  | 28.0380 (76) |
| West  |  |  | 5.6100 |  | 19.6403 |  | 0.4500 |  | 0.0000 |  | 0.7700 |  | 38.1780 (80) |
| East  |  |  | 3.3300 |  | 19.6403 |  | 0.4500 |  | 0.0000 |  | 0.7700 |  | 22.6618 (76) |

|             |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Solar gains | 90.7938  | 177.5254 | 292.5509 | 427.5877 | 525.2396 | 538.3069 | 512.2248 | 439.1107 | 340.4932 | 210.6627 | 113.1838 | 74.6861 (83)  |
| Total gains | 610.0477 | 709.7565 | 800.8095 | 916.4347 | 987.2586 | 979.3241 | 934.7908 | 862.7171 | 778.2599 | 667.7726 | 600.7889 | 582.3715 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |                           |         |         |              |             |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|--------------|-------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |                           |         |         | 21.0000 (85) |             |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |                           |         |         |              |             |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep                       | Oct     | Nov     | Dec          |             |
| tau                                                                         | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876                   | 43.0876 | 43.0876 | 43.0876      |             |
| alpha                                                                       | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725                    | 3.8725  | 3.8725  | 3.8725       |             |
| util living area                                                            | 0.9798  | 0.9636  | 0.9302  | 0.8473  | 0.7111  | 0.5410  | 0.4033  | 0.4525  | 0.6833                    | 0.8964  | 0.9658  | 0.9830 (86)  |             |
| MIT                                                                         | 19.2294 | 19.5145 | 19.9273 | 20.4232 | 20.7732 | 20.9398 | 20.9849 | 20.9765 | 20.8541                   | 20.3629 | 19.6964 | 19.1595 (87) |             |
| Th 2                                                                        | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701                   | 20.0701 | 20.0701 | 20.0701 (88) |             |
| util rest of house                                                          | 0.9758  | 0.9565  | 0.9166  | 0.8189  | 0.6624  | 0.4719  | 0.3215  | 0.3665  | 0.6154                    | 0.8701  | 0.9578  | 0.9795 (89)  |             |
| MIT 2                                                                       | 18.2387 | 18.5572 | 19.0135 | 19.5427 | 19.8895 | 20.0334 | 20.0639 | 20.0598 | 19.9704                   | 19.4937 | 18.7649 | 18.1601 (90) |             |
| Living area fraction                                                        |         |         |         |         |         |         |         |         | fLA = Living area / (4) = |         |         |              | 0.1933 (91) |
| MIT                                                                         | 18.4302 | 18.7422 | 19.1901 | 19.7129 | 20.0603 | 20.2086 | 20.2419 | 20.2370 | 20.1413                   | 19.6618 | 18.9449 | 18.3533 (92) |             |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |                           |         |         | 0.0000       |             |
| adjusted MIT                                                                | 18.4302 | 18.7422 | 19.1901 | 19.7129 | 20.0603 | 20.2086 | 20.2419 | 20.2370 | 20.1413                   | 19.6618 | 18.9449 | 18.3533 (93) |             |

## 8. Space heating requirement

|                                                                                |           |           |           |          |          |          |          |          |          |          |               |           |       |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|---------------|-----------|-------|
|                                                                                | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov           | Dec       |       |
| Utilisation                                                                    | 0.9659    | 0.9433    | 0.9009    | 0.8066   | 0.6619   | 0.4826   | 0.3368   | 0.3823   | 0.6210   | 0.8563   | 0.9450        | 0.9706    | (94)  |
| Useful gains                                                                   | 589.2343  | 669.5074  | 721.4185  | 739.1854 | 653.4650 | 472.5763 | 314.8829 | 329.8467 | 483.2849 | 571.8229 | 567.7573      | 565.2396  | (95)  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000  | 7.1000        | 4.2000    | (96)  |
| Heat loss rate W                                                               | 1234.2958 | 1209.1430 | 1108.5013 | 944.5263 | 730.2867 | 489.9196 | 318.1297 | 335.1670 | 527.7137 | 791.5589 | 1034.6738     | 1236.3150 | (97)  |
| Space heating kWh                                                              | 479.9257  | 362.6351  | 287.9896  | 147.8455 | 57.1553  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 163.4836 | 336.1799      | 499.2802  | (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |          |          |          |          |          |          |          |               | 2334.4949 |       |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | (98b) |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |          |          |          |          |          |          |          |               | 0.0000    |       |
| Space heating kWh                                                              | 479.9257  | 362.6351  | 287.9896  | 147.8455 | 57.1553  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 163.4836 | 336.1799      | 499.2802  | (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |          |          |          |          |          |          |          |               | 2334.4949 |       |
| Space heating per m2                                                           |           |           |           |          |          |          |          |          |          |          | (98c) / (4) = | 27.1516   | (99)  |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                                                              |          |          |          |          |          |          |          |          |          |          |          |                 |               |
|--------------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|---------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                        |          |          |          |          |          |          |          |          |          |          |          |                 | 0.0000 (201)  |
| Fraction of space heat from main system(s)                                                                   |          |          |          |          |          |          |          |          |          |          |          |                 | 1.0000 (202)  |
| Efficiency of main space heating system 1 (in %)                                                             |          |          |          |          |          |          |          |          |          |          |          |                 | 91.7000 (206) |
| Efficiency of main space heating system 2 (in %)                                                             |          |          |          |          |          |          |          |          |          |          |          |                 | 0.0000 (207)  |
| Efficiency of secondary/supplementary heating system, %                                                      |          |          |          |          |          |          |          |          |          |          |          |                 | 0.0000 (208)  |
|                                                                                                              | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec             |               |
| Space heating requirement                                                                                    | 479.9257 | 362.6351 | 287.9896 | 147.8455 | 57.1553  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 163.4836 | 336.1799 | 499.2802 (98)   |               |
| Space heating efficiency (main heating system 1)                                                             | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 91.7000  | 91.7000  | 91.7000 (210)   |               |
| Space heating fuel (main heating system)                                                                     | 523.3650 | 395.4581 | 314.0563 | 161.2273 | 62.3286  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 178.2809 | 366.6084 | 544.4713 (211)  |               |
| Space heating efficiency (main heating system 2)                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)    |               |
| Space heating fuel (main heating system 2)                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)    |               |
| Space heating fuel (secondary)                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)    |               |
| Water heating                                                                                                |          |          |          |          |          |          |          |          |          |          |          |                 |               |
| Water heating requirement                                                                                    | 199.3541 | 175.5504 | 185.1250 | 160.0708 | 153.2041 | 135.9618 | 132.9234 | 139.5422 | 142.5031 | 161.3478 | 174.4610 | 196.8757 (64)   |               |
| Efficiency of water heater (217)m                                                                            | 88.1732  | 88.1039  | 87.9663  | 87.6958  | 87.2607  | 86.7000  | 86.7000  | 86.7000  | 86.7000  | 87.7443  | 88.0712  | 86.7000 (216)   |               |
| Fuel for water heating, kWh/month                                                                            | 226.0938 | 199.2538 | 210.4500 | 182.5297 | 175.5705 | 156.8186 | 153.3142 | 160.9484 | 164.3635 | 183.8840 | 198.0909 | 88.1959 (217)   |               |
| Space cooling fuel requirement (221)m                                                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)    |               |
| Pumps and Fa                                                                                                 | 10.9478  | 9.8883   | 10.9478  | 10.5947  | 10.9478  | 10.5947  | 10.9478  | 10.9478  | 10.5947  | 10.9478  | 10.5947  | 10.9478 (231)   |               |
| Lighting                                                                                                     | 23.4106  | 18.7809  | 16.9101  | 12.3891  | 9.5697   | 7.8185   | 8.7298   | 11.3473  | 14.7390  | 19.3384  | 21.8427  | 24.0613 (232)   |               |
| Electricity generated by PVs (Appendix M) (negative quantity) (233a)m                                        | -11.5165 | -19.1763 | -33.0031 | -43.5351 | -52.0099 | -50.4050 | -49.4409 | -43.7568 | -34.6383 | -24.0771 | -13.4902 | -9.5519 (233a)  |               |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)   |               |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)   |               |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)   |               |
| Electricity generated by PVs (Appendix M) (negative quantity) (233b)m                                        | -2.7365  | -6.8505  | -16.7864 | -30.3061 | -44.7949 | -46.9105 | -45.6945 | -35.7548 | -22.5599 | -10.7273 | -3.8701  | -2.0623 (233b)  |               |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234b)   |               |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)   |               |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235d)   |               |
| Annual totals kWh/year                                                                                       |          |          |          |          |          |          |          |          |          |          |          |                 |               |
| Space heating fuel - main system 1                                                                           |          |          |          |          |          |          |          |          |          |          |          | 2545.7960 (211) |               |
| Space heating fuel - main system 2                                                                           |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)    |               |
| Space heating fuel - secondary                                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)    |               |
| Efficiency of water heater                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 86.7000         |               |

# Full SAP Calculation Printout



|                                                                                         |                 |
|-----------------------------------------------------------------------------------------|-----------------|
| Water heating fuel used                                                                 | 2234.5429 (219) |
| Space cooling fuel                                                                      | 0.0000 (221)    |
| Electricity for pumps and fans:                                                         |                 |
| (MEVDecentralised, Database: total watage = 5.7980, total flow = 37.0000, SFP = 0.1567) |                 |
| mechanical ventilation fans (SFP = 0.1567)                                              | 42.9017 (230a)  |
| central heating pump                                                                    | 41.0000 (230c)  |
| main heating flue fan                                                                   | 45.0000 (230e)  |
| Total electricity for the above, kWh/year                                               | 128.9017 (231)  |
| Electricity for lighting (calculated in Appendix L)                                     | 188.9373 (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                           |                 |
| PV generation                                                                           | -653.6551 (233) |
| Wind generation                                                                         | 0.0000 (234)    |
| Hydro-electric generation (Appendix N)                                                  | 0.0000 (235a)   |
| Electricity generated - Micro CHP (Appendix N)                                          | 0.0000 (235)    |
| Appendix Q - special features                                                           |                 |
| Energy saved or generated                                                               | -0.0000 (236)   |
| Energy used                                                                             | 0.0000 (237)    |
| Total delivered energy for all uses                                                     | 4444.5227 (238) |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                                 | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |  |
|-------------------------------------------------|--------------------|-------------------------------|--------------------------|--|
| Space heating - main system 1                   | 2545.7960          | 0.2100                        | 534.6172 (261)           |  |
| Total CO2 associated with community systems     |                    |                               | 0.0000 (373)             |  |
| Water heating (other fuel)                      | 2234.5429          | 0.2100                        | 469.2540 (264)           |  |
| Space and water heating                         |                    |                               | 1003.8712 (265)          |  |
| Pumps, fans and electric keep-hot               | 128.9017           | 0.1387                        | 17.8803 (267)            |  |
| Energy for lighting                             | 188.9373           | 0.1443                        | 27.2695 (268)            |  |
| Energy saving/generation technologies           |                    |                               |                          |  |
| PV Unit electricity used in dwelling            | -384.6011          | 0.1316                        | -50.6173                 |  |
| PV Unit electricity exported                    | -269.0539          | 0.1216                        | -32.7148                 |  |
| Total                                           |                    |                               | -83.3322 (269)           |  |
| Total CO2, kg/year                              |                    |                               | 965.6887 (272)           |  |
| EPC Dwelling Carbon Dioxide Emission Rate (DER) |                    |                               | 11.2300 (273)            |  |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |  |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|--|
| Space heating - main system 1               | 2545.7960          | 1.1300                              | 2876.7494 (275)            |  |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |  |
| Water heating (other fuel)                  | 2234.5429          | 1.1300                              | 2525.0334 (278)            |  |
| Space and water heating                     |                    |                                     | 5401.7829 (279)            |  |
| Pumps, fans and electric keep-hot           | 128.9017           | 1.5128                              | 195.0025 (281)             |  |
| Energy for lighting                         | 188.9373           | 1.5338                              | 289.7983 (282)             |  |
| Energy saving/generation technologies       |                    |                                     |                            |  |
| PV Unit electricity used in dwelling        | -384.6011          | 1.4862                              | -571.6091                  |  |
| PV Unit electricity exported                | -269.0539          | 0.4461                              | -120.0268                  |  |
| Total                                       |                    |                                     | -691.6359 (283)            |  |
| Total Primary energy kWh/year               |                    |                                     | 5194.9477 (286)            |  |
| Dwelling Primary energy Rate (DPER)         |                    |                                     | 60.4200 (287)              |  |

## SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF TARGET EMISSIONS

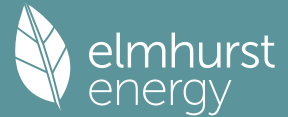
### 1. Overall dwelling characteristics

|                                                         | Area<br>(m2) | Storey height<br>(m)               | Volume<br>(m3)         |  |
|---------------------------------------------------------|--------------|------------------------------------|------------------------|--|
| Main dwelling                                           |              |                                    |                        |  |
| Ground floor                                            | 42.9900 (1b) | x 2.4600 (2b)                      | = 105.7554 (1b) - (3b) |  |
| First floor                                             | 42.9900 (1c) | x 2.7600 (2c)                      | = 118.6524 (1c) - (3c) |  |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)... (1n) | 85.9800      |                                    | (4)                    |  |
| Dwelling volume                                         |              | (3a)+(3b)+(3c)+(3d)+(3e)... (3n) = | 224.4078 (5)           |  |

### 2. Ventilation rate

|                                                                                                    | m3 per hour     |              |
|----------------------------------------------------------------------------------------------------|-----------------|--------------|
| Number of open chimneys                                                                            | 0 * 80 =        | 0.0000 (6a)  |
| Number of open flues                                                                               | 0 * 20 =        | 0.0000 (6b)  |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 =        | 0.0000 (6c)  |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 =        | 0.0000 (6d)  |
| Number of flues attached to other heater                                                           | 0 * 35 =        | 0.0000 (6e)  |
| Number of blocked chimneys                                                                         | 0 * 20 =        | 0.0000 (6f)  |
| Number of intermittent extract fans                                                                | 3 * 10 =        | 30.0000 (7a) |
| Number of passive vents                                                                            | 0 * 10 =        | 0.0000 (7b)  |
| Number of flueless gas fires                                                                       | 0 * 40 =        | 0.0000 (7c)  |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 30.0000 / (5) = | 0.1337 (8)   |
| Pressure test                                                                                      | Yes             |              |
| Pressure Test Method                                                                               | Blower Door     |              |
| Measured/design AP50                                                                               | 5.0000          | (17)         |
| Infiltration rate                                                                                  | 0.3837          | (18)         |
| Number of sides sheltered                                                                          | 2               | (19)         |

# Full SAP Calculation Printout



Shelter factor  
Infiltration rate adjusted to include shelter factor

$$(20) = 1 - [0.075 \times (19)] = 0.8500 \quad (20)$$

$$(21) = (18) \times (20) = 0.3261 \quad (21)$$

|                 | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |       |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|
| Wind speed      | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 | (22)  |
| Wind factor     | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 | (22a) |
| Adj infilt rate | 0.4158 | 0.4077 | 0.3995 | 0.3587 | 0.3506 | 0.3098 | 0.3098 | 0.3017 | 0.3261 | 0.3506 | 0.3669 | 0.3832 | (22b) |
| Effective ac    | 0.5865 | 0.5831 | 0.5798 | 0.5643 | 0.5615 | 0.5480 | 0.5480 | 0.5455 | 0.5532 | 0.5615 | 0.5673 | 0.5734 | (25)  |

## 3. Heat losses and heat loss parameter

| Element                                           | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K | A x U<br>W/K         | K-value<br>kJ/m2K | A x K<br>kJ/K |       |
|---------------------------------------------------|-------------|----------------|---------------|------------------|----------------------|-------------------|---------------|-------|
| Main dwelling                                     |             |                |               |                  |                      |                   |               |       |
| TER Opaque door                                   |             |                | 2.5500        | 1.0000           | 2.5500               |                   |               | (26)  |
| TER Opening Type                                  |             |                | 13.5800       | 1.1450           | 15.5496              |                   |               | (27)  |
| GF SPVL 125TS P/A                                 |             |                | 42.9900       | 0.1300           | 5.5887               |                   |               | (28a) |
| EW Brick AAC011                                   | 97.2486     | 16.1300        | 81.1186       | 0.1800           | 14.6013              |                   |               | (29a) |
| PR 500mm MW044                                    | 42.9900     |                | 42.9900       | 0.1100           | 4.7289               |                   |               | (30)  |
| Total net area of external elements Aum(A, m2)    |             |                | 183.2286      |                  |                      |                   |               | (31)  |
| Fabric heat loss, W/K = Sum (A x U)               |             |                |               |                  | (26)...(30) + (32) = | 43.0186           |               | (33)  |
| Main dwelling                                     |             |                |               |                  |                      |                   |               |       |
| E-WM-30                                           |             |                | 43.8000       | 0.0000           | 0.0000               |                   |               | (32)  |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K |             |                |               |                  |                      |                   | 157.5901      | (35)  |

List of Thermal Bridges

|                                                            | Length  | Psi-value | Total                 |              |
|------------------------------------------------------------|---------|-----------|-----------------------|--------------|
| K1 Element                                                 | 10.7800 | 0.0500    | 0.5390                |              |
| E2 Other lintels (including other steel lintels)           | 9.2000  | 0.0500    | 0.4600                |              |
| E3 Sill                                                    | 21.1500 | 0.0500    | 1.0575                |              |
| E4 Jamb                                                    | 10.2300 | 0.1600    | 1.6368                |              |
| E5 Ground floor (normal)                                   | 18.6300 | 0.0000    | 0.0000                |              |
| E6 Intermediate floor within a dwelling                    | 10.2500 | 0.0600    | 0.6150                |              |
| E10 Eaves (insulation at ceiling level)                    | 10.4400 | 0.0600    | 0.6264                |              |
| E18 Party wall between dwellings                           | 4.8000  | 0.0500    | 0.2400                |              |
| E4 Jamb                                                    | 1.0600  | 0.0500    | 0.0530                |              |
| E2 Other lintels (including other steel lintels)           | 8.3900  | 0.0800    | 0.6712                |              |
| P1 Party wall - Ground floor                               | 8.3900  | 0.0000    | 0.0000                |              |
| P2 Party wall - Intermediate floor within a dwelling       | 8.3900  | 0.1200    | 1.0068                |              |
| P4 Party wall - Roof (insulation at ceiling level)         | 8.3900  | 0.1600    | 1.3424                |              |
| E5 Ground floor (normal)                                   | 8.3900  | 0.0600    | 0.5034                |              |
| E12 Gable (insulation at ceiling level)                    | 10.4400 | 0.0900    | 0.9396                |              |
| E16 Corner (normal)                                        |         |           |                       |              |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |         |           |                       | 9.6911 (36)  |
| Point Thermal bridges                                      |         |           | (36a) =               | 0.0000       |
| Total fabric heat loss                                     |         |           | (33) + (36) + (36a) = | 52.7097 (37) |

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

Point Thermal bridges  
Total fabric heat loss

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

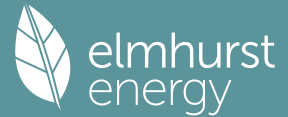
|                           | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |      |
|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| (38)m                     | 43.4295 | 43.1809 | 42.9372 | 41.7926 | 41.5785 | 40.5816 | 40.5816 | 40.3970 | 40.9656 | 41.5785 | 42.0117 | 42.4646 | (38) |
| Heat transfer coeff       | 96.1392 | 95.8906 | 95.6469 | 94.5023 | 94.2882 | 93.2913 | 93.2913 | 93.1067 | 93.6753 | 94.2882 | 94.7214 | 95.1743 | (39) |
| Average = Sum(39)m / 12 = |         |         |         |         |         |         |         |         |         |         |         | 94.5013 |      |

|               | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |      |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| HLP           | 1.1182 | 1.1153 | 1.1124 | 1.0991 | 1.0966 | 1.0850 | 1.0850 | 1.0829 | 1.0895 | 1.0966 | 1.1017 | 1.1069 | (40) |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 1.0991 |      |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31     |      |

## 4. Water heating energy requirements (kWh/year)

|                                                                                |          |          |          |          |          |          |          |          |          |          |          |           |             |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-------------|
| Assumed occupancy                                                              |          |          |          |          |          |          |          |          |          |          |          |           | 2.5666 (42) |
| Hot water usage for mixer showers                                              |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 67.2533                                                                        | 66.2426  | 64.7698  | 61.9519  | 59.8724  | 57.5533  | 56.2352  | 57.6968  | 59.2990  | 61.7890  | 64.6674  | 66.9956  | 66.9956   | (42a)       |
| Hot water usage for baths                                                      |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 29.0443                                                                        | 28.6130  | 28.0055  | 26.8856  | 26.0469  | 25.1170  | 24.6147  | 25.2179  | 25.8746  | 26.8697  | 28.0127  | 28.9461  | 28.9461   | (42b)       |
| Hot water usage for other uses                                                 |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 40.9146                                                                        | 39.4268  | 37.9390  | 36.4512  | 34.9634  | 33.4756  | 33.4756  | 34.9634  | 36.4512  | 37.9390  | 39.4268  | 40.9146  | 40.9146   | (42c)       |
| Average daily hot water use (litres/day)                                       |          |          |          |          |          |          |          |          |          |          |          | 126.1290  | (43)        |
| Daily hot water use                                                            |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 137.2122                                                                       | 134.2823 | 130.7143 | 125.2887 | 120.8827 | 116.1459 | 114.3255 | 117.8781 | 121.6248 | 126.5977 | 132.1069 | 136.8563 | 136.8563  | (44)        |
| Energy conte                                                                   | 217.3105 | 191.2162 | 200.9030 | 171.5139 | 162.7313 | 142.8150 | 138.2667 | 145.9577 | 149.9756 | 171.7918 | 188.2105 | 214.2839  | (45)        |
| Energy content (annual)                                                        |          |          |          |          |          |          |          |          |          |          |          |           |             |
| Distribution loss (46)m = 0.15 x (45)m                                         | 32.5966  | 28.6824  | 30.1355  | 25.7271  | 24.4097  | 21.4222  | 20.7400  | 21.8937  | 22.4963  | 25.7688  | 28.2316  | 32.1426   | (46)        |
| Water storage loss (or HIU loss):                                              |          |          |          |          |          |          |          |          |          |          |          |           |             |
| Total storage loss                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (56)        |
| If cylinder contains dedicated solar storage                                   |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (57)        |
| Primary loss                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (59)        |
| Combi loss                                                                     | 50.9589  | 46.0274  | 50.9589  | 49.3151  | 50.9589  | 49.3151  | 50.9589  | 50.9589  | 49.3151  | 50.9589  | 49.3151  | 50.9589   | (61)        |
| Total heat required for water heating calculated for each month                |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 268.2694                                                                       | 237.2436 | 251.8620 | 220.8290 | 213.6902 | 192.1300 | 189.2257 | 196.9166 | 199.2907 | 222.7507 | 237.5256 | 265.2428 | 265.2428  | (62)        |
| WWHRS                                                                          | -30.7454 | -27.1915 | -28.4733 | -23.5770 | -21.9730 | -18.8024 | -17.6243 | -18.7416 | -19.4537 | -22.9338 | -25.9812 | -30.1760  | (63a)       |
| PV diverter                                                                    | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000   | (63b)       |
| Solar input                                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (63c)       |
| FGHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (63d)       |
| Output from w/h                                                                | 237.5241 | 210.0522 | 223.3886 | 197.2519 | 191.7173 | 173.3276 | 171.6014 | 178.1749 | 179.8370 | 199.8169 | 211.5444 | 235.0668  | (64)        |
| 12Total per year (kWh/year)                                                    |          |          |          |          |          |          |          |          |          |          |          | 2409.3031 | (64)        |
| Electric shower(s)                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (64a)       |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (64a)       |
| Heat gains from water heating, kWh/month                                       | 84.9955  | 75.0862  | 79.5400  | 69.3571  | 66.8479  | 59.8147  | 58.7134  | 61.2707  | 62.1957  | 69.8605  | 74.9088  | 83.9891   | (65)        |

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## 5. Internal gains (see Table 5 and 5a)

| Metabolic gains (Table 5), Watts                                                    |           |           |           |           |           |           |           |           |           |           |           |                |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
|                                                                                     | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec            |
| (66)m                                                                               | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 122.1242  | 135.2090  | 122.1242  | 126.1950  | 122.1242  | 126.1950  | 122.1242  | 122.1242  | 126.1950  | 122.1242  | 126.1950  | 122.1242 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 231.4847  | 233.8867  | 227.8336  | 214.9471  | 198.6802  | 183.3916  | 173.1779  | 170.7758  | 176.8289  | 189.7154  | 205.9823  | 221.2709 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330 (69)   |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 3.0000    | 3.0000    | 3.0000 (70)    |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 (71) |
| Water heating gains (Table 5)                                                       | 114.2412  | 111.7355  | 106.9086  | 96.3294   | 89.8493   | 83.0760   | 78.9159   | 82.3530   | 86.3828   | 93.8985   | 104.0399  | 112.8886 (72)  |
| Total internal gains                                                                | 532.3492  | 545.3303  | 521.3654  | 501.9705  | 475.1528  | 454.1617  | 435.7170  | 436.7521  | 450.9059  | 470.2373  | 500.7164  | 520.7828 (73)  |

## 6. Solar gains

| [Jan]       |          |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c |          |          | Access<br>factor<br>Table 6d | Gains<br>W    |
|-------------|----------|----------|----------|----------|------------|--------------------------------|-----------------------------------|------------------------------------|----------|----------|------------------------------|---------------|
| North       |          |          |          |          | 0.5200     | 10.6334                        | 0.6300                            | 0.7000                             |          |          | 0.7700                       | 1.6898 (74)   |
| East        |          |          |          |          | 7.4500     | 19.6403                        | 0.6300                            | 0.7000                             |          |          | 0.7700                       | 44.7173 (76)  |
| West        |          |          |          |          | 5.6100     | 19.6403                        | 0.6300                            | 0.7000                             |          |          | 0.7700                       | 33.6730 (80)  |
|             |          |          |          |          |            |                                |                                   |                                    |          |          |                              |               |
| Solar gains | 80.0801  | 156.5774 | 258.0299 | 377.1324 | 463.2613   | 474.7867                       | 451.7822                          | 387.2956                           | 300.3150 | 185.8045 | 99.8281                      | 65.8731 (83)  |
| Total gains | 612.4293 | 701.9077 | 779.3954 | 879.1029 | 938.4141   | 928.9484                       | 887.4993                          | 824.0477                           | 751.2209 | 656.0418 | 600.5445                     | 586.6559 (84) |

## 7. Mean internal temperature (heating season)

| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |         |         |         |              |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| tau                                                                         | 39.1493 | 39.2508 | 39.3508 | 39.8274 | 39.9178 | 40.3444 | 40.3444 | 40.4244 | 40.1790 | 39.9178 | 39.7352 | 39.5462      |
| alpha                                                                       | 3.6100  | 3.6167  | 3.6234  | 3.6552  | 3.6612  | 3.6896  | 3.6896  | 3.6950  | 3.6786  | 3.6612  | 3.6490  | 3.6364       |
| util living area                                                            | 0.9807  | 0.9676  | 0.9417  | 0.8747  | 0.7581  | 0.5913  | 0.4477  | 0.4964  | 0.7236  | 0.9102  | 0.9682  | 0.9833 (86)  |
| MIT                                                                         | 19.2152 | 19.4632 | 19.8386 | 20.3316 | 20.7044 | 20.9144 | 20.9764 | 20.9656 | 20.8162 | 20.3152 | 19.6886 | 19.1795 (87) |
| Th 2                                                                        | 19.9860 | 19.9884 | 19.9907 | 20.0016 | 20.0036 | 20.0131 | 20.0131 | 20.0148 | 20.0094 | 20.0036 | 19.9995 | 19.9952 (88) |
| util rest of house                                                          | 0.9767  | 0.9610  | 0.9294  | 0.8486  | 0.7094  | 0.5158  | 0.3535  | 0.3995  | 0.6539  | 0.8856  | 0.9605  | 0.9798 (89)  |
| MIT 2                                                                       | 17.9124 | 18.2270 | 18.6989 | 19.3073 | 19.7350 | 19.9538 | 20.0023 | 19.9978 | 19.8664 | 19.3030 | 18.5231 | 17.8730 (90) |
| Living area fraction                                                        | 18.1642 | 18.4659 | 18.9192 | 19.5053 | 19.9224 | 20.1395 | 20.1906 | 20.1849 | 20.0500 | 19.4987 | 18.7484 | 18.1255 (92) |
| MIT                                                                         | 18.1642 | 18.4659 | 18.9192 | 19.5053 | 19.9224 | 20.1395 | 20.1906 | 20.1849 | 20.0500 | 19.4987 | 18.7484 | 18.1255 (93) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT                                                                | 18.1642 | 18.4659 | 18.9192 | 19.5053 | 19.9224 | 20.1395 | 20.1906 | 20.1849 | 20.0500 | 19.4987 | 18.7484 | 18.1255 (93) |

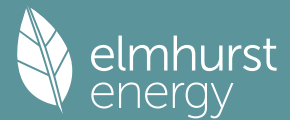
## 8. Space heating requirement

|                                                                                | Jan       | Feb       | Mar       | Apr       | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov       | Dec            |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|---------------|-----------|----------------|
| Utilisation                                                                    | 0.9664    | 0.9475    | 0.9129    | 0.8334    | 0.7050   | 0.5260   | 0.3709   | 0.4168   | 0.6571   | 0.8701        | 0.9474    | 0.9706 (94)    |
| Useful gains                                                                   | 591.8768  | 665.0715  | 711.5034  | 732.6621  | 661.6285 | 488.6394 | 329.1842 | 343.4928 | 493.6143 | 570.8523      | 568.9397  | 569.3794 (95)  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000    | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000    | 4.2000 (96)    |
| Heat loss rate W                                                               | 1332.8934 | 1300.8437 | 1187.8602 | 1002.2269 | 775.2704 | 516.7837 | 334.9706 | 352.3990 | 557.3633 | 839.0393      | 1103.3502 | 1325.3533 (97) |
| Space heating kWh                                                              | 551.3163  | 427.2389  | 354.4095  | 194.0867  | 84.5496  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 199.5311      | 384.7756  | 562.4446 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |          |          |          |          |          |               |           | 2758.3523      |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |           |          |          |          |          |          |               |           | 0.0000         |
| Space heating kWh                                                              | 551.3163  | 427.2389  | 354.4095  | 194.0867  | 84.5496  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 199.5311      | 384.7756  | 562.4446 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |          |          |          |          |          |               |           | 2758.3523      |
| Space heating per m2                                                           |           |           |           |           |          |          |          |          |          | (98c) / (4) = |           | 32.0813 (99)   |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

| Fraction of space heat from secondary/supplementary system (Table 11) |          |          |          |          |          |          |          |          |          |          |          |                |
|-----------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| Efficiency of main space heating system 1 (in %)                      |          |          |          |          |          |          |          |          |          |          |          |                |
| Efficiency of main space heating system 2 (in %)                      |          |          |          |          |          |          |          |          |          |          |          |                |
| Efficiency of secondary/supplementary heating system, %               |          |          |          |          |          |          |          |          |          |          |          |                |
|                                                                       | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec            |
| Space heating requirement                                             | 551.3163 | 427.2389 | 354.4095 | 194.0867 | 84.5496  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 199.5311 | 384.7756 | 562.4446 (98)  |
| Space heating efficiency (main heating system 1)                      | 92.4000  | 92.4000  | 92.4000  | 92.4000  | 92.4000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 92.4000  | 92.4000  | 92.4000 (210)  |
| Space heating fuel (main heating system)                              | 596.6627 | 462.3798 | 383.5601 | 210.0505 | 91.5039  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 215.9428 | 416.4238 | 608.7063 (211) |
| Space heating efficiency (main heating system 2)                      | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)   |
| Space heating fuel (main heating system 2)                            | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)   |
| Space heating fuel (secondary)                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)   |
| Water heating                                                         |          |          |          |          |          |          |          |          |          |          |          |                |
| Water heating requirement                                             | 237.5241 | 210.0522 | 223.3886 | 197.2519 | 191.7173 | 173.3276 | 171.6014 | 178.1749 | 179.8370 | 199.8169 | 211.5444 | 235.0668 (64)  |
| Efficiency of water heater                                            |          |          |          |          |          |          |          |          |          |          |          | 80.3000 (216)  |

# Full SAP Calculation Printout



|                                                                                                      |          |          |          |           |           |           |           |           |           |          |          |            |        |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|----------|------------|--------|
| (217)m                                                                                               | 86.1227  | 85.8688  | 85.3653  | 84.3468   | 82.7499   | 80.3000   | 80.3000   | 80.3000   | 80.3000   | 84.3784  | 85.6460  | 86.1795    | (217)  |
| Fuel for water heating, kWh/month                                                                    | 275.7972 | 244.6198 | 261.6854 | 233.8583  | 231.6828  | 215.8501  | 213.7004  | 221.8866  | 223.9564  | 236.8106 | 246.9985 | 272.7640   | (219)  |
| Space cooling fuel requirement                                                                       |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (221)m                                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (221)  |
| Pumps and Fa                                                                                         | 7.3041   | 6.5973   | 7.3041   | 7.0685    | 7.3041    | 7.0685    | 7.3041    | 7.0685    | 7.3041    | 7.0685   | 7.3041   | 7.0685     | (231)  |
| Lighting                                                                                             | 25.3750  | 20.3568  | 18.3290  | 13.4286   | 10.3727   | 8.4745    | 9.4623    | 12.2994   | 15.9757   | 20.9610  | 23.6755  | 26.0803    | (232)  |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (233a)m                                                                                              | -39.8696 | -56.0257 | -80.2676 | -89.9369  | -96.7057  | -90.1510  | -89.0213  | -84.1676  | -75.5697  | -63.9045 | -43.7612 | -34.4899   | (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (234a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (234a) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (235a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (235a) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (235c)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (235c) |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (233b)m                                                                                              | -23.0762 | -48.4849 | -96.2662 | -144.4459 | -190.8693 | -191.7487 | -189.5061 | -160.5221 | -117.7385 | -69.3076 | -30.7987 | -18.2537   | (233b) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (234b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (234b) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (235b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (235b) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (235d)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (235d) |
| Annual totals kWh/year                                                                               |          |          |          |           |           |           |           |           |           |          |          |            |        |
| Space heating fuel - main system 1                                                                   |          |          |          |           |           |           |           |           |           |          |          | 2985.2297  | (211)  |
| Space heating fuel - main system 2                                                                   |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (213)  |
| Space heating fuel - secondary                                                                       |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (215)  |
| Efficiency of water heater                                                                           |          |          |          |           |           |           |           |           |           |          |          | 80.3000    |        |
| Water heating fuel used                                                                              |          |          |          |           |           |           |           |           |           |          |          | 2879.6100  | (219)  |
| Space cooling fuel                                                                                   |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (221)  |
| Electricity for pumps and fans:                                                                      |          |          |          |           |           |           |           |           |           |          |          |            |        |
| Total electricity for the above, kWh/year                                                            |          |          |          |           |           |           |           |           |           |          |          | 86.0000    | (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |          |          |          |           |           |           |           |           |           |          |          | 204.7908   | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |          |          |           |           |           |           |           |           |          |          |            |        |
| PV generation                                                                                        |          |          |          |           |           |           |           |           |           |          |          | -2124.8885 | (233)  |
| Wind generation                                                                                      |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (234)  |
| Hydro-electric generation (Appendix N)                                                               |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (235a) |
| Electricity generated - Micro CHP (Appendix N)                                                       |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (235)  |
| Appendix Q - special features                                                                        |          |          |          |           |           |           |           |           |           |          |          |            |        |
| Energy saved or generated                                                                            |          |          |          |           |           |           |           |           |           |          |          | -0.0000    | (236)  |
| Energy used                                                                                          |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (237)  |
| Total delivered energy for all uses                                                                  |          |          |          |           |           |           |           |           |           |          |          | 4030.7421  | (238)  |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                               | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|-----------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1                 | 2985.2297          | 0.2100                        | 626.8982 (261)           |
| Total CO2 associated with community systems   |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                    | 2879.6100          | 0.2100                        | 604.7181 (264)           |
| Space and water heating                       |                    |                               | 1231.6163 (265)          |
| Pumps, fans and electric keep-hot             | 86.0000            | 0.1387                        | 11.9293 (267)            |
| Energy for lighting                           | 204.7908           | 0.1443                        | 29.5576 (268)            |
| Energy saving/generation technologies         |                    |                               |                          |
| PV Unit electricity used in dwelling          | -843.8706          | 0.1347                        | -113.6365                |
| PV Unit electricity exported                  | -1281.0179         | 0.1259                        | -161.3091                |
| Total                                         |                    |                               | -274.9456 (269)          |
| Total CO2, kg/year                            |                    |                               | 998.1576 (272)           |
| EPC Target Carbon Dioxide Emission Rate (TER) |                    |                               | 11.6100 (273)            |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1               | 2985.2297          | 1.1300                              | 3373.3096 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 2879.6100          | 1.1300                              | 3253.9593 (278)            |
| Space and water heating                     |                    |                                     | 6627.2689 (279)            |
| Pumps, fans and electric keep-hot           | 86.0000            | 1.5128                              | 130.1008 (281)             |
| Energy for lighting                         | 204.7908           | 1.5338                              | 314.1150 (282)             |
| Energy saving/generation technologies       |                    |                                     |                            |
| PV Unit electricity used in dwelling        | -843.8706          | 1.4977                              | -1263.8554                 |
| PV Unit electricity exported                | -1281.0179         | 0.4622                              | -592.1168                  |
| Total                                       |                    |                                     | -1855.9722 (283)           |
| Total Primary energy kWh/year               |                    |                                     | 5215.5125 (286)            |
| Target Primary Energy Rate (TPER)           |                    |                                     | 60.6600 (287)              |

# Full SAP Calculation Printout



|                                    |                                                          |               |        |                |            |
|------------------------------------|----------------------------------------------------------|---------------|--------|----------------|------------|
| Plot Reference                     | 4907-R823-9471-002                                       |               |        | Issued on Date | 21/07/2026 |
| Assessment Reference               | Plot 2                                                   | Plot Type Ref | Plot 2 |                |            |
| Plot Address                       | Plot 2, Beaconsfield-Semi, K, WC, B, ES, 1012            |               |        | SAP Version    | 10.2       |
|                                    |                                                          |               |        |                |            |
| SAP Rating                         | 90 B                                                     | DER           | 11.23  | TER            | 11.61      |
| Environmental                      | 90 B                                                     | % DER < TER   |        |                | 3.27       |
| CO <sub>2</sub> Emissions (t/year) | 0.86                                                     | DFEE          | 35.32  | TFEE           | 37.71      |
| Compliance Check                   | See BREL                                                 | % DFEE < TFEE |        |                | 6.34       |
| % DPER < TPER                      | 0.39                                                     | DPER          | 60.42  | TPER           | 60.66      |
|                                    |                                                          |               |        |                |            |
| Assessor Details                   | Mr. Daniel Harris                                        |               |        | Assessor ID    | R823-0001  |
| Client                             | Crest Nicholson Head Office, Crest Nicholson Head Office |               |        |                |            |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF FABRIC ENERGY EFFICIENCY

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)            | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Main dwelling                                          |                           |                                 |                             |
| Ground floor                                           | 42.9900 (1b)              | x 2.4600 (2b)                   | = 105.7554 (1b) - (3b)      |
| First floor                                            | 42.9900 (1c)              | x 2.7600 (2c)                   | = 118.6524 (1c) - (3c)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 85.9800                   |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 224.4078 (5)              |

## 2. Ventilation rate

|                                                                                                    | m <sup>3</sup> per hour                            |
|----------------------------------------------------------------------------------------------------|----------------------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                               |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                               |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                               |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                               |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                               |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                               |
| Number of intermittent extract fans                                                                | 3 * 10 = 30.0000 (7a)                              |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)                               |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)                               |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | Air changes per hour<br>30.0000 / (5) = 0.1337 (8) |
| Pressure test                                                                                      | Yes                                                |
| Pressure Test Method                                                                               | Blower Door                                        |
| Measured/design AP50                                                                               | 4.5000 (17)                                        |
| Infiltration rate                                                                                  | 0.3587 (18)                                        |
| Number of sides sheltered                                                                          | 2 (19)                                             |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 0.8500 (20)            |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.3049 (21)                   |

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor                                                                                             | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate                                                                                         | 0.3887 | 0.3811 | 0.3735 | 0.3354 | 0.3277 | 0.2896 | 0.2896 | 0.2820 | 0.3049 | 0.3277 | 0.3430 | 0.3582 (22b) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.0000 (23b) |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =            |        |        |        |        |        |        |        |        |        |        |        | 0.0000 (23c) |
| Effective ac                                                                                            | 0.5756 | 0.5726 | 0.5697 | 0.5562 | 0.5537 | 0.5419 | 0.5419 | 0.5398 | 0.5465 | 0.5537 | 0.5588 | 0.5642 (25)  |

## 3. Heat losses and heat loss parameter

| Element                                                        | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K                 | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K                                        |
|----------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|------------------------------|--------------------------------|------------------------------------------------------|
| Main dwelling                                                  |                         |                            |                           |                               |                              |                                |                                                      |
| Front Door                                                     |                         |                            | 2.5500                    | 1.2000                        | 3.0600                       |                                | (26)                                                 |
| Windows                                                        |                         |                            | 10.2500                   | 1.2357                        | 12.6663                      |                                | (27)                                                 |
| French Doors                                                   |                         |                            | 3.3300                    | 1.2357                        | 4.1150                       |                                | (27)                                                 |
| GF SPVL 125TS P/A                                              |                         |                            | 42.9900                   | 0.1300                        | 5.5887                       | 75.0000                        | 3224.2500 (28a)                                      |
| EW Brick AAC011                                                | 97.2486                 | 16.1300                    | 81.1186                   | 0.1800                        | 14.6013                      | 60.0000                        | 4867.1160 (29a)                                      |
| PR 500mm MW044                                                 | 42.9900                 |                            | 42.9900                   | 0.0900                        | 3.8691                       | 9.0000                         | 386.9100 (30)                                        |
| Total net area of external elements Aum(A, m <sup>2</sup> )    |                         |                            | 183.2286                  |                               |                              |                                | (31)                                                 |
| Fabric heat loss, W/K = Sum (A x U)                            |                         |                            |                           |                               | (26)...(30) + (32) = 43.9005 |                                | (33)                                                 |
| Main dwelling                                                  |                         |                            |                           |                               |                              |                                |                                                      |
| E-WM-30                                                        |                         |                            | 43.8000                   | 0.0000                        | 0.0000                       | 45.0000                        | 1971.0000 (32)                                       |
| Timber - GF                                                    |                         |                            | 88.6100                   |                               |                              | 9.0000                         | 797.4900 (32c)                                       |
| Timber - FF                                                    |                         |                            | 126.9000                  |                               |                              | 9.0000                         | 1142.1000 (32c)                                      |
| Internal Floor FF                                              |                         |                            | 42.9900                   |                               |                              | 18.0000                        | 773.8200 (32d)                                       |
| Internal Ceiling GF                                            |                         |                            | 42.9900                   |                               |                              | 9.0000                         | 386.9100 (32e)                                       |
| Heat capacity Cm = Sum(A x k)                                  |                         |                            |                           |                               |                              |                                | (28)...(30) + (32) + (32a)...(32e) = 13549.5960 (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K |                         |                            |                           |                               |                              |                                | 157.5901 (35)                                        |

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## List of Thermal Bridges

|                                                            | Length  | Psi-value             | Total        |
|------------------------------------------------------------|---------|-----------------------|--------------|
| K1 Element                                                 |         |                       |              |
| E2 Other lintels (including other steel lintels)           | 10.7800 | 0.0410                | 0.4420       |
| E3 Sill                                                    | 9.2000  | 0.0220                | 0.2024       |
| E4 Jamb                                                    | 21.1500 | 0.0190                | 0.4018       |
| E5 Ground floor (normal)                                   | 10.2300 | 0.0928                | 0.9493       |
| E6 Intermediate floor within a dwelling                    | 18.6300 | 0.0020                | 0.0373       |
| E10 Eaves (insulation at ceiling level)                    | 10.2500 | 0.0390                | 0.3997       |
| E18 Party wall between dwellings                           | 10.4400 | 0.0330                | 0.3445       |
| E4 Jamb                                                    | 4.8000  | 0.1000                | 0.4800       |
| E2 Other lintels (including other steel lintels)           | 1.0600  | 0.0410                | 0.0435       |
| P1 Party wall - Ground floor                               | 8.3900  | 0.1000                | 0.8390       |
| P2 Party wall - Intermediate floor within a dwelling       | 8.3900  | 0.0000                | 0.0000       |
| P4 Party wall - Roof (insulation at ceiling level)         | 8.3900  | 0.0350                | 0.2937       |
| E5 Ground floor (normal)                                   | 8.3900  | 0.0980                | 0.8222       |
| E12 Gable (insulation at ceiling level)                    | 8.3900  | 0.0870                | 0.7299       |
| E16 Corner (normal)                                        | 10.4400 | 0.0420                | 0.4385       |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |         |                       | 6.4238 (36)  |
| Point Thermal bridges                                      |         |                       | 0.0000       |
| Total fabric heat loss                                     |         | (33) + (36) + (36a) = | 50.3244 (37) |

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

|                           | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |      |
|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| (38)m                     | 42.6224 | 42.4051 | 42.1922 | 41.1919 | 41.0047 | 40.1335 | 40.1335 | 39.9722 | 40.4691 | 41.0047 | 41.3833 | 41.7791 | (38) |
| Heat transfer coeff       | 92.9467 | 92.7295 | 92.5165 | 91.5162 | 91.3291 | 90.4579 | 90.4579 | 90.2965 | 90.7935 | 91.3291 | 91.7077 | 92.1035 | (39) |
| Average = Sum(39)m / 12 = |         |         |         |         |         |         |         |         |         |         |         | 91.5153 |      |
| HLP                       | 1.0810  | 1.0785  | 1.0760  | 1.0644  | 1.0622  | 1.0521  | 1.0521  | 1.0502  | 1.0560  | 1.0622  | 1.0666  | 1.0712  | (40) |
| HLP (average)             |         |         |         |         |         |         |         |         |         |         |         | 1.0644  |      |
| Days in mont              | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31      |      |

## 4. Water heating energy requirements (kWh/year)

|                                                                                |          |         |          |         |         |         |         |         |         |                                        |         |           |             |
|--------------------------------------------------------------------------------|----------|---------|----------|---------|---------|---------|---------|---------|---------|----------------------------------------|---------|-----------|-------------|
| Assumed occupancy                                                              |          |         |          |         |         |         |         |         |         |                                        |         |           | 2.5666 (42) |
| Hot water usage for mixer showers                                              |          |         |          |         |         |         |         |         |         |                                        |         |           |             |
| 0.0000                                                                         | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000    | (42a)       |
| Hot water usage for baths                                                      | 29.0443  | 28.6130 | 28.0055  | 26.8856 | 26.0469 | 25.1170 | 24.6147 | 25.2179 | 25.8746 | 26.8697                                | 28.0127 | 28.9461   | (42b)       |
| Hot water usage for other uses                                                 | 40.9146  | 39.4268 | 37.9390  | 36.4512 | 34.9634 | 33.4756 | 33.4756 | 34.9634 | 36.4512 | 37.9390                                | 39.4268 | 40.9146   | (42c)       |
| Average daily hot water use (litres/day)                                       |          |         |          |         |         |         |         |         |         |                                        |         | 64.1237   | (43)        |
| Daily hot water use                                                            | 69.9589  | 68.0398 | 65.9445  | 63.3367 | 61.0103 | 58.5926 | 58.0903 | 60.1813 | 62.3258 | 64.8087                                | 67.4395 | 69.8607   | (44)        |
| Energy conte                                                                   | 110.7978 | 96.8877 | 101.3543 | 86.7048 | 82.1316 | 72.0464 | 70.2552 | 74.5170 | 76.8540 | 87.9448                                | 96.0800 | 109.3850  | (45)        |
| Energy content (annual)                                                        |          |         |          |         |         |         |         |         |         | Total = Sum(45)m =                     |         | 1064.9585 |             |
| Distribution loss (46)m = 0.15 x (45)m                                         | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000    | (46)        |
| Water storage loss (or HIU loss):                                              |          |         |          |         |         |         |         |         |         |                                        |         |           |             |
| Total storage loss                                                             | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000    | (56)        |
| If cylinder contains dedicated solar storage                                   |          |         |          |         |         |         |         |         |         |                                        |         |           |             |
| 0.0000                                                                         | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000    | (57)        |
| Primary loss                                                                   | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000    | (59)        |
| Combi loss                                                                     | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000    | (61)        |
| Total heat required for water heating calculated for each month                | 94.1781  | 82.3546 | 86.1511  | 73.6991 | 69.8118 | 61.2394 | 59.7169 | 63.3394 | 65.3259 | 74.7530                                | 81.6680 | 92.9773   | (62)        |
| WWHRS                                                                          | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000    | (63a)       |
| PV diverter                                                                    | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000    | (63b)       |
| Solar input                                                                    | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000    | (63c)       |
| FGHRS                                                                          | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000    | (63d)       |
| Output from w/h                                                                | 94.1781  | 82.3546 | 86.1511  | 73.6991 | 69.8118 | 61.2394 | 59.7169 | 63.3394 | 65.3259 | 74.7530                                | 81.6680 | 92.9773   | (64)        |
| 12Total per year (kWh/year)                                                    |          |         |          |         |         |         |         |         |         | Total per year (kWh/year) = Sum(64)m = |         | 905.2147  | (64)        |
| Electric shower(s)                                                             | 53.8586  | 47.9885 | 52.4016  | 50.0062 | 50.9446 | 48.5962 | 50.2160 | 50.9446 | 50.0062 | 52.4016                                | 51.4162 | 53.8586   | (64a)       |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |         |          |         |         |         |         |         |         |                                        |         | 612.6389  | (64a)       |
| Heat gains from water heating, kWh/month                                       | 37.0092  | 32.5858 | 34.6382  | 30.9263 | 30.1891 | 27.4589 | 27.4832 | 28.5710 | 28.8330 | 31.7887                                | 33.2711 | 36.7090   | (65)        |

## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |           |           |           |           |           |           |           |           |           |           |           |           |      |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------|
| Metabolic gains (Table 5), Watts                                                    |           |           |           |           |           |           |           |           |           |           |           |           |      |
| (66)m                                                                               | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 122.1242  | 135.2090  | 122.1242  | 126.1950  | 122.1242  | 126.1950  | 122.1242  | 122.1242  | 126.1950  | 122.1242  | 126.1950  | 122.1242  | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 231.4847  | 233.8867  | 227.8336  | 214.9471  | 198.6802  | 183.3916  | 173.1779  | 170.7758  | 176.8289  | 189.7154  | 205.9823  | 221.2709  | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | (69) |
| Pumps, fans                                                                         | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | (71) |
| Water heating gains (Table 5)                                                       | 49.7435   | 48.4907   | 46.5567   | 42.9532   | 40.5767   | 38.1374   | 36.9398   | 38.4019   | 40.0459   | 42.7267   | 46.2098   | 49.3400   | (72) |
| Total internal gains                                                                | 464.8515  | 479.0855  | 458.0136  | 445.5944  | 422.8802  | 409.2230  | 393.7410  | 392.8009  | 404.5689  | 416.0654  | 439.8863  | 454.2343  | (73) |

## 6. Solar gains

| [Jan] | Area<br>m <sup>2</sup> | Solar flux<br>Table 6a<br>W/m <sup>2</sup> | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W   |
|-------|------------------------|--------------------------------------------|-----------------------------------|------------------------------------|------------------------------|--------------|
| North | 0.5200                 | 10.6334                                    | 0.4500                            | 0.0000                             | 0.7700                       | 1.9159 (74)  |
| East  | 4.1200                 | 19.6403                                    | 0.4500                            | 0.0000                             | 0.7700                       | 28.0380 (76) |

# Full SAP Calculation Printout



|      |        |         |        |        |        |              |
|------|--------|---------|--------|--------|--------|--------------|
| West | 5.6100 | 19.6403 | 0.4500 | 0.0000 | 0.7700 | 38.1780 (80) |
| East | 3.3300 | 19.6403 | 0.4500 | 0.0000 | 0.7700 | 22.6618 (76) |

|             |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Solar gains | 90.7938  | 177.5254 | 292.5509 | 427.5877 | 525.2396 | 538.3069 | 512.2248 | 439.1107 | 340.4932 | 210.6627 | 113.1838 | 74.6861 (83)  |
| Total gains | 555.6453 | 656.6109 | 750.5645 | 873.1821 | 948.1198 | 947.5299 | 905.9657 | 831.9116 | 745.0621 | 626.7282 | 553.0701 | 528.9203 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |                           |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |                           |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |                           |         |         |              |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep                       | Oct     | Nov     | Dec          |
| tau                                                                         | 40.4939 | 40.5888 | 40.6822 | 41.1269 | 41.2111 | 41.6081 | 41.6081 | 41.6824 | 41.4543                   | 41.2111 | 41.0410 | 40.8646      |
| alpha                                                                       | 3.6996  | 3.7059  | 3.7121  | 3.7418  | 3.7474  | 3.7739  | 3.7739  | 3.7788  | 3.7636                    | 3.7474  | 3.7361  | 3.7243       |
| util living area                                                            | 0.9855  | 0.9727  | 0.9454  | 0.8714  | 0.7439  | 0.5701  | 0.4281  | 0.4805  | 0.7169                    | 0.9168  | 0.9745  | 0.9878 (86)  |
| MIT                                                                         | 19.1984 | 19.4671 | 19.8654 | 20.3759 | 20.7404 | 20.9299 | 20.9815 | 20.9717 | 20.8332                   | 20.3238 | 19.6755 | 19.1574 (87) |
| Th 2                                                                        | 20.0164 | 20.0184 | 20.0205 | 20.0300 | 20.0318 | 20.0402 | 20.0402 | 20.0417 | 20.0369                   | 20.0318 | 20.0282 | 20.0244 (88) |
| util rest of house                                                          | 0.9825  | 0.9671  | 0.9340  | 0.8452  | 0.6953  | 0.4973  | 0.3395  | 0.3880  | 0.6482                    | 0.8938  | 0.9682  | 0.9853 (89)  |
| MIT 2                                                                       | 18.3757 | 18.6422 | 19.0331 | 19.5247 | 19.8486 | 20.0024 | 20.0336 | 20.0308 | 19.9357                   | 19.4889 | 18.8579 | 18.3409 (90) |
| Living area fraction                                                        |         |         |         |         |         |         |         |         | fLA = Living area / (4) = |         |         | 0.1933 (91)  |
| MIT                                                                         | 18.5347 | 18.8016 | 19.1940 | 19.6892 | 20.0210 | 20.1817 | 20.2168 | 20.2127 | 20.1092                   | 19.6503 | 19.0160 | 18.4987 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |                           |         |         | 0.0000       |
| adjusted MIT                                                                | 18.5347 | 18.8016 | 19.1940 | 19.6892 | 20.0210 | 20.1817 | 20.2168 | 20.2127 | 20.1092                   | 19.6503 | 19.0160 | 18.4987 (93) |

## 8. Space heating requirement

|                                                                                |           |           |           |          |          |          |          |          |          |               |           |                |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|---------------|-----------|----------------|
|                                                                                | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov       | Dec            |
| Utilisation                                                                    | 0.9762    | 0.9580    | 0.9221    | 0.8347   | 0.6947   | 0.5085   | 0.3561   | 0.4051   | 0.6538   | 0.8828        | 0.9596    | 0.9797 (94)    |
| Useful gains                                                                   | 542.4103  | 629.0130  | 692.0619  | 728.8280 | 658.6937 | 481.8426 | 322.6592 | 336.9704 | 487.1328 | 553.2769      | 530.7310  | 518.1870 (95)  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000    | 4.2000 (96)    |
| Heat loss rate W                                                               | 1323.0698 | 1289.0908 | 1174.4033 | 987.3905 | 759.9456 | 504.9113 | 327.1697 | 344.2721 | 545.5957 | 826.5572      | 1092.7849 | 1316.9609 (97) |
| Space heating kWh                                                              | 580.8107  | 443.5723  | 358.8620  | 186.1650 | 75.3314  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 203.3206      | 404.6788  | 594.2878 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |          |          |          |          |          |          |               |           | 2847.0285      |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |          |          |          |          |          |          |               |           | 0.0000         |
| Space heating kWh                                                              | 580.8107  | 443.5723  | 358.8620  | 186.1650 | 75.3314  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 203.3206      | 404.6788  | 594.2878 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |          |          |          |          |          |          |               |           | 2847.0285      |
| Space heating per m2                                                           |           |           |           |          |          |          |          |          |          | (98c) / (4) = |           | 33.1127 (99)   |

## 8c. Space cooling requirement

|                                                     |        |        |        |        |         |           |           |          |                          |         |        |                |
|-----------------------------------------------------|--------|--------|--------|--------|---------|-----------|-----------|----------|--------------------------|---------|--------|----------------|
| Calculated for June, July and August. See Table 10b |        |        |        |        |         |           |           |          |                          |         |        |                |
|                                                     | Jan    | Feb    | Mar    | Apr    | May     | Jun       | Jul       | Aug      | Sep                      | Oct     | Nov    | Dec            |
| Ext. temp.                                          | 4.3000 | 4.9000 | 6.5000 | 8.9000 | 11.7000 | 14.6000   | 16.6000   | 16.4000  | 14.1000                  | 10.6000 | 7.1000 | 4.2000         |
| Heat loss rate W                                    | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 850.3041  | 669.3883  | 686.2537 | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (100)   |
| Utilisation                                         | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 0.8666    | 0.9169    | 0.8903   | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (101)   |
| Useful loss                                         | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 736.8561  | 613.7781  | 610.9848 | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (102)   |
| Total gains                                         | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 1056.0297 | 1009.9627 | 925.8435 | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (103)   |
| Space cooling kWh                                   | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 229.8050  | 294.7614  | 234.2548 | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (104)   |
| Cooled fraction                                     |        |        |        |        |         |           |           |          | fC = cooled area / (4) = |         |        | 1.0000 (105)   |
| Intermittency factor (Table 10b)                    | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500  | 0.2500    | 0.2500    | 0.2500   | 0.2500                   | 0.2500  | 0.2500 | 0.2500 (106)   |
| Space cooling kWh                                   | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 57.4513   | 73.6903   | 58.5637  | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (107)   |
| Space cooling requirement                           |        |        |        |        |         |           |           |          |                          |         |        | 189.7053 (107) |
| Energy for space heating                            |        |        |        |        |         |           |           |          |                          |         |        | 33.1127 (99)   |
| Energy for space cooling                            |        |        |        |        |         |           |           |          |                          |         |        | 2.2064 (108)   |
| Total                                               |        |        |        |        |         |           |           |          |                          |         |        | 35.3191 (109)  |
| Fabric Energy Efficiency (DFEE)                     |        |        |        |        |         |           |           |          |                          |         |        | 35.3 (109)     |

## SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

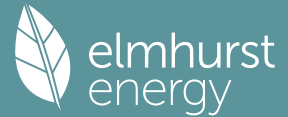
### 1. Overall dwelling characteristics

|                                                        |              |                                   |                        |
|--------------------------------------------------------|--------------|-----------------------------------|------------------------|
| Main dwelling                                          | Area (m2)    | Storey height (m)                 | Volume (m3)            |
| Ground floor                                           | 42.9900 (1b) | x 2.4600 (2b)                     | = 105.7554 (1b) - (3b) |
| First floor                                            | 42.9900 (1c) | x 2.7600 (2c)                     | = 118.6524 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 85.9800      |                                   | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 224.4078 (5)           |

### 2. Ventilation rate

|                         |          |             |
|-------------------------|----------|-------------|
| Number of open chimneys | 0 * 80 = | 0.0000 (6a) |
|-------------------------|----------|-------------|

# Full SAP Calculation Printout



Number of open flues  
Number of chimneys / flues attached to closed fire  
Number of flues attached to solid fuel boiler  
Number of flues attached to other heater  
Number of blocked chimneys  
Number of intermittent extract fans  
Number of passive vents  
Number of flueless gas fires

0 \* 20 = 0.0000 (6b)  
0 \* 10 = 0.0000 (6c)  
0 \* 20 = 0.0000 (6d)  
0 \* 35 = 0.0000 (6e)  
0 \* 20 = 0.0000 (6f)  
3 \* 10 = 30.0000 (7a)  
0 \* 10 = 0.0000 (7b)  
0 \* 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 30.0000  
Air changes per hour  
Pressure test  
Pressure Test Method  
Measured/design AP50  
Infiltration rate  
Number of sides sheltered  
Blower Door  
Shelter factor  
Infiltration rate adjusted to include shelter factor

0.1337 (8)  
Yes  
5.0000 (17)  
0.3837 (18)  
2 (19)  
(20) = 1 - [0.075 x (19)] = 0.8500 (20)  
(21) = (18) x (20) = 0.3261 (21)

|                                                                                                         |        |        |        |        |        |        |        |        |        |        |        |              |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
| Wind factor                                                                                             | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000       |
| Adj infilt rate                                                                                         | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750       |
|                                                                                                         | 0.4158 | 0.4077 | 0.3995 | 0.3587 | 0.3506 | 0.3098 | 0.3098 | 0.3017 | 0.3261 | 0.3506 | 0.3669 | 0.3832       |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.0000 (22b) |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =            |        |        |        |        |        |        |        |        |        |        |        | 0.0000 (23b) |
| Effective ac                                                                                            | 0.5865 | 0.5831 | 0.5798 | 0.5643 | 0.5615 | 0.5480 | 0.5480 | 0.5455 | 0.5532 | 0.5615 | 0.5673 | 0.5734 (25)  |

### 3. Heat losses and heat loss parameter

| Element                                           | Gross m2 | Openings m2 | NetArea m2 | U-value W/m2K        | A x U W/K | K-value kJ/m2K | A x K kJ/K    |
|---------------------------------------------------|----------|-------------|------------|----------------------|-----------|----------------|---------------|
| Main dwelling                                     |          |             |            |                      |           |                |               |
| TER Opaque door                                   |          |             | 2.5500     | 1.0000               | 2.5500    |                | (26)          |
| TER Opening Type                                  |          |             | 13.5800    | 1.1450               | 15.5496   |                | (27)          |
| GF SPVL 125TS P/A                                 |          |             | 42.9900    | 0.1300               | 5.5887    |                | (28a)         |
| EW Brick AAC011                                   | 97.2486  | 16.1300     | 81.1186    | 0.1800               | 14.6013   |                | (29a)         |
| PR 500mm MW044                                    | 42.9900  |             | 42.9900    | 0.1100               | 4.7289    |                | (30)          |
| Total net area of external elements Aum(A, m2)    |          |             | 183.2286   |                      |           |                | (31)          |
| Fabric heat loss, W/K = Sum (A x U)               |          |             |            | (26)...(30) + (32) = | 43.0186   |                | (33)          |
| Main dwelling                                     |          |             |            |                      |           |                |               |
| E-WM-30                                           |          |             | 43.8000    | 0.0000               | 0.0000    |                | (32)          |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K |          |             |            |                      |           |                | 157.5901 (35) |

List of Thermal Bridges

| K1 Element                                                 | Length  | Psi-value             | Total        |
|------------------------------------------------------------|---------|-----------------------|--------------|
| E2 Other lintels (including other steel lintels)           | 10.7800 | 0.0500                | 0.5390       |
| E3 Sill                                                    | 9.2000  | 0.0500                | 0.4600       |
| E4 Jamb                                                    | 21.1500 | 0.0500                | 1.0575       |
| E5 Ground floor (normal)                                   | 10.2300 | 0.1600                | 1.6368       |
| E6 Intermediate floor within a dwelling                    | 18.6300 | 0.0000                | 0.0000       |
| E10 Eaves (insulation at ceiling level)                    | 10.2500 | 0.0600                | 0.6150       |
| E18 Party wall between dwellings                           | 10.4400 | 0.0600                | 0.6264       |
| E4 Jamb                                                    | 4.8000  | 0.0500                | 0.2400       |
| E2 Other lintels (including other steel lintels)           | 1.0600  | 0.0500                | 0.0530       |
| P1 Party wall - Ground floor                               | 8.3900  | 0.0800                | 0.6712       |
| P2 Party wall - Intermediate floor within a dwelling       | 8.3900  | 0.0000                | 0.0000       |
| P4 Party wall - Roof (insulation at ceiling level)         | 8.3900  | 0.1200                | 1.0068       |
| E5 Ground floor (normal)                                   | 8.3900  | 0.1600                | 1.3424       |
| E12 Gable (insulation at ceiling level)                    | 8.3900  | 0.0600                | 0.5034       |
| E16 Corner (normal)                                        | 10.4400 | 0.0900                | 0.9396       |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |         |                       | 9.6911 (36)  |
| Point Thermal Bridges                                      |         |                       | 0.0000       |
| Total fabric heat loss                                     |         | (33) + (36) + (36a) = | 52.7097 (37) |

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

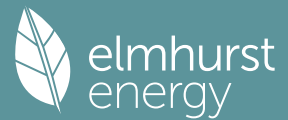
|                           |         |         |         |         |         |         |         |         |         |         |         |              |
|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| (38)m                     | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| Heat transfer coeff       | 43.4295 | 43.1809 | 42.9372 | 41.7926 | 41.5785 | 40.5816 | 40.5816 | 40.3970 | 40.9656 | 41.5785 | 42.0117 | 42.4646      |
| Average = Sum(39)m / 12 = | 96.1392 | 95.8906 | 95.6469 | 94.5023 | 94.2882 | 93.2913 | 93.2913 | 93.1067 | 93.6753 | 94.2882 | 94.7214 | 95.1743      |
|                           |         |         |         |         |         |         |         |         |         |         |         | 94.5013 (39) |
| HLP                       | 1.1182  | 1.1153  | 1.1124  | 1.0991  | 1.0966  | 1.0850  | 1.0850  | 1.0829  | 1.0895  | 1.0966  | 1.1017  | 1.1069       |
| HLP (average)             |         |         |         |         |         |         |         |         |         |         |         | 1.0991       |
| Days in mont              | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31           |

### 4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5666 (42)

|                                                                 |          |         |          |         |         |         |         |         |         |                    |         |                |
|-----------------------------------------------------------------|----------|---------|----------|---------|---------|---------|---------|---------|---------|--------------------|---------|----------------|
| Hot water usage for mixer showers                               | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000             | 0.0000  | 0.0000         |
| Hot water usage for baths                                       | 29.0443  | 28.6130 | 28.0055  | 26.8856 | 26.0469 | 25.1170 | 24.6147 | 25.2179 | 25.8746 | 26.8697            | 28.0127 | 28.9461        |
| Hot water usage for other uses                                  | 40.9146  | 39.4268 | 37.9390  | 36.4512 | 34.9634 | 33.4756 | 33.4756 | 34.9634 | 36.4512 | 37.9390            | 39.4268 | 40.9146        |
| Average daily hot water use (litres/day)                        |          |         |          |         |         |         |         |         |         |                    |         | 64.1237 (43)   |
| Daily hot water use                                             | 69.9589  | 68.0398 | 65.9445  | 63.3367 | 61.0103 | 58.5926 | 58.0903 | 60.1813 | 62.3258 | 64.8087            | 67.4395 | 69.8607        |
| Energy conte                                                    | 110.7978 | 96.8877 | 101.3543 | 86.7048 | 82.1316 | 72.0464 | 70.2552 | 74.5170 | 76.8540 | 87.9448            | 96.0800 | 109.3850       |
| Energy content (annual)                                         |          |         |          |         |         |         |         |         |         | Total = Sum(45)m = |         | 1064.9585 (45) |
| Distribution loss (46)m = 0.15 x (45)m                          | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000             | 0.0000  | 0.0000         |
| Water storage loss (or HIU loss):                               |          |         |          |         |         |         |         |         |         |                    |         |                |
| Total storage loss                                              | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000             | 0.0000  | 0.0000         |
| If cylinder contains dedicated solar storage                    | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000             | 0.0000  | 0.0000         |
| Primary loss                                                    | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000             | 0.0000  | 0.0000         |
| Combi loss                                                      | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000             | 0.0000  | 0.0000         |
| Total heat required for water heating calculated for each month |          |         |          |         |         |         |         |         |         |                    |         |                |

# Full SAP Calculation Printout



|                                                                                         |         |         |         |         |         |         |         |         |         |         |         |                |
|-----------------------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|----------------|
| WWHRS                                                                                   | 94.1781 | 82.3546 | 86.1511 | 73.6991 | 69.8118 | 61.2394 | 59.7169 | 63.3394 | 65.3259 | 74.7530 | 81.6680 | 92.9773 (62)   |
| PV diverter                                                                             | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (63a)   |
| Solar input                                                                             | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (63b)   |
| FGHRS                                                                                   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (63c)   |
| Output from w/h                                                                         | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (63d)   |
| 12Total per year (kWh/year)                                                             | 94.1781 | 82.3546 | 86.1511 | 73.6991 | 69.8118 | 61.2394 | 59.7169 | 63.3394 | 65.3259 | 74.7530 | 81.6680 | 92.9773 (64)   |
| Electric shower(s)                                                                      | 53.8586 | 47.9885 | 52.4016 | 50.0062 | 50.9446 | 48.5962 | 50.2160 | 50.9446 | 50.0062 | 52.4016 | 51.4162 | 905.2147 (64a) |
| Heat gains from water heating, kWh/month                                                | 37.0092 | 32.5858 | 34.6382 | 30.9263 | 30.1891 | 27.4589 | 27.4832 | 28.5710 | 28.8330 | 31.7887 | 33.2711 | 36.7090 (65)   |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 905 (64) |         |         |         |         |         |         |         |         |         |         |         |                |

## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |           |           |           |           |           |           |           |           |           |           |           |           |      |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------|
| Metabolic gains (Table 5), Watts                                                    | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec       |      |
| (66)m                                                                               | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 122.1242  | 135.2090  | 122.1242  | 126.1950  | 122.1242  | 126.1950  | 122.1242  | 122.1242  | 126.1950  | 122.1242  | 126.1950  | 122.1242  | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 231.4847  | 233.8867  | 227.8336  | 214.9471  | 198.6802  | 183.3916  | 173.1779  | 170.7758  | 176.8289  | 189.7154  | 205.9823  | 221.2709  | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | (69) |
| Pumps, fans                                                                         | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | (71) |
| Water heating gains (Table 5)                                                       | 49.7435   | 48.4907   | 46.5567   | 42.9532   | 40.5767   | 38.1374   | 36.9398   | 38.4019   | 40.0459   | 42.7267   | 46.2098   | 49.3400   | (72) |
| Total internal gains                                                                | 464.8515  | 479.0855  | 458.0136  | 445.5944  | 422.8802  | 409.2230  | 393.7410  | 392.8009  | 404.5689  | 416.0654  | 439.8863  | 454.2343  | (73) |

## 6. Solar gains

| [Jan]       |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d |          |          | Gains<br>W   |               |
|-------------|----------|----------|----------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|----------|----------|--------------|---------------|
| North       |          |          |          | 0.5200     | 10.6334                        | 0.6300                            | 0.7000                             | 0.7700                       |          |          | 1.6898 (74)  |               |
| East        |          |          |          | 7.4500     | 19.6403                        | 0.6300                            | 0.7000                             | 0.7700                       |          |          | 44.7173 (76) |               |
| West        |          |          |          | 5.6100     | 19.6403                        | 0.6300                            | 0.7000                             | 0.7700                       |          |          | 33.6730 (80) |               |
|             |          |          |          |            |                                |                                   |                                    |                              |          |          |              |               |
| Solar gains | 80.0801  | 156.5774 | 258.0299 | 377.1324   | 463.2613                       | 474.7867                          | 451.7822                           | 387.2956                     | 300.3150 | 185.8045 | 99.8281      | 65.8731 (83)  |
| Total gains | 544.9316 | 635.6629 | 716.0435 | 822.7268   | 886.1415                       | 884.0097                          | 845.5232                           | 780.0965                     | 704.8839 | 601.8700 | 539.7144     | 520.1074 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |                           |         |         |              |             |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|--------------|-------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |                           |         |         | 21.0000 (85) |             |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |                           |         |         |              |             |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep                       | Oct     | Nov     | Dec          |             |
| tau                                                                         | 39.1493 | 39.2508 | 39.3508 | 39.8274 | 39.9178 | 40.3444 | 40.3444 | 40.4244 | 40.1790                   | 39.9178 | 39.7352 | 39.5462      |             |
| alpha                                                                       | 3.6100  | 3.6167  | 3.6234  | 3.6552  | 3.6612  | 3.6896  | 3.6896  | 3.6950  | 3.6786                    | 3.6612  | 3.6490  | 3.6364       |             |
| util living area                                                            | 0.9865  | 0.9758  | 0.9537  | 0.8926  | 0.7813  | 0.6142  | 0.4675  | 0.5203  | 0.7510                    | 0.9279  | 0.9768  | 0.9886 (86)  |             |
| MIT                                                                         | 19.1033 | 19.3585 | 19.7479 | 20.2698 | 20.6704 | 20.9030 | 20.9728 | 20.9598 | 20.7906                   | 20.2461 | 19.5919 | 19.0678 (87) |             |
| Th 2                                                                        | 19.9860 | 19.9884 | 19.9907 | 20.0016 | 20.0036 | 20.0131 | 20.0131 | 20.0148 | 20.0094                   | 20.0036 | 19.9995 | 19.9952 (88) |             |
| util rest of house                                                          | 0.9837  | 0.9707  | 0.9436  | 0.8690  | 0.7344  | 0.5378  | 0.3701  | 0.4202  | 0.6830                    | 0.9069  | 0.9710  | 0.9861 (89)  |             |
| MIT 2                                                                       | 18.2597 | 18.5135 | 18.8974 | 19.4051 | 19.7676 | 19.9601 | 20.0033 | 19.9992 | 19.8803                   | 19.3949 | 18.7549 | 18.2310 (90) |             |
| Living area fraction                                                        | 18.4227 | 18.6769 | 19.0618 | 19.5722 | 19.9421 | 20.1424 | 20.1907 | 20.1849 | fLA = Living area / (4) = |         |         |              | 0.1933 (91) |
| MIT                                                                         | 18.4227 | 18.6769 | 19.0618 | 19.5722 | 19.9421 | 20.1424 | 20.1907 | 20.1849 | 20.0563                   | 19.5595 | 18.9167 | 18.3928 (92) |             |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |                           |         |         | 0.0000       |             |
| adjusted MIT                                                                | 18.4227 | 18.6769 | 19.0618 | 19.5722 | 19.9421 | 20.1424 | 20.1907 | 20.1849 | 20.0563                   | 19.5595 | 18.9167 | 18.3928 (93) |             |

## 8. Space heating requirement

|                                                                                | Jan       | Feb       | Mar       | Apr       | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov       | Dec            |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|---------------|-----------|----------------|
| Utilisation                                                                    | 0.9775    | 0.9619    | 0.9318    | 0.8571    | 0.7312   | 0.5484   | 0.3882   | 0.4383   | 0.6866   | 0.8953        | 0.9626    | 0.9806 (94)    |
| Useful gains                                                                   | 532.6641  | 611.4355  | 667.2347  | 705.1576  | 647.9515 | 484.7750 | 328.2506 | 341.8920 | 483.9413 | 538.8802      | 519.5179  | 510.0403 (95)  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000    | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000    | 4.2000 (96)    |
| Heat loss rate W                                                               |           |           |           |           |          |          |          |          |          |               |           |                |
| Space heating kWh                                                              | 1357.7491 | 1321.0714 | 1201.4939 | 1008.5514 | 777.1325 | 517.0536 | 334.9803 | 352.3964 | 557.9565 | 844.7715      | 1119.2913 | 1350.7856 (97) |
| Space heating requirement - total per year (kWh/year)                          | 613.8633  | 476.8753  | 397.4888  | 218.4435  | 96.1106  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 227.5831      | 431.8369  | 625.5145 (98a) |
| Solar heating kWh                                                              |           |           |           |           |          |          |          |          |          |               |           | 3087.7160      |
| Space heating contribution - total per year (kWh/year)                         | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | 0.0000 (98b)   |
| Space heating kWh                                                              |           |           |           |           |          |          |          |          |          |               |           | 0.0000         |
| Space heating requirement after solar contribution - total per year (kWh/year) | 613.8633  | 476.8753  | 397.4888  | 218.4435  | 96.1106  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 227.5831      | 431.8369  | 625.5145 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |          |          |          |          |          |               |           | 3087.7160      |
| Space heating per m2                                                           |           |           |           |           |          |          |          |          |          | (98c) / (4) = |           | 35.9120 (99)   |

## 8c. Space cooling requirement

|                                                     |        |        |        |        |         |          |          |          |         |         |        |              |
|-----------------------------------------------------|--------|--------|--------|--------|---------|----------|----------|----------|---------|---------|--------|--------------|
| Calculated for June, July and August. See Table 10b |        |        |        |        |         |          |          |          |         |         |        |              |
|                                                     | Jan    | Feb    | Mar    | Apr    | May     | Jun      | Jul      | Aug      | Sep     | Oct     | Nov    | Dec          |
| Ext. temp.                                          | 4.3000 | 4.9000 | 6.5000 | 8.9000 | 11.7000 | 14.6000  | 16.6000  | 16.4000  | 14.1000 | 10.6000 | 7.1000 | 4.2000       |
| Heat loss rate W                                    | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 876.9380 | 690.3555 | 707.6107 | 0.0000  | 0.0000  | 0.0000 | 0.0000 (100) |
| Utilisation                                         | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 0.8288   | 0.8886   | 0.8582   | 0.0000  | 0.0000  | 0.0000 | 0.0000 (101) |

# Full SAP Calculation Printout



|                                  |        |        |        |        |        |          |          |          |                          |        |        |                |
|----------------------------------|--------|--------|--------|--------|--------|----------|----------|----------|--------------------------|--------|--------|----------------|
| Useful loss                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 726.7920 | 613.4739 | 607.2711 | 0.0000                   | 0.0000 | 0.0000 | 0.0000 (102)   |
| Total gains                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 981.7853 | 939.3156 | 865.2804 | 0.0000                   | 0.0000 | 0.0000 | 0.0000 (103)   |
| Space cooling kWh                |        |        |        |        |        |          |          |          |                          |        |        |                |
|                                  | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 183.5952 | 242.4262 | 191.9589 | 0.0000                   | 0.0000 | 0.0000 | 0.0000 (104)   |
| Cooled fraction                  |        |        |        |        |        |          |          |          | fC = cooled area / (4) = |        |        | 1.0000 (105)   |
| Intermittency factor (Table 10b) |        |        |        |        |        |          |          |          |                          |        |        |                |
|                                  | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500   | 0.2500   | 0.2500   | 0.2500                   | 0.2500 | 0.2500 | 0.2500 (106)   |
| Space cooling kWh                |        |        |        |        |        |          |          |          |                          |        |        |                |
|                                  | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 45.8988  | 60.6066  | 47.9897  | 0.0000                   | 0.0000 | 0.0000 | 0.0000 (107)   |
| Space cooling requirement        |        |        |        |        |        |          |          |          |                          |        |        | 154.4951 (107) |
| Energy for space heating         |        |        |        |        |        |          |          |          |                          |        |        | 35.9120 (99)   |
| Energy for space cooling         |        |        |        |        |        |          |          |          |                          |        |        | 1.7969 (108)   |
| Total                            |        |        |        |        |        |          |          |          |                          |        |        | 37.7089 (109)  |
| Fabric Energy Efficiency (TFEE)  |        |        |        |        |        |          |          |          |                          |        |        | 37.7 (109)     |

# Full SAP Calculation Printout



|                                    |                                                          |               |        |                |            |
|------------------------------------|----------------------------------------------------------|---------------|--------|----------------|------------|
| Plot Reference                     | 4907-R823-9471-002                                       |               |        | Issued on Date | 21/07/2026 |
| Assessment Reference               | Plot 2                                                   | Plot Type Ref | Plot 2 |                |            |
| Plot Address                       | Plot 2, Beaconsfield-Semi, K, WC, B, ES, 1012            |               |        | SAP Version    | 10.2       |
| SAP Rating                         | 90 B                                                     | DER           | 11.23  | TER            | 11.61      |
| Environmental                      | 90 B                                                     | % DER < TER   |        | 3.27           |            |
| CO <sub>2</sub> Emissions (t/year) | 0.86                                                     | DFEE          | 35.32  | TFEE           | 37.71      |
| Compliance Check                   | See BREL                                                 | % DFEE < TFEE |        | 6.34           |            |
| % DPER < TPER                      | 0.39                                                     | DPER          | 60.42  | TPER           | 60.66      |
| Assessor Details                   | Mr. Daniel Harris                                        |               |        | Assessor ID    | R823-0001  |
| Client                             | Crest Nicholson Head Office, Crest Nicholson Head Office |               |        |                |            |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)            | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Main dwelling                                          |                           |                                 |                             |
| Ground floor                                           | 42.9900 (1b)              | x 2.4600 (2b)                   | = 105.7554 (1b) - (3b)      |
| First floor                                            | 42.9900 (1c)              | x 2.7600 (2c)                   | = 118.6524 (1c) - (3c)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 85.9800                   |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 224.4078 (5)              |

## 2. Ventilation rate

|                                                                                                    | m <sup>3</sup> per hour                 |
|----------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                    |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                    |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                    |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                    |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                    |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                    |
| Number of intermittent extract fans                                                                | 0 * 10 = 0.0000 (7a)                    |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)                    |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 0.0000 / (5) = 0.0000 (8)               |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 4.5000 (17)                             |
| Infiltration rate                                                                                  | 0.2250 (18)                             |
| Number of sides sheltered                                                                          | 2 (19)                                  |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 0.8500 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.1913 (21)        |

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor                                                                                             | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate                                                                                         | 0.2438 | 0.2391 | 0.2343 | 0.2104 | 0.2056 | 0.1817 | 0.1817 | 0.1769 | 0.1913 | 0.2056 | 0.2152 | 0.2247 (22b) |
| Mechanical extract ventilation - decentralised                                                          |        |        |        |        |        |        |        |        |        |        |        |              |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 (25)  |

## 3. Heat losses and heat loss parameter

| Element                                                      | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K   |
|--------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|-----------------|
| Main dwelling                                                |                         |                            |                           |                               |              |                                |                 |
| Front Door                                                   |                         |                            | 2.5500                    | 1.2000                        | 3.0600       |                                | (26)            |
| Windows                                                      |                         |                            | 10.2500                   | 1.2357                        | 12.6663      |                                | (27)            |
| French Doors                                                 |                         |                            | 3.3300                    | 1.2357                        | 4.1150       |                                | (27)            |
| GF SPVL 125TS P/A                                            |                         |                            | 42.9900                   | 0.1300                        | 5.5887       | 75.0000                        | 3224.2500 (28a) |
| EW Brick AAC011                                              | 97.2486                 | 16.1300                    | 81.1186                   | 0.1800                        | 14.6013      | 60.0000                        | 4867.1160 (29a) |
| PR 500mm MW044                                               | 42.9900                 |                            | 42.9900                   | 0.0900                        | 3.8691       | 9.0000                         | 386.9100 (30)   |
| Total net area of external elements Aum (A, m <sup>2</sup> ) |                         |                            | 183.2286                  |                               |              |                                | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                          |                         |                            | (26)...(30) + (32) =      |                               | 43.9005      |                                | (33)            |
| Main dwelling                                                |                         |                            |                           |                               |              |                                |                 |
| E-WM-30                                                      |                         |                            | 43.8000                   | 0.0000                        | 0.0000       | 45.0000                        | 1971.0000 (32)  |
| Timber - GF                                                  |                         |                            | 88.6100                   |                               |              | 9.0000                         | 797.4900 (32c)  |
| Timber - FF                                                  |                         |                            | 126.9000                  |                               |              | 9.0000                         | 1142.1000 (32c) |
| Internal Floor FF                                            |                         |                            | 42.9900                   |                               |              | 18.0000                        | 773.8200 (32d)  |
| Internal Ceiling GF                                          |                         |                            | 42.9900                   |                               |              | 9.0000                         | 386.9100 (32e)  |

# Full SAP Calculation Printout



Heat capacity  $C_m = \text{Sum}(A \times k)$   
Thermal mass parameter (TMP) =  $C_m / \text{TFA}$  in  $\text{kJ/m}^2\text{K}$   
List of Thermal Bridges

|                                                      | Length  | Psi-value | Total  |
|------------------------------------------------------|---------|-----------|--------|
| K1 Element                                           |         |           |        |
| E2 Other lintels (including other steel lintels)     | 10.7800 | 0.0410    | 0.4420 |
| E3 Sill                                              | 9.2000  | 0.0220    | 0.2024 |
| E4 Jamb                                              | 21.1500 | 0.0190    | 0.4018 |
| E5 Ground floor (normal)                             | 10.2300 | 0.0928    | 0.9493 |
| E6 Intermediate floor within a dwelling              | 18.6300 | 0.0020    | 0.0373 |
| E10 Eaves (insulation at ceiling level)              | 10.2500 | 0.0390    | 0.3997 |
| E18 Party wall between dwellings                     | 10.4400 | 0.0330    | 0.3445 |
| E4 Jamb                                              | 4.8000  | 0.1000    | 0.4800 |
| E2 Other lintels (including other steel lintels)     | 1.0600  | 0.0410    | 0.0435 |
| P1 Party wall - Ground floor                         | 8.3900  | 0.1000    | 0.8390 |
| P2 Party wall - Intermediate floor within a dwelling | 8.3900  | 0.0000    | 0.0000 |
| P4 Party wall - Roof (insulation at ceiling level)   | 8.3900  | 0.0350    | 0.2937 |
| E5 Ground floor (normal)                             | 8.3900  | 0.0980    | 0.8222 |
| E12 Gable (insulation at ceiling level)              | 8.3900  | 0.0870    | 0.7299 |
| E16 Corner (normal)                                  | 10.4400 | 0.0420    | 0.4385 |

Thermal bridges (Sum(L x Psi) calculated using Appendix K)  
Point Thermal bridges (36a) = 6.4238 (36)  
Total fabric heat loss (33) + (36) + (36a) = 50.3244 (37)

|                                                                                        |         |         |         |         |         |         |         |         |         |         |         |         |      |
|----------------------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)\text{m} \times (5)$ | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |      |
| (38)m                                                                                  | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | (38) |
| Heat transfer coeff                                                                    | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | (39) |
| Average = Sum(39)m / 12 =                                                              |         |         |         |         |         |         |         |         |         |         |         | 87.3516 | (39) |
| HLP                                                                                    | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |      |
| HLP (average)                                                                          | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | (40) |
| Days in mont                                                                           | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31      |      |

## 4. Water heating energy requirements (kWh/year)

|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------------|-----------|-------------|
| Assumed occupancy                                               |          |          |          |          |          |          |          |          |          |          |            |           | 2.5666 (42) |
| Hot water usage for mixer showers                               |          |          |          |          |          |          |          |          |          |          |            |           |             |
| 67.2533                                                         | 66.2426  | 64.7698  | 61.9519  | 59.8724  | 57.5533  | 56.2352  | 57.6968  | 59.2990  | 61.7890  | 64.6674  | 66.9956    | (42a)     |             |
| Hot water usage for baths                                       |          |          |          |          |          |          |          |          |          |          |            |           |             |
| 29.0443                                                         | 28.6130  | 28.0055  | 26.8856  | 26.0469  | 25.1170  | 24.6147  | 25.2179  | 25.8746  | 26.8697  | 28.0127  | 28.9461    | (42b)     |             |
| Hot water usage for other uses                                  |          |          |          |          |          |          |          |          |          |          |            |           |             |
| 40.9146                                                         | 39.4268  | 37.9390  | 36.4512  | 34.9634  | 33.4756  | 33.4756  | 34.9634  | 36.4512  | 37.9390  | 39.4268  | 40.9146    | (42c)     |             |
| Average daily hot water use (litres/day)                        |          |          |          |          |          |          |          |          |          |          |            | 126.1290  | (43)        |
| Daily hot water use                                             | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov        | Dec       |             |
| 137.2122                                                        | 134.2823 | 130.7143 | 125.2887 | 120.8827 | 116.1459 | 114.3255 | 117.8781 | 121.6248 | 126.5977 | 132.1069 | 136.8563   | (44)      |             |
| Energy conte                                                    | 217.3105 | 191.2162 | 200.9030 | 171.5139 | 162.7313 | 142.8150 | 138.2667 | 145.9577 | 149.9756 | 171.7918 | 188.2105   | 214.2839  | (45)        |
| Energy content (annual)                                         |          |          |          |          |          |          |          |          |          | Total =  | Sum(45)m = | 2094.9763 |             |
| Distribution loss (46)m = 0.15 x (45)m                          |          |          |          |          |          |          |          |          |          |          |            |           |             |
| 32.5966                                                         | 28.6824  | 30.1355  | 25.7271  | 24.4097  | 21.4222  | 20.7400  | 21.8937  | 22.4963  | 25.7688  | 28.2316  | 32.1426    | (46)      |             |
| Water storage loss (or HIU loss):                               |          |          |          |          |          |          |          |          |          |          |            |           |             |
| Total storage loss                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | 0.0000    | (56)        |
| If cylinder contains dedicated solar storage                    |          |          |          |          |          |          |          |          |          |          |            |           |             |
| 0.0000                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | 0.0000    | (57)        |
| Primary loss                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | 0.0000    | (59)        |
| Combi loss                                                      | 11.9874  | 10.8167  | 11.9530  | 11.5193  | 11.8728  | 11.4590  | 11.8214  | 11.8376  | 11.4740  | 11.8918  | 11.5543    | 11.9811   | (61)        |
| Total heat required for water heating calculated for each month |          |          |          |          |          |          |          |          |          |          |            |           |             |
| 229.2979                                                        | 202.0330 | 212.8560 | 183.0332 | 174.6042 | 154.2740 | 150.0882 | 157.7953 | 161.4496 | 183.6836 | 199.7649 | 226.2650   | (62)      |             |
| WWHRS                                                           | -29.9438 | -26.4825 | -27.7310 | -22.9624 | -21.4001 | -18.3122 | -17.1648 | -18.2530 | -18.9465 | -22.3359 | -25.3038   | -29.3893  | (63a)       |
| PV diverter                                                     | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000    | -0.0000   | (63b)       |
| Solar input                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | 0.0000    | (63c)       |
| FGHRS                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | 0.0000    | (63d)       |
| Output from w/h                                                 | 199.3541 | 175.5504 | 185.1250 | 160.0708 | 153.2041 | 135.9618 | 132.9234 | 139.5422 | 142.5031 | 161.3478 | 174.4610   | 196.8757  | (64)        |
| 12Total per year (kWh/year)                                     |          |          |          |          |          |          |          |          |          |          |            |           |             |
| Electric shower(s)                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | 0.0000    | (64a)       |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |

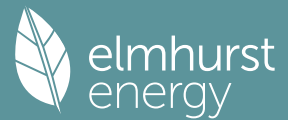
## 5. Internal gains (see Table 5 and 5a)

| Metabolic gains (Table 5), Watts                                                    |           |           |           |           |           |           |           |           |           |           |           |                |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
|                                                                                     | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec            |
| (66)m                                                                               | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 122.1242  | 135.2090  | 122.1242  | 126.1950  | 122.1242  | 126.1950  | 122.1242  | 122.1242  | 126.1950  | 122.1242  | 126.1950  | 122.1242 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 231.4847  | 233.8867  | 227.8336  | 214.9471  | 198.6802  | 183.3916  | 173.1779  | 170.7758  | 176.8289  | 189.7154  | 205.9823  | 221.2709 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330 (69)   |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 3.0000    | 3.0000    | 3.0000 (70)    |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 (71) |
| Water heating gains (Table 5)                                                       | 101.1460  | 98.6363   | 93.8018   | 83.2058   | 76.7156   | 69.9316   | 65.7649   | 69.2074   | 73.2436   | 80.7712   | 90.9286   | 99.7912 (72)   |
| Total internal gains                                                                | 519.2539  | 532.2311  | 508.2586  | 488.8470  | 462.0190  | 441.0172  | 422.5660  | 423.6065  | 437.7667  | 457.1099  | 487.6050  | 507.6854 (73)  |

## 6. Solar gains

| [Jan] | Area<br>m <sup>2</sup> | Solar flux<br>Table 6a<br>W/m <sup>2</sup> | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W |
|-------|------------------------|--------------------------------------------|-----------------------------------|------------------------------------|------------------------------|------------|
|-------|------------------------|--------------------------------------------|-----------------------------------|------------------------------------|------------------------------|------------|

# Full SAP Calculation Printout



|       |  |  |        |  |         |  |        |  |        |  |        |  |              |
|-------|--|--|--------|--|---------|--|--------|--|--------|--|--------|--|--------------|
| North |  |  | 0.5200 |  | 10.6334 |  | 0.4500 |  | 0.0000 |  | 0.7700 |  | 1.9159 (74)  |
| East  |  |  | 4.1200 |  | 19.6403 |  | 0.4500 |  | 0.0000 |  | 0.7700 |  | 28.0380 (76) |
| West  |  |  | 5.6100 |  | 19.6403 |  | 0.4500 |  | 0.0000 |  | 0.7700 |  | 38.1780 (80) |
| East  |  |  | 3.3300 |  | 19.6403 |  | 0.4500 |  | 0.0000 |  | 0.7700 |  | 22.6618 (76) |

|             |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Solar gains | 90.7938  | 177.5254 | 292.5509 | 427.5877 | 525.2396 | 538.3069 | 512.2248 | 439.1107 | 340.4932 | 210.6627 | 113.1838 | 74.6861 (83)  |
| Total gains | 610.0477 | 709.7565 | 800.8095 | 916.4347 | 987.2586 | 979.3241 | 934.7908 | 862.7171 | 778.2599 | 667.7726 | 600.7889 | 582.3715 (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)  
Utilisation factor for gains for living area, nil,m (see Table 9a)

|                        | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep                       | Oct     | Nov     | Dec          |             |
|------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|--------------|-------------|
| tau                    | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876                   | 43.0876 | 43.0876 | 43.0876      |             |
| alpha                  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725                    | 3.8725  | 3.8725  | 3.8725       |             |
| util living area       | 0.9798  | 0.9636  | 0.9302  | 0.8473  | 0.7111  | 0.5410  | 0.4033  | 0.4525  | 0.6833                    | 0.8964  | 0.9658  | 0.9830 (86)  |             |
| MIT                    | 19.2294 | 19.5145 | 19.9273 | 20.4232 | 20.7732 | 20.9398 | 20.9849 | 20.9765 | 20.8541                   | 20.3629 | 19.6964 | 19.1595 (87) |             |
| Th 2                   | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701                   | 20.0701 | 20.0701 | 20.0701 (88) |             |
| util rest of house     | 0.9758  | 0.9565  | 0.9166  | 0.8189  | 0.6624  | 0.4719  | 0.3215  | 0.3665  | 0.6154                    | 0.8701  | 0.9578  | 0.9795 (89)  |             |
| MIT 2                  | 18.2387 | 18.5572 | 19.0135 | 19.5427 | 19.8895 | 20.0334 | 20.0639 | 20.0598 | 19.9704                   | 19.4937 | 18.7649 | 18.1601 (90) |             |
| Living area fraction   |         |         |         |         |         |         |         |         | FLA = Living area / (4) = |         |         |              | 0.1933 (91) |
| MIT                    | 18.4302 | 18.7422 | 19.1901 | 19.7129 | 20.0603 | 20.2086 | 20.2419 | 20.2370 | 20.1413                   | 19.6618 | 18.9449 | 18.3533 (92) |             |
| Temperature adjustment |         |         |         |         |         |         |         |         |                           |         |         | 0.0000       |             |
| adjusted MIT           | 18.4302 | 18.7422 | 19.1901 | 19.7129 | 20.0603 | 20.2086 | 20.2419 | 20.2370 | 20.1413                   | 19.6618 | 18.9449 | 18.3533 (93) |             |

## 8. Space heating requirement

|                                                                                | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov       | Dec            |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|---------------|-----------|----------------|
| Utilisation                                                                    | 0.9659    | 0.9433    | 0.9009    | 0.8066   | 0.6619   | 0.4826   | 0.3368   | 0.3823   | 0.6210   | 0.8563        | 0.9450    | 0.9706 (94)    |
| Useful gains                                                                   | 589.2343  | 669.5074  | 721.4185  | 739.1854 | 653.4650 | 472.5763 | 314.8829 | 329.8467 | 483.2849 | 571.8229      | 567.7573  | 565.2396 (95)  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000    | 4.2000 (96)    |
| Heat loss rate W                                                               | 1234.2958 | 1209.1430 | 1108.5013 | 944.5263 | 730.2867 | 489.9196 | 318.1297 | 335.1670 | 527.7137 | 791.5589      | 1034.6738 | 1236.3150 (97) |
| Space heating kWh                                                              | 479.9257  | 362.6351  | 287.9896  | 147.8455 | 57.1553  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 163.4836      | 336.1799  | 499.2802 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |          |          |          |          |          |          |               |           | 2334.4949      |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |          |          |          |          |          |          |               |           | 0.0000         |
| Space heating kWh                                                              | 479.9257  | 362.6351  | 287.9896  | 147.8455 | 57.1553  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 163.4836      | 336.1799  | 499.2802 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |          |          |          |          |          |          |               |           | 2334.4949      |
| Space heating per m2                                                           |           |           |           |          |          |          |          |          |          | (98c) / (4) = |           | 27.1516 (99)   |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

| Fraction of space heat from secondary/supplementary system (Table 11)                                        |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (201)    |
|--------------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Fraction of space heat from main system(s)                                                                   |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (202)    |
| Efficiency of main space heating system 1 (in %)                                                             |          |          |          |          |          |          |          |          |          |          |          | 91.7000 (206)   |
| Efficiency of main space heating system 2 (in %)                                                             |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)    |
| Efficiency of secondary/supplementary heating system, %                                                      |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)    |
|                                                                                                              | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec             |
| Space heating requirement                                                                                    | 479.9257 | 362.6351 | 287.9896 | 147.8455 | 57.1553  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 163.4836 | 336.1799 | 499.2802 (98)   |
| Space heating efficiency (main heating system 1)                                                             | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 91.7000  | 91.7000  | 91.7000 (210)   |
| Space heating fuel (main heating system)                                                                     | 523.3650 | 395.4581 | 314.0563 | 161.2273 | 62.3286  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 178.2809 | 366.6084 | 544.4713 (211)  |
| Space heating efficiency (main heating system 2)                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)    |
| Space heating fuel (main heating system 2)                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)    |
| Space heating fuel (secondary)                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)    |
| Water heating                                                                                                |          |          |          |          |          |          |          |          |          |          |          |                 |
| Water heating requirement                                                                                    | 199.3541 | 175.5504 | 185.1250 | 160.0708 | 153.2041 | 135.9618 | 132.9234 | 139.5422 | 142.5031 | 161.3478 | 174.4610 | 196.8757 (64)   |
| Efficiency of water heater (217)m                                                                            | 88.1732  | 88.1039  | 87.9663  | 87.6958  | 87.2607  | 86.7000  | 86.7000  | 86.7000  | 86.7000  | 87.7443  | 88.0712  | 86.7000 (216)   |
| Fuel for water heating, kWh/month                                                                            | 226.0938 | 199.2538 | 210.4500 | 182.5297 | 175.5705 | 156.8186 | 153.3142 | 160.9484 | 164.3635 | 183.8840 | 198.0909 | 223.2255 (219)  |
| Space cooling fuel requirement (221)m                                                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)    |
| Pumps and Fa                                                                                                 | 10.9478  | 9.8883   | 10.9478  | 10.9478  | 10.9478  | 10.9478  | 10.9478  | 10.9478  | 10.9478  | 10.9478  | 10.9478  | 10.9478 (231)   |
| Lighting                                                                                                     | 23.4106  | 18.7809  | 16.9101  | 12.3891  | 9.5697   | 7.8185   | 8.7298   | 11.3473  | 14.7390  | 19.3384  | 21.8427  | 24.0613 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity) (233a)m                                        | -11.5165 | -19.1763 | -33.0031 | -43.5351 | -52.0099 | -50.4050 | -49.4409 | -43.7568 | -34.6383 | -24.0771 | -13.4902 | -9.5519 (233a)  |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)   |
| Electricity generated by PVs (Appendix M) (negative quantity) (233b)m                                        | -2.7365  | -6.8505  | -16.7864 | -30.3061 | -44.7949 | -46.9105 | -45.6945 | -35.7548 | -22.5599 | -10.7273 | -3.8701  | -2.0623 (233b)  |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234b)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235d)   |
| Annual totals kWh/year                                                                                       |          |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating fuel - main system 1                                                                           |          |          |          |          |          |          |          |          |          |          |          | 2545.7960 (211) |
| Space heating fuel - main system 2                                                                           |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)    |
| Space heating fuel - secondary                                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)    |
| Efficiency of water heater                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 86.7000         |

# Full SAP Calculation Printout



|                                                                                         |                 |
|-----------------------------------------------------------------------------------------|-----------------|
| Water heating fuel used                                                                 | 2234.5429 (219) |
| Space cooling fuel                                                                      | 0.0000 (221)    |
| Electricity for pumps and fans:                                                         |                 |
| (MEVDecentralised, Database: total watage = 5.7980, total flow = 37.0000, SFP = 0.1567) |                 |
| mechanical ventilation fans (SFP = 0.1567)                                              | 42.9017 (230a)  |
| central heating pump                                                                    | 41.0000 (230c)  |
| main heating flue fan                                                                   | 45.0000 (230e)  |
| Total electricity for the above, kWh/year                                               | 128.9017 (231)  |
| Electricity for lighting (calculated in Appendix L)                                     | 188.9373 (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                           |                 |
| PV generation                                                                           | -653.6551 (233) |
| Wind generation                                                                         | 0.0000 (234)    |
| Hydro-electric generation (Appendix N)                                                  | 0.0000 (235a)   |
| Electricity generated - Micro CHP (Appendix N)                                          | 0.0000 (235)    |
| Appendix Q - special features                                                           |                 |
| Energy saved or generated                                                               | -0.0000 (236)   |
| Energy used                                                                             | 0.0000 (237)    |
| Total delivered energy for all uses                                                     | 4444.5227 (238) |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                                 | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |  |
|-------------------------------------------------|--------------------|-------------------------------|--------------------------|--|
| Space heating - main system 1                   | 2545.7960          | 0.2100                        | 534.6172 (261)           |  |
| Total CO2 associated with community systems     |                    |                               | 0.0000 (373)             |  |
| Water heating (other fuel)                      | 2234.5429          | 0.2100                        | 469.2540 (264)           |  |
| Space and water heating                         |                    |                               | 1003.8712 (265)          |  |
| Pumps, fans and electric keep-hot               | 128.9017           | 0.1387                        | 17.8803 (267)            |  |
| Energy for lighting                             | 188.9373           | 0.1443                        | 27.2695 (268)            |  |
| Energy saving/generation technologies           |                    |                               |                          |  |
| PV Unit electricity used in dwelling            | -384.6011          | 0.1316                        | -50.6173                 |  |
| PV Unit electricity exported                    | -269.0539          | 0.1216                        | -32.7148                 |  |
| Total                                           |                    |                               | -83.3322 (269)           |  |
| Total CO2, kg/year                              |                    |                               | 965.6887 (272)           |  |
| EPC Dwelling Carbon Dioxide Emission Rate (DER) |                    |                               | 11.2300 (273)            |  |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |  |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|--|
| Space heating - main system 1               | 2545.7960          | 1.1300                              | 2876.7494 (275)            |  |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |  |
| Water heating (other fuel)                  | 2234.5429          | 1.1300                              | 2525.0334 (278)            |  |
| Space and water heating                     |                    |                                     | 5401.7829 (279)            |  |
| Pumps, fans and electric keep-hot           | 128.9017           | 1.5128                              | 195.0025 (281)             |  |
| Energy for lighting                         | 188.9373           | 1.5338                              | 289.7983 (282)             |  |
| Energy saving/generation technologies       |                    |                                     |                            |  |
| PV Unit electricity used in dwelling        | -384.6011          | 1.4862                              | -571.6091                  |  |
| PV Unit electricity exported                | -269.0539          | 0.4461                              | -120.0268                  |  |
| Total                                       |                    |                                     | -691.6359 (283)            |  |
| Total Primary energy kWh/year               |                    |                                     | 5194.9477 (286)            |  |
| Dwelling Primary energy Rate (DPER)         |                    |                                     | 60.4200 (287)              |  |

## SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF TARGET EMISSIONS

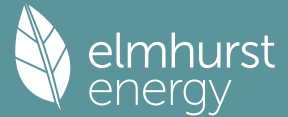
### 1. Overall dwelling characteristics

|                                                         | Area<br>(m2) | Storey height<br>(m)               | Volume<br>(m3)         |  |
|---------------------------------------------------------|--------------|------------------------------------|------------------------|--|
| Main dwelling                                           |              |                                    |                        |  |
| Ground floor                                            | 42.9900 (1b) | x 2.4600 (2b)                      | = 105.7554 (1b) - (3b) |  |
| First floor                                             | 42.9900 (1c) | x 2.7600 (2c)                      | = 118.6524 (1c) - (3c) |  |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)... (1n) | 85.9800      |                                    | (4)                    |  |
| Dwelling volume                                         |              | (3a)+(3b)+(3c)+(3d)+(3e)... (3n) = | 224.4078 (5)           |  |

### 2. Ventilation rate

|                                                                                                    | m3 per hour     |              |
|----------------------------------------------------------------------------------------------------|-----------------|--------------|
| Number of open chimneys                                                                            | 0 * 80 =        | 0.0000 (6a)  |
| Number of open flues                                                                               | 0 * 20 =        | 0.0000 (6b)  |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 =        | 0.0000 (6c)  |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 =        | 0.0000 (6d)  |
| Number of flues attached to other heater                                                           | 0 * 35 =        | 0.0000 (6e)  |
| Number of blocked chimneys                                                                         | 0 * 20 =        | 0.0000 (6f)  |
| Number of intermittent extract fans                                                                | 3 * 10 =        | 30.0000 (7a) |
| Number of passive vents                                                                            | 0 * 10 =        | 0.0000 (7b)  |
| Number of flueless gas fires                                                                       | 0 * 40 =        | 0.0000 (7c)  |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 30.0000 / (5) = | 0.1337 (8)   |
| Pressure test                                                                                      | Yes             |              |
| Pressure Test Method                                                                               | Blower Door     |              |
| Measured/design AP50                                                                               | 5.0000          | (17)         |
| Infiltration rate                                                                                  | 0.3837          | (18)         |
| Number of sides sheltered                                                                          | 2               | (19)         |

# Full SAP Calculation Printout



Shelter factor  
Infiltration rate adjusted to include shelter factor

$$(20) = 1 - [0.075 \times (19)] = 0.8500 \quad (20)$$

$$(21) = (18) \times (20) = 0.3261 \quad (21)$$

|                 | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |       |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|
| Wind speed      | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 | (22)  |
| Wind factor     | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 | (22a) |
| Adj infilt rate | 0.4158 | 0.4077 | 0.3995 | 0.3587 | 0.3506 | 0.3098 | 0.3098 | 0.3017 | 0.3261 | 0.3506 | 0.3669 | 0.3832 | (22b) |
| Effective ac    | 0.5865 | 0.5831 | 0.5798 | 0.5643 | 0.5615 | 0.5480 | 0.5480 | 0.5455 | 0.5532 | 0.5615 | 0.5673 | 0.5734 | (25)  |

## 3. Heat losses and heat loss parameter

| Element                                           | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K | A x U<br>W/K         | K-value<br>kJ/m2K | A x K<br>kJ/K |       |
|---------------------------------------------------|-------------|----------------|---------------|------------------|----------------------|-------------------|---------------|-------|
| Main dwelling                                     |             |                |               |                  |                      |                   |               |       |
| TER Opaque door                                   |             |                | 2.5500        | 1.0000           | 2.5500               |                   |               | (26)  |
| TER Opening Type                                  |             |                | 13.5800       | 1.1450           | 15.5496              |                   |               | (27)  |
| GF SPVL 125TS P/A                                 |             |                | 42.9900       | 0.1300           | 5.5887               |                   |               | (28a) |
| EW Brick AAC011                                   | 97.2486     | 16.1300        | 81.1186       | 0.1800           | 14.6013              |                   |               | (29a) |
| PR 500mm MW044                                    | 42.9900     |                | 42.9900       | 0.1100           | 4.7289               |                   |               | (30)  |
| Total net area of external elements Aum(A, m2)    |             |                | 183.2286      |                  |                      |                   |               | (31)  |
| Fabric heat loss, W/K = Sum (A x U)               |             |                |               |                  | (26)...(30) + (32) = | 43.0186           |               | (33)  |
| Main dwelling                                     |             |                |               |                  |                      |                   |               |       |
| E-WM-30                                           |             |                | 43.8000       | 0.0000           | 0.0000               |                   |               | (32)  |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K |             |                |               |                  |                      |                   | 157.5901      | (35)  |

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

List of Thermal Bridges

|                                                            | Length  | Psi-value | Total                 |              |
|------------------------------------------------------------|---------|-----------|-----------------------|--------------|
| K1 Element                                                 | 10.7800 | 0.0500    | 0.5390                |              |
| E2 Other lintels (including other steel lintels)           | 9.2000  | 0.0500    | 0.4600                |              |
| E3 Sill                                                    | 21.1500 | 0.0500    | 1.0575                |              |
| E4 Jamb                                                    | 10.2300 | 0.1600    | 1.6368                |              |
| E5 Ground floor (normal)                                   | 18.6300 | 0.0000    | 0.0000                |              |
| E6 Intermediate floor within a dwelling                    | 10.2500 | 0.0600    | 0.6150                |              |
| E10 Eaves (insulation at ceiling level)                    | 10.4400 | 0.0600    | 0.6264                |              |
| E18 Party wall between dwellings                           | 4.8000  | 0.0500    | 0.2400                |              |
| E4 Jamb                                                    | 1.0600  | 0.0500    | 0.0530                |              |
| E2 Other lintels (including other steel lintels)           | 8.3900  | 0.0800    | 0.6712                |              |
| P1 Party wall - Ground floor                               | 8.3900  | 0.0000    | 0.0000                |              |
| P2 Party wall - Intermediate floor within a dwelling       | 8.3900  | 0.1200    | 1.0068                |              |
| P4 Party wall - Roof (insulation at ceiling level)         | 8.3900  | 0.1600    | 1.3424                |              |
| E5 Ground floor (normal)                                   | 8.3900  | 0.0600    | 0.5034                |              |
| E12 Gable (insulation at ceiling level)                    | 10.4400 | 0.0900    | 0.9396                |              |
| E16 Corner (normal)                                        |         |           |                       |              |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |         |           |                       | 9.6911 (36)  |
| Point Thermal bridges                                      |         |           | (36a) =               | 0.0000       |
| Total fabric heat loss                                     |         |           | (33) + (36) + (36a) = | 52.7097 (37) |

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

Point Thermal bridges

Total fabric heat loss

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

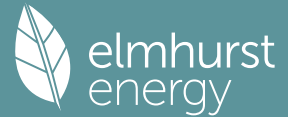
|                           | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |      |
|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| (38)m                     | 43.4295 | 43.1809 | 42.9372 | 41.7926 | 41.5785 | 40.5816 | 40.5816 | 40.3970 | 40.9656 | 41.5785 | 42.0117 | 42.4646 | (38) |
| Heat transfer coeff       | 96.1392 | 95.8906 | 95.6469 | 94.5023 | 94.2882 | 93.2913 | 93.2913 | 93.1067 | 93.6753 | 94.2882 | 94.7214 | 95.1743 | (39) |
| Average = Sum(39)m / 12 = |         |         |         |         |         |         |         |         |         |         |         | 94.5013 |      |

|               | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |      |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| HLP           | 1.1182 | 1.1153 | 1.1124 | 1.0991 | 1.0966 | 1.0850 | 1.0850 | 1.0829 | 1.0895 | 1.0966 | 1.1017 | 1.1069 | (40) |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 1.0991 |      |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31     |      |

## 4. Water heating energy requirements (kWh/year)

|                                                                                |          |          |          |          |          |          |          |          |          |          |          |           |             |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-------------|
| Assumed occupancy                                                              |          |          |          |          |          |          |          |          |          |          |          |           | 2.5666 (42) |
| Hot water usage for mixer showers                                              |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 67.2533                                                                        | 66.2426  | 64.7698  | 61.9519  | 59.8724  | 57.5533  | 56.2352  | 57.6968  | 59.2990  | 61.7890  | 64.6674  | 66.9956  | 66.9956   | (42a)       |
| Hot water usage for baths                                                      |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 29.0443                                                                        | 28.6130  | 28.0055  | 26.8856  | 26.0469  | 25.1170  | 24.6147  | 25.2179  | 25.8746  | 26.8697  | 28.0127  | 28.9461  | 28.9461   | (42b)       |
| Hot water usage for other uses                                                 |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 40.9146                                                                        | 39.4268  | 37.9390  | 36.4512  | 34.9634  | 33.4756  | 33.4756  | 34.9634  | 36.4512  | 37.9390  | 39.4268  | 40.9146  | 40.9146   | (42c)       |
| Average daily hot water use (litres/day)                                       |          |          |          |          |          |          |          |          |          |          |          | 126.1290  | (43)        |
| Daily hot water use                                                            |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 137.2122                                                                       | 134.2823 | 130.7143 | 125.2887 | 120.8827 | 116.1459 | 114.3255 | 117.8781 | 121.6248 | 126.5977 | 132.1069 | 136.8563 | 136.8563  | (44)        |
| Energy conte                                                                   | 217.3105 | 191.2162 | 200.9030 | 171.5139 | 162.7313 | 142.8150 | 138.2667 | 145.9577 | 149.9756 | 171.7918 | 188.2105 | 214.2839  | (45)        |
| Energy content (annual)                                                        |          |          |          |          |          |          |          |          |          |          |          | 2094.9763 |             |
| Distribution loss (46)m = 0.15 x (45)m                                         |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 32.5966                                                                        | 28.6824  | 30.1355  | 25.7271  | 24.4097  | 21.4222  | 20.7400  | 21.8937  | 22.4963  | 25.7688  | 28.2316  | 32.1426  | 32.1426   | (46)        |
| Water storage loss (or HIU loss):                                              |          |          |          |          |          |          |          |          |          |          |          |           |             |
| Total storage loss                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (56)        |
| If cylinder contains dedicated solar storage                                   |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (57)        |
| Primary loss                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (59)        |
| Combi loss                                                                     | 50.9589  | 46.0274  | 50.9589  | 49.3151  | 50.9589  | 49.3151  | 50.9589  | 50.9589  | 49.3151  | 50.9589  | 49.3151  | 50.9589   | (61)        |
| Total heat required for water heating calculated for each month                |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 268.2694                                                                       | 237.2436 | 251.8620 | 220.8290 | 213.6902 | 192.1300 | 189.2257 | 196.9166 | 199.2907 | 222.7507 | 237.5256 | 265.2428 | 265.2428  | (62)        |
| WWHRS                                                                          | -30.7454 | -27.1915 | -28.4733 | -23.5770 | -21.9730 | -18.8024 | -17.6243 | -18.7416 | -19.4537 | -22.9338 | -25.9812 | -30.1760  | (63a)       |
| PV diverter                                                                    | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000   | (63b)       |
| Solar input                                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (63c)       |
| FGHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (63d)       |
| Output from w/h                                                                | 237.5241 | 210.0522 | 223.3886 | 197.2519 | 191.7173 | 173.3276 | 171.6014 | 178.1749 | 179.8370 | 199.8169 | 211.5444 | 235.0668  | (64)        |
| 12Total per year (kWh/year)                                                    |          |          |          |          |          |          |          |          |          |          |          | 2409.3031 | (64)        |
| Electric shower(s)                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (64a)       |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (64a)       |
| Heat gains from water heating, kWh/month                                       |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 84.9955                                                                        | 75.0862  | 79.5400  | 69.3571  | 66.8479  | 59.8147  | 58.7134  | 61.2707  | 62.1957  | 69.8605  | 74.9088  | 83.9891  | 83.9891   | (65)        |

# Full SAP Calculation Printout



## 5. Internal gains (see Table 5 and 5a)

| Metabolic gains (Table 5), Watts                                                    |           |           |           |           |           |           |           |           |           |           |           |                |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
|                                                                                     | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec            |
| (66)m                                                                               | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 122.1242  | 135.2090  | 122.1242  | 126.1950  | 122.1242  | 126.1950  | 122.1242  | 122.1242  | 126.1950  | 122.1242  | 126.1950  | 122.1242 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 231.4847  | 233.8867  | 227.8336  | 214.9471  | 198.6802  | 183.3916  | 173.1779  | 170.7758  | 176.8289  | 189.7154  | 205.9823  | 221.2709 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330 (69)   |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 3.0000    | 3.0000    | 3.0000 (70)    |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 (71) |
| Water heating gains (Table 5)                                                       | 114.2412  | 111.7355  | 106.9086  | 96.3294   | 89.8493   | 83.0760   | 78.9159   | 82.3530   | 86.3828   | 93.8985   | 104.0399  | 112.8886 (72)  |
| Total internal gains                                                                | 532.3492  | 545.3303  | 521.3654  | 501.9705  | 475.1528  | 454.1617  | 435.7170  | 436.7521  | 450.9059  | 470.2373  | 500.7164  | 520.7828 (73)  |

## 6. Solar gains

| [Jan]       |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | Specific data<br>or Table 6b | g        | Specific data<br>or Table 6c | FF       |          |          |  | Access<br>factor<br>Table 6d | Gains<br>W    |
|-------------|----------|----------|----------|------------|--------------------------------|------------------------------|----------|------------------------------|----------|----------|----------|--|------------------------------|---------------|
| North       |          |          |          | 0.5200     | 10.6334                        | 0.6300                       |          | 0.7000                       |          |          |          |  | 0.7700                       | 1.6898 (74)   |
| East        |          |          |          | 7.4500     | 19.6403                        | 0.6300                       |          | 0.7000                       |          |          |          |  | 0.7700                       | 44.7173 (76)  |
| West        |          |          |          | 5.6100     | 19.6403                        | 0.6300                       |          | 0.7000                       |          |          |          |  | 0.7700                       | 33.6730 (80)  |
|             |          |          |          |            |                                |                              |          |                              |          |          |          |  |                              |               |
| Solar gains | 80.0801  | 156.5774 | 258.0299 | 377.1324   | 463.2613                       | 474.7867                     | 451.7822 | 387.2956                     | 300.3150 | 185.8045 | 99.8281  |  |                              | 65.8731 (83)  |
| Total gains | 612.4293 | 701.9077 | 779.3954 | 879.1029   | 938.4141                       | 928.9484                     | 887.4993 | 824.0477                     | 751.2209 | 656.0418 | 600.5445 |  |                              | 586.6559 (84) |

## 7. Mean internal temperature (heating season)

| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |         |         |         |              |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| tau                                                                         | 39.1493 | 39.2508 | 39.3508 | 39.8274 | 39.9178 | 40.3444 | 40.3444 | 40.4244 | 40.1790 | 39.9178 | 39.7352 | 39.5462      |
| alpha                                                                       | 3.6100  | 3.6167  | 3.6234  | 3.6552  | 3.6612  | 3.6896  | 3.6896  | 3.6950  | 3.6786  | 3.6612  | 3.6490  | 3.6364       |
| util living area                                                            | 0.9807  | 0.9676  | 0.9417  | 0.8747  | 0.7581  | 0.5913  | 0.4477  | 0.4964  | 0.7236  | 0.9102  | 0.9682  | 0.9833 (86)  |
| MIT                                                                         | 19.2152 | 19.4632 | 19.8386 | 20.3316 | 20.7044 | 20.9144 | 20.9764 | 20.9656 | 20.8162 | 20.3152 | 19.6886 | 19.1795 (87) |
| Th 2                                                                        | 19.9860 | 19.9884 | 19.9907 | 20.0016 | 20.0036 | 20.0131 | 20.0131 | 20.0148 | 20.0094 | 20.0036 | 19.9995 | 19.9952 (88) |
| util rest of house                                                          | 0.9767  | 0.9610  | 0.9294  | 0.8486  | 0.7094  | 0.5158  | 0.3535  | 0.3995  | 0.6539  | 0.8856  | 0.9605  | 0.9798 (89)  |
| MIT 2                                                                       | 17.9124 | 18.2270 | 18.6989 | 19.3073 | 19.7350 | 19.9538 | 20.0023 | 19.9978 | 19.8664 | 19.3030 | 18.5231 | 17.8730 (90) |
| Living area fraction                                                        | 18.1642 | 18.4659 | 18.9192 | 19.5053 | 19.9224 | 20.1395 | 20.1906 | 20.1849 | 20.0500 | 19.4987 | 18.7484 | 18.1255 (92) |
| MIT                                                                         | 18.1642 | 18.4659 | 18.9192 | 19.5053 | 19.9224 | 20.1395 | 20.1906 | 20.1849 | 20.0500 | 19.4987 | 18.7484 | 18.1255 (93) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT                                                                | 18.1642 | 18.4659 | 18.9192 | 19.5053 | 19.9224 | 20.1395 | 20.1906 | 20.1849 | 20.0500 | 19.4987 | 18.7484 | 18.1255 (93) |

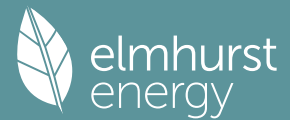
## 8. Space heating requirement

|                                                                                | Jan       | Feb       | Mar       | Apr       | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov       | Dec            |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|-----------|----------------|
| Utilisation                                                                    | 0.9664    | 0.9475    | 0.9129    | 0.8334    | 0.7050   | 0.5260   | 0.3709   | 0.4168   | 0.6571   | 0.8701   | 0.9474    | 0.9706 (94)    |
| Useful gains                                                                   | 591.8768  | 665.0715  | 711.5034  | 732.6621  | 661.6285 | 488.6394 | 329.1842 | 343.4928 | 493.6143 | 570.8523 | 568.9397  | 569.3794 (95)  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000    | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000  | 7.1000    | 4.2000 (96)    |
| Heat loss rate W                                                               | 1332.8934 | 1300.8437 | 1187.8602 | 1002.2269 | 775.2704 | 516.7837 | 334.9706 | 352.3990 | 557.3633 | 839.0393 | 1103.3502 | 1325.3533 (97) |
| Space heating kWh                                                              | 551.3163  | 427.2389  | 354.4095  | 194.0867  | 84.5496  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 199.5311 | 384.7756  | 562.4446 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |          |          |          |          |          |          |           | 2758.3523      |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |           |          |          |          |          |          |          |           | 0.0000         |
| Space heating kWh                                                              | 551.3163  | 427.2389  | 354.4095  | 194.0867  | 84.5496  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 199.5311 | 384.7756  | 562.4446 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |          |          |          |          |          |          |           | 2758.3523      |
| Space heating per m <sup>2</sup>                                               |           |           |           |           |          |          |          |          |          |          |           | 32.0813 (99)   |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

| Fraction of space heat from secondary/supplementary system (Table 11) |          |          |          |          |          |          |          |          |          |          |          |                |
|-----------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| Efficiency of main space heating system 1 (in %)                      |          |          |          |          |          |          |          |          |          |          |          |                |
| Efficiency of main space heating system 2 (in %)                      |          |          |          |          |          |          |          |          |          |          |          |                |
| Efficiency of secondary/supplementary heating system, %               |          |          |          |          |          |          |          |          |          |          |          |                |
|                                                                       | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec            |
| Space heating requirement                                             | 551.3163 | 427.2389 | 354.4095 | 194.0867 | 84.5496  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 199.5311 | 384.7756 | 562.4446 (98)  |
| Space heating efficiency (main heating system 1)                      | 92.4000  | 92.4000  | 92.4000  | 92.4000  | 92.4000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 92.4000  | 92.4000  | 92.4000 (210)  |
| Space heating fuel (main heating system)                              | 596.6627 | 462.3798 | 383.5601 | 210.0505 | 91.5039  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 215.9428 | 416.4238 | 608.7063 (211) |
| Space heating efficiency (main heating system 2)                      | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)   |
| Space heating fuel (main heating system 2)                            | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)   |
| Space heating fuel (secondary)                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)   |
| Water heating                                                         |          |          |          |          |          |          |          |          |          |          |          |                |
| Water heating requirement                                             | 237.5241 | 210.0522 | 223.3886 | 197.2519 | 191.7173 | 173.3276 | 171.6014 | 178.1749 | 179.8370 | 199.8169 | 211.5444 | 235.0668 (64)  |
| Efficiency of water heater                                            |          |          |          |          |          |          |          |          |          |          |          | 80.3000 (216)  |

# Full SAP Calculation Printout



|                                                                                                      |          |          |          |           |           |           |           |           |           |          |          |            |        |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|----------|------------|--------|
| (217)m                                                                                               | 86.1227  | 85.8688  | 85.3653  | 84.3468   | 82.7499   | 80.3000   | 80.3000   | 80.3000   | 80.3000   | 84.3784  | 85.6460  | 86.1795    | (217)  |
| Fuel for water heating, kWh/month                                                                    | 275.7972 | 244.6198 | 261.6854 | 233.8583  | 231.6828  | 215.8501  | 213.7004  | 221.8866  | 223.9564  | 236.8106 | 246.9985 | 272.7640   | (219)  |
| Space cooling fuel requirement                                                                       |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (221)m                                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (221)  |
| Pumps and Fa                                                                                         | 7.3041   | 6.5973   | 7.3041   | 7.0685    | 7.3041    | 7.0685    | 7.3041    | 7.0685    | 7.3041    | 7.0685   | 7.3041   | 7.0685     | (231)  |
| Lighting                                                                                             | 25.3750  | 20.3568  | 18.3290  | 13.4286   | 10.3727   | 8.4745    | 9.4623    | 12.2994   | 15.9757   | 20.9610  | 23.6755  | 26.0803    | (232)  |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (233a)m                                                                                              | -39.8696 | -56.0257 | -80.2676 | -89.9369  | -96.7057  | -90.1510  | -89.0213  | -84.1676  | -75.5697  | -63.9045 | -43.7612 | -34.4899   | (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (234a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (234a) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (235a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (235a) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (235c)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (235c) |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (233b)m                                                                                              | -23.0762 | -48.4849 | -96.2662 | -144.4459 | -190.8693 | -191.7487 | -189.5061 | -160.5221 | -117.7385 | -69.3076 | -30.7987 | -18.2537   | (233b) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (234b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (234b) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (235b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (235b) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (235d)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (235d) |
| Annual totals kWh/year                                                                               |          |          |          |           |           |           |           |           |           |          |          |            |        |
| Space heating fuel - main system 1                                                                   |          |          |          |           |           |           |           |           |           |          |          | 2985.2297  | (211)  |
| Space heating fuel - main system 2                                                                   |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (213)  |
| Space heating fuel - secondary                                                                       |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (215)  |
| Efficiency of water heater                                                                           |          |          |          |           |           |           |           |           |           |          |          | 80.3000    |        |
| Water heating fuel used                                                                              |          |          |          |           |           |           |           |           |           |          |          | 2879.6100  | (219)  |
| Space cooling fuel                                                                                   |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (221)  |
| Electricity for pumps and fans:                                                                      |          |          |          |           |           |           |           |           |           |          |          |            |        |
| Total electricity for the above, kWh/year                                                            |          |          |          |           |           |           |           |           |           |          |          | 86.0000    | (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |          |          |          |           |           |           |           |           |           |          |          | 204.7908   | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |          |          |           |           |           |           |           |           |          |          |            |        |
| PV generation                                                                                        |          |          |          |           |           |           |           |           |           |          |          | -2124.8885 | (233)  |
| Wind generation                                                                                      |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (234)  |
| Hydro-electric generation (Appendix N)                                                               |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (235a) |
| Electricity generated - Micro CHP (Appendix N)                                                       |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (235)  |
| Appendix Q - special features                                                                        |          |          |          |           |           |           |           |           |           |          |          |            |        |
| Energy saved or generated                                                                            |          |          |          |           |           |           |           |           |           |          |          | -0.0000    | (236)  |
| Energy used                                                                                          |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (237)  |
| Total delivered energy for all uses                                                                  |          |          |          |           |           |           |           |           |           |          |          | 4030.7421  | (238)  |

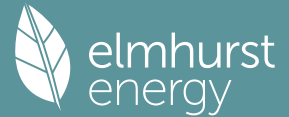
## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                               | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|-----------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1                 | 2985.2297          | 0.2100                        | 626.8982 (261)           |
| Total CO2 associated with community systems   |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                    | 2879.6100          | 0.2100                        | 604.7181 (264)           |
| Space and water heating                       |                    |                               | 1231.6163 (265)          |
| Pumps, fans and electric keep-hot             | 86.0000            | 0.1387                        | 11.9293 (267)            |
| Energy for lighting                           | 204.7908           | 0.1443                        | 29.5576 (268)            |
| Energy saving/generation technologies         |                    |                               |                          |
| PV Unit electricity used in dwelling          | -843.8706          | 0.1347                        | -113.6365                |
| PV Unit electricity exported                  | -1281.0179         | 0.1259                        | -161.3091                |
| Total                                         |                    |                               | -274.9456 (269)          |
| Total CO2, kg/year                            |                    |                               | 998.1576 (272)           |
| EPC Target Carbon Dioxide Emission Rate (TER) |                    |                               | 11.6100 (273)            |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1               | 2985.2297          | 1.1300                              | 3373.3096 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 2879.6100          | 1.1300                              | 3253.9593 (278)            |
| Space and water heating                     |                    |                                     | 6627.2689 (279)            |
| Pumps, fans and electric keep-hot           | 86.0000            | 1.5128                              | 130.1008 (281)             |
| Energy for lighting                         | 204.7908           | 1.5338                              | 314.1150 (282)             |
| Energy saving/generation technologies       |                    |                                     |                            |
| PV Unit electricity used in dwelling        | -843.8706          | 1.4977                              | -1263.8554                 |
| PV Unit electricity exported                | -1281.0179         | 0.4622                              | -592.1168                  |
| Total                                       |                    |                                     | -1855.9722 (283)           |
| Total Primary energy kWh/year               |                    |                                     | 5215.5125 (286)            |
| Target Primary Energy Rate (TPER)           |                    |                                     | 60.6600 (287)              |

# Full SAP Calculation Printout



|                                    |                                                          |               |        |                |            |
|------------------------------------|----------------------------------------------------------|---------------|--------|----------------|------------|
| Plot Reference                     | 4907-R823-9471-002                                       |               |        | Issued on Date | 21/07/2026 |
| Assessment Reference               | Plot 2                                                   | Plot Type Ref | Plot 2 |                |            |
| Plot Address                       | Plot 2, Beaconsfield-Semi, K, WC, B, ES, 1012            |               |        | SAP Version    | 10.2       |
| SAP Rating                         | 90 B                                                     | DER           | 11.23  | TER            | 11.61      |
| Environmental                      | 90 B                                                     | % DER < TER   |        | 3.27           |            |
| CO <sub>2</sub> Emissions (t/year) | 0.86                                                     | DFEE          | 35.32  | TFEE           | 37.71      |
| Compliance Check                   | See BREL                                                 | % DFEE < TFEE |        | 6.34           |            |
| % DPER < TPER                      | 0.39                                                     | DPER          | 60.42  | TPER           | 60.66      |
| Assessor Details                   | Mr. Daniel Harris                                        |               |        | Assessor ID    | R823-0001  |
| Client                             | Crest Nicholson Head Office, Crest Nicholson Head Office |               |        |                |            |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF ENERGY RATING

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)              | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|-----------------------------------|-----------------------------|
| Main dwelling                                          |                           |                                   |                             |
| Ground floor                                           | 42.9900 (1b)              | x 2.4600 (2b)                     | = 105.7554 (1b) - (3b)      |
| First floor                                            | 42.9900 (1c)              | x 2.7600 (2c)                     | = 118.6524 (1c) - (3c)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 85.9800                   |                                   | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 224.4078 (5)                |

## 2. Ventilation rate

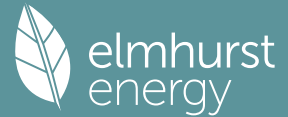
|                                                                                                    | m <sup>3</sup> per hour                 |
|----------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                    |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                    |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                    |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                    |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                    |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                    |
| Number of intermittent extract fans                                                                | 0 * 10 = 0.0000 (7a)                    |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)                    |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 0.0000 / (5) = 0.0000 (8)               |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 4.5000 (17)                             |
| Infiltration rate                                                                                  | 0.2250 (18)                             |
| Number of sides sheltered                                                                          | 2 (19)                                  |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 0.8500 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.1913 (21)        |

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor                                                                                             | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate                                                                                         | 0.2438 | 0.2391 | 0.2343 | 0.2104 | 0.2056 | 0.1817 | 0.1817 | 0.1769 | 0.1913 | 0.2056 | 0.2152 | 0.2247 (22b) |
| Mechanical extract ventilation - decentralised                                                          |        |        |        |        |        |        |        |        |        |        |        |              |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 (25)  |

## 3. Heat losses and heat loss parameter

| Element                                                     | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K   |
|-------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|-----------------|
| Main dwelling                                               |                         |                            |                           |                               |              |                                |                 |
| Front Door                                                  |                         |                            | 2.5500                    | 1.2000                        | 3.0600       |                                | (26)            |
| Windows                                                     |                         |                            | 10.2500                   | 1.2357                        | 12.6663      |                                | (27)            |
| French Doors                                                |                         |                            | 3.3300                    | 1.2357                        | 4.1150       |                                | (27)            |
| GF SPVL 125TS P/A                                           |                         |                            | 42.9900                   | 0.1300                        | 5.5887       | 75.0000                        | 3224.2500 (28a) |
| EW Brick AAC011                                             | 97.2486                 | 16.1300                    | 81.1186                   | 0.1800                        | 14.6013      | 60.0000                        | 4867.1160 (29a) |
| PR 500mm MW044                                              | 42.9900                 |                            | 42.9900                   | 0.0900                        | 3.8691       | 9.0000                         | 386.9100 (30)   |
| Total net area of external elements Aum(A, m <sup>2</sup> ) |                         |                            | 183.2286                  |                               |              |                                | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                         |                         |                            | (26)...(30) + (32) =      |                               | 43.9005      |                                | (33)            |
| Main dwelling                                               |                         |                            |                           |                               |              |                                |                 |
| E-WM-30                                                     |                         |                            | 43.8000                   | 0.0000                        | 0.0000       | 45.0000                        | 1971.0000 (32)  |
| Timber - GF                                                 |                         |                            | 88.6100                   |                               |              | 9.0000                         | 797.4900 (32c)  |
| Timber - FF                                                 |                         |                            | 126.9000                  |                               |              | 9.0000                         | 1142.1000 (32c) |
| Internal Floor FF                                           |                         |                            | 42.9900                   |                               |              | 18.0000                        | 773.8200 (32d)  |
| Internal Ceiling GF                                         |                         |                            | 42.9900                   |                               |              | 9.0000                         | 386.9100 (32e)  |

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Heat capacity  $C_m = \text{Sum}(A \times k)$   
Thermal mass parameter (TMP) =  $C_m / \text{TFA}$  in  $\text{kJ/m}^2\text{K}$   
List of Thermal Bridges

(28)...(30) + (32) + (32a)...(32e) = 13549.5960 (34)  
157.5901 (35)

|                                                      | Length  | Psi-value | Total  |
|------------------------------------------------------|---------|-----------|--------|
| K1 Element                                           |         |           |        |
| E2 Other lintels (including other steel lintels)     | 10.7800 | 0.0410    | 0.4420 |
| E3 Sill                                              | 9.2000  | 0.0220    | 0.2024 |
| E4 Jamb                                              | 21.1500 | 0.0190    | 0.4018 |
| E5 Ground floor (normal)                             | 10.2300 | 0.0928    | 0.9493 |
| E6 Intermediate floor within a dwelling              | 18.6300 | 0.0020    | 0.0373 |
| E10 Eaves (insulation at ceiling level)              | 10.2500 | 0.0390    | 0.3997 |
| E18 Party wall between dwellings                     | 10.4400 | 0.0330    | 0.3445 |
| E4 Jamb                                              | 4.8000  | 0.1000    | 0.4800 |
| E2 Other lintels (including other steel lintels)     | 1.0600  | 0.0410    | 0.0435 |
| P1 Party wall - Ground floor                         | 8.3900  | 0.1000    | 0.8390 |
| P2 Party wall - Intermediate floor within a dwelling | 8.3900  | 0.0000    | 0.0000 |
| P4 Party wall - Roof (insulation at ceiling level)   | 8.3900  | 0.0350    | 0.2937 |
| E5 Ground floor (normal)                             | 8.3900  | 0.0980    | 0.8222 |
| E12 Gable (insulation at ceiling level)              | 8.3900  | 0.0870    | 0.7299 |
| E16 Corner (normal)                                  | 10.4400 | 0.0420    | 0.4385 |

Thermal bridges (Sum(L x Psi) calculated using Appendix K)  
Point Thermal bridges (36a) = 0.0000  
Total fabric heat loss (33) + (36) + (36a) = 50.3244 (37)

| Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)\text{m} \times (5)$ | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |      |
|----------------------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| (38)m                                                                                  | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | (38) |
| Heat transfer coeff                                                                    | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | (39) |
| Average = Sum(39)m / 12 =                                                              |         |         |         |         |         |         |         |         |         |         |         | 87.3516 |      |
| HLP                                                                                    | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | (40) |
| HLP (average)                                                                          |         |         |         |         |         |         |         |         |         |         |         | 1.0160  |      |
| Days in mont                                                                           | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31      |      |

## 4. Water heating energy requirements (kWh/year)

|                                                                                |          |          |          |          |          |          |          |          |          |                    |          |           |             |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------------------|----------|-----------|-------------|
| Assumed occupancy                                                              |          |          |          |          |          |          |          |          |          |                    |          |           | 2.5666 (42) |
| Hot water usage for mixer showers                                              |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| 67.2533                                                                        | 66.2426  | 64.7698  | 61.9519  | 59.8724  | 57.5533  | 56.2352  | 57.6968  | 59.2990  | 61.7890  | 64.6674            | 66.9956  | (42a)     |             |
| Hot water usage for baths                                                      |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| 29.0443                                                                        | 28.6130  | 28.0055  | 26.8856  | 26.0469  | 25.1170  | 24.6147  | 25.2179  | 25.8746  | 26.8697  | 28.0127            | 28.9461  | (42b)     |             |
| Hot water usage for other uses                                                 |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| 40.9146                                                                        | 39.4268  | 37.9390  | 36.4512  | 34.9634  | 33.4756  | 33.4756  | 34.9634  | 36.4512  | 37.9390  | 39.4268            | 40.9146  | (42c)     |             |
| Average daily hot water use (litres/day)                                       |          |          |          |          |          |          |          |          |          |                    |          | 126.1290  | (43)        |
| Daily hot water use                                                            | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct                | Nov      | Dec       |             |
| 137.2122                                                                       | 134.2823 | 130.7143 | 125.2887 | 120.8827 | 116.1459 | 114.3255 | 117.8781 | 121.6248 | 126.5977 | 132.1069           | 136.8563 | (44)      |             |
| Energy content (annual)                                                        | 217.3105 | 191.2162 | 200.9030 | 171.5139 | 162.7313 | 142.8150 | 138.2667 | 145.9577 | 149.9756 | 171.7918           | 188.2105 | 214.2839  | (45)        |
| Distribution loss (46)m = 0.15 x (45)m                                         |          |          |          |          |          |          |          |          |          | Total = Sum(45)m = |          | 2094.9763 |             |
| 32.5966                                                                        | 28.6824  | 30.1355  | 25.7271  | 24.4097  | 21.4222  | 20.7400  | 21.8937  | 22.4963  | 25.7688  | 28.2316            | 32.1426  | (46)      |             |
| Water storage loss (or HIU loss):                                              |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| Total storage loss                                                             |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | 0.0000    | (56)        |
| If cylinder contains dedicated solar storage                                   |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | 0.0000    | (57)        |
| Primary loss                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | 0.0000    | (59)        |
| Combi loss                                                                     | 11.9874  | 10.8167  | 11.9530  | 11.5193  | 11.8728  | 11.4590  | 11.8214  | 11.8376  | 11.4740  | 11.8918            | 11.5543  | 11.9811   | (61)        |
| Total heat required for water heating calculated for each month                |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| 229.2979                                                                       | 202.0330 | 212.8560 | 183.0332 | 174.6042 | 154.2740 | 150.0882 | 157.7953 | 161.4496 | 183.6836 | 199.7649           | 226.2650 | (62)      |             |
| WWHRS                                                                          | -29.9438 | -26.4825 | -27.7310 | -22.9624 | -21.4001 | -18.3122 | -17.1648 | -18.2530 | -18.9465 | -22.3359           | -25.3038 | -29.3893  | (63a)       |
| PV diverter                                                                    | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000            | -0.0000  | -0.0000   | (63b)       |
| Solar input                                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | 0.0000    | (63c)       |
| FGHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | 0.0000    | (63d)       |
| Output from w/h                                                                |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| 199.3541                                                                       | 175.5504 | 185.1250 | 160.0708 | 153.2041 | 135.9618 | 132.9234 | 139.5422 | 142.5031 | 161.3478 | 174.4610           | 196.8757 | (64)      |             |
| Electric shower(s)                                                             |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | 0.0000    | (64a)       |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |          |          |          |          |          |          |                    |          | 0.0000    | (64a)       |
| Heat gains from water heating, kWh/month                                       |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| 75.2526                                                                        | 66.2836  | 69.7885  | 59.9082  | 57.0764  | 50.3507  | 48.9291  | 51.4903  | 52.7354  | 60.0937  | 65.4686            | 74.2447  | (65)      |             |

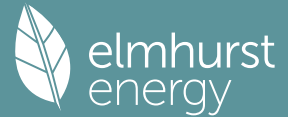
## 5. Internal gains (see Table 5 and 5a)

| Metabolic gains (Table 5), Watts                                                    |           |           |           |           |           |           |           |           |           |           |           |                |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
|                                                                                     | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec            |
| (66)m                                                                               | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     |           |           |           |           |           |           |           |           |           |           |           |                |
|                                                                                     | 26.7460   | 23.7556   | 19.3193   | 14.6260   | 10.9331   | 9.2302    | 9.9735    | 12.9640   | 17.4002   | 22.0936   | 25.7865   | 27.4894 (67)   |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 |           |           |           |           |           |           |           |           |           |           |           |                |
|                                                                                     | 345.4995  | 349.0847  | 340.0501  | 320.8165  | 296.5375  | 273.7188  | 258.4744  | 254.8892  | 263.9238  | 283.1574  | 307.4363  | 330.2551 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    |           |           |           |           |           |           |           |           |           |           |           |                |
|                                                                                     | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662 (69)   |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 3.0000    | 3.0000    | 3.0000 (70)    |
| Losses e.g. evaporation (negative values) (Table 5)                                 |           |           |           |           |           |           |           |           |           |           |           |                |
|                                                                                     | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 (71) |
| Water heating gains (Table 5)                                                       |           |           |           |           |           |           |           |           |           |           |           |                |
|                                                                                     | 101.1460  | 98.6363   | 93.8018   | 83.2058   | 76.7156   | 69.9316   | 65.7649   | 69.2074   | 73.2436   | 80.7712   | 90.9286   | 99.7912 (72)   |
| Total internal gains                                                                |           |           |           |           |           |           |           |           |           |           |           |                |
|                                                                                     | 580.6898  | 578.7749  | 560.4695  | 525.9466  | 491.4845  | 457.1788  | 438.5111  | 441.3589  | 458.8659  | 493.3204  | 531.4497  | 564.8340 (73)  |

## 6. Solar gains

| [Jan] | Area<br>m <sup>2</sup> | Solar flux<br>Table 6a<br>W/m <sup>2</sup> | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W  |
|-------|------------------------|--------------------------------------------|-----------------------------------|------------------------------------|------------------------------|-------------|
| North | 0.5200                 | 10.6334                                    | 0.4500                            | 0.0000                             | 0.7700                       | 1.9159 (74) |

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|      |  |  |        |  |         |  |        |  |        |  |        |  |              |
|------|--|--|--------|--|---------|--|--------|--|--------|--|--------|--|--------------|
| East |  |  | 4.1200 |  | 19.6403 |  | 0.4500 |  | 0.0000 |  | 0.7700 |  | 28.0380 (76) |
| West |  |  | 5.6100 |  | 19.6403 |  | 0.4500 |  | 0.0000 |  | 0.7700 |  | 38.1780 (80) |
| East |  |  | 3.3300 |  | 19.6403 |  | 0.4500 |  | 0.0000 |  | 0.7700 |  | 22.6618 (76) |

|             |          |          |          |          |           |          |          |          |          |          |          |               |
|-------------|----------|----------|----------|----------|-----------|----------|----------|----------|----------|----------|----------|---------------|
| Solar gains | 90.7938  | 177.5254 | 292.5509 | 427.5877 | 525.2396  | 538.3069 | 512.2248 | 439.1107 | 340.4932 | 210.6627 | 113.1838 | 74.6861 (83)  |
| Total gains | 671.4836 | 756.3003 | 853.0204 | 953.5343 | 1016.7241 | 995.4857 | 950.7359 | 880.4696 | 799.3592 | 703.9832 | 644.6335 | 639.5201 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |                           |         |         |              |             |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|--------------|-------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |                           |         |         | 21.0000 (85) |             |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |                           |         |         |              |             |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep                       | Oct     | Nov     | Dec          |             |
| tau                                                                         | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876                   | 43.0876 | 43.0876 | 43.0876      |             |
| alpha                                                                       | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725                    | 3.8725  | 3.8725  | 3.8725       |             |
| util living area                                                            | 0.9726  | 0.9560  | 0.9173  | 0.8335  | 0.6977  | 0.5335  | 0.3970  | 0.4442  | 0.6709                    | 0.8821  | 0.9577  | 0.9770 (86)  |             |
| MIT                                                                         | 19.3433 | 19.5949 | 20.0045 | 20.4610 | 20.7882 | 20.9426 | 20.9857 | 20.9780 | 20.8633                   | 20.4089 | 19.7727 | 19.2671 (87) |             |
| Th 2                                                                        | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701                   | 20.0701 | 20.0701 | 20.0701 (88) |             |
| util rest of house                                                          | 0.9673  | 0.9477  | 0.9018  | 0.8038  | 0.6486  | 0.4650  | 0.3162  | 0.3594  | 0.6028                    | 0.8535  | 0.9481  | 0.9724 (89)  |             |
| MIT 2                                                                       | 18.3657 | 18.6457 | 19.0960 | 19.5801 | 19.9023 | 20.0352 | 20.0643 | 20.0604 | 19.9773                   | 19.5400 | 18.8486 | 18.2806 (90) |             |
| Living area fraction                                                        |         |         |         |         |         |         |         |         | fLA = Living area / (4) = |         |         |              | 0.1933 (91) |
| MIT                                                                         | 18.5547 | 18.8292 | 19.2716 | 19.7504 | 20.0736 | 20.2106 | 20.2424 | 20.2378 | 20.1486                   | 19.7080 | 19.0272 | 18.4713 (92) |             |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |                           |         |         | 0.0000       |             |
| adjusted MIT                                                                | 18.5547 | 18.8292 | 19.2716 | 19.7504 | 20.0736 | 20.2106 | 20.2424 | 20.2378 | 20.1486                   | 19.7080 | 19.0272 | 18.4713 (93) |             |

## 8. Space heating requirement

|                                                                                | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov       | Dec       |       |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|---------------|-----------|-----------|-------|
| Utilisation                                                                    | 0.9557    | 0.9334    | 0.8859    | 0.7924   | 0.6488   | 0.4757   | 0.3314   | 0.3751   | 0.6090   | 0.8403        | 0.9343    | 0.9618    | (94)  |
| Useful gains                                                                   | 641.7069  | 705.9434  | 755.6759  | 755.5458 | 659.6935 | 473.5720 | 315.1001 | 330.2594 | 486.7815 | 591.5762      | 602.2535  | 615.0884  | (95)  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000    | 4.2000    | (96)  |
| Heat loss rate W                                                               | 1245.1695 | 1216.7383 | 1115.6187 | 947.8010 | 731.4454 | 490.0938 | 318.1677 | 335.2390 | 528.3527 | 795.5979      | 1041.8615 | 1246.6189 | (97)  |
| Space heating kWh                                                              | 448.9762  | 343.2542  | 267.7975  | 138.4237 | 53.3834  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 151.7922      | 316.5178  | 469.8587  | (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |          |          |          |          |          |          |               |           | 2190.0037 |       |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | 0.0000    | (98b) |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |          |          |          |          |          |          |               |           | 0.0000    |       |
| Space heating kWh                                                              | 448.9762  | 343.2542  | 267.7975  | 138.4237 | 53.3834  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 151.7922      | 316.5178  | 469.8587  | (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |          |          |          |          |          |          |               |           | 2190.0037 |       |
| Space heating per m2                                                           |           |           |           |          |          |          |          |          |          | (98c) / (4) = |           | 25.4711   | (99)  |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                                                              |          |          |          |          |          |          |          |          |          |          |          |                |                 |
|--------------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                        |          |          |          |          |          |          |          |          |          |          |          |                | 0.0000 (201)    |
| Fraction of space heat from main system(s)                                                                   |          |          |          |          |          |          |          |          |          |          |          |                | 1.0000 (202)    |
| Efficiency of main space heating system 1 (in %)                                                             |          |          |          |          |          |          |          |          |          |          |          |                | 91.7000 (206)   |
| Efficiency of main space heating system 2 (in %)                                                             |          |          |          |          |          |          |          |          |          |          |          |                | 0.0000 (207)    |
| Efficiency of secondary/supplementary heating system, %                                                      |          |          |          |          |          |          |          |          |          |          |          |                | 0.0000 (208)    |
|                                                                                                              | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec            |                 |
| Space heating requirement                                                                                    | 448.9762 | 343.2542 | 267.7975 | 138.4237 | 53.3834  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 151.7922 | 316.5178 | 469.8587 (98)  |                 |
| Space heating efficiency (main heating system 1)                                                             | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 91.7000  | 91.7000  | 91.7000 (210)  |                 |
| Space heating fuel (main heating system)                                                                     | 489.6142 | 374.3230 | 292.0365 | 150.9528 | 58.2153  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 165.5313 | 345.1666 | 512.3868 (211) |                 |
| Space heating efficiency (main heating system 2)                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)   |                 |
| Space heating fuel (main heating system 2)                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)   |                 |
| Space heating fuel (secondary)                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)   |                 |
| Water heating                                                                                                |          |          |          |          |          |          |          |          |          |          |          |                |                 |
| Water heating requirement                                                                                    | 199.3541 | 175.5504 | 185.1250 | 160.0708 | 153.2041 | 135.9618 | 132.9234 | 139.5422 | 142.5031 | 161.3478 | 174.4610 | 196.8757 (64)  |                 |
| Efficiency of water heater (217)m                                                                            | 88.1435  | 88.0781  | 87.9295  | 87.6614  | 87.2331  | 86.7000  | 86.7000  | 86.7000  | 86.7000  | 87.7054  | 88.0422  | 86.7000 (216)  |                 |
| Fuel for water heating, kWh/month                                                                            | 226.1699 | 199.3122 | 210.5380 | 182.6013 | 175.6261 | 156.8186 | 153.3142 | 160.9484 | 164.3635 | 183.9656 | 198.1560 | 223.2925 (219) |                 |
| Space cooling fuel requirement (221)m                                                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)   |                 |
| Pumps and Fa                                                                                                 | 10.9478  | 9.8883   | 10.9478  | 10.5947  | 10.9478  | 10.5947  | 10.9478  | 10.9478  | 10.5947  | 10.9478  | 10.5947  | 10.9478 (231)  |                 |
| Lighting                                                                                                     | 23.4106  | 18.7809  | 16.9101  | 12.3891  | 9.5697   | 7.8185   | 8.7298   | 11.3473  | 14.7390  | 19.3384  | 21.8427  | 24.0613 (232)  |                 |
| Electricity generated by PVs (Appendix M) (negative quantity) (233a)m                                        | -11.5165 | -19.1763 | -33.0031 | -43.5351 | -52.0099 | -50.4050 | -49.4409 | -43.7568 | -34.6383 | -24.0771 | -13.4902 | -9.5519 (233a) |                 |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)  |                 |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)  |                 |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)  |                 |
| Electricity generated by PVs (Appendix M) (negative quantity) (233b)m                                        | -2.7365  | -6.8505  | -16.7864 | -30.3061 | -44.7949 | -46.9105 | -45.6945 | -35.7548 | -22.5599 | -10.7273 | -3.8701  | -2.0623 (233b) |                 |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234b)  |                 |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)  |                 |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235d)  |                 |
| Annual totals kWh/year                                                                                       |          |          |          |          |          |          |          |          |          |          |          |                |                 |
| Space heating fuel - main system 1                                                                           |          |          |          |          |          |          |          |          |          |          |          |                | 2388.2265 (211) |
| Space heating fuel - main system 2                                                                           |          |          |          |          |          |          |          |          |          |          |          |                | 0.0000 (213)    |
| Space heating fuel - secondary                                                                               |          |          |          |          |          |          |          |          |          |          |          |                | 0.0000 (215)    |
| Efficiency of water heater                                                                                   |          |          |          |          |          |          |          |          |          |          |          |                | 86.7000         |
| Water heating fuel used                                                                                      |          |          |          |          |          |          |          |          |          |          |          |                | 2235.1064 (219) |

# Full SAP Calculation Printout



|                                                                                                                            |                 |
|----------------------------------------------------------------------------------------------------------------------------|-----------------|
| Space cooling fuel                                                                                                         | 0.0000 (221)    |
| Electricity for pumps and fans:<br>(MEVDecentralised, Database: total watage = 5.7980, total flow = 37.0000, SFP = 0.1567) |                 |
| mechanical ventilation fans (SFP = 0.1567)                                                                                 | 42.9017 (230a)  |
| central heating pump                                                                                                       | 41.0000 (230c)  |
| main heating flue fan                                                                                                      | 45.0000 (230e)  |
| Total electricity for the above, kWh/year                                                                                  | 128.9017 (231)  |
| Electricity for lighting (calculated in Appendix L)                                                                        | 188.9373 (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                                              |                 |
| PV generation                                                                                                              | -653.6551 (233) |
| Wind generation                                                                                                            | 0.0000 (234)    |
| Hydro-electric generation (Appendix N)                                                                                     | 0.0000 (235a)   |
| Electricity generated - Micro CHP (Appendix N)                                                                             | 0.0000 (235)    |
| Appendix Q - special features                                                                                              |                 |
| Energy saved or generated                                                                                                  | -0.0000 (236)   |
| Energy used                                                                                                                | 0.0000 (237)    |
| Total delivered energy for all uses                                                                                        | 4287.5169 (238) |

## 10a. Fuel costs - using Table 12 prices

|                                             | Fuel<br>kWh/year | Fuel price<br>p/kWh | Fuel cost<br>£/year |
|---------------------------------------------|------------------|---------------------|---------------------|
| Space heating - main system 1               | 2388.2265        | 3.6400              | 86.9314 (240)       |
| Total CO2 associated with community systems |                  |                     | 0.0000 (473)        |
| Water heating (other fuel)                  | 2235.1064        | 3.6400              | 81.3579 (247)       |
| Energy for instantaneous electric shower(s) | 0.0000           | 16.4900             | 0.0000 (247a)       |
| Pumps, fans and electric keep-hot           | 128.9017         | 16.4900             | 21.2559 (249)       |
| Energy for lighting                         | 188.9373         | 16.4900             | 31.1558 (250)       |
| Additional standing charges                 |                  |                     | 92.0000 (251)       |
| Energy saving/generation technologies       |                  |                     |                     |
| PV Unit electricity used in dwelling        | -384.6011        | 16.4900             | -63.4207            |
| PV Unit electricity exported                | -269.0539        | 5.5900              | -15.0401            |
| Total                                       |                  |                     | -78.4608 (252)      |
| Total energy cost                           |                  |                     | 234.2401 (255)      |

## 11a. SAP rating - Individual heating systems

|                                  |              |
|----------------------------------|--------------|
| Energy cost deflator (Table 12): | 0.3600 (256) |
| Energy cost factor (ECF)         | 0.6438 (257) |
| SAP value                        | 89.5638      |
| SAP rating (Section 12)          | 90 (258)     |
| SAP band                         | B            |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|---------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1               | 2388.2265          | 0.2100                        | 501.5276 (261)           |
| Total CO2 associated with community systems |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                  | 2235.1064          | 0.2100                        | 469.3724 (264)           |
| Space and water heating                     |                    |                               | 970.8999 (265)           |
| Pumps, fans and electric keep-hot           | 128.9017           | 0.1387                        | 17.8803 (267)            |
| Energy for lighting                         | 188.9373           | 0.1443                        | 27.2695 (268)            |
| Energy saving/generation technologies       |                    |                               |                          |
| PV Unit electricity used in dwelling        | -384.6011          | 0.1316                        | -50.6173                 |
| PV Unit electricity exported                | -269.0539          | 0.1216                        | -32.7148                 |
| Total                                       |                    |                               | -83.3322 (269)           |
| Total CO2, kg/year                          |                    |                               | 932.7175 (272)           |
| CO2 emissions per m2                        |                    |                               | 10.8500 (273)            |
| EI value                                    |                    |                               | 90.4578                  |
| EI rating                                   |                    |                               | 90 (274)                 |
| EI band                                     |                    |                               | B                        |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

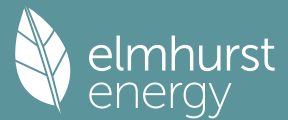
## 1. Overall dwelling characteristics

|                                                        | Area<br>(m2) | Storey height<br>(m)              | Volume<br>(m3)         |
|--------------------------------------------------------|--------------|-----------------------------------|------------------------|
| Main dwelling                                          |              |                                   |                        |
| Ground floor                                           | 42.9900 (1b) | x 2.4600 (2b)                     | = 105.7554 (1b) - (3b) |
| First floor                                            | 42.9900 (1c) | x 2.7600 (2c)                     | = 118.6524 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 85.9800      |                                   | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 224.4078 (5)           |

## 2. Ventilation rate

|                                                    | m3 per hour          |
|----------------------------------------------------|----------------------|
| Number of open chimneys                            | 0 * 80 = 0.0000 (6a) |
| Number of open flues                               | 0 * 20 = 0.0000 (6b) |
| Number of chimneys / flues attached to closed fire | 0 * 10 = 0.0000 (6c) |

# Full SAP Calculation Printout



Number of flues attached to solid fuel boiler 0 \* 20 = 0.0000 (6d)  
Number of flues attached to other heater 0 \* 35 = 0.0000 (6e)  
Number of blocked chimneys 0 \* 20 = 0.0000 (6f)  
Number of intermittent extract fans 0 \* 10 = 0.0000 (7a)  
Number of passive vents 0 \* 10 = 0.0000 (7b)  
Number of flueless gas fires 0 \* 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 0.0000 / (5) = 0.0000 (8)  
Pressure test Yes  
Pressure Test Method Blower Door  
Measured/design AP50 4.5000 (17)  
Infiltration rate 0.2250 (18)  
Number of sides sheltered 2 (19)  
Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)  
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1913 (21)

|                                                                                                         |        |        |        |        |        |        |        |        |        |        |        |              |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|                                                                                                         | 4.2000 | 4.0000 | 4.0000 | 3.7000 | 3.7000 | 3.3000 | 3.4000 | 3.2000 | 3.3000 | 3.5000 | 3.5000 | 3.8000       |
| Wind factor                                                                                             | 1.0500 | 1.0000 | 1.0000 | 0.9250 | 0.9250 | 0.8250 | 0.8500 | 0.8000 | 0.8250 | 0.8750 | 0.8750 | 0.9500       |
| Adj infilt rate                                                                                         | 0.2008 | 0.1913 | 0.1913 | 0.1769 | 0.1769 | 0.1578 | 0.1626 | 0.1530 | 0.1578 | 0.1673 | 0.1673 | 0.1817       |
| Mechanical extract ventilation - decentralised                                                          |        |        |        |        |        |        |        |        |        |        |        |              |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 (25)  |

## 3. Heat losses and heat loss parameter

| Element                                        | Gross m2 | Openings m2 | NetArea m2 | U-value W/m2K        | A x U W/K | K-value kJ/m2K | A x K kJ/K      |
|------------------------------------------------|----------|-------------|------------|----------------------|-----------|----------------|-----------------|
| Main dwelling                                  |          |             |            |                      |           |                |                 |
| Front Door                                     |          |             | 2.5500     | 1.2000               | 3.0600    |                | (26)            |
| Windows                                        |          |             | 10.2500    | 1.2357               | 12.6663   |                | (27)            |
| French Doors                                   |          |             | 3.3300     | 1.2357               | 4.1150    |                | (27)            |
| GF SPVL 125TS P/A                              |          |             | 42.9900    | 0.1300               | 5.5887    | 75.0000        | 3224.2500 (28a) |
| EW Brick AAC011                                | 97.2486  | 16.1300     | 81.1186    | 0.1800               | 14.6013   | 60.0000        | 4867.1160 (29a) |
| PR 500mm MW044                                 | 42.9900  |             | 42.9900    | 0.0900               | 3.8691    | 9.0000         | 386.9100 (30)   |
| Total net area of external elements Aum(A, m2) |          |             | 183.2286   |                      |           |                | (31)            |
| Fabric heat loss, W/K = Sum (A x U)            |          |             |            | (26)...(30) + (32) = | 43.9005   |                | (33)            |
| Main dwelling                                  |          |             |            |                      |           |                |                 |
| E-WM-30                                        |          |             | 43.8000    | 0.0000               | 0.0000    | 45.0000        | 1971.0000 (32)  |
| Timber - GF                                    |          |             | 88.6100    |                      |           | 9.0000         | 797.4900 (32c)  |
| Timber - FF                                    |          |             | 126.9000   |                      |           | 9.0000         | 1142.1000 (32c) |
| Internal Floor FF                              |          |             | 42.9900    |                      |           | 18.0000        | 773.8200 (32d)  |
| Internal Ceiling GF                            |          |             | 42.9900    |                      |           | 9.0000         | 386.9100 (32e)  |

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13549.5960 (34)  
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 157.5901 (35)

## List of Thermal Bridges

| K1 Element                                           | Length  | Psi-value | Total  |
|------------------------------------------------------|---------|-----------|--------|
| E2 Other lintels (including other steel lintels)     | 10.7800 | 0.0410    | 0.4420 |
| E3 Sill                                              | 9.2000  | 0.0220    | 0.2024 |
| E4 Jamb                                              | 21.1500 | 0.0190    | 0.4018 |
| E5 Ground floor (normal)                             | 10.2300 | 0.0928    | 0.9493 |
| E6 Intermediate floor within a dwelling              | 18.6300 | 0.0020    | 0.0373 |
| E10 Eaves (insulation at ceiling level)              | 10.2500 | 0.0390    | 0.3997 |
| E18 Party wall between dwellings                     | 10.4400 | 0.0330    | 0.3445 |
| E4 Jamb                                              | 4.8000  | 0.1000    | 0.4800 |
| E2 Other lintels (including other steel lintels)     | 1.0600  | 0.0410    | 0.0435 |
| P1 Party wall - Ground floor                         | 8.3900  | 0.1000    | 0.8390 |
| P2 Party wall - Intermediate floor within a dwelling | 8.3900  | 0.0000    | 0.0000 |
| P4 Party wall - Roof (insulation at ceiling level)   | 8.3900  | 0.0350    | 0.2937 |
| E5 Ground floor (normal)                             | 8.3900  | 0.0980    | 0.8222 |
| E12 Gable (insulation at ceiling level)              | 8.3900  | 0.0870    | 0.7299 |
| E16 Corner (normal)                                  | 10.4400 | 0.0420    | 0.4385 |

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.4238 (36)  
Point Thermal bridges (36a) = 0.0000  
Total fabric heat loss (33) + (36) + (36a) = 50.3244 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

|                           |         |         |         |         |         |         |         |         |         |         |         |         |
|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| (38)m                     | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |
|                           | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 |
| Heat transfer coeff       | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 |
| Average = Sum(39)m / 12 = |         |         |         |         |         |         |         |         |         |         |         | 87.3516 |

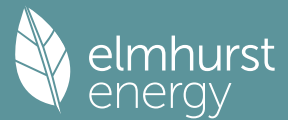
|               |        |        |        |        |        |        |        |        |        |        |        |        |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| HLP           | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |
|               | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 1.0160 |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31     |

## 4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5666 (42)  
Hot water usage for mixer showers 67.2533 66.2426 64.7698 61.9519 59.8724 57.5533 56.2352 57.6968 59.2990 61.7890 64.6674 66.9956 (42a)  
Hot water usage for baths 29.0443 28.6130 28.0055 26.8856 26.0469 25.1170 24.6147 25.2179 25.8746 26.8697 28.0127 28.9461 (42b)  
Hot water usage for other uses 40.9146 39.4268 37.9390 36.4512 34.9634 33.4756 33.4756 34.9634 36.4512 37.9390 39.4268 40.9146 (42c)  
Average daily hot water use (litres/day) 126.1290 (43)

|                                        |          |          |          |          |          |          |          |          |          |          |          |          |
|----------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| Daily hot water use                    | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |
|                                        | 137.2122 | 134.2823 | 130.7143 | 125.2887 | 120.8827 | 116.1459 | 114.3255 | 117.8781 | 121.6248 | 126.5977 | 132.1069 | 136.8563 |
| Energy conte                           | 217.3105 | 191.2162 | 200.9030 | 171.5139 | 162.7313 | 142.8150 | 138.2667 | 145.9577 | 149.9756 | 171.7918 | 188.2105 | 214.2839 |
| Energy content (annual)                |          |          |          |          |          |          |          |          |          |          |          |          |
| Distribution loss (46)m = 0.15 x (45)m |          |          |          |          |          |          |          |          |          |          |          |          |
|                                        | 32.5966  | 28.6824  | 30.1355  | 25.7271  | 24.4097  | 21.4222  | 20.7400  | 21.8937  | 22.4963  | 25.7688  | 28.2316  | 32.1426  |
| Water storage loss (or HIU loss):      |          |          |          |          |          |          |          |          |          |          |          |          |
| Total storage loss                     |          |          |          |          |          |          |          |          |          |          |          |          |

# Full SAP Calculation Printout



|                                                                                             |          |          |          |          |          |          |          |          |          |          |          |                |
|---------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| If cylinder contains dedicated solar storage                                                | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (56)    |
| Primary loss                                                                                | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (57)    |
| Combi loss                                                                                  | 11.9874  | 10.8167  | 11.9530  | 11.5193  | 11.8728  | 11.4590  | 11.8214  | 11.8376  | 11.4740  | 11.8918  | 11.5543  | 11.9811 (61)   |
| Total heat required for water heating calculated for each month                             | 229.2979 | 202.0330 | 212.8560 | 183.0332 | 174.6042 | 154.2740 | 150.0882 | 157.7953 | 161.4496 | 183.6836 | 199.7649 | 226.2650 (62)  |
| WWHRS                                                                                       | -29.9438 | -26.4825 | -27.7310 | -22.9624 | -21.4001 | -18.3122 | -17.1648 | -18.2530 | -18.9465 | -22.3359 | -25.3038 | -29.3893 (63a) |
| PV diverter                                                                                 | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000 (63b)  |
| Solar input                                                                                 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63c)   |
| FGHRS                                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63d)   |
| Output from w/h                                                                             | 199.3541 | 175.5504 | 185.1250 | 160.0708 | 153.2041 | 135.9618 | 132.9234 | 139.5422 | 142.5031 | 161.3478 | 174.4610 | 196.8757 (64)  |
| Electric shower(s)                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (64a)   |
| Heat gains from water heating, kWh/month                                                    | 75.2526  | 66.2836  | 69.7885  | 59.9082  | 57.0764  | 50.3507  | 48.9291  | 51.4903  | 52.7354  | 60.0937  | 65.4686  | 74.2447 (65)   |
| Total per year (kWh/year) = Sum(64)m = 1956.9195 (64)                                       |          |          |          |          |          |          |          |          |          |          |          |                |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a) |          |          |          |          |          |          |          |          |          |          |          |                |

## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |           |           |           |           |           |           |           |           |           |           |           |                |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
| Metabolic gains (Table 5), Watts                                                    | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec            |
| (66)m                                                                               | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 26.7460   | 23.7556   | 19.3193   | 14.6260   | 10.9331   | 9.2302    | 9.9735    | 12.9640   | 17.4002   | 22.0936   | 25.7865   | 27.4894 (67)   |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 345.4995  | 349.0847  | 340.0501  | 320.8165  | 296.5375  | 273.7188  | 258.4744  | 254.8892  | 263.9238  | 283.1574  | 307.4363  | 330.2551 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662 (69)   |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 3.0000    | 3.0000    | 3.0000 (70)    |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 (71) |
| Water heating gains (Table 5)                                                       | 101.1460  | 98.6363   | 93.8018   | 83.2058   | 76.7156   | 69.9316   | 65.7649   | 69.2074   | 73.2436   | 80.7712   | 90.9286   | 99.7912 (72)   |
| Total internal gains                                                                | 580.6898  | 578.7749  | 560.4695  | 525.9466  | 491.4845  | 457.1788  | 438.5111  | 441.3589  | 458.8659  | 493.3204  | 531.4497  | 564.8340 (73)  |

## 6. Solar gains

| [Jan]       |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W   |          |          |               |
|-------------|----------|----------|----------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|--------------|----------|----------|---------------|
| North       |          |          |          | 0.5200     | 11.9814                        | 0.4500                            | 0.0000                             | 0.7700                       | 2.1588 (74)  |          |          |               |
| East        |          |          |          | 4.1200     | 22.3313                        | 0.4500                            | 0.0000                             | 0.7700                       | 31.8797 (76) |          |          |               |
| West        |          |          |          | 5.6100     | 22.3313                        | 0.4500                            | 0.0000                             | 0.7700                       | 43.4091 (80) |          |          |               |
| East        |          |          |          | 3.3300     | 22.3313                        | 0.4500                            | 0.0000                             | 0.7700                       | 25.7669 (76) |          |          |               |
|             |          |          |          |            |                                |                                   |                                    |                              |              |          |          |               |
| Solar gains | 103.2145 | 181.5675 | 295.1032 | 443.3153   | 529.4853                       | 580.2956                          | 546.3815                           | 479.7107                     | 371.9166     | 229.9510 | 131.8216 | 84.0748 (83)  |
| Total gains | 683.9043 | 760.3424 | 855.5727 | 969.2619   | 1020.9698                      | 1037.4744                         | 984.8926                           | 921.0697                     | 830.7825     | 723.2714 | 663.2713 | 648.9089 (84) |

## 7. Mean internal temperature (heating season)

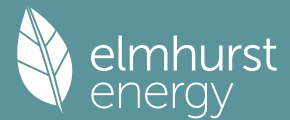
|                                                                             |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 (85) |
| tau                                                                         | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725       |
| alpha                                                                       | 0.9663  | 0.9491  | 0.9016  | 0.7949  | 0.6254  | 0.4123  | 0.2736  | 0.3014  | 0.5713  | 0.8419  | 0.9441  | 0.9713 (86)  |
| util living area                                                            | 19.5029 | 19.7178 | 20.1434 | 20.5905 | 20.8760 | 20.9815 | 20.9973 | 20.9960 | 20.9342 | 20.5637 | 19.9525 | 19.4401 (87) |
| MIT                                                                         | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 (88) |
| util rest of house                                                          | 0.9595  | 0.9392  | 0.8828  | 0.7588  | 0.5676  | 0.3391  | 0.1922  | 0.2148  | 0.4926  | 0.8037  | 0.9312  | 0.9655 (89)  |
| MIT 2                                                                       | 18.5450 | 18.7828 | 19.2473 | 19.7121 | 19.9808 | 20.0614 | 20.0695 | 20.0691 | 20.0322 | 19.6988 | 19.0477 | 18.4754 (90) |
| Living area fraction                                                        | 18.7301 | 18.9635 | 19.4205 | 19.8819 | 20.1539 | 20.2392 | 20.2488 | 20.2483 | 20.2066 | 19.8660 | 19.2226 | 18.6619 (92) |
| MIT                                                                         | 18.7301 | 18.9635 | 19.4205 | 19.8819 | 20.1539 | 20.2392 | 20.2488 | 20.2483 | 20.2066 | 19.8660 | 19.2226 | 18.6619 (93) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT                                                                | 18.7301 | 18.9635 | 19.4205 | 19.8819 | 20.1539 | 20.2392 | 20.2488 | 20.2483 | 20.2066 | 19.8660 | 19.2226 | 18.6619 (93) |

## 8. Space heating requirement

|                                                                                |           |           |           |          |          |          |          |          |          |          |          |                |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| Utilisation                                                                    | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec            |
| Useful gains                                                                   | 0.9467    | 0.9244    | 0.8673    | 0.7507   | 0.5730   | 0.3527   | 0.2079   | 0.2316   | 0.5047   | 0.7941   | 0.9163   | 0.9536 (94)    |
| Ext temp.                                                                      | 647.4500  | 702.8237  | 742.0226  | 727.6734 | 585.0358 | 365.8666 | 204.7979 | 213.2862 | 419.2810 | 574.3444 | 607.7491 | 618.7780 (95)  |
| Heat loss rate W                                                               | 5.1000    | 5.6000    | 7.4000    | 9.9000   | 13.0000  | 16.0000  | 17.9000  | 17.8000  | 15.2000  | 11.6000  | 8.0000   | 5.1000 (96)    |
| Space heating kWh                                                              | 1190.6151 | 1167.3270 | 1050.0123 | 871.9340 | 624.9009 | 370.3033 | 205.1717 | 213.8616 | 437.3330 | 722.0459 | 980.3109 | 1184.6518 (97) |
| Space heating requirement - total per year (kWh/year)                          | 404.1148  | 312.1462  | 229.1444  | 103.8676 | 29.6597  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 109.8899 | 268.2445 | 421.0101 (98a) |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (98b)   |
| Space heating kWh                                                              | 404.1148  | 312.1462  | 229.1444  | 103.8676 | 29.6597  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 109.8899 | 268.2445 | 421.0101 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |          |          |          |          |          |          |          |          | 1878.0772      |
| Space heating per m2                                                           |           |           |           |          |          |          |          |          |          |          |          | 21.8432 (99)   |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

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|                                                                                                      |          |          |          |          |          |          |          |          |          |          |          |                 |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (201)    |
| Fraction of space heat from main system(s)                                                           |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (202)    |
| Efficiency of main space heating system 1 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 91.7000 (206)   |
| Efficiency of main space heating system 2 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)    |
| Efficiency of secondary/supplementary heating system, %                                              |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)    |
|                                                                                                      | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec             |
| Space heating requirement                                                                            | 404.1148 | 312.1462 | 229.1444 | 103.8676 | 29.6597  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 109.8899 | 268.2445 | 421.0101 (98)   |
| Space heating efficiency (main heating system 1)                                                     | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 91.7000  | 91.7000  | 91.7000 (210)   |
| Space heating fuel (main heating system)                                                             | 440.6923 | 340.3994 | 249.8848 | 113.2690 | 32.3442  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 119.8363 | 292.5240 | 459.1168 (211)  |
| Space heating efficiency (main heating system 2)                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)    |
| Space heating fuel (main heating system 2)                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)    |
| Space heating fuel (secondary)                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)    |
| Water heating                                                                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| Water heating requirement                                                                            | 199.3541 | 175.5504 | 185.1250 | 160.0708 | 153.2041 | 135.9618 | 132.9234 | 139.5422 | 142.5031 | 161.3478 | 174.4610 | 196.8757 (64)   |
| Efficiency of water heater                                                                           | 88.0951  | 88.0325  | 87.8491  | 87.5144  | 87.0338  | 86.7000  | 86.7000  | 86.7000  | 86.7000  | 87.5387  | 87.9604  | 86.7000 (216)   |
| Fuel for water heating, kWh/month                                                                    | 226.2942 | 199.4155 | 210.7306 | 182.9079 | 176.0282 | 156.8186 | 153.3142 | 160.9484 | 164.3635 | 184.3159 | 198.3404 | 88.1199 (217)   |
| Space cooling fuel requirement                                                                       |          |          |          |          |          |          |          |          |          |          |          |                 |
| (221)m                                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)    |
| Pumps and Fa                                                                                         | 10.9478  | 9.8883   | 10.9478  | 10.5947  | 10.9478  | 10.5947  | 10.9478  | 10.9478  | 10.5947  | 10.9478  | 10.5947  | 10.9478 (231)   |
| Lighting                                                                                             | 23.4106  | 18.7809  | 16.9101  | 12.3891  | 9.5697   | 7.8185   | 8.7298   | 11.3473  | 14.7390  | 19.3384  | 21.8427  | 24.0613 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| (233a)m                                                                                              | -12.9948 | -19.6788 | -33.4418 | -44.9288 | -52.5148 | -53.1453 | -51.7882 | -46.7161 | -37.1809 | -26.0128 | -15.5005 | -10.6965 (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |          |          |          |          |          |          |          |          |                 |
| (234a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |          |          |          |          |          |          |          |          |                 |
| (235a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |          |          |          |          |          |          |          |          |                 |
| (235c)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| (233b)m                                                                                              | -3.3366  | -7.1593  | -17.1881 | -32.1833 | -45.6724 | -52.3387 | -50.2796 | -40.7390 | -25.7852 | -12.2915 | -4.8814  | -2.4799 (233b)  |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |          |          |          |          |          |          |          |          |                 |
| (234b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234b)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |          |          |          |          |          |          |          |          |                 |
| (235b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |          |          |          |          |          |          |          |          |                 |
| (235d)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235d)   |
| Annual totals kWh/year                                                                               |          |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating fuel - main system 1                                                                   |          |          |          |          |          |          |          |          |          |          |          | 2048.0668 (211) |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)    |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)    |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          | 86.7000         |
| Water heating fuel used                                                                              |          |          |          |          |          |          |          |          |          |          |          | 2236.8953 (219) |
| Space cooling fuel                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (221)    |
| Electricity for pumps and fans:                                                                      |          |          |          |          |          |          |          |          |          |          |          |                 |
| (MEV)Decentralised, Database: total watage = 5.7980, total flow = 37.0000, SFP = 0.1567)             |          |          |          |          |          |          |          |          |          |          |          |                 |
| mechanical ventilation fans (SFP = 0.1567)                                                           |          |          |          |          |          |          |          |          |          |          |          | 42.9017 (230a)  |
| central heating pump                                                                                 |          |          |          |          |          |          |          |          |          |          |          | 41.0000 (230c)  |
| main heating flue fan                                                                                |          |          |          |          |          |          |          |          |          |          |          | 45.0000 (230e)  |
| Total electricity for the above, kWh/year                                                            |          |          |          |          |          |          |          |          |          |          |          | 128.9017 (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |          |          |          |          |          |          |          |          |          |          |          | 188.9373 (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| PV generation                                                                                        |          |          |          |          |          |          |          |          |          |          |          | -698.9344 (233) |
| Wind generation                                                                                      |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (234)    |
| Hydro-electric generation (Appendix N)                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (235a)   |
| Electricity generated - Micro CHP (Appendix N)                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (235)    |
| Appendix Q - special features                                                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| Energy saved or generated                                                                            |          |          |          |          |          |          |          |          |          |          |          | -0.0000 (236)   |
| Energy used                                                                                          |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (237)    |
| Total delivered energy for all uses                                                                  |          |          |          |          |          |          |          |          |          |          |          | 3903.8667 (238) |

## 10a. Fuel costs - using BEDF prices (596)

|                                             | Fuel kWh/year | Fuel price p/kWh | Fuel cost £/year |
|---------------------------------------------|---------------|------------------|------------------|
| Space heating - main system 1               | 2048.0668     | 7.3200           | 149.9185 (240)   |
| Total CO2 associated with community systems |               |                  | 0.0000 (473)     |
| Water heating (other fuel)                  | 2236.8953     | 7.3200           | 163.7407 (247)   |
| Energy for instantaneous electric shower(s) | 0.0000        | 27.6700          | 0.0000 (247a)    |
| Pumps, fans and electric keep-hot           | 128.9017      | 27.6700          | 35.6671 (249)    |
| Energy for lighting                         | 188.9373      | 27.6700          | 52.2789 (250)    |
| Additional standing charges                 |               |                  | 108.0000 (251)   |
| Energy saving/generation technologies       |               |                  |                  |
| PV Unit electricity used in dwelling        | -404.5993     | 27.6700          | -111.9526        |
| PV Unit electricity exported                | -294.3350     | 5.8100           | -17.1009         |
| Total                                       |               |                  | -129.0535 (252)  |
| Total energy cost                           |               |                  | 380.5518 (255)   |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                             | Energy kWh/year | Emission factor kg CO2/kWh | Emissions kg CO2/year |
|---------------------------------------------|-----------------|----------------------------|-----------------------|
| Space heating - main system 1               | 2048.0668       | 0.2100                     | 430.0940 (261)        |
| Total CO2 associated with community systems |                 |                            | 0.0000 (373)          |
| Water heating (other fuel)                  | 2236.8953       | 0.2100                     | 469.7480 (264)        |
| Space and water heating                     |                 |                            | 899.8420 (265)        |
| Pumps, fans and electric keep-hot           | 128.9017        | 0.1387                     | 17.8803 (267)         |
| Energy for lighting                         | 188.9373        | 0.1443                     | 27.2695 (268)         |
| Energy saving/generation technologies       |                 |                            |                       |
| PV Unit electricity used in dwelling        | -404.5993       | 0.1316                     | -53.2562              |
| PV Unit electricity exported                | -294.3350       | 0.1211                     | -35.6464              |

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Total  
Total CO2, kg/year -88.9026 (269)  
856.0892 (272)

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy kWh/year | Primary energy factor kg CO2/kWh | Primary energy kWh/year |
|---------------------------------------------|-----------------|----------------------------------|-------------------------|
| Space heating - main system 1               | 2048.0668       | 1.1300                           | 2314.3155 (275)         |
| Total CO2 associated with community systems |                 |                                  | 0.0000 (473)            |
| Water heating (other fuel)                  | 2236.8953       | 1.1300                           | 2527.6917 (278)         |
| Space and water heating                     |                 |                                  | 4842.0072 (279)         |
| Pumps, fans and electric keep-hot           | 128.9017        | 1.5128                           | 195.0025 (281)          |
| Energy for lighting                         | 188.9373        | 1.5338                           | 289.7983 (282)          |
| Energy saving/generation technologies       |                 |                                  |                         |
| PV Unit electricity used in dwelling        | -404.5993       | 1.4863                           | -601.3523               |
| PV Unit electricity exported                | -294.3350       | 0.4442                           | -130.7519               |
| Total                                       |                 |                                  | -732.1042 (283)         |
| Total Primary energy kWh/year               |                 |                                  | 4594.7037 (286)         |

## SAP 10 EPC IMPROVEMENTS

### Plot 2

Current energy efficiency rating: B 90  
Current environmental impact rating: B 90

N Solar water heating SAP increase too small  
U Solar photovoltaic panels Already installed  
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change  
(none)

Measures omitted - SAP change or cost saving too small:  
N Solar water heating + 0.5 -£ 31 -140 kg (16.4%)

Recommended measures Typical annual savings Energy Environmental efficiency impact  
(none) Total Savings £0 0.00 kg/m²

Potential energy efficiency rating: B 90  
Potential environmental impact rating: B 90

Fuel prices for cost data on this page from database revision number 596 TEST (30 Jun 2026)  
Recommendation texts revision number 6.1 (11 Jun 2019)

| Typical heating and lighting costs of this home (per year, Thames Valley): |            |            |            |
|----------------------------------------------------------------------------|------------|------------|------------|
|                                                                            | Current    | Potential  | Saving     |
| Electricity                                                                | £88        | £88        | £0         |
| Mains gas                                                                  | £422       | £422       | £0         |
| Space heating                                                              | £294       | £294       | £0         |
| Water heating                                                              | £164       | £164       | £0         |
| Lighting                                                                   | £52        | £52        | £0         |
| Generated (PV)                                                             | -£129      | -£129      | £0         |
| Total cost of fuels                                                        | £381       | £381       | £0         |
| Total cost of uses                                                         | £381       | £381       | £0         |
| Delivered energy                                                           | 45 kWh/m²  | 45 kWh/m²  | 0 kWh/m²   |
| Carbon dioxide emissions                                                   | 0.9 tonnes | 0.9 tonnes | 0.0 tonnes |
| CO2 emissions per m²                                                       | 10 kg/m²   | 10 kg/m²   | 0 kg/m²    |
| Primary energy                                                             | 53 kWh/m²  | 53 kWh/m²  | 0 kWh/m²   |

## SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

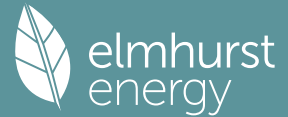
### 1. Overall dwelling characteristics

|                                                        | Area (m²)    | Storey height (m)               | Volume (m³)            |
|--------------------------------------------------------|--------------|---------------------------------|------------------------|
| Main dwelling                                          |              |                                 |                        |
| Ground floor                                           | 42.9900 (1b) | x 2.4600 (2b)                   | = 105.7554 (1b) - (3b) |
| First floor                                            | 42.9900 (1c) | x 2.7600 (2c)                   | = 118.6524 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 85.9800      |                                 | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 224.4078 (5)         |

### 2. Ventilation rate

m3 per hour  
Number of open chimneys 0 \* 80 = 0.0000 (6a)  
Number of open flues 0 \* 20 = 0.0000 (6b)

# Full SAP Calculation Printout



Number of chimneys / flues attached to closed fire 0 \* 10 = 0.0000 (6c)  
Number of flues attached to solid fuel boiler 0 \* 20 = 0.0000 (6d)  
Number of flues attached to other heater 0 \* 35 = 0.0000 (6e)  
Number of blocked chimneys 0 \* 20 = 0.0000 (6f)  
Number of intermittent extract fans 0 \* 10 = 0.0000 (7a)  
Number of passive vents 0 \* 10 = 0.0000 (7b)  
Number of flueless gas fires 0 \* 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 0.0000 / (5) = 0.0000 (8)  
Pressure test Yes  
Pressure Test Method Blower Door  
Measured/design AP50 4.5000 (17)  
Infiltration rate 0.2250 (18)  
Number of sides sheltered 2 (19)  
Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)  
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1913 (21)

|                                                                                                         |        |        |        |        |        |        |        |        |        |        |        |        |              |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |              |
|                                                                                                         | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 | (22)         |
| Wind factor                                                                                             | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 | (22a)        |
| Adj infilt rate                                                                                         |        |        |        |        |        |        |        |        |        |        |        |        |              |
|                                                                                                         | 0.2438 | 0.2391 | 0.2343 | 0.2104 | 0.2056 | 0.1817 | 0.1817 | 0.1769 | 0.1913 | 0.2056 | 0.2152 | 0.2247 | (22b)        |
| Mechanical extract ventilation - decentralised                                                          |        |        |        |        |        |        |        |        |        |        |        |        |              |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | (25)         |

### 3. Heat losses and heat loss parameter

| Element                                                    | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K | A x U<br>W/K | K-value<br>kJ/m2K | A x K<br>kJ/K                 |                                                      |
|------------------------------------------------------------|-------------|----------------|---------------|------------------|--------------|-------------------|-------------------------------|------------------------------------------------------|
| Main dwelling                                              |             |                |               |                  |              |                   |                               |                                                      |
| Front Door                                                 |             |                | 2.5500        | 1.2000           | 3.0600       |                   |                               | (26)                                                 |
| Windows                                                    |             |                | 10.2500       | 1.2357           | 12.6663      |                   |                               | (27)                                                 |
| French Doors                                               |             |                | 3.3300        | 1.2357           | 4.1150       |                   |                               | (27)                                                 |
| GF SPVL 125TS P/A                                          |             |                | 42.9900       | 0.1300           | 5.5887       | 75.0000           | 3224.2500                     | (28a)                                                |
| EW Brick AAC011                                            | 97.2486     | 16.1300        | 81.1186       | 0.1800           | 14.6013      | 60.0000           | 4867.1160                     | (29a)                                                |
| PR 500mm MW044                                             | 42.9900     |                | 42.9900       | 0.0900           | 3.8691       | 9.0000            | 386.9100                      | (30)                                                 |
| Total net area of external elements Aum(A, m2)             |             |                | 183.2286      |                  |              |                   |                               | (31)                                                 |
| Fabric heat loss, W/K = Sum (A x U)                        |             |                |               |                  | 43.9005      |                   |                               | (33)                                                 |
| Main dwelling                                              |             |                |               |                  |              |                   |                               |                                                      |
| E-WM-30                                                    |             |                | 43.8000       | 0.0000           | 0.0000       | 45.0000           | 1971.0000                     | (32)                                                 |
| Timber - GF                                                |             |                | 88.6100       |                  |              | 9.0000            | 797.4900                      | (32c)                                                |
| Timber - FF                                                |             |                | 126.9000      |                  |              | 9.0000            | 1142.1000                     | (32c)                                                |
| Internal Floor FF                                          |             |                | 42.9900       |                  |              | 18.0000           | 773.8200                      | (32d)                                                |
| Internal Ceiling GF                                        |             |                | 42.9900       |                  |              | 9.0000            | 386.9100                      | (32e)                                                |
| Heat capacity Cm = Sum(A x k)                              |             |                |               |                  |              |                   |                               | (28)...(30) + (32) + (32a)...(32e) = 13549.5960 (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K          |             |                |               |                  |              |                   |                               | 157.5901 (35)                                        |
| List of Thermal Bridges                                    |             |                |               |                  |              |                   |                               |                                                      |
| K1 Element                                                 |             |                |               | Length           | Psi-value    | Total             |                               |                                                      |
| E2 Other lintels (including other steel lintels)           |             |                |               | 10.7800          | 0.0410       | 0.4420            |                               |                                                      |
| E3 Sill                                                    |             |                |               | 9.2000           | 0.0220       | 0.2024            |                               |                                                      |
| E4 Jamb                                                    |             |                |               | 21.1500          | 0.0190       | 0.4018            |                               |                                                      |
| E5 Ground floor (normal)                                   |             |                |               | 10.2300          | 0.0928       | 0.9493            |                               |                                                      |
| E6 Intermediate floor within a dwelling                    |             |                |               | 18.6300          | 0.0020       | 0.0373            |                               |                                                      |
| E10 Eaves (insulation at ceiling level)                    |             |                |               | 10.2500          | 0.0390       | 0.3997            |                               |                                                      |
| E18 Party wall between dwellings                           |             |                |               | 10.4400          | 0.0330       | 0.3445            |                               |                                                      |
| E4 Jamb                                                    |             |                |               | 4.8000           | 0.1000       | 0.4800            |                               |                                                      |
| E2 Other lintels (including other steel lintels)           |             |                |               | 1.0600           | 0.0410       | 0.0435            |                               |                                                      |
| P1 Party wall - Ground floor                               |             |                |               | 8.3900           | 0.1000       | 0.8390            |                               |                                                      |
| P2 Party wall - Intermediate floor within a dwelling       |             |                |               | 8.3900           | 0.0000       | 0.0000            |                               |                                                      |
| P4 Party wall - Roof (insulation at ceiling level)         |             |                |               | 8.3900           | 0.0350       | 0.2937            |                               |                                                      |
| E5 Ground floor (normal)                                   |             |                |               | 8.3900           | 0.0980       | 0.8222            |                               |                                                      |
| E12 Gable (insulation at ceiling level)                    |             |                |               | 8.3900           | 0.0870       | 0.7299            |                               |                                                      |
| E16 Corner (normal)                                        |             |                |               | 10.4400          | 0.0420       | 0.4385            |                               |                                                      |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |             |                |               |                  |              |                   | 6.4238                        | (36)                                                 |
| Point Thermal bridges                                      |             |                |               |                  |              |                   | (36a) = 0.0000                |                                                      |
| Total fabric heat loss                                     |             |                |               |                  |              |                   | (33) + (36) + (36a) = 50.3244 | (37)                                                 |

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

|                           |         |         |         |         |         |         |         |         |         |         |         |         |         |
|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| (38)m                     | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |         |
|                           | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | (38)    |
| Heat transfer coeff       |         |         |         |         |         |         |         |         |         |         |         |         |         |
|                           | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | (39)    |
| Average = Sum(39)m / 12 = |         |         |         |         |         |         |         |         |         |         |         |         | 87.3516 |

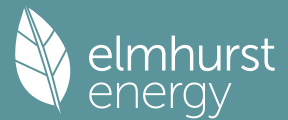
|               |        |        |        |        |        |        |        |        |        |        |        |        |        |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| HLP           | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |        |
|               | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | (40)   |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        |        | 1.0160 |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31     |        |

### 4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5666 (42)  
Hot water usage for mixer showers 67.2533 66.2426 64.7698 61.9519 59.8724 57.5533 56.2352 57.6968 59.2990 61.7890 64.6674 66.9956 (42a)  
Hot water usage for baths 29.0443 28.6130 28.0055 26.8856 26.0469 25.1170 24.6147 25.2179 25.8746 26.8697 28.0127 28.9461 (42b)  
Hot water usage for other uses 40.9146 39.4268 37.9390 36.4512 34.9634 33.4756 33.4756 34.9634 36.4512 37.9390 39.4268 40.9146 (42c)  
Average daily hot water use (litres/day) 126.1290 (43)

|                                        |          |          |          |          |          |          |          |          |          |                    |           |          |      |
|----------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------------------|-----------|----------|------|
| Daily hot water use                    | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct                | Nov       | Dec      |      |
|                                        | 137.2122 | 134.2823 | 130.7143 | 125.2887 | 120.8827 | 116.1459 | 114.3255 | 117.8781 | 121.6248 | 126.5977           | 132.1069  | 136.8563 | (44) |
| Energy conte                           | 217.3105 | 191.2162 | 200.9030 | 171.5139 | 162.7313 | 142.8150 | 138.2667 | 145.9577 | 149.9756 | 171.7918           | 188.2105  | 214.2839 | (45) |
| Energy content (annual)                |          |          |          |          |          |          |          |          |          | Total = Sum(45)m = | 2094.9763 |          |      |
| Distribution loss (46)m = 0.15 x (45)m |          |          |          |          |          |          |          |          |          |                    |           |          |      |
|                                        | 32.5966  | 28.6824  | 30.1355  | 25.7271  | 24.4097  | 21.4222  | 20.7400  | 21.8937  | 22.4963  | 25.7688            | 28.2316   | 32.1426  | (46) |
| Water storage loss (or HIU loss):      |          |          |          |          |          |          |          |          |          |                    |           |          |      |

# Full SAP Calculation Printout



|                                                                 |                                                                                |          |          |          |          |          |          |          |          |          |          |                |
|-----------------------------------------------------------------|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| Total storage loss                                              | 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (56)    |
| If cylinder contains dedicated solar storage                    | 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (57)    |
| Primary loss                                                    | 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (59)    |
| Combi loss                                                      | 11.9874                                                                        | 10.8167  | 11.9530  | 11.5193  | 11.8728  | 11.4590  | 11.8214  | 11.8376  | 11.4740  | 11.8918  | 11.5543  | 11.9811 (61)   |
| Total heat required for water heating calculated for each month | 229.2979                                                                       | 202.0330 | 212.8560 | 183.0332 | 174.6042 | 154.2740 | 150.0882 | 157.7953 | 161.4496 | 183.6836 | 199.7649 | 226.2650 (62)  |
| WWHRS                                                           | -29.9438                                                                       | -26.4825 | -27.7310 | -22.9624 | -21.4001 | -18.3122 | -17.1648 | -18.2530 | -18.9465 | -22.3359 | -25.3038 | -29.3893 (63a) |
| PV diverter                                                     | -0.0000                                                                        | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000 (63b)  |
| Solar input                                                     | 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63c)   |
| FGHRS                                                           | 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63d)   |
| Output from w/h                                                 | 199.3541                                                                       | 175.5504 | 185.1250 | 160.0708 | 153.2041 | 135.9618 | 132.9234 | 139.5422 | 142.5031 | 161.3478 | 174.4610 | 196.8757 (64)  |
|                                                                 | Total per year (kWh/year) = Sum(64)m =                                         |          |          |          |          |          |          |          |          |          |          | 1956.9195 (64) |
| Electric shower(s)                                              | 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (64a)   |
|                                                                 | Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |          |          |          |          |          |          |          | 0.0000 (64a)   |
| Heat gains from water heating, kWh/month                        | 75.2526                                                                        | 66.2836  | 69.7885  | 59.9082  | 57.0764  | 50.3507  | 48.9291  | 51.4903  | 52.7354  | 60.0937  | 65.4686  | 74.2447 (65)   |

## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |           |           |           |           |           |           |           |           |           |           |           |           |      |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------|
| Metabolic gains (Table 5), Watts                                                    | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec       |      |
| (66)m                                                                               | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 26.7460   | 23.7556   | 19.3193   | 14.6260   | 10.9331   | 9.2302    | 9.9735    | 12.9640   | 17.4002   | 22.0936   | 25.7865   | 27.4894   | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 345.4995  | 349.0847  | 340.0501  | 320.8165  | 296.5375  | 273.7188  | 258.4744  | 254.8892  | 263.9238  | 283.1574  | 307.4363  | 330.2551  | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | (69) |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 3.0000    | 3.0000    | 3.0000    | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | (71) |
| Water heating gains (Table 5)                                                       | 101.1460  | 98.6363   | 93.8018   | 83.2058   | 76.7156   | 69.9316   | 65.7649   | 69.2074   | 73.2436   | 80.7712   | 90.9286   | 99.7912   | (72) |
| Total internal gains                                                                | 580.6898  | 578.7749  | 560.4695  | 525.9466  | 491.4845  | 457.1788  | 438.5111  | 441.3589  | 458.8659  | 493.3204  | 531.4497  | 564.8340  | (73) |

## 6. Solar gains

| [Jan]       |          |          |          |          |            |          |               |          |               |          |          |          |              |  |
|-------------|----------|----------|----------|----------|------------|----------|---------------|----------|---------------|----------|----------|----------|--------------|--|
|             | Area     |          |          |          | Solar flux |          | g             |          | FF            |          | Access   |          | Gains        |  |
|             | m2       |          |          |          | Table 6a   |          | Specific data |          | Specific data |          | factor   |          | W            |  |
|             |          |          |          |          | W/m2       |          | or Table 6b   |          | or Table 6c   |          | Table 6d |          |              |  |
| North       | 0.5200   |          |          |          | 10.6334    |          | 0.4500        |          | 0.0000        |          | 0.7700   |          | 1.9159 (74)  |  |
| East        | 4.1200   |          |          |          | 19.6403    |          | 0.4500        |          | 0.0000        |          | 0.7700   |          | 28.0380 (76) |  |
| West        | 5.6100   |          |          |          | 19.6403    |          | 0.4500        |          | 0.0000        |          | 0.7700   |          | 38.1780 (80) |  |
| East        | 3.3300   |          |          |          | 19.6403    |          | 0.4500        |          | 0.0000        |          | 0.7700   |          | 22.6618 (76) |  |
|             |          |          |          |          |            |          |               |          |               |          |          |          |              |  |
| Solar gains | 90.7938  | 177.5254 | 292.5509 | 427.5877 | 525.2396   | 538.3069 | 512.2248      | 439.1107 | 340.4932      | 210.6627 | 113.1838 | 74.6861  | (83)         |  |
| Total gains | 671.4836 | 756.3003 | 853.0204 | 953.5343 | 1016.7241  | 995.4857 | 950.7359      | 880.4696 | 799.3592      | 703.9832 | 644.6335 | 639.5201 | (84)         |  |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |         |         |         |              |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| tau                                                                         | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876      |
| alpha                                                                       | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725       |
| util living area                                                            | 0.9726  | 0.9560  | 0.9173  | 0.8335  | 0.6977  | 0.5335  | 0.3970  | 0.4442  | 0.6709  | 0.8821  | 0.9577  | 0.9770 (86)  |
| MIT                                                                         | 19.3433 | 19.5949 | 20.0045 | 20.4610 | 20.7882 | 20.9426 | 20.9857 | 20.9780 | 20.8633 | 20.4089 | 19.7727 | 19.2671 (87) |
| Th 2                                                                        | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 (88) |
| util rest of house                                                          | 0.9673  | 0.9477  | 0.9018  | 0.8038  | 0.6486  | 0.4650  | 0.3162  | 0.3594  | 0.6028  | 0.8535  | 0.9481  | 0.9724 (89)  |
| MIT 2                                                                       | 18.3657 | 18.6457 | 19.0960 | 19.5801 | 19.9023 | 20.0352 | 20.0643 | 20.0604 | 19.9773 | 19.5400 | 18.8486 | 18.2806 (90) |
| Living area fraction                                                        | 18.5547 | 18.8292 | 19.2716 | 19.7504 | 20.0736 | 20.2106 | 20.2424 | 20.2378 | 20.1486 | 19.7080 | 19.0272 | 18.4713 (91) |
| MIT                                                                         | 18.5547 | 18.8292 | 19.2716 | 19.7504 | 20.0736 | 20.2106 | 20.2424 | 20.2378 | 20.1486 | 19.7080 | 19.0272 | 18.4713 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT                                                                | 18.5547 | 18.8292 | 19.2716 | 19.7504 | 20.0736 | 20.2106 | 20.2424 | 20.2378 | 20.1486 | 19.7080 | 19.0272 | 18.4713 (93) |

## 8. Space heating requirement

|                                                                                |           |           |           |          |          |          |          |          |          |          |           |               |              |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|-----------|---------------|--------------|
| Utilisation                                                                    | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov       | Dec           |              |
|                                                                                | 0.9557    | 0.9334    | 0.8859    | 0.7924   | 0.6488   | 0.4757   | 0.3314   | 0.3751   | 0.6090   | 0.8403   | 0.9343    | 0.9618        | (94)         |
| Useful gains                                                                   | 641.7069  | 705.9434  | 755.6759  | 755.5458 | 659.6935 | 473.5720 | 315.1001 | 330.2594 | 486.7815 | 591.5762 | 602.2535  | 615.0884      | (95)         |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000  | 7.1000    | 4.2000        | (96)         |
| Heat loss rate W                                                               | 1245.1695 | 1216.7383 | 1115.6187 | 947.8010 | 731.4454 | 490.0938 | 318.1677 | 335.2390 | 528.3527 | 795.5979 | 1041.8615 | 1246.6189     | (97)         |
| Space heating kWh                                                              | 448.9762  | 343.2542  | 267.7975  | 138.4237 | 53.3834  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 151.7922 | 316.5178  | 469.8587      | (98a)        |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |          |          |          |          |          |          |          |           | 2190.0037     |              |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000        | (98b)        |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |          |          |          |          |          |          |          |           | 0.0000        |              |
| Space heating kWh                                                              | 448.9762  | 343.2542  | 267.7975  | 138.4237 | 53.3834  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 151.7922 | 316.5178  | 469.8587      | (98c)        |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |          |          |          |          |          |          |          |           | 2190.0037     |              |
| Space heating per m <sup>2</sup>                                               |           |           |           |          |          |          |          |          |          |          |           | (98c) / (4) = | 25.4711 (99) |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

# Full SAP Calculation Printout



|                                                                                                      |          |          |          |          |          |               |                  |          |          |          |                  |                 |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|---------------|------------------|----------|----------|----------|------------------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                |          |          |          |          |          |               |                  |          |          |          |                  | 0.0000 (201)    |
| Fraction of space heat from main system(s)                                                           |          |          |          |          |          |               |                  |          |          |          |                  | 1.0000 (202)    |
| Efficiency of main space heating system 1 (in %)                                                     |          |          |          |          |          |               |                  |          |          |          |                  | 91.7000 (206)   |
| Efficiency of main space heating system 2 (in %)                                                     |          |          |          |          |          |               |                  |          |          |          |                  | 0.0000 (207)    |
| Efficiency of secondary/supplementary heating system, %                                              |          |          |          |          |          |               |                  |          |          |          |                  | 0.0000 (208)    |
|                                                                                                      | Jan      | Feb      | Mar      | Apr      | May      | Jun           | Jul              | Aug      | Sep      | Oct      | Nov              | Dec             |
| Space heating requirement                                                                            | 448.9762 | 343.2542 | 267.7975 | 138.4237 | 53.3834  | 0.0000        | 0.0000           | 0.0000   | 0.0000   | 151.7922 | 316.5178         | 469.8587 (98)   |
| Space heating efficiency (main heating system 1)                                                     | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 0.0000        | 0.0000           | 0.0000   | 0.0000   | 91.7000  | 91.7000          | 91.7000 (210)   |
| Space heating fuel (main heating system)                                                             | 489.6142 | 374.3230 | 292.0365 | 150.9528 | 58.2153  | 0.0000        | 0.0000           | 0.0000   | 0.0000   | 165.5313 | 345.1666         | 512.3868 (211)  |
| Space heating efficiency (main heating system 2)                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000           | 0.0000   | 0.0000   | 0.0000   | 0.0000           | 0.0000 (212)    |
| Space heating fuel (main heating system 2)                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000           | 0.0000   | 0.0000   | 0.0000   | 0.0000           | 0.0000 (213)    |
| Space heating fuel (secondary)                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000           | 0.0000   | 0.0000   | 0.0000   | 0.0000           | 0.0000 (215)    |
| Water heating                                                                                        |          |          |          |          |          |               |                  |          |          |          |                  |                 |
| Water heating requirement                                                                            | 199.3541 | 175.5504 | 185.1250 | 160.0708 | 153.2041 | 135.9618      | 132.9234         | 139.5422 | 142.5031 | 161.3478 | 174.4610         | 196.8757 (64)   |
| Efficiency of water heater                                                                           | 88.1435  | 88.0781  | 87.9295  | 87.6614  | 87.2331  | 86.7000       | 86.7000          | 86.7000  | 86.7000  | 87.7054  | 88.0422          | 88.1694 (217)   |
| Fuel for water heating, kWh/month                                                                    | 226.1699 | 199.3122 | 210.5380 | 182.6013 | 175.6261 | 156.8186      | 153.3142         | 160.9484 | 164.3635 | 183.9656 | 198.1560         | 223.2925 (219)  |
| Space cooling fuel requirement                                                                       |          |          |          |          |          |               |                  |          |          |          |                  |                 |
| (221)m                                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000           | 0.0000   | 0.0000   | 0.0000   | 0.0000           | 0.0000 (221)    |
| Pumps and Fa                                                                                         | 10.9478  | 9.8883   | 10.9478  | 10.5947  | 10.9478  | 10.5947       | 10.9478          | 10.9478  | 10.5947  | 10.9478  | 10.5947          | 10.9478 (231)   |
| Lighting                                                                                             | 23.4106  | 18.7809  | 16.9101  | 12.3891  | 9.5697   | 7.8185        | 8.7298           | 11.3473  | 14.7390  | 19.3384  | 21.8427          | 24.0613 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |               |                  |          |          |          |                  |                 |
| (233a)m                                                                                              | -11.5165 | -19.1763 | -33.0031 | -43.5351 | -52.0099 | -50.4050      | -49.4409         | -43.7568 | -34.6383 | -24.0771 | -13.4902         | -9.5519 (233a)  |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |          |          |               |                  |          |          |          |                  |                 |
| (234a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000           | 0.0000   | 0.0000   | 0.0000   | 0.0000           | 0.0000 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |          |          |               |                  |          |          |          |                  |                 |
| (235a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000           | 0.0000   | 0.0000   | 0.0000   | 0.0000           | 0.0000 (235a)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |          |          |               |                  |          |          |          |                  |                 |
| (235c)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000           | 0.0000   | 0.0000   | 0.0000   | 0.0000           | 0.0000 (235c)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |               |                  |          |          |          |                  |                 |
| (233b)m                                                                                              | -2.7365  | -6.8505  | -16.7864 | -30.3061 | -44.7949 | -46.9105      | -45.6945         | -35.7548 | -22.5599 | -10.7273 | -3.8701          | -2.0623 (233b)  |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |          |          |               |                  |          |          |          |                  |                 |
| (234b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000           | 0.0000   | 0.0000   | 0.0000   | 0.0000           | 0.0000 (234b)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |          |          |               |                  |          |          |          |                  |                 |
| (235b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000           | 0.0000   | 0.0000   | 0.0000   | 0.0000           | 0.0000 (235b)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |          |          |               |                  |          |          |          |                  |                 |
| (235d)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000           | 0.0000   | 0.0000   | 0.0000   | 0.0000           | 0.0000 (235d)   |
| Annual totals kWh/year                                                                               |          |          |          |          |          |               |                  |          |          |          |                  |                 |
| Space heating fuel - main system 1                                                                   |          |          |          |          |          |               |                  |          |          |          |                  | 2388.2265 (211) |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |               |                  |          |          |          |                  | 0.0000 (213)    |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |               |                  |          |          |          |                  | 0.0000 (215)    |
| Efficiency of water heater                                                                           |          |          |          |          |          |               |                  |          |          |          |                  | 86.7000         |
| Water heating fuel used                                                                              |          |          |          |          |          |               |                  |          |          |          |                  | 2235.1064 (219) |
| Space cooling fuel                                                                                   |          |          |          |          |          |               |                  |          |          |          |                  | 0.0000 (221)    |
| Electricity for pumps and fans:                                                                      |          |          |          |          |          |               |                  |          |          |          |                  |                 |
| (MEV)Decentralised, Database: total watage = 5.7980, total flow = 37.0000, SFP = 0.1567)             |          |          |          |          |          |               |                  |          |          |          |                  |                 |
| mechanical ventilation fans (SFP = 0.1567)                                                           |          |          |          |          |          |               |                  |          |          |          |                  | 42.9017 (230a)  |
| central heating pump                                                                                 |          |          |          |          |          |               |                  |          |          |          |                  | 41.0000 (230c)  |
| main heating flue fan                                                                                |          |          |          |          |          |               |                  |          |          |          |                  | 45.0000 (230e)  |
| Total electricity for the above, kWh/year                                                            |          |          |          |          |          |               |                  |          |          |          |                  | 128.9017 (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |          |          |          |          |          |               |                  |          |          |          |                  | 188.9373 (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |          |          |          |          |               |                  |          |          |          |                  |                 |
| PV generation                                                                                        |          |          |          |          |          |               |                  |          |          |          |                  | -653.6551 (233) |
| Wind generation                                                                                      |          |          |          |          |          |               |                  |          |          |          |                  | 0.0000 (234)    |
| Hydro-electric generation (Appendix N)                                                               |          |          |          |          |          |               |                  |          |          |          |                  | 0.0000 (235a)   |
| Electricity generated - Micro CHP (Appendix N)                                                       |          |          |          |          |          |               |                  |          |          |          |                  | 0.0000 (235)    |
| Appendix Q - special features                                                                        |          |          |          |          |          |               |                  |          |          |          |                  |                 |
| Energy saved or generated                                                                            |          |          |          |          |          |               |                  |          |          |          |                  | -0.0000 (236)   |
| Energy used                                                                                          |          |          |          |          |          |               |                  |          |          |          |                  | 0.0000 (237)    |
| Total delivered energy for all uses                                                                  |          |          |          |          |          |               |                  |          |          |          |                  | 4287.5169 (238) |
| 10a. Fuel costs - using Table 12 prices                                                              |          |          |          |          |          |               |                  |          |          |          |                  |                 |
|                                                                                                      |          |          |          |          |          | Fuel kWh/year | Fuel price p/kWh |          |          |          | Fuel cost £/year |                 |
| Space heating - main system 1                                                                        |          |          |          |          |          | 2388.2265     | 3.6400           |          |          |          | 86.9314 (240)    |                 |
| Total CO2 associated with community systems                                                          |          |          |          |          |          |               |                  |          |          |          | 0.0000 (473)     |                 |
| Water heating (other fuel)                                                                           |          |          |          |          |          | 2235.1064     | 3.6400           |          |          |          | 81.3579 (247)    |                 |
| Energy for instantaneous electric shower(s)                                                          |          |          |          |          |          | 0.0000        | 16.4900          |          |          |          | 0.0000 (247a)    |                 |
| Pumps, fans and electric keep-hot                                                                    |          |          |          |          |          | 128.9017      | 16.4900          |          |          |          | 21.2559 (249)    |                 |
| Energy for lighting                                                                                  |          |          |          |          |          | 188.9373      | 16.4900          |          |          |          | 31.1558 (250)    |                 |
| Additional standing charges                                                                          |          |          |          |          |          |               |                  |          |          |          | 92.0000 (251)    |                 |
| Energy saving/generation technologies                                                                |          |          |          |          |          |               |                  |          |          |          |                  |                 |
| PV Unit electricity used in dwelling                                                                 |          |          |          |          |          | -384.6011     | 16.4900          |          |          |          | -63.4207         |                 |
| PV Unit electricity exported                                                                         |          |          |          |          |          | -269.0539     | 5.5900           |          |          |          | -15.0401         |                 |
| Total                                                                                                |          |          |          |          |          |               |                  |          |          |          | -78.4608 (252)   |                 |
| Total energy cost                                                                                    |          |          |          |          |          |               |                  |          |          |          | 234.2401 (255)   |                 |
| 11a. SAP rating - Individual heating systems                                                         |          |          |          |          |          |               |                  |          |          |          |                  |                 |
| Energy cost deflator (Table 12):                                                                     |          |          |          |          |          |               |                  |          |          |          | 0.3600 (256)     |                 |
| Energy cost factor (ECF)                                                                             |          |          |          |          |          |               |                  |          |          |          | 0.6438 (257)     |                 |
| SAP value                                                                                            |          |          |          |          |          |               |                  |          |          |          | 89.5638          |                 |
| SAP rating (Section 12)                                                                              |          |          |          |          |          |               |                  |          |          |          | 90 (258)         |                 |
| SAP band                                                                                             |          |          |          |          |          |               |                  |          |          |          | B                |                 |
| 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP                       |          |          |          |          |          |               |                  |          |          |          |                  |                 |

# Full SAP Calculation Printout



|                                             | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|---------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1               | 2388.2265          | 0.2100                        | 501.5276 (261)           |
| Total CO2 associated with community systems |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                  | 2235.1064          | 0.2100                        | 469.3724 (264)           |
| Space and water heating                     |                    |                               | 970.8999 (265)           |
| Pumps, fans and electric keep-hot           | 128.9017           | 0.1387                        | 17.8803 (267)            |
| Energy for lighting                         | 188.9373           | 0.1443                        | 27.2695 (268)            |
| Energy saving/generation technologies       |                    |                               |                          |
| PV Unit electricity used in dwelling        | -384.6011          | 0.1316                        | -50.6173                 |
| PV Unit electricity exported                | -269.0539          | 0.1216                        | -32.7148                 |
| Total                                       |                    |                               | -83.3322 (269)           |
| Total CO2, kg/year                          |                    |                               | 932.7175 (272)           |
| CO2 emissions per m2                        |                    |                               | 10.8500 (273)            |
| EI value                                    |                    |                               | 90.4578                  |
| EI rating                                   |                    |                               | 90 (274)                 |
| EI band                                     |                    |                               | B                        |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m2) | Storey height<br>(m)            | Volume<br>(m3)         |
|--------------------------------------------------------|--------------|---------------------------------|------------------------|
| Main dwelling                                          |              |                                 |                        |
| Ground floor                                           | 42.9900 (1b) | x 2.4600 (2b)                   | = 105.7554 (1b) - (3b) |
| First floor                                            | 42.9900 (1c) | x 2.7600 (2c)                   | = 118.6524 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 85.9800      |                                 | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 224.4078 (5)         |

## 2. Ventilation rate

|                                                                                                    | m3 per hour                             |
|----------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                    |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                    |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                    |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                    |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                    |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                    |
| Number of intermittent extract fans                                                                | 0 * 10 = 0.0000 (7a)                    |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)                    |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 0.0000 / (5) = 0.0000 (8)               |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 4.5000 (17)                             |
| Infiltration rate                                                                                  | 0.2250 (18)                             |
| Number of sides sheltered                                                                          | 2 (19)                                  |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 0.8500 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.1913 (21)        |

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | 4.2000 | 4.0000 | 4.0000 | 3.7000 | 3.7000 | 3.3000 | 3.4000 | 3.2000 | 3.3000 | 3.5000 | 3.5000 | 3.8000 (22)  |
| Wind factor                                                                                             | 1.0500 | 1.0000 | 1.0000 | 0.9250 | 0.9250 | 0.8250 | 0.8500 | 0.8000 | 0.8250 | 0.8750 | 0.8750 | 0.9500 (22a) |
| Adj infilt rate                                                                                         | 0.2008 | 0.1913 | 0.1913 | 0.1769 | 0.1769 | 0.1578 | 0.1626 | 0.1530 | 0.1578 | 0.1673 | 0.1673 | 0.1817 (22b) |
| Mechanical extract ventilation - decentralised                                                          |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 (25)  |

## 3. Heat losses and heat loss parameter

| Element                                           | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2        | U-value<br>W/m2K | A x U<br>W/K | K-value<br>kJ/m2K                    | A x K<br>kJ/K   |
|---------------------------------------------------|-------------|----------------|----------------------|------------------|--------------|--------------------------------------|-----------------|
| Main dwelling                                     |             |                |                      |                  |              |                                      |                 |
| Front Door                                        |             |                | 2.5500               | 1.2000           | 3.0600       |                                      | (26)            |
| Windows                                           |             |                | 10.2500              | 1.2357           | 12.6663      |                                      | (27)            |
| French Doors                                      |             |                | 3.3300               | 1.2357           | 4.1150       |                                      | (27)            |
| GF SPVL 125TS P/A                                 |             |                | 42.9900              | 0.1300           | 5.5887       | 75.0000                              | 3224.2500 (28a) |
| EW Brick AAC011                                   | 97.2486     | 16.1300        | 81.1186              | 0.1800           | 14.6013      | 60.0000                              | 4867.1160 (29a) |
| PR 500mm MW044                                    | 42.9900     |                | 42.9900              | 0.0900           | 3.8691       | 9.0000                               | 386.9100 (30)   |
| Total net area of external elements Aum(A, m2)    |             |                | 183.2286             |                  |              |                                      | (31)            |
| Fabric heat loss, W/K = Sum (A x U)               |             |                | (26)...(30) + (32) = | 43.9005          |              |                                      | (33)            |
| Main dwelling                                     |             |                |                      |                  |              |                                      |                 |
| E-WM-30                                           |             |                | 43.8000              | 0.0000           | 0.0000       | 45.0000                              | 1971.0000 (32)  |
| Timber - GF                                       |             |                | 88.6100              |                  |              | 9.0000                               | 797.4900 (32c)  |
| Timber - FF                                       |             |                | 126.9000             |                  |              | 9.0000                               | 1142.1000 (32c) |
| Internal Floor FF                                 |             |                | 42.9900              |                  |              | 18.0000                              | 773.8200 (32d)  |
| Internal Ceiling GF                               |             |                | 42.9900              |                  |              | 9.0000                               | 386.9100 (32e)  |
| Heat capacity Cm = Sum(A x k)                     |             |                |                      |                  |              | (28)...(30) + (32) + (32a)...(32e) = | 13549.5960 (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K |             |                |                      |                  |              |                                      | 157.5901 (35)   |
| List of Thermal Bridges                           |             |                |                      |                  |              |                                      |                 |
| K1 Element                                        |             |                |                      | Length           | Psi-value    | Total                                |                 |
| E2 Other lintels (including other steel lintels)  |             |                |                      | 10.7800          | 0.0410       | 0.4420                               |                 |

# Full SAP Calculation Printout



|                                                            |         |                       |              |
|------------------------------------------------------------|---------|-----------------------|--------------|
| E3 Sill                                                    | 9.2000  | 0.0220                | 0.2024       |
| E4 Jamb                                                    | 21.1500 | 0.0190                | 0.4018       |
| E5 Ground floor (normal)                                   | 10.2300 | 0.0928                | 0.9493       |
| E6 Intermediate floor within a dwelling                    | 18.6300 | 0.0020                | 0.0373       |
| E10 Baves (insulation at ceiling level)                    | 10.2500 | 0.0390                | 0.3997       |
| E18 Party wall between dwellings                           | 10.4400 | 0.0330                | 0.3445       |
| E4 Jamb                                                    | 4.8000  | 0.1000                | 0.4800       |
| E2 Other lintels (including other steel lintels)           | 1.0600  | 0.0410                | 0.0435       |
| P1 Party wall - Ground floor                               | 8.3900  | 0.1000                | 0.8390       |
| P2 Party wall - Intermediate floor within a dwelling       | 8.3900  | 0.0000                | 0.0000       |
| P4 Party wall - Roof (insulation at ceiling level)         | 8.3900  | 0.0350                | 0.2937       |
| E5 Ground floor (normal)                                   | 8.3900  | 0.0980                | 0.8222       |
| E12 Gable (insulation at ceiling level)                    | 8.3900  | 0.0870                | 0.7299       |
| E16 Corner (normal)                                        | 10.4400 | 0.0420                | 0.4385       |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |         |                       | 6.4238 (36)  |
| Point Thermal bridges                                      |         | (36a) =               | 0.0000       |
| Total fabric heat loss                                     |         | (33) + (36) + (36a) = | 50.3244 (37) |

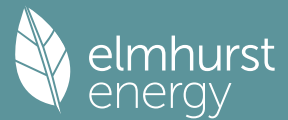
|                                                                     |                |                |                |                |                |                |                |                |                |                |                |                     |
|---------------------------------------------------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|---------------------|
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) |                |                |                |                |                |                |                |                |                |                |                |                     |
| (38)m                                                               | Jan<br>37.0273 | Feb<br>37.0273 | Mar<br>37.0273 | Apr<br>37.0273 | May<br>37.0273 | Jun<br>37.0273 | Jul<br>37.0273 | Aug<br>37.0273 | Sep<br>37.0273 | Oct<br>37.0273 | Nov<br>37.0273 | Dec<br>37.0273 (38) |
| Heat transfer coeff                                                 | 87.3516        | 87.3516        | 87.3516        | 87.3516        | 87.3516        | 87.3516        | 87.3516        | 87.3516        | 87.3516        | 87.3516        | 87.3516        | 87.3516 (39)        |
| Average = Sum(39)m / 12 =                                           |                |                |                |                |                |                |                |                |                |                |                | 87.3516             |
| HLP                                                                 | Jan<br>1.0160  | Feb<br>1.0160  | Mar<br>1.0160  | Apr<br>1.0160  | May<br>1.0160  | Jun<br>1.0160  | Jul<br>1.0160  | Aug<br>1.0160  | Sep<br>1.0160  | Oct<br>1.0160  | Nov<br>1.0160  | Dec<br>1.0160 (40)  |
| HLP (average)                                                       |                |                |                |                |                |                |                |                |                |                |                | 1.0160              |
| Days in mont                                                        | 31             | 28             | 31             | 30             | 31             | 30             | 31             | 31             | 30             | 31             | 30             | 31                  |

|                                                                 |                 |                 |                 |                 |                 |                 |                 |                                                                                |                 |                    |                 |                      |
|-----------------------------------------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|--------------------------------------------------------------------------------|-----------------|--------------------|-----------------|----------------------|
| 4. Water heating energy requirements (kWh/year)                 |                 |                 |                 |                 |                 |                 |                 |                                                                                |                 |                    |                 |                      |
| Assumed occupancy                                               |                 |                 |                 |                 |                 |                 |                 |                                                                                |                 |                    |                 | 2.5666 (42)          |
| Hot water usage for mixer showers                               | 67.2533         | 66.2426         | 64.7698         | 61.9519         | 59.8724         | 57.5533         | 56.2352         | 57.6968                                                                        | 59.2990         | 61.7890            | 64.6674         | 66.9956 (42a)        |
| Hot water usage for baths                                       | 29.0443         | 28.6130         | 28.0055         | 26.8856         | 26.0469         | 25.1170         | 24.6147         | 25.2179                                                                        | 25.8746         | 26.8697            | 28.0127         | 28.9461 (42b)        |
| Hot water usage for other uses                                  | 40.9146         | 39.4268         | 37.9390         | 36.4512         | 34.9634         | 33.4756         | 33.4756         | 34.9634                                                                        | 36.4512         | 37.9390            | 39.4268         | 40.9146 (42c)        |
| Average daily hot water use (litres/day)                        |                 |                 |                 |                 |                 |                 |                 |                                                                                |                 |                    |                 | 126.1290 (43)        |
| Daily hot water use                                             | Jan<br>137.2122 | Feb<br>134.2823 | Mar<br>130.7143 | Apr<br>125.2887 | May<br>120.8827 | Jun<br>116.1459 | Jul<br>114.3255 | Aug<br>117.8781                                                                | Sep<br>121.6248 | Oct<br>126.5977    | Nov<br>132.1069 | Dec<br>136.8563 (44) |
| Energy conte                                                    | 217.3105        | 191.2162        | 200.9030        | 171.5139        | 162.7313        | 142.8150        | 138.2667        | 145.9577                                                                       | 149.9756        | 171.7918           | 188.2105        | 214.2839 (45)        |
| Energy content (annual)                                         |                 |                 |                 |                 |                 |                 |                 |                                                                                |                 | Total = Sum(45)m = |                 | 2094.9763            |
| Distribution loss (46)m = 0.15 x (45)m                          | 32.5966         | 28.6824         | 30.1355         | 25.7271         | 24.4097         | 21.4222         | 20.7400         | 21.8937                                                                        | 22.4963         | 25.7688            | 28.2316         | 32.1426 (46)         |
| Water storage loss (or HIU loss):                               |                 |                 |                 |                 |                 |                 |                 |                                                                                |                 |                    |                 |                      |
| Total storage loss                                              | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000                                                                         | 0.0000          | 0.0000             | 0.0000          | 0.0000 (56)          |
| If cylinder contains dedicated solar storage                    | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000                                                                         | 0.0000          | 0.0000             | 0.0000          | 0.0000 (57)          |
| Primary loss                                                    | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000                                                                         | 0.0000          | 0.0000             | 0.0000          | 0.0000 (59)          |
| Combi loss                                                      | 11.9874         | 10.8167         | 11.9530         | 11.5193         | 11.8728         | 11.4590         | 11.8214         | 11.8376                                                                        | 11.4740         | 11.8918            | 11.5543         | 11.9811 (61)         |
| Total heat required for water heating calculated for each month | 229.2979        | 202.0330        | 212.8560        | 183.0332        | 174.6042        | 154.2740        | 150.0882        | 157.7953                                                                       | 161.4496        | 183.6836           | 199.7649        | 226.2650 (62)        |
| WWHRS                                                           | -29.9438        | -26.4825        | -27.7310        | -22.9624        | -21.4001        | -18.3122        | -17.1648        | -18.2530                                                                       | -18.9465        | -22.3359           | -25.3038        | -29.3893 (63a)       |
| FV diverter                                                     | -0.0000         | -0.0000         | -0.0000         | -0.0000         | -0.0000         | -0.0000         | -0.0000         | -0.0000                                                                        | -0.0000         | -0.0000            | -0.0000         | -0.0000 (63b)        |
| Solar input                                                     | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000                                                                         | 0.0000          | 0.0000             | 0.0000          | 0.0000 (63c)         |
| FGHRS                                                           | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000                                                                         | 0.0000          | 0.0000             | 0.0000          | 0.0000 (63d)         |
| Output from w/h                                                 | 199.3541        | 175.5504        | 185.1250        | 160.0708        | 153.2041        | 135.9618        | 132.9234        | 139.5422                                                                       | 142.5031        | 161.3478           | 174.4610        | 196.8757 (64)        |
|                                                                 |                 |                 |                 |                 |                 |                 |                 | Total per year (kWh/year) = Sum(64)m =                                         |                 |                    |                 | 1956.9195 (64)       |
| Electric shower(s)                                              | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000                                                                         | 0.0000          | 0.0000             | 0.0000          | 0.0000 (64a)         |
|                                                                 |                 |                 |                 |                 |                 |                 |                 | Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |                 |                    |                 | 0.0000 (64a)         |
| Heat gains from water heating, kWh/month                        | 75.2526         | 66.2836         | 69.7885         | 59.9082         | 57.0764         | 50.3507         | 48.9291         | 51.4903                                                                        | 52.7354         | 60.0937            | 65.4686         | 74.2447 (65)         |

|                                                                                     |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                      |
|-------------------------------------------------------------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|----------------------|
| 5. Internal gains (see Table 5 and 5a)                                              |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                      |
| Metabolic gains (Table 5), Watts                                                    | Jan<br>153.9962 | Feb<br>153.9962 | Mar<br>153.9962 | Apr<br>153.9962 | May<br>153.9962 | Jun<br>153.9962 | Jul<br>153.9962 | Aug<br>153.9962 | Sep<br>153.9962 | Oct<br>153.9962 | Nov<br>153.9962 | Dec<br>153.9962 (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 26.7460         | 23.7556         | 19.3193         | 14.6260         | 10.9331         | 9.2302          | 9.9735          | 12.9640         | 17.4002         | 22.0936         | 25.7865         | 27.4894 (67)         |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 345.4995        | 349.0847        | 340.0501        | 320.8165        | 296.5375        | 273.7188        | 258.4744        | 254.8892        | 263.9238        | 283.1574        | 307.4363        | 330.2551 (68)        |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 52.9662         | 52.9662         | 52.9662         | 52.9662         | 52.9662         | 52.9662         | 52.9662         | 52.9662         | 52.9662         | 52.9662         | 52.9662         | 52.9662 (69)         |
| Pumps, fans                                                                         | 3.0000          | 3.0000          | 3.0000          | 3.0000          | 3.0000          | 3.0000          | 3.0000          | 3.0000          | 3.0000          | 3.0000          | 3.0000          | 3.0000 (70)          |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -102.6642       | -102.6642       | -102.6642       | -102.6642       | -102.6642       | -102.6642       | -102.6642       | -102.6642       | -102.6642       | -102.6642       | -102.6642       | -102.6642 (71)       |
| Water heating gains (Table 5)                                                       | 101.1460        | 98.6363         | 93.8018         | 83.2058         | 76.7156         | 69.9316         | 65.7649         | 69.2074         | 73.2436         | 80.7712         | 90.9286         | 99.7912 (72)         |
| Total internal gains                                                                | 580.6898        | 578.7749        | 560.4695        | 525.9466        | 491.4845        | 457.1788        | 438.5111        | 441.3589        | 458.8659        | 493.3204        | 531.4497        | 564.8340 (73)        |

|                |            |                                |                                   |                                    |                              |              |  |
|----------------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|--------------|--|
| 6. Solar gains |            |                                |                                   |                                    |                              |              |  |
| [Jan]          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W   |  |
| North          | 0.5200     | 11.9814                        | 0.4500                            | 0.0000                             | 0.7700                       | 2.1588 (74)  |  |
| East           | 4.1200     | 22.3313                        | 0.4500                            | 0.0000                             | 0.7700                       | 31.8797 (76) |  |
| West           | 5.6100     | 22.3313                        | 0.4500                            | 0.0000                             | 0.7700                       | 43.4091 (80) |  |
| East           | 3.3300     | 22.3313                        | 0.4500                            | 0.0000                             | 0.7700                       | 25.7669 (76) |  |

# Full SAP Calculation Printout



|             |          |          |          |          |           |           |          |          |          |          |          |               |
|-------------|----------|----------|----------|----------|-----------|-----------|----------|----------|----------|----------|----------|---------------|
| Solar gains | 103.2145 | 181.5675 | 295.1032 | 443.3153 | 529.4853  | 580.2956  | 546.3815 | 479.7107 | 371.9166 | 229.9510 | 131.8216 | 84.0748 (83)  |
| Total gains | 683.9043 | 760.3424 | 855.5727 | 969.2619 | 1020.9698 | 1037.4744 | 984.8926 | 921.0697 | 830.7825 | 723.2714 | 663.2713 | 648.9089 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |         |         |         |              |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| tau                                                                         | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876      |
| alpha                                                                       | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725       |
| util living area                                                            | 0.9663  | 0.9491  | 0.9016  | 0.7949  | 0.6254  | 0.4123  | 0.2736  | 0.3014  | 0.5713  | 0.8419  | 0.9441  | 0.9713 (86)  |
| MIT                                                                         | 19.5029 | 19.7178 | 20.1434 | 20.5905 | 20.8760 | 20.9815 | 20.9973 | 20.9960 | 20.9342 | 20.5637 | 19.9525 | 19.4401 (87) |
| Th 2                                                                        | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 (88) |
| util rest of house                                                          | 0.9595  | 0.9392  | 0.8828  | 0.7588  | 0.5676  | 0.3391  | 0.1922  | 0.2148  | 0.4926  | 0.8037  | 0.9312  | 0.9655 (89)  |
| MIT 2                                                                       | 18.5450 | 18.7828 | 19.2473 | 19.7121 | 19.9808 | 20.0614 | 20.0695 | 20.0691 | 20.0322 | 19.6988 | 19.0477 | 18.4754 (90) |
| Living area fraction                                                        |         |         |         |         |         |         |         |         |         |         |         | 0.1933 (91)  |
| MIT                                                                         | 18.7301 | 18.9635 | 19.4205 | 19.8819 | 20.1539 | 20.2392 | 20.2488 | 20.2483 | 20.2066 | 19.8660 | 19.2226 | 18.6619 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT                                                                | 18.7301 | 18.9635 | 19.4205 | 19.8819 | 20.1539 | 20.2392 | 20.2488 | 20.2483 | 20.2066 | 19.8660 | 19.2226 | 18.6619 (93) |

## 8. Space heating requirement

|                                                                                |           |           |           |          |          |          |          |          |          |               |          |                |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|---------------|----------|----------------|
|                                                                                | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov      | Dec            |
| Utilisation                                                                    | 0.9467    | 0.9244    | 0.8673    | 0.7507   | 0.5730   | 0.3527   | 0.2079   | 0.2316   | 0.5047   | 0.7941        | 0.9163   | 0.9536 (94)    |
| Useful gains                                                                   | 647.4500  | 702.8237  | 742.0226  | 727.6734 | 585.0358 | 365.8666 | 204.7979 | 213.2862 | 419.2810 | 574.3444      | 607.7491 | 618.7780 (95)  |
| Ext temp.                                                                      | 5.1000    | 5.6000    | 7.4000    | 9.9000   | 13.0000  | 16.0000  | 17.9000  | 17.8000  | 15.2000  | 11.6000       | 8.0000   | 5.1000 (96)    |
| Heat loss rate W                                                               | 1190.6151 | 1167.3270 | 1050.0123 | 871.9340 | 624.9009 | 370.3033 | 205.1717 | 213.8616 | 437.3330 | 722.0459      | 980.3109 | 1184.6518 (97) |
| Space heating kWh                                                              | 404.1148  | 312.1462  | 229.1444  | 103.8676 | 29.6597  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 109.8899      | 268.2445 | 421.0101 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |          |          |          |          |          |          |               |          | 1878.0772      |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000   | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |          |          |          |          |          |          |               |          | 0.0000         |
| Space heating kWh                                                              | 404.1148  | 312.1462  | 229.1444  | 103.8676 | 29.6597  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 109.8899      | 268.2445 | 421.0101 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |          |          |          |          |          |          |               |          | 1878.0772      |
| Space heating per m2                                                           |           |           |           |          |          |          |          |          |          | (98c) / (4) = |          | 21.8432 (99)   |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                                                      |          |          |          |          |          |          |          |          |          |          |          |                 |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (201)    |
| Fraction of space heat from main system(s)                                                           |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (202)    |
| Efficiency of main space heating system 1 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 91.7000 (206)   |
| Efficiency of main space heating system 2 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)    |
| Efficiency of secondary/supplementary heating system, %                                              |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)    |
|                                                                                                      | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec             |
| Space heating requirement                                                                            | 404.1148 | 312.1462 | 229.1444 | 103.8676 | 29.6597  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 109.8899 | 268.2445 | 421.0101 (98)   |
| Space heating efficiency (main heating system 1)                                                     | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 91.7000  | 91.7000  | 91.7000 (210)   |
| Space heating fuel (main heating system)                                                             | 440.6923 | 340.3994 | 249.8848 | 113.2690 | 32.3442  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 119.8363 | 292.5240 | 459.1168 (211)  |
| Space heating efficiency (main heating system 2)                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)    |
| Space heating fuel (main heating system 2)                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)    |
| Space heating fuel (secondary)                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)    |
| Water heating                                                                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| Water heating requirement                                                                            | 199.3541 | 175.5504 | 185.1250 | 160.0708 | 153.2041 | 135.9618 | 132.9234 | 139.5422 | 142.5031 | 161.3478 | 174.4610 | 196.8757 (64)   |
| Efficiency of water heater                                                                           | 88.0951  | 88.0325  | 87.8491  | 87.5144  | 87.0338  | 86.7000  | 86.7000  | 86.7000  | 86.7000  | 87.5387  | 87.9604  | 86.7000 (216)   |
| Fuel for water heating, kWh/month                                                                    | 226.2942 | 199.4155 | 210.7306 | 182.9079 | 176.0282 | 156.8186 | 153.3142 | 160.9484 | 164.3635 | 184.3159 | 198.3404 | 223.4179 (219)  |
| Space cooling fuel requirement                                                                       |          |          |          |          |          |          |          |          |          |          |          |                 |
| (221)m                                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)    |
| Pumps and Fa                                                                                         | 10.9478  | 9.8883   | 10.9478  | 10.5947  | 10.9478  | 10.5947  | 10.9478  | 10.9478  | 10.5947  | 10.9478  | 10.5947  | 10.9478 (231)   |
| Lighting                                                                                             | 23.4106  | 18.7809  | 16.9101  | 12.3891  | 9.5697   | 7.8185   | 8.7298   | 11.3473  | 14.7390  | 19.3384  | 21.8427  | 24.0613 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | -12.9948 | -19.6788 | -33.4418 | -44.9288 | -52.5148 | -53.1453 | -51.7882 | -46.7161 | -37.1809 | -26.0128 | -15.5005 | -10.6965 (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | -3.3366  | -7.1593  | -17.1881 | -32.1833 | -45.6724 | -52.3387 | -50.2796 | -40.7390 | -25.7852 | -12.2915 | -4.8814  | -2.4799 (233b)  |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234b)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235d)   |
| Annual totals kWh/year                                                                               |          |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating fuel - main system 1                                                                   |          |          |          |          |          |          |          |          |          |          |          | 2048.0668 (211) |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)    |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)    |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          | 86.7000         |
| Water heating fuel used                                                                              |          |          |          |          |          |          |          |          |          |          |          | 2236.8953 (219) |
| Space cooling fuel                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (221)    |

|                                                                                            |  |  |  |  |  |  |  |  |  |  |  |                |
|--------------------------------------------------------------------------------------------|--|--|--|--|--|--|--|--|--|--|--|----------------|
| Electricity for pumps and fans:                                                            |  |  |  |  |  |  |  |  |  |  |  |                |
| (MEVDe decentralised, Database: total watage = 5.7980, total flow = 37.0000, SFP = 0.1567) |  |  |  |  |  |  |  |  |  |  |  |                |
| mechanical ventilation fans (SFP = 0.1567)                                                 |  |  |  |  |  |  |  |  |  |  |  | 42.9017 (230a) |

# Full SAP Calculation Printout



|                                                     |                |
|-----------------------------------------------------|----------------|
| central heating pump                                | 41.0000 (230c) |
| main heating flue fan                               | 45.0000 (230e) |
| Total electricity for the above, kWh/year           | 128.9017 (231) |
| Electricity for lighting (calculated in Appendix L) | 188.9373 (232) |

|                                                               |                 |
|---------------------------------------------------------------|-----------------|
| Energy saving/generation technologies (Appendices M ,N and Q) |                 |
| PV generation                                                 | -698.9344 (233) |
| Wind generation                                               | 0.0000 (234)    |
| Hydro-electric generation (Appendix N)                        | 0.0000 (235a)   |
| Electricity generated - Micro CHP (Appendix N)                | 0.0000 (235)    |
| Appendix Q - special features                                 |                 |
| Energy saved or generated                                     | -0.0000 (236)   |
| Energy used                                                   | 0.0000 (237)    |
| Total delivered energy for all uses                           | 3903.8667 (238) |

## 10a. Fuel costs - using BEDF prices (596)

|                                             | Fuel<br>kWh/year | Fuel price<br>p/kWh | Fuel cost<br>£/year |
|---------------------------------------------|------------------|---------------------|---------------------|
| Space heating - main system 1               | 2048.0668        | 7.3200              | 149.9185 (240)      |
| Total CO2 associated with community systems |                  |                     | 0.0000 (473)        |
| Water heating (other fuel)                  | 2236.8953        | 7.3200              | 163.7407 (247)      |
| Energy for instantaneous electric shower(s) | 0.0000           | 27.6700             | 0.0000 (247a)       |
| Pumps, fans and electric keep-hot           | 128.9017         | 27.6700             | 35.6671 (249)       |
| Energy for lighting                         | 188.9373         | 27.6700             | 52.2789 (250)       |
| Additional standing charges                 |                  |                     | 108.0000 (251)      |
| Energy saving/generation technologies       |                  |                     |                     |
| PV Unit electricity used in dwelling        | -404.5993        | 27.6700             | -111.9526           |
| PV Unit electricity exported                | -294.3350        | 5.8100              | -17.1009            |
| Total                                       |                  |                     | -129.0535 (252)     |
| Total energy cost                           |                  |                     | 380.5518 (255)      |

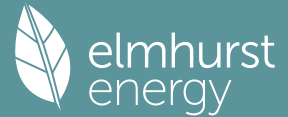
## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|---------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1               | 2048.0668          | 0.2100                        | 430.0940 (261)           |
| Total CO2 associated with community systems |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                  | 2236.8953          | 0.2100                        | 469.7480 (264)           |
| Space and water heating                     |                    |                               | 899.8420 (265)           |
| Pumps, fans and electric keep-hot           | 128.9017           | 0.1387                        | 17.8803 (267)            |
| Energy for lighting                         | 188.9373           | 0.1443                        | 27.2695 (268)            |
| Energy saving/generation technologies       |                    |                               |                          |
| PV Unit electricity used in dwelling        | -404.5993          | 0.1316                        | -53.2562                 |
| PV Unit electricity exported                | -294.3350          | 0.1211                        | -35.6464                 |
| Total                                       |                    |                               | -88.9026 (269)           |
| Total CO2, kg/year                          |                    |                               | 856.0892 (272)           |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1               | 2048.0668          | 1.1300                              | 2314.3155 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 2236.8953          | 1.1300                              | 2527.6917 (278)            |
| Space and water heating                     |                    |                                     | 4842.0072 (279)            |
| Pumps, fans and electric keep-hot           | 128.9017           | 1.5128                              | 195.0025 (281)             |
| Energy for lighting                         | 188.9373           | 1.5338                              | 289.7983 (282)             |
| Energy saving/generation technologies       |                    |                                     |                            |
| PV Unit electricity used in dwelling        | -404.5993          | 1.4863                              | -601.3523                  |
| PV Unit electricity exported                | -294.3350          | 0.4442                              | -130.7519                  |
| Total                                       |                    |                                     | -732.1042 (283)            |
| Total Primary energy kWh/year               |                    |                                     | 4594.7037 (286)            |

# Full SAP Calculation Printout



|                                    |                                                          |               |        |                |            |
|------------------------------------|----------------------------------------------------------|---------------|--------|----------------|------------|
| Plot Reference                     | 4907-R823-9471-003                                       |               |        | Issued on Date | 21/07/2026 |
| Assessment Reference               | Plot 3                                                   | Plot Type Ref | Plot 3 |                |            |
| Plot Address                       | Plot 3, Beaconsfield-Semi, K, WC, B, ES, 1012            |               |        | SAP Version    | 10.2       |
|                                    |                                                          |               |        |                |            |
| SAP Rating                         | 90 B                                                     | DER           | 11.23  | TER            | 11.61      |
| Environmental                      | 90 B                                                     | % DER < TER   |        |                | 3.27       |
| CO <sub>2</sub> Emissions (t/year) | 0.86                                                     | DFEE          | 35.32  | TFEE           | 37.71      |
| Compliance Check                   | See BREL                                                 | % DFEE < TFEE |        |                | 6.34       |
| % DPER < TPER                      | 0.39                                                     | DPER          | 60.42  | TPER           | 60.66      |
|                                    |                                                          |               |        |                |            |
| Assessor Details                   | Mr. Daniel Harris                                        |               |        | Assessor ID    | R823-0001  |
| Client                             | Crest Nicholson Head Office, Crest Nicholson Head Office |               |        |                |            |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)              | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|-----------------------------------|-----------------------------|
| Main dwelling                                          |                           |                                   |                             |
| Ground floor                                           | 42.9900 (1b)              | x 2.4600 (2b)                     | = 105.7554 (1b) - (3b)      |
| First floor                                            | 42.9900 (1c)              | x 2.7600 (2c)                     | = 118.6524 (1c) - (3c)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 85.9800                   |                                   | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 224.4078 (5)                |

## 2. Ventilation rate

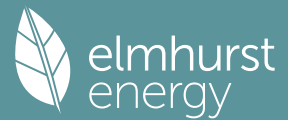
|                                                                                                    | m <sup>3</sup> per hour                 |
|----------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                    |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                    |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                    |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                    |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                    |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                    |
| Number of intermittent extract fans                                                                | 0 * 10 = 0.0000 (7a)                    |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)                    |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 0.0000 / (5) = 0.0000 (8)               |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 4.5000 (17)                             |
| Infiltration rate                                                                                  | 0.2250 (18)                             |
| Number of sides sheltered                                                                          | 2 (19)                                  |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 0.8500 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.1913 (21)        |

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor                                                                                             | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate                                                                                         | 0.2438 | 0.2391 | 0.2343 | 0.2104 | 0.2056 | 0.1817 | 0.1817 | 0.1769 | 0.1913 | 0.2056 | 0.2152 | 0.2247 (22b) |
| Mechanical extract ventilation - decentralised                                                          |        |        |        |        |        |        |        |        |        |        |        |              |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 (25)  |

## 3. Heat losses and heat loss parameter

| Element                                                      | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K   |
|--------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|-----------------|
| Main dwelling                                                |                         |                            |                           |                               |              |                                |                 |
| Front Door                                                   |                         |                            | 2.5500                    | 1.2000                        | 3.0600       |                                | (26)            |
| Windows                                                      |                         |                            | 10.2500                   | 1.2357                        | 12.6663      |                                | (27)            |
| French Doors                                                 |                         |                            | 3.3300                    | 1.2357                        | 4.1150       |                                | (27)            |
| GF SPVL 125TS P/A                                            |                         |                            | 42.9900                   | 0.1300                        | 5.5887       | 75.0000                        | 3224.2500 (28a) |
| EW Brick AAC011                                              | 97.2486                 | 16.1300                    | 81.1186                   | 0.1800                        | 14.6013      | 60.0000                        | 4867.1160 (29a) |
| PR 500mm MW044                                               | 42.9900                 |                            | 42.9900                   | 0.0900                        | 3.8691       | 9.0000                         | 386.9100 (30)   |
| Total net area of external elements Aum (A, m <sup>2</sup> ) |                         |                            | 183.2286                  |                               |              |                                | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                          |                         |                            | (26)...(30) + (32) =      |                               | 43.9005      |                                | (33)            |
| Main dwelling                                                |                         |                            |                           |                               |              |                                |                 |
| E-WM-30                                                      |                         |                            | 43.8000                   | 0.0000                        | 0.0000       | 45.0000                        | 1971.0000 (32)  |
| Timber - GF                                                  |                         |                            | 88.6100                   |                               |              | 9.0000                         | 797.4900 (32c)  |
| Timber - FF                                                  |                         |                            | 126.9000                  |                               |              | 9.0000                         | 1142.1000 (32c) |
| Internal Floor FF                                            |                         |                            | 42.9900                   |                               |              | 18.0000                        | 773.8200 (32d)  |
| Internal Ceiling GF                                          |                         |                            | 42.9900                   |                               |              | 9.0000                         | 386.9100 (32e)  |

# Full SAP Calculation Printout



Heat capacity  $C_m = \text{Sum}(A \times k)$   
Thermal mass parameter (TMP) =  $C_m / \text{TFA}$  in  $\text{kJ/m}^2\text{K}$   
List of Thermal Bridges

(28)...(30) + (32) + (32a)...(32e) = 13549.5960 (34)  
157.5901 (35)

|                                                      | Length  | Psi-value | Total  |
|------------------------------------------------------|---------|-----------|--------|
| K1 Element                                           |         |           |        |
| E2 Other lintels (including other steel lintels)     | 10.7800 | 0.0410    | 0.4420 |
| E3 Sill                                              | 9.2000  | 0.0220    | 0.2024 |
| E4 Jamb                                              | 21.1500 | 0.0190    | 0.4018 |
| E5 Ground floor (normal)                             | 10.2300 | 0.0928    | 0.9493 |
| E6 Intermediate floor within a dwelling              | 18.6300 | 0.0020    | 0.0373 |
| E10 Eaves (insulation at ceiling level)              | 10.2500 | 0.0390    | 0.3997 |
| E18 Party wall between dwellings                     | 10.4400 | 0.0330    | 0.3445 |
| E4 Jamb                                              | 4.8000  | 0.1000    | 0.4800 |
| E2 Other lintels (including other steel lintels)     | 1.0600  | 0.0410    | 0.0435 |
| P1 Party wall - Ground floor                         | 8.3900  | 0.1000    | 0.8390 |
| P2 Party wall - Intermediate floor within a dwelling | 8.3900  | 0.0000    | 0.0000 |
| P4 Party wall - Roof (insulation at ceiling level)   | 8.3900  | 0.0350    | 0.2937 |
| E5 Ground floor (normal)                             | 8.3900  | 0.0980    | 0.8222 |
| E12 Gable (insulation at ceiling level)              | 8.3900  | 0.0870    | 0.7299 |
| E16 Corner (normal)                                  | 10.4400 | 0.0420    | 0.4385 |

Thermal bridges (Sum(L x Psi) calculated using Appendix K)  
Point Thermal bridges (36a) = 6.4238 (36)  
Total fabric heat loss (33) + (36) + (36a) = 50.3244 (37)

|                                                                                        |         |         |         |         |         |         |         |         |         |         |         |         |      |
|----------------------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)\text{m} \times (5)$ | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |      |
| (38)m                                                                                  | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | (38) |
| Heat transfer coeff                                                                    | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | (39) |
| Average = Sum(39)m / 12 =                                                              |         |         |         |         |         |         |         |         |         |         |         | 87.3516 | (39) |
| HLP                                                                                    | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |      |
| HLP (average)                                                                          | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | (40) |
| Days in mont                                                                           | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31      |      |

## 4. Water heating energy requirements (kWh/year)

|                                                                 |          |          |          |          |          |          |          |          |          |                    |          |           |             |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------------------|----------|-----------|-------------|
| Assumed occupancy                                               |          |          |          |          |          |          |          |          |          |                    |          |           | 2.5666 (42) |
| Hot water usage for mixer showers                               |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| 67.2533                                                         | 66.2426  | 64.7698  | 61.9519  | 59.8724  | 57.5533  | 56.2352  | 57.6968  | 59.2990  | 61.7890  | 64.6674            | 66.9956  | (42a)     |             |
| Hot water usage for baths                                       |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| 29.0443                                                         | 28.6130  | 28.0055  | 26.8856  | 26.0469  | 25.1170  | 24.6147  | 25.2179  | 25.8746  | 26.8697  | 28.0127            | 28.9461  | (42b)     |             |
| Hot water usage for other uses                                  |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| 40.9146                                                         | 39.4268  | 37.9390  | 36.4512  | 34.9634  | 33.4756  | 33.4756  | 34.9634  | 36.4512  | 37.9390  | 39.4268            | 40.9146  | (42c)     |             |
| Average daily hot water use (litres/day)                        |          |          |          |          |          |          |          |          |          |                    |          | 126.1290  | (43)        |
| Daily hot water use                                             | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct                | Nov      | Dec       |             |
| 137.2122                                                        | 134.2823 | 130.7143 | 125.2887 | 120.8827 | 116.1459 | 114.3255 | 117.8781 | 121.6248 | 126.5977 | 132.1069           | 136.8563 | (44)      |             |
| Energy content (annual)                                         | 217.3105 | 191.2162 | 200.9030 | 171.5139 | 162.7313 | 142.8150 | 138.2667 | 145.9577 | 149.9756 | 171.7918           | 188.2105 | 214.2839  | (45)        |
| Distribution loss (46)m = 0.15 x (45)m                          |          |          |          |          |          |          |          |          |          | Total = Sum(45)m = |          | 2094.9763 |             |
| 32.5966                                                         | 28.6824  | 30.1355  | 25.7271  | 24.4097  | 21.4222  | 20.7400  | 21.8937  | 22.4963  | 25.7688  | 28.2316            | 32.1426  | (46)      |             |
| Water storage loss (or HIU loss):                               |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| Total storage loss                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | 0.0000    | (56)        |
| If cylinder contains dedicated solar storage                    |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| 0.0000                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | 0.0000    | (57)        |
| Primary loss                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | 0.0000    | (59)        |
| Combi loss                                                      | 11.9874  | 10.8167  | 11.9530  | 11.5193  | 11.8728  | 11.4590  | 11.8214  | 11.8376  | 11.4740  | 11.8918            | 11.5543  | 11.9811   | (61)        |
| Total heat required for water heating calculated for each month |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| 229.2979                                                        | 202.0330 | 212.8560 | 183.0332 | 174.6042 | 154.2740 | 150.0882 | 157.7953 | 161.4496 | 183.6836 | 199.7649           | 226.2650 | (62)      |             |
| WWHRS                                                           | -29.9438 | -26.4825 | -27.7310 | -22.9624 | -21.4001 | -18.3122 | -17.1648 | -18.2530 | -18.9465 | -22.3359           | -25.3038 | -29.3893  | (63a)       |
| PV diverter                                                     | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000            | -0.0000  | -0.0000   | (63b)       |
| Solar input                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | 0.0000    | (63c)       |
| FGHRS                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | 0.0000    | (63d)       |
| Output from w/h                                                 | 199.3541 | 175.5504 | 185.1250 | 160.0708 | 153.2041 | 135.9618 | 132.9234 | 139.5422 | 142.5031 | 161.3478           | 174.4610 | 196.8757  | (64)        |
| 12Total per year (kWh/year)                                     |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| Electric shower(s)                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | 0.0000    | (64a)       |
|                                                                 |          |          |          |          |          |          |          |          |          |                    |          | 1956.9195 | (64)        |
|                                                                 |          |          |          |          |          |          |          |          |          |                    |          | 1957      | (64)        |
|                                                                 |          |          |          |          |          |          |          |          |          |                    |          | 0.0000    | (64a)       |
|                                                                 |          |          |          |          |          |          |          |          |          |                    |          | 0.0000    | (64a)       |
| Heat gains from water heating, kWh/month                        |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| 75.2526                                                         | 66.2836  | 69.7885  | 59.9082  | 57.0764  | 50.3507  | 48.9291  | 51.4903  | 52.7354  | 60.0937  | 65.4686            | 74.2447  | (65)      |             |

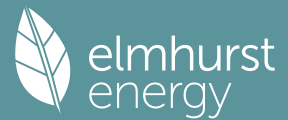
## 5. Internal gains (see Table 5 and 5a)

| Metabolic gains (Table 5), Watts                                                    |           |           |           |           |           |           |           |           |           |           |           |                |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
|                                                                                     | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec            |
| (66)m                                                                               | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     |           |           |           |           |           |           |           |           |           |           |           |                |
|                                                                                     | 122.1242  | 135.2090  | 122.1242  | 126.1950  | 122.1242  | 126.1950  | 122.1242  | 122.1242  | 126.1950  | 122.1242  | 126.1950  | 122.1242 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 |           |           |           |           |           |           |           |           |           |           |           |                |
|                                                                                     | 231.4847  | 233.8867  | 227.8336  | 214.9471  | 198.6802  | 183.3916  | 173.1779  | 170.7758  | 176.8289  | 189.7154  | 205.9823  | 221.2709 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    |           |           |           |           |           |           |           |           |           |           |           |                |
|                                                                                     | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330 (69)   |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 3.0000    | 3.0000    | 3.0000 (70)    |
| Losses e.g. evaporation (negative values) (Table 5)                                 |           |           |           |           |           |           |           |           |           |           |           |                |
|                                                                                     | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 (71) |
| Water heating gains (Table 5)                                                       |           |           |           |           |           |           |           |           |           |           |           |                |
|                                                                                     | 101.1460  | 98.6363   | 93.8018   | 83.2058   | 76.7156   | 69.9316   | 65.7649   | 69.2074   | 73.2436   | 80.7712   | 90.9286   | 99.7912 (72)   |
| Total internal gains                                                                |           |           |           |           |           |           |           |           |           |           |           |                |
|                                                                                     | 519.2539  | 532.2311  | 508.2586  | 488.8470  | 462.0190  | 441.0172  | 422.5660  | 423.6065  | 437.7667  | 457.1099  | 487.6050  | 507.6854 (73)  |

## 6. Solar gains

| [Jan] | Area<br>m <sup>2</sup> | Solar flux<br>Table 6a<br>W/m <sup>2</sup> | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W |
|-------|------------------------|--------------------------------------------|-----------------------------------|------------------------------------|------------------------------|------------|
|-------|------------------------|--------------------------------------------|-----------------------------------|------------------------------------|------------------------------|------------|

# Full SAP Calculation Printout



|       |  |  |        |  |         |  |        |  |        |  |        |  |              |
|-------|--|--|--------|--|---------|--|--------|--|--------|--|--------|--|--------------|
| North |  |  | 0.5200 |  | 10.6334 |  | 0.4500 |  | 0.0000 |  | 0.7700 |  | 1.9159 (74)  |
| East  |  |  | 4.1200 |  | 19.6403 |  | 0.4500 |  | 0.0000 |  | 0.7700 |  | 28.0380 (76) |
| West  |  |  | 5.6100 |  | 19.6403 |  | 0.4500 |  | 0.0000 |  | 0.7700 |  | 38.1780 (80) |
| East  |  |  | 3.3300 |  | 19.6403 |  | 0.4500 |  | 0.0000 |  | 0.7700 |  | 22.6618 (76) |

|             |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Solar gains | 90.7938  | 177.5254 | 292.5509 | 427.5877 | 525.2396 | 538.3069 | 512.2248 | 439.1107 | 340.4932 | 210.6627 | 113.1838 | 74.6861 (83)  |
| Total gains | 610.0477 | 709.7565 | 800.8095 | 916.4347 | 987.2586 | 979.3241 | 934.7908 | 862.7171 | 778.2599 | 667.7726 | 600.7889 | 582.3715 (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)  
Utilisation factor for gains for living area, nil,m (see Table 9a)

|                        | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep                       | Oct     | Nov     | Dec          |
|------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|--------------|
| tau                    | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876                   | 43.0876 | 43.0876 | 43.0876      |
| alpha                  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725                    | 3.8725  | 3.8725  | 3.8725       |
| util living area       | 0.9798  | 0.9636  | 0.9302  | 0.8473  | 0.7111  | 0.5410  | 0.4033  | 0.4525  | 0.6833                    | 0.8964  | 0.9658  | 0.9830 (86)  |
| MIT                    | 19.2294 | 19.5145 | 19.9273 | 20.4232 | 20.7732 | 20.9398 | 20.9849 | 20.9765 | 20.8541                   | 20.3629 | 19.6964 | 19.1595 (87) |
| Th 2                   | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701                   | 20.0701 | 20.0701 | 20.0701 (88) |
| util rest of house     | 0.9758  | 0.9565  | 0.9166  | 0.8189  | 0.6624  | 0.4719  | 0.3215  | 0.3665  | 0.6154                    | 0.8701  | 0.9578  | 0.9795 (89)  |
| MIT 2                  | 18.2387 | 18.5572 | 19.0135 | 19.5427 | 19.8895 | 20.0334 | 20.0639 | 20.0598 | 19.9704                   | 19.4937 | 18.7649 | 18.1601 (90) |
| Living area fraction   |         |         |         |         |         |         |         |         | FLA = Living area / (4) = |         |         | 0.1933 (91)  |
| MIT                    | 18.4302 | 18.7422 | 19.1901 | 19.7129 | 20.0603 | 20.2086 | 20.2419 | 20.2370 | 20.1413                   | 19.6618 | 18.9449 | 18.3533 (92) |
| Temperature adjustment |         |         |         |         |         |         |         |         |                           |         |         | 0.0000       |
| adjusted MIT           | 18.4302 | 18.7422 | 19.1901 | 19.7129 | 20.0603 | 20.2086 | 20.2419 | 20.2370 | 20.1413                   | 19.6618 | 18.9449 | 18.3533 (93) |

## 8. Space heating requirement

|                                                                                | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov       | Dec            |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|---------------|-----------|----------------|
| Utilisation                                                                    | 0.9659    | 0.9433    | 0.9009    | 0.8066   | 0.6619   | 0.4826   | 0.3368   | 0.3823   | 0.6210   | 0.8563        | 0.9450    | 0.9706 (94)    |
| Useful gains                                                                   | 589.2343  | 669.5074  | 721.4185  | 739.1854 | 653.4650 | 472.5763 | 314.8829 | 329.8467 | 483.2849 | 571.8229      | 567.7573  | 565.2396 (95)  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000    | 4.2000 (96)    |
| Heat loss rate W                                                               | 1234.2958 | 1209.1430 | 1108.5013 | 944.5263 | 730.2867 | 489.9196 | 318.1297 | 335.1670 | 527.7137 | 791.5589      | 1034.6738 | 1236.3150 (97) |
| Space heating kWh                                                              | 479.9257  | 362.6351  | 287.9896  | 147.8455 | 57.1553  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 163.4836      | 336.1799  | 499.2802 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |          |          |          |          |          |          |               |           | 2334.4949      |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |          |          |          |          |          |          |               |           | 0.0000         |
| Space heating kWh                                                              | 479.9257  | 362.6351  | 287.9896  | 147.8455 | 57.1553  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 163.4836      | 336.1799  | 499.2802 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |          |          |          |          |          |          |               |           | 2334.4949      |
| Space heating per m2                                                           |           |           |           |          |          |          |          |          |          | (98c) / (4) = |           | 27.1516 (99)   |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

| Fraction of space heat from secondary/supplementary system (Table 11)                                        |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (201)    |
|--------------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Fraction of space heat from main system(s)                                                                   |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (202)    |
| Efficiency of main space heating system 1 (in %)                                                             |          |          |          |          |          |          |          |          |          |          |          | 91.7000 (206)   |
| Efficiency of main space heating system 2 (in %)                                                             |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)    |
| Efficiency of secondary/supplementary heating system, %                                                      |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)    |
|                                                                                                              | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec             |
| Space heating requirement                                                                                    | 479.9257 | 362.6351 | 287.9896 | 147.8455 | 57.1553  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 163.4836 | 336.1799 | 499.2802 (98)   |
| Space heating efficiency (main heating system 1)                                                             | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 91.7000  | 91.7000  | 91.7000 (210)   |
| Space heating fuel (main heating system)                                                                     | 523.3650 | 395.4581 | 314.0563 | 161.2273 | 62.3286  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 178.2809 | 366.6084 | 544.4713 (211)  |
| Space heating efficiency (main heating system 2)                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)    |
| Space heating fuel (main heating system 2)                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)    |
| Space heating fuel (secondary)                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)    |
| Water heating                                                                                                |          |          |          |          |          |          |          |          |          |          |          |                 |
| Water heating requirement                                                                                    | 199.3541 | 175.5504 | 185.1250 | 160.0708 | 153.2041 | 135.9618 | 132.9234 | 139.5422 | 142.5031 | 161.3478 | 174.4610 | 196.8757 (64)   |
| Efficiency of water heater (217)m                                                                            | 88.1732  | 88.1039  | 87.9663  | 87.6958  | 87.2607  | 86.7000  | 86.7000  | 86.7000  | 86.7000  | 87.7443  | 88.0712  | 86.7000 (216)   |
| Fuel for water heating, kWh/month                                                                            | 226.0938 | 199.2538 | 210.4500 | 182.5297 | 175.5705 | 156.8186 | 153.3142 | 160.9484 | 164.3635 | 183.8840 | 198.0909 | 223.2255 (219)  |
| Space cooling fuel requirement (221)m                                                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)    |
| Pumps and Fa                                                                                                 | 10.9478  | 9.8883   | 10.9478  | 10.9478  | 10.9478  | 10.9478  | 10.9478  | 10.9478  | 10.9478  | 10.9478  | 10.9478  | 10.9478 (231)   |
| Lighting                                                                                                     | 23.4106  | 18.7809  | 16.9101  | 12.3891  | 9.5697   | 7.8185   | 8.7298   | 11.3473  | 14.7390  | 19.3384  | 21.8427  | 24.0613 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity) (233a)m                                        | -11.5165 | -19.1763 | -33.0031 | -43.5351 | -52.0099 | -50.4050 | -49.4409 | -43.7568 | -34.6383 | -24.0771 | -13.4902 | -9.5519 (233a)  |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)   |
| Electricity generated by PVs (Appendix M) (negative quantity) (233b)m                                        | -2.7365  | -6.8505  | -16.7864 | -30.3061 | -44.7949 | -46.9105 | -45.6945 | -35.7548 | -22.5599 | -10.7273 | -3.8701  | -2.0623 (233b)  |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234b)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235d)   |
| Annual totals kWh/year                                                                                       |          |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating fuel - main system 1                                                                           |          |          |          |          |          |          |          |          |          |          |          | 2545.7960 (211) |
| Space heating fuel - main system 2                                                                           |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)    |
| Space heating fuel - secondary                                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)    |
| Efficiency of water heater                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 86.7000         |

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|                                                                                                                            |                 |
|----------------------------------------------------------------------------------------------------------------------------|-----------------|
| Water heating fuel used                                                                                                    | 2234.5429 (219) |
| Space cooling fuel                                                                                                         | 0.0000 (221)    |
| Electricity for pumps and fans:<br>(MEVDecentralised, Database: total watage = 5.7980, total flow = 37.0000, SFP = 0.1567) |                 |
| mechanical ventilation fans (SFP = 0.1567)                                                                                 | 42.9017 (230a)  |
| central heating pump                                                                                                       | 41.0000 (230c)  |
| main heating flue fan                                                                                                      | 45.0000 (230e)  |
| Total electricity for the above, kWh/year                                                                                  | 128.9017 (231)  |
| Electricity for lighting (calculated in Appendix L)                                                                        | 188.9373 (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                                              |                 |
| PV generation                                                                                                              | -653.6551 (233) |
| Wind generation                                                                                                            | 0.0000 (234)    |
| Hydro-electric generation (Appendix N)                                                                                     | 0.0000 (235a)   |
| Electricity generated - Micro CHP (Appendix N)                                                                             | 0.0000 (235)    |
| Appendix Q - special features                                                                                              |                 |
| Energy saved or generated                                                                                                  | -0.0000 (236)   |
| Energy used                                                                                                                | 0.0000 (237)    |
| Total delivered energy for all uses                                                                                        | 4444.5227 (238) |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                                 | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |  |
|-------------------------------------------------|--------------------|-------------------------------|--------------------------|--|
| Space heating - main system 1                   | 2545.7960          | 0.2100                        | 534.6172 (261)           |  |
| Total CO2 associated with community systems     |                    |                               | 0.0000 (373)             |  |
| Water heating (other fuel)                      | 2234.5429          | 0.2100                        | 469.2540 (264)           |  |
| Space and water heating                         |                    |                               | 1003.8712 (265)          |  |
| Pumps, fans and electric keep-hot               | 128.9017           | 0.1387                        | 17.8803 (267)            |  |
| Energy for lighting                             | 188.9373           | 0.1443                        | 27.2695 (268)            |  |
| Energy saving/generation technologies           |                    |                               |                          |  |
| PV Unit electricity used in dwelling            | -384.6011          | 0.1316                        | -50.6173                 |  |
| PV Unit electricity exported                    | -269.0539          | 0.1216                        | -32.7148                 |  |
| Total                                           |                    |                               | -83.3322 (269)           |  |
| Total CO2, kg/year                              |                    |                               | 965.6887 (272)           |  |
| EPC Dwelling Carbon Dioxide Emission Rate (DER) |                    |                               | 11.2300 (273)            |  |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |  |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|--|
| Space heating - main system 1               | 2545.7960          | 1.1300                              | 2876.7494 (275)            |  |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |  |
| Water heating (other fuel)                  | 2234.5429          | 1.1300                              | 2525.0334 (278)            |  |
| Space and water heating                     |                    |                                     | 5401.7829 (279)            |  |
| Pumps, fans and electric keep-hot           | 128.9017           | 1.5128                              | 195.0025 (281)             |  |
| Energy for lighting                         | 188.9373           | 1.5338                              | 289.7983 (282)             |  |
| Energy saving/generation technologies       |                    |                                     |                            |  |
| PV Unit electricity used in dwelling        | -384.6011          | 1.4862                              | -571.6091                  |  |
| PV Unit electricity exported                | -269.0539          | 0.4461                              | -120.0268                  |  |
| Total                                       |                    |                                     | -691.6359 (283)            |  |
| Total Primary energy kWh/year               |                    |                                     | 5194.9477 (286)            |  |
| Dwelling Primary energy Rate (DPER)         |                    |                                     | 60.4200 (287)              |  |

## SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF TARGET EMISSIONS

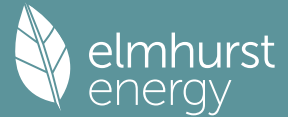
### 1. Overall dwelling characteristics

|                                                         | Area<br>(m2) | Storey height<br>(m)               | Volume<br>(m3)         |  |
|---------------------------------------------------------|--------------|------------------------------------|------------------------|--|
| Main dwelling                                           |              |                                    |                        |  |
| Ground floor                                            | 42.9900 (1b) | x 2.4600 (2b)                      | = 105.7554 (1b) - (3b) |  |
| First floor                                             | 42.9900 (1c) | x 2.7600 (2c)                      | = 118.6524 (1c) - (3c) |  |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)... (1n) | 85.9800      |                                    | (4)                    |  |
| Dwelling volume                                         |              | (3a)+(3b)+(3c)+(3d)+(3e)... (3n) = | 224.4078 (5)           |  |

### 2. Ventilation rate

|                                                                                                    | m3 per hour     |              |
|----------------------------------------------------------------------------------------------------|-----------------|--------------|
| Number of open chimneys                                                                            | 0 * 80 =        | 0.0000 (6a)  |
| Number of open flues                                                                               | 0 * 20 =        | 0.0000 (6b)  |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 =        | 0.0000 (6c)  |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 =        | 0.0000 (6d)  |
| Number of flues attached to other heater                                                           | 0 * 35 =        | 0.0000 (6e)  |
| Number of blocked chimneys                                                                         | 0 * 20 =        | 0.0000 (6f)  |
| Number of intermittent extract fans                                                                | 3 * 10 =        | 30.0000 (7a) |
| Number of passive vents                                                                            | 0 * 10 =        | 0.0000 (7b)  |
| Number of flueless gas fires                                                                       | 0 * 40 =        | 0.0000 (7c)  |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 30.0000 / (5) = | 0.1337 (8)   |
| Pressure test                                                                                      | Yes             |              |
| Pressure Test Method                                                                               | Blower Door     |              |
| Measured/design AP50                                                                               | 5.0000          | (17)         |
| Infiltration rate                                                                                  | 0.3837          | (18)         |
| Number of sides sheltered                                                                          | 2               | (19)         |

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Shelter factor  
Infiltration rate adjusted to include shelter factor

$$(20) = 1 - [0.075 \times (19)] = 0.8500 \quad (20)$$

$$(21) = (18) \times (20) = 0.3261 \quad (21)$$

|                 | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |       |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|
| Wind speed      | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 | (22)  |
| Wind factor     | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 | (22a) |
| Adj infilt rate | 0.4158 | 0.4077 | 0.3995 | 0.3587 | 0.3506 | 0.3098 | 0.3098 | 0.3017 | 0.3261 | 0.3506 | 0.3669 | 0.3832 | (22b) |
| Effective ac    | 0.5865 | 0.5831 | 0.5798 | 0.5643 | 0.5615 | 0.5480 | 0.5480 | 0.5455 | 0.5532 | 0.5615 | 0.5673 | 0.5734 | (25)  |

## 3. Heat losses and heat loss parameter

| Element                                           | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K | A x U<br>W/K         | K-value<br>kJ/m2K | A x K<br>kJ/K |       |
|---------------------------------------------------|-------------|----------------|---------------|------------------|----------------------|-------------------|---------------|-------|
| Main dwelling                                     |             |                |               |                  |                      |                   |               |       |
| TER Opaque door                                   |             |                | 2.5500        | 1.0000           | 2.5500               |                   |               | (26)  |
| TER Opening Type                                  |             |                | 13.5800       | 1.1450           | 15.5496              |                   |               | (27)  |
| GF SPVL 125TS P/A                                 |             |                | 42.9900       | 0.1300           | 5.5887               |                   |               | (28a) |
| EW Brick AAC011                                   | 97.2486     | 16.1300        | 81.1186       | 0.1800           | 14.6013              |                   |               | (29a) |
| PR 500mm MW044                                    | 42.9900     |                | 42.9900       | 0.1100           | 4.7289               |                   |               | (30)  |
| Total net area of external elements Aum(A, m2)    |             |                | 183.2286      |                  |                      |                   |               | (31)  |
| Fabric heat loss, W/K = Sum (A x U)               |             |                |               |                  | (26)...(30) + (32) = | 43.0186           |               | (33)  |
| Main dwelling                                     |             |                |               |                  |                      |                   |               |       |
| E-WM-30                                           |             |                | 43.8000       | 0.0000           | 0.0000               |                   |               | (32)  |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K |             |                |               |                  |                      |                   | 157.5901      | (35)  |

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

List of Thermal Bridges

|                                                            | Length  | Psi-value | Total                 |              |
|------------------------------------------------------------|---------|-----------|-----------------------|--------------|
| K1 Element                                                 | 10.7800 | 0.0500    | 0.5390                |              |
| E2 Other lintels (including other steel lintels)           | 9.2000  | 0.0500    | 0.4600                |              |
| E3 Sill                                                    | 21.1500 | 0.0500    | 1.0575                |              |
| E4 Jamb                                                    | 10.2300 | 0.1600    | 1.6368                |              |
| E5 Ground floor (normal)                                   | 18.6300 | 0.0000    | 0.0000                |              |
| E6 Intermediate floor within a dwelling                    | 10.2500 | 0.0600    | 0.6150                |              |
| E10 Eaves (insulation at ceiling level)                    | 10.4400 | 0.0600    | 0.6264                |              |
| E18 Party wall between dwellings                           | 4.8000  | 0.0500    | 0.2400                |              |
| E4 Jamb                                                    | 1.0600  | 0.0500    | 0.0530                |              |
| E2 Other lintels (including other steel lintels)           | 8.3900  | 0.0800    | 0.6712                |              |
| P1 Party wall - Ground floor                               | 8.3900  | 0.0000    | 0.0000                |              |
| P2 Party wall - Intermediate floor within a dwelling       | 8.3900  | 0.1200    | 1.0068                |              |
| P4 Party wall - Roof (insulation at ceiling level)         | 8.3900  | 0.1600    | 1.3424                |              |
| E5 Ground floor (normal)                                   | 8.3900  | 0.0600    | 0.5034                |              |
| E12 Gable (insulation at ceiling level)                    | 10.4400 | 0.0900    | 0.9396                |              |
| E16 Corner (normal)                                        |         |           |                       |              |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |         |           |                       | 9.6911 (36)  |
| Point Thermal bridges                                      |         |           | (36a) =               | 0.0000       |
| Total fabric heat loss                                     |         |           | (33) + (36) + (36a) = | 52.7097 (37) |

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

Point Thermal bridges

Total fabric heat loss

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

|                           | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |      |
|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| (38)m                     | 43.4295 | 43.1809 | 42.9372 | 41.7926 | 41.5785 | 40.5816 | 40.5816 | 40.3970 | 40.9656 | 41.5785 | 42.0117 | 42.4646 | (38) |
| Heat transfer coeff       | 96.1392 | 95.8906 | 95.6469 | 94.5023 | 94.2882 | 93.2913 | 93.2913 | 93.1067 | 93.6753 | 94.2882 | 94.7214 | 95.1743 | (39) |
| Average = Sum(39)m / 12 = |         |         |         |         |         |         |         |         |         |         |         | 94.5013 |      |

|               | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |      |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| HLP           | 1.1182 | 1.1153 | 1.1124 | 1.0991 | 1.0966 | 1.0850 | 1.0850 | 1.0829 | 1.0895 | 1.0966 | 1.1017 | 1.1069 | (40) |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 1.0991 |      |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31     |      |

## 4. Water heating energy requirements (kWh/year)

|                                                                                |          |          |          |          |          |          |          |          |          |          |          |           |             |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-------------|
| Assumed occupancy                                                              |          |          |          |          |          |          |          |          |          |          |          |           | 2.5666 (42) |
| Hot water usage for mixer showers                                              |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 67.2533                                                                        | 66.2426  | 64.7698  | 61.9519  | 59.8724  | 57.5533  | 56.2352  | 57.6968  | 59.2990  | 61.7890  | 64.6674  | 66.9956  | 66.9956   | (42a)       |
| Hot water usage for baths                                                      |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 29.0443                                                                        | 28.6130  | 28.0055  | 26.8856  | 26.0469  | 25.1170  | 24.6147  | 25.2179  | 25.8746  | 26.8697  | 28.0127  | 28.9461  | 28.9461   | (42b)       |
| Hot water usage for other uses                                                 |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 40.9146                                                                        | 39.4268  | 37.9390  | 36.4512  | 34.9634  | 33.4756  | 33.4756  | 34.9634  | 36.4512  | 37.9390  | 39.4268  | 40.9146  | 40.9146   | (42c)       |
| Average daily hot water use (litres/day)                                       |          |          |          |          |          |          |          |          |          |          |          | 126.1290  | (43)        |
| Daily hot water use                                                            |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 137.2122                                                                       | 134.2823 | 130.7143 | 125.2887 | 120.8827 | 116.1459 | 114.3255 | 117.8781 | 121.6248 | 126.5977 | 132.1069 | 136.8563 | 136.8563  | (44)        |
| Energy conte                                                                   | 217.3105 | 191.2162 | 200.9030 | 171.5139 | 162.7313 | 142.8150 | 138.2667 | 145.9577 | 149.9756 | 171.7918 | 188.2105 | 214.2839  | (45)        |
| Energy content (annual)                                                        |          |          |          |          |          |          |          |          |          |          |          |           |             |
| Distribution loss (46)m = 0.15 x (45)m                                         | 32.5966  | 28.6824  | 30.1355  | 25.7271  | 24.4097  | 21.4222  | 20.7400  | 21.8937  | 22.4963  | 25.7688  | 28.2316  | 32.1426   | (46)        |
| Water storage loss (or HIU loss):                                              |          |          |          |          |          |          |          |          |          |          |          |           |             |
| Total storage loss                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (56)        |
| If cylinder contains dedicated solar storage                                   |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (57)        |
| Primary loss                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (59)        |
| Combi loss                                                                     | 50.9589  | 46.0274  | 50.9589  | 49.3151  | 50.9589  | 49.3151  | 50.9589  | 50.9589  | 49.3151  | 50.9589  | 49.3151  | 50.9589   | (61)        |
| Total heat required for water heating calculated for each month                |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 268.2694                                                                       | 237.2436 | 251.8620 | 220.8290 | 213.6902 | 192.1300 | 189.2257 | 196.9166 | 199.2907 | 222.7507 | 237.5256 | 265.2428 | 265.2428  | (62)        |
| WWHRS                                                                          | -30.7454 | -27.1915 | -28.4733 | -23.5770 | -21.9730 | -18.8024 | -17.6243 | -18.7416 | -19.4537 | -22.9338 | -25.9812 | -30.1760  | (63a)       |
| PV diverter                                                                    | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000   | (63b)       |
| Solar input                                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (63c)       |
| FGHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (63d)       |
| Output from w/h                                                                | 237.5241 | 210.0522 | 223.3886 | 197.2519 | 191.7173 | 173.3276 | 171.6014 | 178.1749 | 179.8370 | 199.8169 | 211.5444 | 235.0668  | (64)        |
| 12Total per year (kWh/year)                                                    |          |          |          |          |          |          |          |          |          |          |          | 2409.3031 | (64)        |
| Electric shower(s)                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (64a)       |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (64a)       |
| Heat gains from water heating, kWh/month                                       |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 84.9955                                                                        | 75.0862  | 79.5400  | 69.3571  | 66.8479  | 59.8147  | 58.7134  | 61.2707  | 62.1957  | 69.8605  | 74.9088  | 83.9891  | 83.9891   | (65)        |

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## 5. Internal gains (see Table 5 and 5a)

| Metabolic gains (Table 5), Watts                                                    |           |           |           |           |           |           |           |           |           |           |           |                |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
|                                                                                     | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec            |
| (66)m                                                                               | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 122.1242  | 135.2090  | 122.1242  | 126.1950  | 122.1242  | 126.1950  | 122.1242  | 122.1242  | 126.1950  | 122.1242  | 126.1950  | 122.1242 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 231.4847  | 233.8867  | 227.8336  | 214.9471  | 198.6802  | 183.3916  | 173.1779  | 170.7758  | 176.8289  | 189.7154  | 205.9823  | 221.2709 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330 (69)   |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 3.0000    | 3.0000    | 3.0000 (70)    |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 (71) |
| Water heating gains (Table 5)                                                       | 114.2412  | 111.7355  | 106.9086  | 96.3294   | 89.8493   | 83.0760   | 78.9159   | 82.3530   | 86.3828   | 93.8985   | 104.0399  | 112.8886 (72)  |
| Total internal gains                                                                | 532.3492  | 545.3303  | 521.3654  | 501.9705  | 475.1528  | 454.1617  | 435.7170  | 436.7521  | 450.9059  | 470.2373  | 500.7164  | 520.7828 (73)  |

## 6. Solar gains

| [Jan]       |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c |          | Access<br>factor<br>Table 6d |          | Gains<br>W   |               |
|-------------|----------|----------|----------|------------|--------------------------------|-----------------------------------|------------------------------------|----------|------------------------------|----------|--------------|---------------|
|             |          |          |          |            |                                |                                   |                                    |          |                              |          |              |               |
| North       |          |          |          | 0.5200     | 10.6334                        | 0.6300                            | 0.7000                             |          | 0.7700                       |          | 1.6898 (74)  |               |
| East        |          |          |          | 7.4500     | 19.6403                        | 0.6300                            | 0.7000                             |          | 0.7700                       |          | 44.7173 (76) |               |
| West        |          |          |          | 5.6100     | 19.6403                        | 0.6300                            | 0.7000                             |          | 0.7700                       |          | 33.6730 (80) |               |
|             |          |          |          |            |                                |                                   |                                    |          |                              |          |              |               |
| Solar gains | 80.0801  | 156.5774 | 258.0299 | 377.1324   | 463.2613                       | 474.7867                          | 451.7822                           | 387.2956 | 300.3150                     | 185.8045 | 99.8281      | 65.8731 (83)  |
| Total gains | 612.4293 | 701.9077 | 779.3954 | 879.1029   | 938.4141                       | 928.9484                          | 887.4993                           | 824.0477 | 751.2209                     | 656.0418 | 600.5445     | 586.6559 (84) |

## 7. Mean internal temperature (heating season)

| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |         |         |         |              |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| tau                                                                         | 39.1493 | 39.2508 | 39.3508 | 39.8274 | 39.9178 | 40.3444 | 40.3444 | 40.4244 | 40.1790 | 39.9178 | 39.7352 | 39.5462      |
| alpha                                                                       | 3.6100  | 3.6167  | 3.6234  | 3.6552  | 3.6612  | 3.6896  | 3.6896  | 3.6950  | 3.6786  | 3.6612  | 3.6490  | 3.6364       |
| util living area                                                            | 0.9807  | 0.9676  | 0.9417  | 0.8747  | 0.7581  | 0.5913  | 0.4477  | 0.4964  | 0.7236  | 0.9102  | 0.9682  | 0.9833 (86)  |
| MIT                                                                         | 19.2152 | 19.4632 | 19.8386 | 20.3316 | 20.7044 | 20.9144 | 20.9764 | 20.9656 | 20.8162 | 20.3152 | 19.6886 | 19.1795 (87) |
| Th 2                                                                        | 19.9860 | 19.9884 | 19.9907 | 20.0016 | 20.0036 | 20.0131 | 20.0131 | 20.0148 | 20.0094 | 20.0036 | 19.9995 | 19.9952 (88) |
| util rest of house                                                          | 0.9767  | 0.9610  | 0.9294  | 0.8486  | 0.7094  | 0.5158  | 0.3535  | 0.3995  | 0.6539  | 0.8856  | 0.9605  | 0.9798 (89)  |
| MIT 2                                                                       | 17.9124 | 18.2270 | 18.6989 | 19.3073 | 19.7350 | 19.9538 | 20.0023 | 19.9978 | 19.8664 | 19.3030 | 18.5231 | 17.8730 (90) |
| Living area fraction                                                        | 18.1642 | 18.4659 | 18.9192 | 19.5053 | 19.9224 | 20.1395 | 20.1906 | 20.1849 | 20.0500 | 19.4987 | 18.7484 | 18.1255 (92) |
| MIT                                                                         | 18.1642 | 18.4659 | 18.9192 | 19.5053 | 19.9224 | 20.1395 | 20.1906 | 20.1849 | 20.0500 | 19.4987 | 18.7484 | 18.1255 (93) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT                                                                | 18.1642 | 18.4659 | 18.9192 | 19.5053 | 19.9224 | 20.1395 | 20.1906 | 20.1849 | 20.0500 | 19.4987 | 18.7484 | 18.1255 (93) |

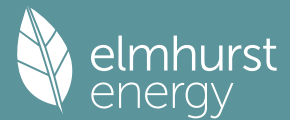
## 8. Space heating requirement

|                                                                                | Jan       | Feb       | Mar       | Apr       | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov       | Dec            |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|---------------|-----------|----------------|
| Utilisation                                                                    | 0.9664    | 0.9475    | 0.9129    | 0.8334    | 0.7050   | 0.5260   | 0.3709   | 0.4168   | 0.6571   | 0.8701        | 0.9474    | 0.9706 (94)    |
| Useful gains                                                                   | 591.8768  | 665.0715  | 711.5034  | 732.6621  | 661.6285 | 488.6394 | 329.1842 | 343.4928 | 493.6143 | 570.8523      | 568.9397  | 569.3794 (95)  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000    | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000    | 4.2000 (96)    |
| Heat loss rate W                                                               | 1332.8934 | 1300.8437 | 1187.8602 | 1002.2269 | 775.2704 | 516.7837 | 334.9706 | 352.3990 | 557.3633 | 839.0393      | 1103.3502 | 1325.3533 (97) |
| Space heating kWh                                                              | 551.3163  | 427.2389  | 354.4095  | 194.0867  | 84.5496  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 199.5311      | 384.7756  | 562.4446 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |          |          |          |          |          |               |           | 2758.3523      |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |           |          |          |          |          |          |               |           | 0.0000         |
| Space heating kWh                                                              | 551.3163  | 427.2389  | 354.4095  | 194.0867  | 84.5496  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 199.5311      | 384.7756  | 562.4446 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |          |          |          |          |          |               |           | 2758.3523      |
| Space heating per m2                                                           |           |           |           |           |          |          |          |          |          | (98c) / (4) = |           | 32.0813 (99)   |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

| Fraction of space heat from secondary/supplementary system (Table 11) |          |          |          |          |          |          |          |          |          |          |          |                |
|-----------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| Efficiency of main space heating system 1 (in %)                      |          |          |          |          |          |          |          |          |          |          |          |                |
| Efficiency of main space heating system 2 (in %)                      |          |          |          |          |          |          |          |          |          |          |          |                |
| Efficiency of secondary/supplementary heating system, %               |          |          |          |          |          |          |          |          |          |          |          |                |
|                                                                       | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec            |
| Space heating requirement                                             | 551.3163 | 427.2389 | 354.4095 | 194.0867 | 84.5496  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 199.5311 | 384.7756 | 562.4446 (98)  |
| Space heating efficiency (main heating system 1)                      | 92.4000  | 92.4000  | 92.4000  | 92.4000  | 92.4000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 92.4000  | 92.4000  | 92.4000 (210)  |
| Space heating fuel (main heating system)                              | 596.6627 | 462.3798 | 383.5601 | 210.0505 | 91.5039  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 215.9428 | 416.4238 | 608.7063 (211) |
| Space heating efficiency (main heating system 2)                      | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)   |
| Space heating fuel (main heating system 2)                            | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)   |
| Space heating fuel (secondary)                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)   |
| Water heating                                                         |          |          |          |          |          |          |          |          |          |          |          |                |
| Water heating requirement                                             | 237.5241 | 210.0522 | 223.3886 | 197.2519 | 191.7173 | 173.3276 | 171.6014 | 178.1749 | 179.8370 | 199.8169 | 211.5444 | 235.0668 (64)  |
| Efficiency of water heater                                            |          |          |          |          |          |          |          |          |          |          |          | 80.3000 (216)  |

# Full SAP Calculation Printout



|                                                                                                      |          |          |          |           |           |           |           |           |           |          |          |            |        |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|----------|------------|--------|
| (217)m                                                                                               | 86.1227  | 85.8688  | 85.3653  | 84.3468   | 82.7499   | 80.3000   | 80.3000   | 80.3000   | 80.3000   | 84.3784  | 85.6460  | 86.1795    | (217)  |
| Fuel for water heating, kWh/month                                                                    | 275.7972 | 244.6198 | 261.6854 | 233.8583  | 231.6828  | 215.8501  | 213.7004  | 221.8866  | 223.9564  | 236.8106 | 246.9985 | 272.7640   | (219)  |
| Space cooling fuel requirement                                                                       |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (221)m                                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (221)  |
| Pumps and Fa                                                                                         | 7.3041   | 6.5973   | 7.3041   | 7.0685    | 7.3041    | 7.0685    | 7.3041    | 7.0685    | 7.3041    | 7.0685   | 7.3041   | 7.0685     | (231)  |
| Lighting                                                                                             | 25.3750  | 20.3568  | 18.3290  | 13.4286   | 10.3727   | 8.4745    | 9.4623    | 12.2994   | 15.9757   | 20.9610  | 23.6755  | 26.0803    | (232)  |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (233a)m                                                                                              | -39.8696 | -56.0257 | -80.2676 | -89.9369  | -96.7057  | -90.1510  | -89.0213  | -84.1676  | -75.5697  | -63.9045 | -43.7612 | -34.4899   | (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (234a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (234a) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (235a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (235a) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (235c)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (235c) |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (233b)m                                                                                              | -23.0762 | -48.4849 | -96.2662 | -144.4459 | -190.8693 | -191.7487 | -189.5061 | -160.5221 | -117.7385 | -69.3076 | -30.7987 | -18.2537   | (233b) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (234b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (234b) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (235b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (235b) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (235d)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (235d) |
| Annual totals kWh/year                                                                               |          |          |          |           |           |           |           |           |           |          |          |            |        |
| Space heating fuel - main system 1                                                                   |          |          |          |           |           |           |           |           |           |          |          | 2985.2297  | (211)  |
| Space heating fuel - main system 2                                                                   |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (213)  |
| Space heating fuel - secondary                                                                       |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (215)  |
| Efficiency of water heater                                                                           |          |          |          |           |           |           |           |           |           |          |          | 80.3000    |        |
| Water heating fuel used                                                                              |          |          |          |           |           |           |           |           |           |          |          | 2879.6100  | (219)  |
| Space cooling fuel                                                                                   |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (221)  |
| Electricity for pumps and fans:                                                                      |          |          |          |           |           |           |           |           |           |          |          |            |        |
| Total electricity for the above, kWh/year                                                            |          |          |          |           |           |           |           |           |           |          |          | 86.0000    | (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |          |          |          |           |           |           |           |           |           |          |          | 204.7908   | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |          |          |           |           |           |           |           |           |          |          |            |        |
| PV generation                                                                                        |          |          |          |           |           |           |           |           |           |          |          | -2124.8885 | (233)  |
| Wind generation                                                                                      |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (234)  |
| Hydro-electric generation (Appendix N)                                                               |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (235a) |
| Electricity generated - Micro CHP (Appendix N)                                                       |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (235)  |
| Appendix Q - special features                                                                        |          |          |          |           |           |           |           |           |           |          |          |            |        |
| Energy saved or generated                                                                            |          |          |          |           |           |           |           |           |           |          |          | -0.0000    | (236)  |
| Energy used                                                                                          |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (237)  |
| Total delivered energy for all uses                                                                  |          |          |          |           |           |           |           |           |           |          |          | 4030.7421  | (238)  |

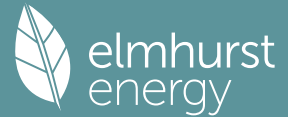
## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                               | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|-----------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1                 | 2985.2297          | 0.2100                        | 626.8982 (261)           |
| Total CO2 associated with community systems   |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                    | 2879.6100          | 0.2100                        | 604.7181 (264)           |
| Space and water heating                       |                    |                               | 1231.6163 (265)          |
| Pumps, fans and electric keep-hot             | 86.0000            | 0.1387                        | 11.9293 (267)            |
| Energy for lighting                           | 204.7908           | 0.1443                        | 29.5576 (268)            |
| Energy saving/generation technologies         |                    |                               |                          |
| PV Unit electricity used in dwelling          | -843.8706          | 0.1347                        | -113.6365                |
| PV Unit electricity exported                  | -1281.0179         | 0.1259                        | -161.3091                |
| Total                                         |                    |                               | -274.9456 (269)          |
| Total CO2, kg/year                            |                    |                               | 998.1576 (272)           |
| EPC Target Carbon Dioxide Emission Rate (TER) |                    |                               | 11.6100 (273)            |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1               | 2985.2297          | 1.1300                              | 3373.3096 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 2879.6100          | 1.1300                              | 3253.9593 (278)            |
| Space and water heating                     |                    |                                     | 6627.2689 (279)            |
| Pumps, fans and electric keep-hot           | 86.0000            | 1.5128                              | 130.1008 (281)             |
| Energy for lighting                         | 204.7908           | 1.5338                              | 314.1150 (282)             |
| Energy saving/generation technologies       |                    |                                     |                            |
| PV Unit electricity used in dwelling        | -843.8706          | 1.4977                              | -1263.8554                 |
| PV Unit electricity exported                | -1281.0179         | 0.4622                              | -592.1168                  |
| Total                                       |                    |                                     | -1855.9722 (283)           |
| Total Primary energy kWh/year               |                    |                                     | 5215.5125 (286)            |
| Target Primary Energy Rate (TPER)           |                    |                                     | 60.6600 (287)              |

# Full SAP Calculation Printout



|                                    |                                                          |               |        |      |                |            |
|------------------------------------|----------------------------------------------------------|---------------|--------|------|----------------|------------|
| Plot Reference                     | 4907-R823-9471-003                                       |               |        |      | Issued on Date | 21/07/2026 |
| Assessment Reference               | Plot 3                                                   | Plot Type Ref | Plot 3 |      |                |            |
| Plot Address                       | Plot 3, Beaconsfield-Semi, K, WC, B, ES, 1012            |               |        |      | SAP Version    | 10.2       |
|                                    |                                                          |               |        |      |                |            |
| SAP Rating                         | 90 B                                                     | DER           | 11.23  | TER  | 11.61          |            |
| Environmental                      | 90 B                                                     | % DER < TER   |        |      |                | 3.27       |
| CO <sub>2</sub> Emissions (t/year) | 0.86                                                     | DFEE          | 35.32  | TFEE | 37.71          |            |
| Compliance Check                   | See BREL                                                 | % DFEE < TFEE |        |      |                | 6.34       |
| % DPER < TPER                      | 0.39                                                     | DPER          | 60.42  | TPER | 60.66          |            |
|                                    |                                                          |               |        |      |                |            |
| Assessor Details                   | Mr. Daniel Harris                                        |               |        |      | Assessor ID    | R823-0001  |
| Client                             | Crest Nicholson Head Office, Crest Nicholson Head Office |               |        |      |                |            |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF FABRIC ENERGY EFFICIENCY

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)            | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Main dwelling                                          |                           |                                 |                             |
| Ground floor                                           | 42.9900 (1b)              | x 2.4600 (2b)                   | = 105.7554 (1b) - (3b)      |
| First floor                                            | 42.9900 (1c)              | x 2.7600 (2c)                   | = 118.6524 (1c) - (3c)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 85.9800                   |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 224.4078 (5)              |

## 2. Ventilation rate

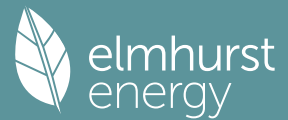
|                                                                                                    | m <sup>3</sup> per hour                            |
|----------------------------------------------------------------------------------------------------|----------------------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                               |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                               |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                               |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                               |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                               |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                               |
| Number of intermittent extract fans                                                                | 3 * 10 = 30.0000 (7a)                              |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)                               |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)                               |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | Air changes per hour<br>30.0000 / (5) = 0.1337 (8) |
| Pressure test                                                                                      | Yes                                                |
| Pressure Test Method                                                                               | Blower Door                                        |
| Measured/design AP50                                                                               | 4.5000 (17)                                        |
| Infiltration rate                                                                                  | 0.3587 (18)                                        |
| Number of sides sheltered                                                                          | 2 (19)                                             |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 0.8500 (20)            |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.3049 (21)                   |

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor                                                                                             | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate                                                                                         | 0.3887 | 0.3811 | 0.3735 | 0.3354 | 0.3277 | 0.2896 | 0.2896 | 0.2820 | 0.3049 | 0.3277 | 0.3430 | 0.3582 (22b) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.0000 (23b) |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =            |        |        |        |        |        |        |        |        |        |        |        | 0.0000 (23c) |
| Effective ac                                                                                            | 0.5756 | 0.5726 | 0.5697 | 0.5562 | 0.5537 | 0.5419 | 0.5419 | 0.5398 | 0.5465 | 0.5537 | 0.5588 | 0.5642 (25)  |

## 3. Heat losses and heat loss parameter

| Element                                                        | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K                 | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K                                        |
|----------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|------------------------------|--------------------------------|------------------------------------------------------|
| Main dwelling                                                  |                         |                            |                           |                               |                              |                                |                                                      |
| Front Door                                                     |                         |                            | 2.5500                    | 1.2000                        | 3.0600                       |                                | (26)                                                 |
| Windows                                                        |                         |                            | 10.2500                   | 1.2357                        | 12.6663                      |                                | (27)                                                 |
| French Doors                                                   |                         |                            | 3.3300                    | 1.2357                        | 4.1150                       |                                | (27)                                                 |
| GF SPVL 125TS P/A                                              |                         |                            | 42.9900                   | 0.1300                        | 5.5887                       | 75.0000                        | 3224.2500 (28a)                                      |
| EW Brick AAC011                                                | 97.2486                 | 16.1300                    | 81.1186                   | 0.1800                        | 14.6013                      | 60.0000                        | 4867.1160 (29a)                                      |
| PR 500mm MW044                                                 | 42.9900                 |                            | 42.9900                   | 0.0900                        | 3.8691                       | 9.0000                         | 386.9100 (30)                                        |
| Total net area of external elements Aum(A, m <sup>2</sup> )    |                         |                            | 183.2286                  |                               |                              |                                | (31)                                                 |
| Fabric heat loss, W/K = Sum (A x U)                            |                         |                            |                           |                               | (26)...(30) + (32) = 43.9005 |                                | (33)                                                 |
| Main dwelling                                                  |                         |                            |                           |                               |                              |                                |                                                      |
| E-WM-30                                                        |                         |                            | 43.8000                   | 0.0000                        | 0.0000                       | 45.0000                        | 1971.0000 (32)                                       |
| Timber - GF                                                    |                         |                            | 88.6100                   |                               |                              | 9.0000                         | 797.4900 (32c)                                       |
| Timber - FF                                                    |                         |                            | 126.9000                  |                               |                              | 9.0000                         | 1142.1000 (32c)                                      |
| Internal Floor FF                                              |                         |                            | 42.9900                   |                               |                              | 18.0000                        | 773.8200 (32d)                                       |
| Internal Ceiling GF                                            |                         |                            | 42.9900                   |                               |                              | 9.0000                         | 386.9100 (32e)                                       |
| Heat capacity Cm = Sum(A x k)                                  |                         |                            |                           |                               |                              |                                | (28)...(30) + (32) + (32a)...(32e) = 13549.5960 (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K |                         |                            |                           |                               |                              |                                | 157.5901 (35)                                        |

# Full SAP Calculation Printout



## List of Thermal Bridges

|                                                            | Length  | Psi-value             | Total        |
|------------------------------------------------------------|---------|-----------------------|--------------|
| K1 Element                                                 |         |                       |              |
| E2 Other lintels (including other steel lintels)           | 10.7800 | 0.0410                | 0.4420       |
| E3 Sill                                                    | 9.2000  | 0.0220                | 0.2024       |
| E4 Jamb                                                    | 21.1500 | 0.0190                | 0.4018       |
| E5 Ground floor (normal)                                   | 10.2300 | 0.0928                | 0.9493       |
| E6 Intermediate floor within a dwelling                    | 18.6300 | 0.0020                | 0.0373       |
| E10 Eaves (insulation at ceiling level)                    | 10.2500 | 0.0390                | 0.3997       |
| E18 Party wall between dwellings                           | 10.4400 | 0.0330                | 0.3445       |
| E4 Jamb                                                    | 4.8000  | 0.1000                | 0.4800       |
| E2 Other lintels (including other steel lintels)           | 1.0600  | 0.0410                | 0.0435       |
| P1 Party wall - Ground floor                               | 8.3900  | 0.1000                | 0.8390       |
| P2 Party wall - Intermediate floor within a dwelling       | 8.3900  | 0.0000                | 0.0000       |
| P4 Party wall - Roof (insulation at ceiling level)         | 8.3900  | 0.0350                | 0.2937       |
| E5 Ground floor (normal)                                   | 8.3900  | 0.0980                | 0.8222       |
| E12 Gable (insulation at ceiling level)                    | 8.3900  | 0.0870                | 0.7299       |
| E16 Corner (normal)                                        | 10.4400 | 0.0420                | 0.4385       |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |         |                       | 6.4238 (36)  |
| Point Thermal bridges                                      |         |                       | 0.0000       |
| Total fabric heat loss                                     |         | (33) + (36) + (36a) = | 50.3244 (37) |

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

|                           | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |      |
|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| (38)m                     | 42.6224 | 42.4051 | 42.1922 | 41.1919 | 41.0047 | 40.1335 | 40.1335 | 39.9722 | 40.4691 | 41.0047 | 41.3833 | 41.7791 | (38) |
| Heat transfer coeff       | 92.9467 | 92.7295 | 92.5165 | 91.5162 | 91.3291 | 90.4579 | 90.4579 | 90.2965 | 90.7935 | 91.3291 | 91.7077 | 92.1035 | (39) |
| Average = Sum(39)m / 12 = |         |         |         |         |         |         |         |         |         |         |         | 91.5153 |      |
| HLP                       | 1.0810  | 1.0785  | 1.0760  | 1.0644  | 1.0622  | 1.0521  | 1.0521  | 1.0502  | 1.0560  | 1.0622  | 1.0666  | 1.0712  | (40) |
| HLP (average)             |         |         |         |         |         |         |         |         |         |         |         | 1.0644  |      |
| Days in mont              | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31      |      |

## 4. Water heating energy requirements (kWh/year)

|                                                                                |          |         |          |         |         |         |         |         |         |         |         |          |             |
|--------------------------------------------------------------------------------|----------|---------|----------|---------|---------|---------|---------|---------|---------|---------|---------|----------|-------------|
| Assumed occupancy                                                              |          |         |          |         |         |         |         |         |         |         |         |          | 2.5666 (42) |
| Hot water usage for mixer showers                                              |          |         |          |         |         |         |         |         |         |         |         |          |             |
| 0.0000                                                                         | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000   | (42a)       |
| Hot water usage for baths                                                      |          |         |          |         |         |         |         |         |         |         |         |          |             |
| 29.0443                                                                        | 28.6130  | 28.0055 | 26.8856  | 26.0469 | 25.1170 | 24.6147 | 25.2179 | 25.8746 | 26.8697 | 28.0127 | 28.9461 | 28.9461  | (42b)       |
| Hot water usage for other uses                                                 |          |         |          |         |         |         |         |         |         |         |         |          |             |
| 40.9146                                                                        | 39.4268  | 37.9390 | 36.4512  | 34.9634 | 33.4756 | 33.4756 | 34.9634 | 36.4512 | 37.9390 | 39.4268 | 40.9146 | 40.9146  | (42c)       |
| Average daily hot water use (litres/day)                                       |          |         |          |         |         |         |         |         |         |         |         | 64.1237  | (43)        |
| Daily hot water use                                                            |          |         |          |         |         |         |         |         |         |         |         |          |             |
| 69.9589                                                                        | 68.0398  | 65.9445 | 63.3367  | 61.0103 | 58.5926 | 58.0903 | 60.1813 | 62.3258 | 64.8087 | 67.4395 | 69.8607 | 69.8607  | (44)        |
| Energy conte                                                                   | 110.7978 | 96.8877 | 101.3543 | 86.7048 | 82.1316 | 72.0464 | 70.2552 | 74.5170 | 76.8540 | 87.9448 | 96.0800 | 109.3850 | (45)        |
| Energy content (annual)                                                        |          |         |          |         |         |         |         |         |         |         |         |          |             |
| Distribution loss (46)m = 0.15 x (45)m                                         |          |         |          |         |         |         |         |         |         |         |         |          |             |
| 0.0000                                                                         | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000   | (46)        |
| Water storage loss (or HIU loss):                                              |          |         |          |         |         |         |         |         |         |         |         |          |             |
| Total storage loss                                                             |          |         |          |         |         |         |         |         |         |         |         |          |             |
| 0.0000                                                                         | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000   | (56)        |
| If cylinder contains dedicated solar storage                                   |          |         |          |         |         |         |         |         |         |         |         |          |             |
| 0.0000                                                                         | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000   | (57)        |
| Primary loss                                                                   | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000   | (59)        |
| Combi loss                                                                     | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000   | (61)        |
| Total heat required for water heating calculated for each month                |          |         |          |         |         |         |         |         |         |         |         |          |             |
| 94.1781                                                                        | 82.3546  | 86.1511 | 73.6991  | 69.8118 | 61.2394 | 59.7169 | 63.3394 | 65.3259 | 74.7530 | 81.6680 | 92.9773 | 92.9773  | (62)        |
| WWHRS                                                                          | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000   | (63a)       |
| PV diverter                                                                    | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000   | (63b)       |
| Solar input                                                                    | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000   | (63c)       |
| FGHRS                                                                          | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000   | (63d)       |
| Output from w/h                                                                |          |         |          |         |         |         |         |         |         |         |         |          |             |
| 94.1781                                                                        | 82.3546  | 86.1511 | 73.6991  | 69.8118 | 61.2394 | 59.7169 | 63.3394 | 65.3259 | 74.7530 | 81.6680 | 92.9773 | 92.9773  | (64)        |
| Total per year (kWh/year)                                                      |          |         |          |         |         |         |         |         |         |         |         |          |             |
| Electric shower(s)                                                             |          |         |          |         |         |         |         |         |         |         |         |          |             |
| 53.8586                                                                        | 47.9885  | 52.4016 | 50.0062  | 50.9446 | 48.5962 | 50.2160 | 50.9446 | 50.0062 | 52.4016 | 51.4162 | 53.8586 | 53.8586  | (64a)       |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |         |          |         |         |         |         |         |         |         |         | 612.6389 | (64a)       |
| Heat gains from water heating, kWh/month                                       |          |         |          |         |         |         |         |         |         |         |         |          |             |
| 37.0092                                                                        | 32.5858  | 34.6382 | 30.9263  | 30.1891 | 27.4589 | 27.4832 | 28.5710 | 28.8330 | 31.7887 | 33.2711 | 36.7090 | 36.7090  | (65)        |

## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |           |           |           |           |           |           |           |           |           |           |           |           |      |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------|
| Metabolic gains (Table 5), Watts                                                    |           |           |           |           |           |           |           |           |           |           |           |           |      |
| (66)m                                                                               | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     |           |           |           |           |           |           |           |           |           |           |           |           |      |
| 122.1242                                                                            | 135.2090  | 122.1242  | 126.1950  | 122.1242  | 126.1950  | 122.1242  | 122.1242  | 126.1950  | 122.1242  | 126.1950  | 122.1242  | 122.1242  | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 |           |           |           |           |           |           |           |           |           |           |           |           |      |
| 231.4847                                                                            | 233.8867  | 227.8336  | 214.9471  | 198.6802  | 183.3916  | 173.1779  | 170.7758  | 176.8289  | 189.7154  | 205.9823  | 221.2709  | 221.2709  | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    |           |           |           |           |           |           |           |           |           |           |           |           |      |
| 35.8330                                                                             | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | (69) |
| Pumps, fans                                                                         | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 |           |           |           |           |           |           |           |           |           |           |           |           |      |
| -102.6642                                                                           | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | (71) |
| Water heating gains (Table 5)                                                       |           |           |           |           |           |           |           |           |           |           |           |           |      |
| 49.7435                                                                             | 48.4907   | 46.5567   | 42.9532   | 40.5767   | 38.1374   | 36.9398   | 38.4019   | 40.0459   | 42.7267   | 46.2098   | 49.3400   | 49.3400   | (72) |
| Total internal gains                                                                |           |           |           |           |           |           |           |           |           |           |           |           |      |
| 464.8515                                                                            | 479.0855  | 458.0136  | 445.5944  | 422.8802  | 409.2230  | 393.7410  | 392.8009  | 404.5689  | 416.0654  | 439.8863  | 454.2343  | 454.2343  | (73) |

## 6. Solar gains

| [Jan] | Area<br>m <sup>2</sup> | Solar flux<br>Table 6a<br>W/m <sup>2</sup> | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W   |
|-------|------------------------|--------------------------------------------|-----------------------------------|------------------------------------|------------------------------|--------------|
| North | 0.5200                 | 10.6334                                    | 0.4500                            | 0.0000                             | 0.7700                       | 1.9159 (74)  |
| East  | 4.1200                 | 19.6403                                    | 0.4500                            | 0.0000                             | 0.7700                       | 28.0380 (76) |

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|      |        |         |        |        |        |              |
|------|--------|---------|--------|--------|--------|--------------|
| West | 5.6100 | 19.6403 | 0.4500 | 0.0000 | 0.7700 | 38.1780 (80) |
| East | 3.3300 | 19.6403 | 0.4500 | 0.0000 | 0.7700 | 22.6618 (76) |

|             |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Solar gains | 90.7938  | 177.5254 | 292.5509 | 427.5877 | 525.2396 | 538.3069 | 512.2248 | 439.1107 | 340.4932 | 210.6627 | 113.1838 | 74.6861 (83)  |
| Total gains | 555.6453 | 656.6109 | 750.5645 | 873.1821 | 948.1198 | 947.5299 | 905.9657 | 831.9116 | 745.0621 | 626.7282 | 553.0701 | 528.9203 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |                           |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |                           |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |                           |         |         |              |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep                       | Oct     | Nov     | Dec          |
| tau                                                                         | 40.4939 | 40.5888 | 40.6822 | 41.1269 | 41.2111 | 41.6081 | 41.6081 | 41.6824 | 41.4543                   | 41.2111 | 41.0410 | 40.8646      |
| alpha                                                                       | 3.6996  | 3.7059  | 3.7121  | 3.7418  | 3.7474  | 3.7739  | 3.7739  | 3.7788  | 3.7636                    | 3.7474  | 3.7361  | 3.7243       |
| util living area                                                            | 0.9855  | 0.9727  | 0.9454  | 0.8714  | 0.7439  | 0.5701  | 0.4281  | 0.4805  | 0.7169                    | 0.9168  | 0.9745  | 0.9878 (86)  |
| MIT                                                                         | 19.1984 | 19.4671 | 19.8654 | 20.3759 | 20.7404 | 20.9299 | 20.9815 | 20.9717 | 20.8332                   | 20.3238 | 19.6755 | 19.1574 (87) |
| Th 2                                                                        | 20.0164 | 20.0184 | 20.0205 | 20.0300 | 20.0318 | 20.0402 | 20.0402 | 20.0417 | 20.0369                   | 20.0318 | 20.0282 | 20.0244 (88) |
| util rest of house                                                          | 0.9825  | 0.9671  | 0.9340  | 0.8452  | 0.6953  | 0.4973  | 0.3395  | 0.3880  | 0.6482                    | 0.8938  | 0.9682  | 0.9853 (89)  |
| MIT 2                                                                       | 18.3757 | 18.6422 | 19.0331 | 19.5247 | 19.8486 | 20.0024 | 20.0336 | 20.0308 | 19.9357                   | 19.4889 | 18.8579 | 18.3409 (90) |
| Living area fraction                                                        |         |         |         |         |         |         |         |         | fLA = Living area / (4) = |         |         | 0.1933 (91)  |
| MIT                                                                         | 18.5347 | 18.8016 | 19.1940 | 19.6892 | 20.0210 | 20.1817 | 20.2168 | 20.2127 | 20.1092                   | 19.6503 | 19.0160 | 18.4987 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |                           |         |         | 0.0000       |
| adjusted MIT                                                                | 18.5347 | 18.8016 | 19.1940 | 19.6892 | 20.0210 | 20.1817 | 20.2168 | 20.2127 | 20.1092                   | 19.6503 | 19.0160 | 18.4987 (93) |

## 8. Space heating requirement

|                                                                                |           |           |           |          |          |          |          |          |          |               |           |                |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|---------------|-----------|----------------|
|                                                                                | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov       | Dec            |
| Utilisation                                                                    | 0.9762    | 0.9580    | 0.9221    | 0.8347   | 0.6947   | 0.5085   | 0.3561   | 0.4051   | 0.6538   | 0.8828        | 0.9596    | 0.9797 (94)    |
| Useful gains                                                                   | 542.4103  | 629.0130  | 692.0619  | 728.8280 | 658.6937 | 481.8426 | 322.6592 | 336.9704 | 487.1328 | 553.2769      | 530.7310  | 518.1870 (95)  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000    | 4.2000 (96)    |
| Heat loss rate W                                                               | 1323.0698 | 1289.0908 | 1174.4033 | 987.3905 | 759.9456 | 504.9113 | 327.1697 | 344.2721 | 545.5957 | 826.5572      | 1092.7849 | 1316.9609 (97) |
| Space heating kWh                                                              | 580.8107  | 443.5723  | 358.8620  | 186.1650 | 75.3314  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 203.3206      | 404.6788  | 594.2878 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |          |          |          |          |          |          |               |           | 2847.0285      |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |          |          |          |          |          |          |               |           | 0.0000         |
| Space heating kWh                                                              | 580.8107  | 443.5723  | 358.8620  | 186.1650 | 75.3314  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 203.3206      | 404.6788  | 594.2878 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |          |          |          |          |          |          |               |           | 2847.0285      |
| Space heating per m2                                                           |           |           |           |          |          |          |          |          |          | (98c) / (4) = |           | 33.1127 (99)   |

## 8c. Space cooling requirement

|                                                     |        |        |        |        |         |           |           |          |                          |         |        |                |
|-----------------------------------------------------|--------|--------|--------|--------|---------|-----------|-----------|----------|--------------------------|---------|--------|----------------|
| Calculated for June, July and August. See Table 10b |        |        |        |        |         |           |           |          |                          |         |        |                |
|                                                     | Jan    | Feb    | Mar    | Apr    | May     | Jun       | Jul       | Aug      | Sep                      | Oct     | Nov    | Dec            |
| Ext. temp.                                          | 4.3000 | 4.9000 | 6.5000 | 8.9000 | 11.7000 | 14.6000   | 16.6000   | 16.4000  | 14.1000                  | 10.6000 | 7.1000 | 4.2000         |
| Heat loss rate W                                    | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 850.3041  | 669.3883  | 686.2537 | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (100)   |
| Utilisation                                         | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 0.8666    | 0.9169    | 0.8903   | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (101)   |
| Useful loss                                         | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 736.8561  | 613.7781  | 610.9848 | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (102)   |
| Total gains                                         | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 1056.0297 | 1009.9627 | 925.8435 | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (103)   |
| Space cooling kWh                                   | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 229.8050  | 294.7614  | 234.2548 | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (104)   |
| Cooled fraction                                     |        |        |        |        |         |           |           |          | fC = cooled area / (4) = |         |        | 1.0000 (105)   |
| Intermittency factor (Table 10b)                    | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500  | 0.2500    | 0.2500    | 0.2500   | 0.2500                   | 0.2500  | 0.2500 | 0.2500 (106)   |
| Space cooling kWh                                   | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 57.4513   | 73.6903   | 58.5637  | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (107)   |
| Space cooling requirement                           |        |        |        |        |         |           |           |          |                          |         |        | 189.7053 (107) |
| Energy for space heating                            |        |        |        |        |         |           |           |          |                          |         |        | 33.1127 (99)   |
| Energy for space cooling                            |        |        |        |        |         |           |           |          |                          |         |        | 2.2064 (108)   |
| Total                                               |        |        |        |        |         |           |           |          |                          |         |        | 35.3191 (109)  |
| Fabric Energy Efficiency (DFEE)                     |        |        |        |        |         |           |           |          |                          |         |        | 35.3 (109)     |

## SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

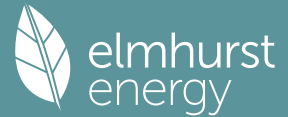
### 1. Overall dwelling characteristics

|                                                        |              |                                   |                        |
|--------------------------------------------------------|--------------|-----------------------------------|------------------------|
| Main dwelling                                          | Area (m2)    | Storey height (m)                 | Volume (m3)            |
| Ground floor                                           | 42.9900 (1b) | x 2.4600 (2b)                     | = 105.7554 (1b) - (3b) |
| First floor                                            | 42.9900 (1c) | x 2.7600 (2c)                     | = 118.6524 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 85.9800      |                                   | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 224.4078 (5)           |

### 2. Ventilation rate

|                         |             |
|-------------------------|-------------|
| Number of open chimneys | m3 per hour |
| 0 * 80 =                | 0.0000 (6a) |

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Number of open flues  
Number of chimneys / flues attached to closed fire  
Number of flues attached to solid fuel boiler  
Number of flues attached to other heater  
Number of blocked chimneys  
Number of intermittent extract fans  
Number of passive vents  
Number of flueless gas fires

0 \* 20 = 0.0000 (6b)  
0 \* 10 = 0.0000 (6c)  
0 \* 20 = 0.0000 (6d)  
0 \* 35 = 0.0000 (6e)  
0 \* 20 = 0.0000 (6f)  
3 \* 10 = 30.0000 (7a)  
0 \* 10 = 0.0000 (7b)  
0 \* 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 30.0000  
Air changes per hour  
Pressure test  
Pressure Test Method  
Measured/design AP50  
Infiltration rate  
Number of sides sheltered  
Blower Door  
Shelter factor  
Infiltration rate adjusted to include shelter factor

0.1337 (8)  
Yes  
5.0000 (17)  
0.3837 (18)  
2 (19)  
(20) = 1 - [0.075 x (19)] = 0.8500 (20)  
(21) = (18) x (20) = 0.3261 (21)

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor                                                                                             | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate                                                                                         | 0.4158 | 0.4077 | 0.3995 | 0.3587 | 0.3506 | 0.3098 | 0.3098 | 0.3017 | 0.3261 | 0.3506 | 0.3669 | 0.3832 (22b) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.0000 (23b) |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =            |        |        |        |        |        |        |        |        |        |        |        | 0.0000 (23c) |
| Effective ac                                                                                            | 0.5865 | 0.5831 | 0.5798 | 0.5643 | 0.5615 | 0.5480 | 0.5480 | 0.5455 | 0.5532 | 0.5615 | 0.5673 | 0.5734 (25)  |

### 3. Heat losses and heat loss parameter

| Element                                           | Gross m2 | Openings m2 | NetArea m2 | U-value W/m2K | A x U W/K                    | K-value kJ/m2K | A x K kJ/K    |
|---------------------------------------------------|----------|-------------|------------|---------------|------------------------------|----------------|---------------|
| Main dwelling                                     |          |             |            |               |                              |                |               |
| TER Opaque door                                   |          |             | 2.5500     | 1.0000        | 2.5500                       |                | (26)          |
| TER Opening Type                                  |          |             | 13.5800    | 1.1450        | 15.5496                      |                | (27)          |
| GF SPVL 125TS P/A                                 |          |             | 42.9900    | 0.1300        | 5.5887                       |                | (28a)         |
| EW Brick AAC011                                   | 97.2486  | 16.1300     | 81.1186    | 0.1800        | 14.6013                      |                | (29a)         |
| PR 500mm MW044                                    | 42.9900  |             | 42.9900    | 0.1100        | 4.7289                       |                | (30)          |
| Total net area of external elements Aum(A, m2)    |          |             | 183.2286   |               |                              |                | (31)          |
| Fabric heat loss, W/K = Sum (A x U)               |          |             |            |               | (26)...(30) + (32) = 43.0186 |                | (33)          |
| Main dwelling                                     |          |             |            |               |                              |                |               |
| E-WM-30                                           |          |             | 43.8000    | 0.0000        | 0.0000                       |                | (32)          |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K |          |             |            |               |                              |                | 157.5901 (35) |

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

List of Thermal Bridges

| K1 Element                                                 | Length  | Psi-value             | Total        |
|------------------------------------------------------------|---------|-----------------------|--------------|
| E2 Other lintels (including other steel lintels)           | 10.7800 | 0.0500                | 0.5390       |
| E3 Sill                                                    | 9.2000  | 0.0500                | 0.4600       |
| E4 Jamb                                                    | 21.1500 | 0.0500                | 1.0575       |
| E5 Ground floor (normal)                                   | 10.2300 | 0.1600                | 1.6368       |
| E6 Intermediate floor within a dwelling                    | 18.6300 | 0.0000                | 0.0000       |
| E10 Eaves (insulation at ceiling level)                    | 10.2500 | 0.0600                | 0.6150       |
| E18 Party wall between dwellings                           | 10.4400 | 0.0600                | 0.6264       |
| E4 Jamb                                                    | 4.8000  | 0.0500                | 0.2400       |
| E2 Other lintels (including other steel lintels)           | 1.0600  | 0.0500                | 0.0530       |
| P1 Party wall - Ground floor                               | 8.3900  | 0.0800                | 0.6712       |
| P2 Party wall - Intermediate floor within a dwelling       | 8.3900  | 0.0000                | 0.0000       |
| P4 Party wall - Roof (insulation at ceiling level)         | 8.3900  | 0.1200                | 1.0068       |
| E5 Ground floor (normal)                                   | 8.3900  | 0.1600                | 1.3424       |
| E12 Gable (insulation at ceiling level)                    | 8.3900  | 0.0600                | 0.5034       |
| E16 Corner (normal)                                        | 10.4400 | 0.0900                | 0.9396       |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |         |                       | 9.6911 (36)  |
| Point Thermal Bridges                                      |         |                       | 0.0000       |
| Total fabric heat loss                                     |         | (33) + (36) + (36a) = | 52.7097 (37) |

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

|                           | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| (38)m                     | 43.4295 | 43.1809 | 42.9372 | 41.7926 | 41.5785 | 40.5816 | 40.5816 | 40.3970 | 40.9656 | 41.5785 | 42.0117 | 42.4646 (38) |
| Heat transfer coeff       | 96.1392 | 95.8906 | 95.6469 | 94.5023 | 94.2882 | 93.2913 | 93.2913 | 93.1067 | 93.6753 | 94.2882 | 94.7214 | 95.1743 (39) |
| Average = Sum(39)m / 12 = |         |         |         |         |         |         |         |         |         |         |         | 94.5013      |
| HLP                       | 1.1182  | 1.1153  | 1.1124  | 1.0991  | 1.0966  | 1.0850  | 1.0850  | 1.0829  | 1.0895  | 1.0966  | 1.1017  | 1.1069 (40)  |
| HLP (average)             |         |         |         |         |         |         |         |         |         |         |         | 1.0991       |
| Days in mont              | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31           |

### 4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5666 (42)

Hot water usage for mixer showers 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (42a)

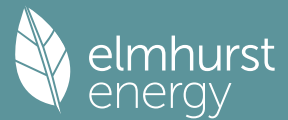
Hot water usage for baths 29.0443 28.6130 28.0055 26.8856 26.0469 25.1170 24.6147 25.2179 25.8746 26.8697 28.0127 28.9461 (42b)

Hot water usage for other uses 40.9146 39.4268 37.9390 36.4512 34.9634 33.4756 33.4756 34.9634 36.4512 37.9390 39.4268 40.9146 (42c)

Average daily hot water use (litres/day) 64.1237 (43)

|                                                                 | Jan      | Feb     | Mar      | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct                | Nov     | Dec           |
|-----------------------------------------------------------------|----------|---------|----------|---------|---------|---------|---------|---------|---------|--------------------|---------|---------------|
| Daily hot water use                                             | 69.9589  | 68.0398 | 65.9445  | 63.3367 | 61.0103 | 58.5926 | 58.0903 | 60.1813 | 62.3258 | 64.8087            | 67.4395 | 69.8607 (44)  |
| Energy conte                                                    | 110.7978 | 96.8877 | 101.3543 | 86.7048 | 82.1316 | 72.0464 | 70.2552 | 74.5170 | 76.8540 | 87.9448            | 96.0800 | 109.3850 (45) |
| Energy content (annual)                                         |          |         |          |         |         |         |         |         |         | Total = Sum(45)m = |         | 1064.9585     |
| Distribution loss (46)m = 0.15 x (45)m                          | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000             | 0.0000  | 0.0000 (46)   |
| Water storage loss (or HIU loss):                               |          |         |          |         |         |         |         |         |         |                    |         |               |
| Total storage loss                                              | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000             | 0.0000  | 0.0000 (56)   |
| If cylinder contains dedicated solar storage                    |          |         |          |         |         |         |         |         |         |                    |         |               |
| 0.0000                                                          | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000             | 0.0000  | 0.0000 (57)   |
| Primary loss                                                    | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000             | 0.0000  | 0.0000 (59)   |
| Combi loss                                                      | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000             | 0.0000  | 0.0000 (61)   |
| Total heat required for water heating calculated for each month |          |         |          |         |         |         |         |         |         |                    |         |               |

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|                                                                                         |         |         |         |         |         |         |         |         |         |         |         |                |
|-----------------------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|----------------|
| WWHRS                                                                                   | 94.1781 | 82.3546 | 86.1511 | 73.6991 | 69.8118 | 61.2394 | 59.7169 | 63.3394 | 65.3259 | 74.7530 | 81.6680 | 92.9773 (62)   |
| PV diverter                                                                             | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (63a)   |
| Solar input                                                                             | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (63b)   |
| FGHRS                                                                                   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (63c)   |
| Output from w/h                                                                         | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (63d)   |
| 12Total per year (kWh/year)                                                             | 94.1781 | 82.3546 | 86.1511 | 73.6991 | 69.8118 | 61.2394 | 59.7169 | 63.3394 | 65.3259 | 74.7530 | 81.6680 | 92.9773 (64)   |
| Electric shower(s)                                                                      | 53.8586 | 47.9885 | 52.4016 | 50.0062 | 50.9446 | 48.5962 | 50.2160 | 50.9446 | 50.0062 | 52.4016 | 51.4162 | 905.2147 (64a) |
| Heat gains from water heating, kWh/month                                                | 37.0092 | 32.5858 | 34.6382 | 30.9263 | 30.1891 | 27.4589 | 27.4832 | 28.5710 | 28.8330 | 31.7887 | 33.2711 | 36.7090 (65)   |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 905 (64) |         |         |         |         |         |         |         |         |         |         |         |                |

## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |           |           |           |           |           |           |           |           |           |           |           |           |      |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------|
| Metabolic gains (Table 5), Watts                                                    | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec       |      |
| (66)m                                                                               | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 122.1242  | 135.2090  | 122.1242  | 126.1950  | 122.1242  | 126.1950  | 122.1242  | 122.1242  | 126.1950  | 122.1242  | 126.1950  | 122.1242  | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 231.4847  | 233.8867  | 227.8336  | 214.9471  | 198.6802  | 183.3916  | 173.1779  | 170.7758  | 176.8289  | 189.7154  | 205.9823  | 221.2709  | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | (69) |
| Pumps, fans                                                                         | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | (71) |
| Water heating gains (Table 5)                                                       | 49.7435   | 48.4907   | 46.5567   | 42.9532   | 40.5767   | 38.1374   | 36.9398   | 38.4019   | 40.0459   | 42.7267   | 46.2098   | 49.3400   | (72) |
| Total internal gains                                                                | 464.8515  | 479.0855  | 458.0136  | 445.5944  | 422.8802  | 409.2230  | 393.7410  | 392.8009  | 404.5689  | 416.0654  | 439.8863  | 454.2343  | (73) |

## 6. Solar gains

| [Jan]       |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d |          |          | Gains<br>W   |               |
|-------------|----------|----------|----------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|----------|----------|--------------|---------------|
| North       |          |          |          | 0.5200     | 10.6334                        | 0.6300                            | 0.7000                             | 0.7700                       |          |          | 1.6898 (74)  |               |
| East        |          |          |          | 7.4500     | 19.6403                        | 0.6300                            | 0.7000                             | 0.7700                       |          |          | 44.7173 (76) |               |
| West        |          |          |          | 5.6100     | 19.6403                        | 0.6300                            | 0.7000                             | 0.7700                       |          |          | 33.6730 (80) |               |
|             |          |          |          |            |                                |                                   |                                    |                              |          |          |              |               |
| Solar gains | 80.0801  | 156.5774 | 258.0299 | 377.1324   | 463.2613                       | 474.7867                          | 451.7822                           | 387.2956                     | 300.3150 | 185.8045 | 99.8281      | 65.8731 (83)  |
| Total gains | 544.9316 | 635.6629 | 716.0435 | 822.7268   | 886.1415                       | 884.0097                          | 845.5232                           | 780.0965                     | 704.8839 | 601.8700 | 539.7144     | 520.1074 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |                           |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |                           |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |                           |         |         |              |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep                       | Oct     | Nov     | Dec          |
| tau                                                                         | 39.1493 | 39.2508 | 39.3508 | 39.8274 | 39.9178 | 40.3444 | 40.3444 | 40.4244 | 40.1790                   | 39.9178 | 39.7352 | 39.5462      |
| alpha                                                                       | 3.6100  | 3.6167  | 3.6234  | 3.6552  | 3.6612  | 3.6896  | 3.6896  | 3.6950  | 3.6786                    | 3.6612  | 3.6490  | 3.6364       |
| util living area                                                            | 0.9865  | 0.9758  | 0.9537  | 0.8926  | 0.7813  | 0.6142  | 0.4675  | 0.5203  | 0.7510                    | 0.9279  | 0.9768  | 0.9886 (86)  |
| MIT                                                                         | 19.1033 | 19.3585 | 19.7479 | 20.2698 | 20.6704 | 20.9030 | 20.9728 | 20.9598 | 20.7906                   | 20.2461 | 19.5919 | 19.0678 (87) |
| Th 2                                                                        | 19.9860 | 19.9884 | 19.9907 | 20.0016 | 20.0036 | 20.0131 | 20.0131 | 20.0148 | 20.0094                   | 20.0036 | 19.9995 | 19.9952 (88) |
| util rest of house                                                          | 0.9837  | 0.9707  | 0.9436  | 0.8690  | 0.7344  | 0.5378  | 0.3701  | 0.4202  | 0.6830                    | 0.9069  | 0.9710  | 0.9861 (89)  |
| MIT 2                                                                       | 18.2597 | 18.5135 | 18.8974 | 19.4051 | 19.7676 | 19.9601 | 20.0033 | 19.9992 | 19.8803                   | 19.3949 | 18.7549 | 18.2310 (90) |
| Living area fraction                                                        | 18.4227 | 18.6769 | 19.0618 | 19.5722 | 19.9421 | 20.1424 | 20.1907 | 20.1849 | fLA = Living area / (4) = |         |         | 0.1933 (91)  |
| MIT                                                                         | 18.4227 | 18.6769 | 19.0618 | 19.5722 | 19.9421 | 20.1424 | 20.1907 | 20.1849 | 20.0563                   | 19.5595 | 18.9167 | 18.3928 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |                           |         |         | 0.0000       |
| adjusted MIT                                                                | 18.4227 | 18.6769 | 19.0618 | 19.5722 | 19.9421 | 20.1424 | 20.1907 | 20.1849 | 20.0563                   | 19.5595 | 18.9167 | 18.3928 (93) |

## 8. Space heating requirement

|                                                                                | Jan       | Feb       | Mar       | Apr       | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov       | Dec            |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|---------------|-----------|----------------|
| Utilisation                                                                    | 0.9775    | 0.9619    | 0.9318    | 0.8571    | 0.7312   | 0.5484   | 0.3882   | 0.4383   | 0.6866   | 0.8953        | 0.9626    | 0.9806 (94)    |
| Useful gains                                                                   | 532.6641  | 611.4355  | 667.2347  | 705.1576  | 647.9515 | 484.7750 | 328.2506 | 341.8920 | 483.9413 | 538.8802      | 519.5179  | 510.0403 (95)  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000    | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000    | 4.2000 (96)    |
| Heat loss rate W                                                               |           |           |           |           |          |          |          |          |          |               |           |                |
| Space heating kWh                                                              | 1357.7491 | 1321.0714 | 1201.4939 | 1008.5514 | 777.1325 | 517.0536 | 334.9803 | 352.3964 | 557.9565 | 844.7715      | 1119.2913 | 1350.7856 (97) |
| Space heating requirement - total per year (kWh/year)                          | 613.8633  | 476.8753  | 397.4888  | 218.4435  | 96.1106  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 227.5831      | 431.8369  | 625.5145 (98a) |
| Solar heating kWh                                                              |           |           |           |           |          |          |          |          |          |               |           | 3087.7160      |
| Space heating contribution - total per year (kWh/year)                         | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | 0.0000 (98b)   |
| Space heating kWh                                                              |           |           |           |           |          |          |          |          |          |               |           | 0.0000         |
| Space heating requirement after solar contribution - total per year (kWh/year) | 613.8633  | 476.8753  | 397.4888  | 218.4435  | 96.1106  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 227.5831      | 431.8369  | 625.5145 (98c) |
| Space heating per m2                                                           |           |           |           |           |          |          |          |          |          |               |           | 3087.7160      |
|                                                                                |           |           |           |           |          |          |          |          |          | (98c) / (4) = |           | 35.9120 (99)   |

## 8c. Space cooling requirement

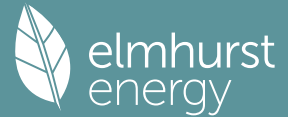
|                                                     |        |        |        |        |         |          |          |          |         |         |        |              |
|-----------------------------------------------------|--------|--------|--------|--------|---------|----------|----------|----------|---------|---------|--------|--------------|
| Calculated for June, July and August. See Table 10b |        |        |        |        |         |          |          |          |         |         |        |              |
|                                                     | Jan    | Feb    | Mar    | Apr    | May     | Jun      | Jul      | Aug      | Sep     | Oct     | Nov    | Dec          |
| Ext. temp.                                          | 4.3000 | 4.9000 | 6.5000 | 8.9000 | 11.7000 | 14.6000  | 16.6000  | 16.4000  | 14.1000 | 10.6000 | 7.1000 | 4.2000       |
| Heat loss rate W                                    | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 876.9380 | 690.3555 | 707.6107 | 0.0000  | 0.0000  | 0.0000 | 0.0000 (100) |
| Utilisation                                         | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 0.8288   | 0.8886   | 0.8582   | 0.0000  | 0.0000  | 0.0000 | 0.0000 (101) |

# Full SAP Calculation Printout



|                                  |        |        |        |        |        |          |          |          |                          |        |        |                |
|----------------------------------|--------|--------|--------|--------|--------|----------|----------|----------|--------------------------|--------|--------|----------------|
| Useful loss                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 726.7920 | 613.4739 | 607.2711 | 0.0000                   | 0.0000 | 0.0000 | 0.0000 (102)   |
| Total gains                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 981.7853 | 939.3156 | 865.2804 | 0.0000                   | 0.0000 | 0.0000 | 0.0000 (103)   |
| Space cooling kWh                |        |        |        |        |        |          |          |          |                          |        |        |                |
|                                  | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 183.5952 | 242.4262 | 191.9589 | 0.0000                   | 0.0000 | 0.0000 | 0.0000 (104)   |
| Cooled fraction                  |        |        |        |        |        |          |          |          | fC = cooled area / (4) = |        |        | 1.0000 (105)   |
| Intermittency factor (Table 10b) |        |        |        |        |        |          |          |          |                          |        |        |                |
|                                  | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500   | 0.2500   | 0.2500   | 0.2500                   | 0.2500 | 0.2500 | 0.2500 (106)   |
| Space cooling kWh                |        |        |        |        |        |          |          |          |                          |        |        |                |
|                                  | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 45.8988  | 60.6066  | 47.9897  | 0.0000                   | 0.0000 | 0.0000 | 0.0000 (107)   |
| Space cooling requirement        |        |        |        |        |        |          |          |          |                          |        |        | 154.4951 (107) |
| Energy for space heating         |        |        |        |        |        |          |          |          |                          |        |        | 35.9120 (99)   |
| Energy for space cooling         |        |        |        |        |        |          |          |          |                          |        |        | 1.7969 (108)   |
| Total                            |        |        |        |        |        |          |          |          |                          |        |        | 37.7089 (109)  |
| Fabric Energy Efficiency (TFEE)  |        |        |        |        |        |          |          |          |                          |        |        | 37.7 (109)     |

# Full SAP Calculation Printout



|                                    |                                                          |               |        |                |            |
|------------------------------------|----------------------------------------------------------|---------------|--------|----------------|------------|
| Plot Reference                     | 4907-R823-9471-003                                       |               |        | Issued on Date | 21/07/2026 |
| Assessment Reference               | Plot 3                                                   | Plot Type Ref | Plot 3 |                |            |
| Plot Address                       | Plot 3, Beaconsfield-Semi, K, WC, B, ES, 1012            |               |        | SAP Version    | 10.2       |
| SAP Rating                         | 90 B                                                     | DER           | 11.23  | TER            | 11.61      |
| Environmental                      | 90 B                                                     | % DER < TER   |        | 3.27           |            |
| CO <sub>2</sub> Emissions (t/year) | 0.86                                                     | DFEE          | 35.32  | TFEE           | 37.71      |
| Compliance Check                   | See BREL                                                 | % DFEE < TFEE |        | 6.34           |            |
| % DPER < TPER                      | 0.39                                                     | DPER          | 60.42  | TPER           | 60.66      |
| Assessor Details                   | Mr. Daniel Harris                                        |               |        | Assessor ID    | R823-0001  |
| Client                             | Crest Nicholson Head Office, Crest Nicholson Head Office |               |        |                |            |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)              | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|-----------------------------------|-----------------------------|
| Main dwelling                                          |                           |                                   |                             |
| Ground floor                                           | 42.9900 (1b)              | x 2.4600 (2b)                     | = 105.7554 (1b) - (3b)      |
| First floor                                            | 42.9900 (1c)              | x 2.7600 (2c)                     | = 118.6524 (1c) - (3c)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 85.9800                   |                                   | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 224.4078 (5)                |

## 2. Ventilation rate

|                                                                                                    | m <sup>3</sup> per hour                 |
|----------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                    |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                    |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                    |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                    |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                    |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                    |
| Number of intermittent extract fans                                                                | 0 * 10 = 0.0000 (7a)                    |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)                    |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 0.0000 / (5) = 0.0000 (8)               |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 4.5000 (17)                             |
| Infiltration rate                                                                                  | 0.2250 (18)                             |
| Number of sides sheltered                                                                          | 2 (19)                                  |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 0.8500 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.1913 (21)        |

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor                                                                                             | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate                                                                                         | 0.2438 | 0.2391 | 0.2343 | 0.2104 | 0.2056 | 0.1817 | 0.1817 | 0.1769 | 0.1913 | 0.2056 | 0.2152 | 0.2247 (22b) |
| Mechanical extract ventilation - decentralised                                                          |        |        |        |        |        |        |        |        |        |        |        |              |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 (25)  |

## 3. Heat losses and heat loss parameter

| Element                                                      | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K   |
|--------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|-----------------|
| Main dwelling                                                |                         |                            |                           |                               |              |                                |                 |
| Front Door                                                   |                         |                            | 2.5500                    | 1.2000                        | 3.0600       |                                | (26)            |
| Windows                                                      |                         |                            | 10.2500                   | 1.2357                        | 12.6663      |                                | (27)            |
| French Doors                                                 |                         |                            | 3.3300                    | 1.2357                        | 4.1150       |                                | (27)            |
| GF SPVL 125TS P/A                                            |                         |                            | 42.9900                   | 0.1300                        | 5.5887       | 75.0000                        | 3224.2500 (28a) |
| EW Brick AAC011                                              | 97.2486                 | 16.1300                    | 81.1186                   | 0.1800                        | 14.6013      | 60.0000                        | 4867.1160 (29a) |
| PR 500mm MW044                                               | 42.9900                 |                            | 42.9900                   | 0.0900                        | 3.8691       | 9.0000                         | 386.9100 (30)   |
| Total net area of external elements Aum (A, m <sup>2</sup> ) |                         |                            | 183.2286                  |                               |              |                                | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                          |                         |                            | (26)...(30) + (32) =      |                               | 43.9005      |                                | (33)            |
| Main dwelling                                                |                         |                            |                           |                               |              |                                |                 |
| E-WM-30                                                      |                         |                            | 43.8000                   | 0.0000                        | 0.0000       | 45.0000                        | 1971.0000 (32)  |
| Timber - GF                                                  |                         |                            | 88.6100                   |                               |              | 9.0000                         | 797.4900 (32c)  |
| Timber - FF                                                  |                         |                            | 126.9000                  |                               |              | 9.0000                         | 1142.1000 (32c) |
| Internal Floor FF                                            |                         |                            | 42.9900                   |                               |              | 18.0000                        | 773.8200 (32d)  |
| Internal Ceiling GF                                          |                         |                            | 42.9900                   |                               |              | 9.0000                         | 386.9100 (32e)  |

# Full SAP Calculation Printout



Heat capacity  $C_m = \text{Sum}(A \times k)$   
Thermal mass parameter (TMP) =  $C_m / \text{TFA}$  in  $\text{kJ/m}^2\text{K}$   
List of Thermal Bridges

|                                                      | Length  | Psi-value | Total  |
|------------------------------------------------------|---------|-----------|--------|
| K1 Element                                           |         |           |        |
| E2 Other lintels (including other steel lintels)     | 10.7800 | 0.0410    | 0.4420 |
| E3 Sill                                              | 9.2000  | 0.0220    | 0.2024 |
| E4 Jamb                                              | 21.1500 | 0.0190    | 0.4018 |
| E5 Ground floor (normal)                             | 10.2300 | 0.0928    | 0.9493 |
| E6 Intermediate floor within a dwelling              | 18.6300 | 0.0020    | 0.0373 |
| E10 Eaves (insulation at ceiling level)              | 10.2500 | 0.0390    | 0.3997 |
| E18 Party wall between dwellings                     | 10.4400 | 0.0330    | 0.3445 |
| E4 Jamb                                              | 4.8000  | 0.1000    | 0.4800 |
| E2 Other lintels (including other steel lintels)     | 1.0600  | 0.0410    | 0.0435 |
| P1 Party wall - Ground floor                         | 8.3900  | 0.1000    | 0.8390 |
| P2 Party wall - Intermediate floor within a dwelling | 8.3900  | 0.0000    | 0.0000 |
| P4 Party wall - Roof (insulation at ceiling level)   | 8.3900  | 0.0350    | 0.2937 |
| E5 Ground floor (normal)                             | 8.3900  | 0.0980    | 0.8222 |
| E12 Gable (insulation at ceiling level)              | 8.3900  | 0.0870    | 0.7299 |
| E16 Corner (normal)                                  | 10.4400 | 0.0420    | 0.4385 |

Thermal bridges (Sum(L x Psi) calculated using Appendix K)  
Point Thermal bridges (36a) = 6.4238 (36)  
Total fabric heat loss (33) + (36) + (36a) = 50.3244 (37)

|                                                                                        |         |         |         |         |         |         |         |         |         |         |         |         |      |
|----------------------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)\text{m} \times (5)$ | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |      |
| (38)m                                                                                  | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | (38) |
| Heat transfer coeff                                                                    | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | (39) |
| Average = Sum(39)m / 12 =                                                              |         |         |         |         |         |         |         |         |         |         |         | 87.3516 | (39) |
| HLP                                                                                    | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |      |
| HLP (average)                                                                          | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | (40) |
| Days in mont                                                                           | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31      |      |

## 4. Water heating energy requirements (kWh/year)

|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------------|-----------|-------------|
| Assumed occupancy                                               |          |          |          |          |          |          |          |          |          |          |            |           | 2.5666 (42) |
| Hot water usage for mixer showers                               |          |          |          |          |          |          |          |          |          |          |            |           |             |
| 67.2533                                                         | 66.2426  | 64.7698  | 61.9519  | 59.8724  | 57.5533  | 56.2352  | 57.6968  | 59.2990  | 61.7890  | 64.6674  | 66.9956    | (42a)     |             |
| Hot water usage for baths                                       |          |          |          |          |          |          |          |          |          |          |            |           |             |
| 29.0443                                                         | 28.6130  | 28.0055  | 26.8856  | 26.0469  | 25.1170  | 24.6147  | 25.2179  | 25.8746  | 26.8697  | 28.0127  | 28.9461    | (42b)     |             |
| Hot water usage for other uses                                  |          |          |          |          |          |          |          |          |          |          |            |           |             |
| 40.9146                                                         | 39.4268  | 37.9390  | 36.4512  | 34.9634  | 33.4756  | 33.4756  | 34.9634  | 36.4512  | 37.9390  | 39.4268  | 40.9146    | (42c)     |             |
| Average daily hot water use (litres/day)                        |          |          |          |          |          |          |          |          |          |          |            | 126.1290  | (43)        |
| Daily hot water use                                             | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov        | Dec       |             |
| 137.2122                                                        | 134.2823 | 130.7143 | 125.2887 | 120.8827 | 116.1459 | 114.3255 | 117.8781 | 121.6248 | 126.5977 | 132.1069 | 136.8563   | (44)      |             |
| Energy conte                                                    | 217.3105 | 191.2162 | 200.9030 | 171.5139 | 162.7313 | 142.8150 | 138.2667 | 145.9577 | 149.9756 | 171.7918 | 188.2105   | 214.2839  | (45)        |
| Energy content (annual)                                         |          |          |          |          |          |          |          |          |          | Total =  | Sum(45)m = | 2094.9763 |             |
| Distribution loss (46)m = 0.15 x (45)m                          |          |          |          |          |          |          |          |          |          |          |            |           |             |
| 32.5966                                                         | 28.6824  | 30.1355  | 25.7271  | 24.4097  | 21.4222  | 20.7400  | 21.8937  | 22.4963  | 25.7688  | 28.2316  | 32.1426    | (46)      |             |
| Water storage loss (or HIU loss):                               |          |          |          |          |          |          |          |          |          |          |            |           |             |
| Total storage loss                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | 0.0000    | (56)        |
| If cylinder contains dedicated solar storage                    |          |          |          |          |          |          |          |          |          |          |            |           |             |
| 0.0000                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | 0.0000    | (57)        |
| Primary loss                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | 0.0000    | (59)        |
| Combi loss                                                      | 11.9874  | 10.8167  | 11.9530  | 11.5193  | 11.8728  | 11.4590  | 11.8214  | 11.8376  | 11.4740  | 11.8918  | 11.5543    | 11.9811   | (61)        |
| Total heat required for water heating calculated for each month |          |          |          |          |          |          |          |          |          |          |            |           |             |
| 229.2979                                                        | 202.0330 | 212.8560 | 183.0332 | 174.6042 | 154.2740 | 150.0882 | 157.7953 | 161.4496 | 183.6836 | 199.7649 | 226.2650   | (62)      |             |
| WWHRS                                                           | -29.9438 | -26.4825 | -27.7310 | -22.9624 | -21.4001 | -18.3122 | -17.1648 | -18.2530 | -18.9465 | -22.3359 | -25.3038   | -29.3893  | (63a)       |
| PV diverter                                                     | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000    | -0.0000   | (63b)       |
| Solar input                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | 0.0000    | (63c)       |
| FGHRS                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | 0.0000    | (63d)       |
| Output from w/h                                                 | 199.3541 | 175.5504 | 185.1250 | 160.0708 | 153.2041 | 135.9618 | 132.9234 | 139.5422 | 142.5031 | 161.3478 | 174.4610   | 196.8757  | (64)        |
| 12Total per year (kWh/year)                                     |          |          |          |          |          |          |          |          |          |          |            |           |             |
| Electric shower(s)                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | 0.0000    | (64a)       |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
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|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
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|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |

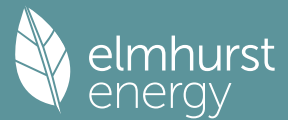
## 5. Internal gains (see Table 5 and 5a)

| Metabolic gains (Table 5), Watts                                                    |           |           |           |           |           |           |           |           |           |           |           |           |      |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------|
|                                                                                     | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec       |      |
| (66)m                                                                               | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 122.1242  | 135.2090  | 122.1242  | 126.1950  | 122.1242  | 126.1950  | 122.1242  | 122.1242  | 126.1950  | 122.1242  | 126.1950  | 122.1242  | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 231.4847  | 233.8867  | 227.8336  | 214.9471  | 198.6802  | 183.3916  | 173.1779  | 170.7758  | 176.8289  | 189.7154  | 205.9823  | 221.2709  | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | (69) |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 3.0000    | 3.0000    | 3.0000    | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | (71) |
| Water heating gains (Table 5)                                                       | 101.1460  | 98.6363   | 93.8018   | 83.2058   | 76.7156   | 69.9316   | 65.7649   | 69.2074   | 73.2436   | 80.7712   | 90.9286   | 99.7912   | (72) |
| Total internal gains                                                                | 519.2539  | 532.2311  | 508.2586  | 488.8470  | 462.0190  | 441.0172  | 422.5660  | 423.6065  | 437.7667  | 457.1099  | 487.6050  | 507.6854  | (73) |

## 6. Solar gains

| [Jan] | Area<br>m <sup>2</sup> | Solar flux<br>Table 6a<br>W/m <sup>2</sup> | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W |
|-------|------------------------|--------------------------------------------|-----------------------------------|------------------------------------|------------------------------|------------|
|-------|------------------------|--------------------------------------------|-----------------------------------|------------------------------------|------------------------------|------------|

# Full SAP Calculation Printout



|       |  |  |        |  |         |  |        |  |        |  |        |  |              |
|-------|--|--|--------|--|---------|--|--------|--|--------|--|--------|--|--------------|
| North |  |  | 0.5200 |  | 10.6334 |  | 0.4500 |  | 0.0000 |  | 0.7700 |  | 1.9159 (74)  |
| East  |  |  | 4.1200 |  | 19.6403 |  | 0.4500 |  | 0.0000 |  | 0.7700 |  | 28.0380 (76) |
| West  |  |  | 5.6100 |  | 19.6403 |  | 0.4500 |  | 0.0000 |  | 0.7700 |  | 38.1780 (80) |
| East  |  |  | 3.3300 |  | 19.6403 |  | 0.4500 |  | 0.0000 |  | 0.7700 |  | 22.6618 (76) |

|             |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Solar gains | 90.7938  | 177.5254 | 292.5509 | 427.5877 | 525.2396 | 538.3069 | 512.2248 | 439.1107 | 340.4932 | 210.6627 | 113.1838 | 74.6861 (83)  |
| Total gains | 610.0477 | 709.7565 | 800.8095 | 916.4347 | 987.2586 | 979.3241 | 934.7908 | 862.7171 | 778.2599 | 667.7726 | 600.7889 | 582.3715 (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)  
Utilisation factor for gains for living area, nil,m (see Table 9a)

|                        | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep                       | Oct     | Nov     | Dec          |             |
|------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|--------------|-------------|
| tau                    | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876                   | 43.0876 | 43.0876 | 43.0876      |             |
| alpha                  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725                    | 3.8725  | 3.8725  | 3.8725       |             |
| util living area       | 0.9798  | 0.9636  | 0.9302  | 0.8473  | 0.7111  | 0.5410  | 0.4033  | 0.4525  | 0.6833                    | 0.8964  | 0.9658  | 0.9830 (86)  |             |
| MIT                    | 19.2294 | 19.5145 | 19.9273 | 20.4232 | 20.7732 | 20.9398 | 20.9849 | 20.9765 | 20.8541                   | 20.3629 | 19.6964 | 19.1595 (87) |             |
| Th 2                   | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701                   | 20.0701 | 20.0701 | 20.0701 (88) |             |
| util rest of house     | 0.9758  | 0.9565  | 0.9166  | 0.8189  | 0.6624  | 0.4719  | 0.3215  | 0.3665  | 0.6154                    | 0.8701  | 0.9578  | 0.9795 (89)  |             |
| MIT 2                  | 18.2387 | 18.5572 | 19.0135 | 19.5427 | 19.8895 | 20.0334 | 20.0639 | 20.0598 | 19.9704                   | 19.4937 | 18.7649 | 18.1601 (90) |             |
| Living area fraction   |         |         |         |         |         |         |         |         | FLA = Living area / (4) = |         |         |              | 0.1933 (91) |
| MIT                    | 18.4302 | 18.7422 | 19.1901 | 19.7129 | 20.0603 | 20.2086 | 20.2419 | 20.2370 | 20.1413                   | 19.6618 | 18.9449 | 18.3533 (92) |             |
| Temperature adjustment |         |         |         |         |         |         |         |         |                           |         |         | 0.0000       |             |
| adjusted MIT           | 18.4302 | 18.7422 | 19.1901 | 19.7129 | 20.0603 | 20.2086 | 20.2419 | 20.2370 | 20.1413                   | 19.6618 | 18.9449 | 18.3533 (93) |             |

## 8. Space heating requirement

|                                                                                | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov       | Dec            |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|---------------|-----------|----------------|
| Utilisation                                                                    | 0.9659    | 0.9433    | 0.9009    | 0.8066   | 0.6619   | 0.4826   | 0.3368   | 0.3823   | 0.6210   | 0.8563        | 0.9450    | 0.9706 (94)    |
| Useful gains                                                                   | 589.2343  | 669.5074  | 721.4185  | 739.1854 | 653.4650 | 472.5763 | 314.8829 | 329.8467 | 483.2849 | 571.8229      | 567.7573  | 565.2396 (95)  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000    | 4.2000 (96)    |
| Heat loss rate W                                                               | 1234.2958 | 1209.1430 | 1108.5013 | 944.5263 | 730.2867 | 489.9196 | 318.1297 | 335.1670 | 527.7137 | 791.5589      | 1034.6738 | 1236.3150 (97) |
| Space heating kWh                                                              | 479.9257  | 362.6351  | 287.9896  | 147.8455 | 57.1553  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 163.4836      | 336.1799  | 499.2802 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |          |          |          |          |          |          |               |           | 2334.4949      |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |          |          |          |          |          |          |               |           | 0.0000         |
| Space heating kWh                                                              | 479.9257  | 362.6351  | 287.9896  | 147.8455 | 57.1553  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 163.4836      | 336.1799  | 499.2802 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |          |          |          |          |          |          |               |           | 2334.4949      |
| Space heating per m2                                                           |           |           |           |          |          |          |          |          |          | (98c) / (4) = |           | 27.1516 (99)   |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

| Fraction of space heat from secondary/supplementary system (Table 11)                                        |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (201)    |
|--------------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Fraction of space heat from main system(s)                                                                   |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (202)    |
| Efficiency of main space heating system 1 (in %)                                                             |          |          |          |          |          |          |          |          |          |          |          | 91.7000 (206)   |
| Efficiency of main space heating system 2 (in %)                                                             |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)    |
| Efficiency of secondary/supplementary heating system, %                                                      |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)    |
|                                                                                                              | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec             |
| Space heating requirement                                                                                    | 479.9257 | 362.6351 | 287.9896 | 147.8455 | 57.1553  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 163.4836 | 336.1799 | 499.2802 (98)   |
| Space heating efficiency (main heating system 1)                                                             | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 91.7000  | 91.7000  | 91.7000 (210)   |
| Space heating fuel (main heating system)                                                                     | 523.3650 | 395.4581 | 314.0563 | 161.2273 | 62.3286  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 178.2809 | 366.6084 | 544.4713 (211)  |
| Space heating efficiency (main heating system 2)                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)    |
| Space heating fuel (main heating system 2)                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)    |
| Space heating fuel (secondary)                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)    |
| Water heating                                                                                                |          |          |          |          |          |          |          |          |          |          |          |                 |
| Water heating requirement                                                                                    | 199.3541 | 175.5504 | 185.1250 | 160.0708 | 153.2041 | 135.9618 | 132.9234 | 139.5422 | 142.5031 | 161.3478 | 174.4610 | 196.8757 (64)   |
| Efficiency of water heater (217)m                                                                            | 88.1732  | 88.1039  | 87.9663  | 87.6958  | 87.2607  | 86.7000  | 86.7000  | 86.7000  | 86.7000  | 87.7443  | 88.0712  | 86.7000 (216)   |
| Fuel for water heating, kWh/month                                                                            | 226.0938 | 199.2538 | 210.4500 | 182.5297 | 175.5705 | 156.8186 | 153.3142 | 160.9484 | 164.3635 | 183.8840 | 198.0909 | 223.2255 (219)  |
| Space cooling fuel requirement (221)m                                                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)    |
| Pumps and Fa                                                                                                 | 10.9478  | 9.8883   | 10.9478  | 10.9478  | 10.9478  | 10.9478  | 10.9478  | 10.9478  | 10.9478  | 10.9478  | 10.9478  | 10.9478 (231)   |
| Lighting                                                                                                     | 23.4106  | 18.7809  | 16.9101  | 12.3891  | 9.5697   | 7.8185   | 8.7298   | 11.3473  | 14.7390  | 19.3384  | 21.8427  | 24.0613 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity) (233a)m                                        | -11.5165 | -19.1763 | -33.0031 | -43.5351 | -52.0099 | -50.4050 | -49.4409 | -43.7568 | -34.6383 | -24.0771 | -13.4902 | -9.5519 (233a)  |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)   |
| Electricity generated by PVs (Appendix M) (negative quantity) (233b)m                                        | -2.7365  | -6.8505  | -16.7864 | -30.3061 | -44.7949 | -46.9105 | -45.6945 | -35.7548 | -22.5599 | -10.7273 | -3.8701  | -2.0623 (233b)  |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234b)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235d)   |
| Annual totals kWh/year                                                                                       |          |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating fuel - main system 1                                                                           |          |          |          |          |          |          |          |          |          |          |          | 2545.7960 (211) |
| Space heating fuel - main system 2                                                                           |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)    |
| Space heating fuel - secondary                                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)    |
| Efficiency of water heater                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 86.7000         |

# Full SAP Calculation Printout



|                                                                                         |                 |
|-----------------------------------------------------------------------------------------|-----------------|
| Water heating fuel used                                                                 | 2234.5429 (219) |
| Space cooling fuel                                                                      | 0.0000 (221)    |
| Electricity for pumps and fans:                                                         |                 |
| (MEVDecentralised, Database: total watage = 5.7980, total flow = 37.0000, SFP = 0.1567) |                 |
| mechanical ventilation fans (SFP = 0.1567)                                              | 42.9017 (230a)  |
| central heating pump                                                                    | 41.0000 (230c)  |
| main heating flue fan                                                                   | 45.0000 (230e)  |
| Total electricity for the above, kWh/year                                               | 128.9017 (231)  |
| Electricity for lighting (calculated in Appendix L)                                     | 188.9373 (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                           |                 |
| PV generation                                                                           | -653.6551 (233) |
| Wind generation                                                                         | 0.0000 (234)    |
| Hydro-electric generation (Appendix N)                                                  | 0.0000 (235a)   |
| Electricity generated - Micro CHP (Appendix N)                                          | 0.0000 (235)    |
| Appendix Q - special features                                                           |                 |
| Energy saved or generated                                                               | -0.0000 (236)   |
| Energy used                                                                             | 0.0000 (237)    |
| Total delivered energy for all uses                                                     | 4444.5227 (238) |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                                 | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |  |
|-------------------------------------------------|--------------------|-------------------------------|--------------------------|--|
| Space heating - main system 1                   | 2545.7960          | 0.2100                        | 534.6172 (261)           |  |
| Total CO2 associated with community systems     |                    |                               | 0.0000 (373)             |  |
| Water heating (other fuel)                      | 2234.5429          | 0.2100                        | 469.2540 (264)           |  |
| Space and water heating                         |                    |                               | 1003.8712 (265)          |  |
| Pumps, fans and electric keep-hot               | 128.9017           | 0.1387                        | 17.8803 (267)            |  |
| Energy for lighting                             | 188.9373           | 0.1443                        | 27.2695 (268)            |  |
| Energy saving/generation technologies           |                    |                               |                          |  |
| PV Unit electricity used in dwelling            | -384.6011          | 0.1316                        | -50.6173                 |  |
| PV Unit electricity exported                    | -269.0539          | 0.1216                        | -32.7148                 |  |
| Total                                           |                    |                               | -83.3322 (269)           |  |
| Total CO2, kg/year                              |                    |                               | 965.6887 (272)           |  |
| EPC Dwelling Carbon Dioxide Emission Rate (DER) |                    |                               | 11.2300 (273)            |  |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |  |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|--|
| Space heating - main system 1               | 2545.7960          | 1.1300                              | 2876.7494 (275)            |  |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |  |
| Water heating (other fuel)                  | 2234.5429          | 1.1300                              | 2525.0334 (278)            |  |
| Space and water heating                     |                    |                                     | 5401.7829 (279)            |  |
| Pumps, fans and electric keep-hot           | 128.9017           | 1.5128                              | 195.0025 (281)             |  |
| Energy for lighting                         | 188.9373           | 1.5338                              | 289.7983 (282)             |  |
| Energy saving/generation technologies       |                    |                                     |                            |  |
| PV Unit electricity used in dwelling        | -384.6011          | 1.4862                              | -571.6091                  |  |
| PV Unit electricity exported                | -269.0539          | 0.4461                              | -120.0268                  |  |
| Total                                       |                    |                                     | -691.6359 (283)            |  |
| Total Primary energy kWh/year               |                    |                                     | 5194.9477 (286)            |  |
| Dwelling Primary energy Rate (DPER)         |                    |                                     | 60.4200 (287)              |  |

## SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF TARGET EMISSIONS

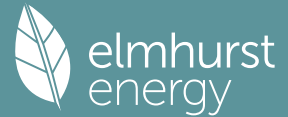
### 1. Overall dwelling characteristics

|                                                         | Area<br>(m2) | Storey height<br>(m)               | Volume<br>(m3)         |  |
|---------------------------------------------------------|--------------|------------------------------------|------------------------|--|
| Main dwelling                                           |              |                                    |                        |  |
| Ground floor                                            | 42.9900 (1b) | x 2.4600 (2b)                      | = 105.7554 (1b) - (3b) |  |
| First floor                                             | 42.9900 (1c) | x 2.7600 (2c)                      | = 118.6524 (1c) - (3c) |  |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)... (1n) | 85.9800      |                                    | (4)                    |  |
| Dwelling volume                                         |              | (3a)+(3b)+(3c)+(3d)+(3e)... (3n) = | 224.4078 (5)           |  |

### 2. Ventilation rate

|                                                                                                    | m3 per hour     |              |
|----------------------------------------------------------------------------------------------------|-----------------|--------------|
| Number of open chimneys                                                                            | 0 * 80 =        | 0.0000 (6a)  |
| Number of open flues                                                                               | 0 * 20 =        | 0.0000 (6b)  |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 =        | 0.0000 (6c)  |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 =        | 0.0000 (6d)  |
| Number of flues attached to other heater                                                           | 0 * 35 =        | 0.0000 (6e)  |
| Number of blocked chimneys                                                                         | 0 * 20 =        | 0.0000 (6f)  |
| Number of intermittent extract fans                                                                | 3 * 10 =        | 30.0000 (7a) |
| Number of passive vents                                                                            | 0 * 10 =        | 0.0000 (7b)  |
| Number of flueless gas fires                                                                       | 0 * 40 =        | 0.0000 (7c)  |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 30.0000 / (5) = | 0.1337 (8)   |
| Pressure test                                                                                      | Yes             |              |
| Pressure Test Method                                                                               | Blower Door     |              |
| Measured/design AP50                                                                               | 5.0000          | (17)         |
| Infiltration rate                                                                                  | 0.3837          | (18)         |
| Number of sides sheltered                                                                          | 2               | (19)         |

# Full SAP Calculation Printout



Shelter factor  
Infiltration rate adjusted to include shelter factor

$$(20) = 1 - [0.075 \times (19)] = 0.8500 \quad (20)$$

$$(21) = (18) \times (20) = 0.3261 \quad (21)$$

|                 | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |       |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|
| Wind speed      | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 | (22)  |
| Wind factor     | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 | (22a) |
| Adj infilt rate | 0.4158 | 0.4077 | 0.3995 | 0.3587 | 0.3506 | 0.3098 | 0.3098 | 0.3017 | 0.3261 | 0.3506 | 0.3669 | 0.3832 | (22b) |
| Effective ac    | 0.5865 | 0.5831 | 0.5798 | 0.5643 | 0.5615 | 0.5480 | 0.5480 | 0.5455 | 0.5532 | 0.5615 | 0.5673 | 0.5734 | (25)  |

## 3. Heat losses and heat loss parameter

| Element                                           | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K | A x U<br>W/K         | K-value<br>kJ/m2K | A x K<br>kJ/K |       |
|---------------------------------------------------|-------------|----------------|---------------|------------------|----------------------|-------------------|---------------|-------|
| Main dwelling                                     |             |                |               |                  |                      |                   |               |       |
| TER Opaque door                                   |             |                | 2.5500        | 1.0000           | 2.5500               |                   |               | (26)  |
| TER Opening Type                                  |             |                | 13.5800       | 1.1450           | 15.5496              |                   |               | (27)  |
| GF SPVL 125TS P/A                                 |             |                | 42.9900       | 0.1300           | 5.5887               |                   |               | (28a) |
| EW Brick AAC011                                   | 97.2486     | 16.1300        | 81.1186       | 0.1800           | 14.6013              |                   |               | (29a) |
| PR 500mm MW044                                    | 42.9900     |                | 42.9900       | 0.1100           | 4.7289               |                   |               | (30)  |
| Total net area of external elements Aum(A, m2)    |             |                | 183.2286      |                  |                      |                   |               | (31)  |
| Fabric heat loss, W/K = Sum (A x U)               |             |                |               |                  | (26)...(30) + (32) = | 43.0186           |               | (33)  |
| Main dwelling                                     |             |                |               |                  |                      |                   |               |       |
| E-WM-30                                           |             |                | 43.8000       | 0.0000           | 0.0000               |                   |               | (32)  |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K |             |                |               |                  |                      |                   | 157.5901      | (35)  |

List of Thermal Bridges

|                                                            | Length  | Psi-value | Total                 |              |
|------------------------------------------------------------|---------|-----------|-----------------------|--------------|
| K1 Element                                                 | 10.7800 | 0.0500    | 0.5390                |              |
| E2 Other lintels (including other steel lintels)           | 9.2000  | 0.0500    | 0.4600                |              |
| E3 Sill                                                    | 21.1500 | 0.0500    | 1.0575                |              |
| E4 Jamb                                                    | 10.2300 | 0.1600    | 1.6368                |              |
| E5 Ground floor (normal)                                   | 18.6300 | 0.0000    | 0.0000                |              |
| E6 Intermediate floor within a dwelling                    | 10.2500 | 0.0600    | 0.6150                |              |
| E10 Eaves (insulation at ceiling level)                    | 10.4400 | 0.0600    | 0.6264                |              |
| E18 Party wall between dwellings                           | 4.8000  | 0.0500    | 0.2400                |              |
| E4 Jamb                                                    | 1.0600  | 0.0500    | 0.0530                |              |
| E2 Other lintels (including other steel lintels)           | 8.3900  | 0.0800    | 0.6712                |              |
| P1 Party wall - Ground floor                               | 8.3900  | 0.0000    | 0.0000                |              |
| P2 Party wall - Intermediate floor within a dwelling       | 8.3900  | 0.1200    | 1.0068                |              |
| P4 Party wall - Roof (insulation at ceiling level)         | 8.3900  | 0.1600    | 1.3424                |              |
| E5 Ground floor (normal)                                   | 8.3900  | 0.0600    | 0.5034                |              |
| E12 Gable (insulation at ceiling level)                    | 10.4400 | 0.0900    | 0.9396                |              |
| E16 Corner (normal)                                        |         |           |                       |              |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |         |           |                       | 9.6911 (36)  |
| Point Thermal bridges                                      |         |           | (36a) =               | 0.0000       |
| Total fabric heat loss                                     |         |           | (33) + (36) + (36a) = | 52.7097 (37) |

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

Point Thermal bridges  
Total fabric heat loss

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

|                           | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |      |
|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| (38)m                     | 43.4295 | 43.1809 | 42.9372 | 41.7926 | 41.5785 | 40.5816 | 40.5816 | 40.3970 | 40.9656 | 41.5785 | 42.0117 | 42.4646 | (38) |
| Heat transfer coeff       | 96.1392 | 95.8906 | 95.6469 | 94.5023 | 94.2882 | 93.2913 | 93.2913 | 93.1067 | 93.6753 | 94.2882 | 94.7214 | 95.1743 | (39) |
| Average = Sum(39)m / 12 = |         |         |         |         |         |         |         |         |         |         |         | 94.5013 |      |

|               | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |      |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| HLP           | 1.1182 | 1.1153 | 1.1124 | 1.0991 | 1.0966 | 1.0850 | 1.0850 | 1.0829 | 1.0895 | 1.0966 | 1.1017 | 1.1069 | (40) |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 1.0991 |      |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31     |      |

## 4. Water heating energy requirements (kWh/year)

|                                                                                |          |          |          |          |          |          |          |          |          |          |          |           |             |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-------------|
| Assumed occupancy                                                              |          |          |          |          |          |          |          |          |          |          |          |           | 2.5666 (42) |
| Hot water usage for mixer showers                                              |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 67.2533                                                                        | 66.2426  | 64.7698  | 61.9519  | 59.8724  | 57.5533  | 56.2352  | 57.6968  | 59.2990  | 61.7890  | 64.6674  | 66.9956  | 66.9956   | (42a)       |
| Hot water usage for baths                                                      |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 29.0443                                                                        | 28.6130  | 28.0055  | 26.8856  | 26.0469  | 25.1170  | 24.6147  | 25.2179  | 25.8746  | 26.8697  | 28.0127  | 28.9461  | 28.9461   | (42b)       |
| Hot water usage for other uses                                                 |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 40.9146                                                                        | 39.4268  | 37.9390  | 36.4512  | 34.9634  | 33.4756  | 33.4756  | 34.9634  | 36.4512  | 37.9390  | 39.4268  | 40.9146  | 40.9146   | (42c)       |
| Average daily hot water use (litres/day)                                       |          |          |          |          |          |          |          |          |          |          |          | 126.1290  | (43)        |
| Daily hot water use                                                            |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 137.2122                                                                       | 134.2823 | 130.7143 | 125.2887 | 120.8827 | 116.1459 | 114.3255 | 117.8781 | 121.6248 | 126.5977 | 132.1069 | 136.8563 | 136.8563  | (44)        |
| Energy conte                                                                   | 217.3105 | 191.2162 | 200.9030 | 171.5139 | 162.7313 | 142.8150 | 138.2667 | 145.9577 | 149.9756 | 171.7918 | 188.2105 | 214.2839  | (45)        |
| Energy content (annual)                                                        |          |          |          |          |          |          |          |          |          |          |          |           |             |
| Distribution loss (46)m = 0.15 x (45)m                                         | 32.5966  | 28.6824  | 30.1355  | 25.7271  | 24.4097  | 21.4222  | 20.7400  | 21.8937  | 22.4963  | 25.7688  | 28.2316  | 32.1426   | (46)        |
| Water storage loss (or HIU loss):                                              |          |          |          |          |          |          |          |          |          |          |          |           |             |
| Total storage loss                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (56)        |
| If cylinder contains dedicated solar storage                                   |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (57)        |
| Primary loss                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (59)        |
| Combi loss                                                                     | 50.9589  | 46.0274  | 50.9589  | 49.3151  | 50.9589  | 49.3151  | 50.9589  | 50.9589  | 49.3151  | 50.9589  | 49.3151  | 50.9589   | (61)        |
| Total heat required for water heating calculated for each month                |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 268.2694                                                                       | 237.2436 | 251.8620 | 220.8290 | 213.6902 | 192.1300 | 189.2257 | 196.9166 | 199.2907 | 222.7507 | 237.5256 | 265.2428 | 265.2428  | (62)        |
| WWHRS                                                                          | -30.7454 | -27.1915 | -28.4733 | -23.5770 | -21.9730 | -18.8024 | -17.6243 | -18.7416 | -19.4537 | -22.9338 | -25.9812 | -30.1760  | (63a)       |
| PV diverter                                                                    | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000   | (63b)       |
| Solar input                                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (63c)       |
| FGHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (63d)       |
| Output from w/h                                                                | 237.5241 | 210.0522 | 223.3886 | 197.2519 | 191.7173 | 173.3276 | 171.6014 | 178.1749 | 179.8370 | 199.8169 | 211.5444 | 235.0668  | (64)        |
| 12Total per year (kWh/year)                                                    |          |          |          |          |          |          |          |          |          |          |          | 2409.3031 | (64)        |
| Electric shower(s)                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (64a)       |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (64a)       |
| Heat gains from water heating, kWh/month                                       | 84.9955  | 75.0862  | 79.5400  | 69.3571  | 66.8479  | 59.8147  | 58.7134  | 61.2707  | 62.1957  | 69.8605  | 74.9088  | 83.9891   | (65)        |

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## 5. Internal gains (see Table 5 and 5a)

| Metabolic gains (Table 5), Watts                                                    |           |           |           |           |           |           |           |           |           |           |           |                |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
|                                                                                     | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec            |
| (66)m                                                                               | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 122.1242  | 135.2090  | 122.1242  | 126.1950  | 122.1242  | 126.1950  | 122.1242  | 122.1242  | 126.1950  | 122.1242  | 126.1950  | 122.1242 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 231.4847  | 233.8867  | 227.8336  | 214.9471  | 198.6802  | 183.3916  | 173.1779  | 170.7758  | 176.8289  | 189.7154  | 205.9823  | 221.2709 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330 (69)   |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 3.0000    | 3.0000    | 3.0000 (70)    |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 (71) |
| Water heating gains (Table 5)                                                       | 114.2412  | 111.7355  | 106.9086  | 96.3294   | 89.8493   | 83.0760   | 78.9159   | 82.3530   | 86.3828   | 93.8985   | 104.0399  | 112.8886 (72)  |
| Total internal gains                                                                | 532.3492  | 545.3303  | 521.3654  | 501.9705  | 475.1528  | 454.1617  | 435.7170  | 436.7521  | 450.9059  | 470.2373  | 500.7164  | 520.7828 (73)  |

## 6. Solar gains

| [Jan]       |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c |          | Access<br>factor<br>Table 6d |          | Gains<br>W   |               |
|-------------|----------|----------|----------|------------|--------------------------------|-----------------------------------|------------------------------------|----------|------------------------------|----------|--------------|---------------|
|             |          |          |          |            |                                |                                   |                                    |          |                              |          |              |               |
| North       |          |          |          | 0.5200     | 10.6334                        | 0.6300                            | 0.7000                             |          | 0.7700                       |          | 1.6898 (74)  |               |
| East        |          |          |          | 7.4500     | 19.6403                        | 0.6300                            | 0.7000                             |          | 0.7700                       |          | 44.7173 (76) |               |
| West        |          |          |          | 5.6100     | 19.6403                        | 0.6300                            | 0.7000                             |          | 0.7700                       |          | 33.6730 (80) |               |
|             |          |          |          |            |                                |                                   |                                    |          |                              |          |              |               |
| Solar gains | 80.0801  | 156.5774 | 258.0299 | 377.1324   | 463.2613                       | 474.7867                          | 451.7822                           | 387.2956 | 300.3150                     | 185.8045 | 99.8281      | 65.8731 (83)  |
| Total gains | 612.4293 | 701.9077 | 779.3954 | 879.1029   | 938.4141                       | 928.9484                          | 887.4993                           | 824.0477 | 751.2209                     | 656.0418 | 600.5445     | 586.6559 (84) |

## 7. Mean internal temperature (heating season)

| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |         |         |         |              |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| tau                                                                         | 39.1493 | 39.2508 | 39.3508 | 39.8274 | 39.9178 | 40.3444 | 40.3444 | 40.4244 | 40.1790 | 39.9178 | 39.7352 | 39.5462      |
| alpha                                                                       | 3.6100  | 3.6167  | 3.6234  | 3.6552  | 3.6612  | 3.6896  | 3.6896  | 3.6950  | 3.6786  | 3.6612  | 3.6490  | 3.6364       |
| util living area                                                            | 0.9807  | 0.9676  | 0.9417  | 0.8747  | 0.7581  | 0.5913  | 0.4477  | 0.4964  | 0.7236  | 0.9102  | 0.9682  | 0.9833 (86)  |
| MIT                                                                         | 19.2152 | 19.4632 | 19.8386 | 20.3316 | 20.7044 | 20.9144 | 20.9764 | 20.9656 | 20.8162 | 20.3152 | 19.6886 | 19.1795 (87) |
| Th 2                                                                        | 19.9860 | 19.9884 | 19.9907 | 20.0016 | 20.0036 | 20.0131 | 20.0131 | 20.0148 | 20.0094 | 20.0036 | 19.9995 | 19.9952 (88) |
| util rest of house                                                          | 0.9767  | 0.9610  | 0.9294  | 0.8486  | 0.7094  | 0.5158  | 0.3535  | 0.3995  | 0.6539  | 0.8856  | 0.9605  | 0.9798 (89)  |
| MIT 2                                                                       | 17.9124 | 18.2270 | 18.6989 | 19.3073 | 19.7350 | 19.9538 | 20.0023 | 19.9978 | 19.8664 | 19.3030 | 18.5231 | 17.8730 (90) |
| Living area fraction                                                        | 18.1642 | 18.4659 | 18.9192 | 19.5053 | 19.9224 | 20.1395 | 20.1906 | 20.1849 | 20.0500 | 19.4987 | 18.7484 | 18.1255 (92) |
| MIT                                                                         | 18.1642 | 18.4659 | 18.9192 | 19.5053 | 19.9224 | 20.1395 | 20.1906 | 20.1849 | 20.0500 | 19.4987 | 18.7484 | 18.1255 (93) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT                                                                | 18.1642 | 18.4659 | 18.9192 | 19.5053 | 19.9224 | 20.1395 | 20.1906 | 20.1849 | 20.0500 | 19.4987 | 18.7484 | 18.1255 (93) |

## 8. Space heating requirement

|                                                                                | Jan       | Feb       | Mar       | Apr       | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov       | Dec            |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|---------------|-----------|----------------|
| Utilisation                                                                    | 0.9664    | 0.9475    | 0.9129    | 0.8334    | 0.7050   | 0.5260   | 0.3709   | 0.4168   | 0.6571   | 0.8701        | 0.9474    | 0.9706 (94)    |
| Useful gains                                                                   | 591.8768  | 665.0715  | 711.5034  | 732.6621  | 661.6285 | 488.6394 | 329.1842 | 343.4928 | 493.6143 | 570.8523      | 568.9397  | 569.3794 (95)  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000    | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000    | 4.2000 (96)    |
| Heat loss rate W                                                               | 1332.8934 | 1300.8437 | 1187.8602 | 1002.2269 | 775.2704 | 516.7837 | 334.9706 | 352.3990 | 557.3633 | 839.0393      | 1103.3502 | 1325.3533 (97) |
| Space heating kWh                                                              | 551.3163  | 427.2389  | 354.4095  | 194.0867  | 84.5496  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 199.5311      | 384.7756  | 562.4446 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |          |          |          |          |          |               |           | 2758.3523      |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |           |          |          |          |          |          |               |           | 0.0000         |
| Space heating kWh                                                              | 551.3163  | 427.2389  | 354.4095  | 194.0867  | 84.5496  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 199.5311      | 384.7756  | 562.4446 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |          |          |          |          |          |               |           | 2758.3523      |
| Space heating per m2                                                           |           |           |           |           |          |          |          |          |          | (98c) / (4) = |           | 32.0813 (99)   |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

| Fraction of space heat from secondary/supplementary system (Table 11) |          |          |          |          |          |          |          |          |          |          |          |                |
|-----------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| Efficiency of main space heating system 1 (in %)                      |          |          |          |          |          |          |          |          |          |          |          |                |
| Efficiency of main space heating system 2 (in %)                      |          |          |          |          |          |          |          |          |          |          |          |                |
| Efficiency of secondary/supplementary heating system, %               |          |          |          |          |          |          |          |          |          |          |          |                |
|                                                                       | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec            |
| Space heating requirement                                             | 551.3163 | 427.2389 | 354.4095 | 194.0867 | 84.5496  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 199.5311 | 384.7756 | 562.4446 (98)  |
| Space heating efficiency (main heating system 1)                      | 92.4000  | 92.4000  | 92.4000  | 92.4000  | 92.4000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 92.4000  | 92.4000  | 92.4000 (210)  |
| Space heating fuel (main heating system)                              | 596.6627 | 462.3798 | 383.5601 | 210.0505 | 91.5039  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 215.9428 | 416.4238 | 608.7063 (211) |
| Space heating efficiency (main heating system 2)                      | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)   |
| Space heating fuel (main heating system 2)                            | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)   |
| Space heating fuel (secondary)                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)   |
| Water heating                                                         |          |          |          |          |          |          |          |          |          |          |          |                |
| Water heating requirement                                             | 237.5241 | 210.0522 | 223.3886 | 197.2519 | 191.7173 | 173.3276 | 171.6014 | 178.1749 | 179.8370 | 199.8169 | 211.5444 | 235.0668 (64)  |
| Efficiency of water heater                                            |          |          |          |          |          |          |          |          |          |          |          | 80.3000 (216)  |

# Full SAP Calculation Printout



|                                                                                                      |          |          |          |           |           |           |           |           |           |          |          |            |        |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|----------|------------|--------|
| (217)m                                                                                               | 86.1227  | 85.8688  | 85.3653  | 84.3468   | 82.7499   | 80.3000   | 80.3000   | 80.3000   | 80.3000   | 84.3784  | 85.6460  | 86.1795    | (217)  |
| Fuel for water heating, kWh/month                                                                    | 275.7972 | 244.6198 | 261.6854 | 233.8583  | 231.6828  | 215.8501  | 213.7004  | 221.8866  | 223.9564  | 236.8106 | 246.9985 | 272.7640   | (219)  |
| Space cooling fuel requirement                                                                       |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (221)m                                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (221)  |
| Pumps and Fa                                                                                         | 7.3041   | 6.5973   | 7.3041   | 7.0685    | 7.3041    | 7.0685    | 7.3041    | 7.0685    | 7.3041    | 7.0685   | 7.3041   | 7.0685     | (231)  |
| Lighting                                                                                             | 25.3750  | 20.3568  | 18.3290  | 13.4286   | 10.3727   | 8.4745    | 9.4623    | 12.2994   | 15.9757   | 20.9610  | 23.6755  | 26.0803    | (232)  |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (233a)m                                                                                              | -39.8696 | -56.0257 | -80.2676 | -89.9369  | -96.7057  | -90.1510  | -89.0213  | -84.1676  | -75.5697  | -63.9045 | -43.7612 | -34.4899   | (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (234a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (234a) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (235a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (235a) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (235c)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (235c) |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (233b)m                                                                                              | -23.0762 | -48.4849 | -96.2662 | -144.4459 | -190.8693 | -191.7487 | -189.5061 | -160.5221 | -117.7385 | -69.3076 | -30.7987 | -18.2537   | (233b) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (234b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (234b) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (235b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (235b) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (235d)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (235d) |
| Annual totals kWh/year                                                                               |          |          |          |           |           |           |           |           |           |          |          |            |        |
| Space heating fuel - main system 1                                                                   |          |          |          |           |           |           |           |           |           |          |          | 2985.2297  | (211)  |
| Space heating fuel - main system 2                                                                   |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (213)  |
| Space heating fuel - secondary                                                                       |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (215)  |
| Efficiency of water heater                                                                           |          |          |          |           |           |           |           |           |           |          |          | 80.3000    |        |
| Water heating fuel used                                                                              |          |          |          |           |           |           |           |           |           |          |          | 2879.6100  | (219)  |
| Space cooling fuel                                                                                   |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (221)  |
| Electricity for pumps and fans:                                                                      |          |          |          |           |           |           |           |           |           |          |          |            |        |
| Total electricity for the above, kWh/year                                                            |          |          |          |           |           |           |           |           |           |          |          | 86.0000    | (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |          |          |          |           |           |           |           |           |           |          |          | 204.7908   | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |          |          |           |           |           |           |           |           |          |          |            |        |
| PV generation                                                                                        |          |          |          |           |           |           |           |           |           |          |          | -2124.8885 | (233)  |
| Wind generation                                                                                      |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (234)  |
| Hydro-electric generation (Appendix N)                                                               |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (235a) |
| Electricity generated - Micro CHP (Appendix N)                                                       |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (235)  |
| Appendix Q - special features                                                                        |          |          |          |           |           |           |           |           |           |          |          |            |        |
| Energy saved or generated                                                                            |          |          |          |           |           |           |           |           |           |          |          | -0.0000    | (236)  |
| Energy used                                                                                          |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (237)  |
| Total delivered energy for all uses                                                                  |          |          |          |           |           |           |           |           |           |          |          | 4030.7421  | (238)  |

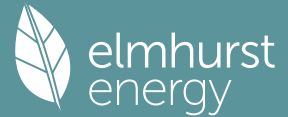
## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                               | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|-----------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1                 | 2985.2297          | 0.2100                        | 626.8982 (261)           |
| Total CO2 associated with community systems   |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                    | 2879.6100          | 0.2100                        | 604.7181 (264)           |
| Space and water heating                       |                    |                               | 1231.6163 (265)          |
| Pumps, fans and electric keep-hot             | 86.0000            | 0.1387                        | 11.9293 (267)            |
| Energy for lighting                           | 204.7908           | 0.1443                        | 29.5576 (268)            |
| Energy saving/generation technologies         |                    |                               |                          |
| PV Unit electricity used in dwelling          | -843.8706          | 0.1347                        | -113.6365                |
| PV Unit electricity exported                  | -1281.0179         | 0.1259                        | -161.3091                |
| Total                                         |                    |                               | -274.9456 (269)          |
| Total CO2, kg/year                            |                    |                               | 998.1576 (272)           |
| EPC Target Carbon Dioxide Emission Rate (TER) |                    |                               | 11.6100 (273)            |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1               | 2985.2297          | 1.1300                              | 3373.3096 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 2879.6100          | 1.1300                              | 3253.9593 (278)            |
| Space and water heating                     |                    |                                     | 6627.2689 (279)            |
| Pumps, fans and electric keep-hot           | 86.0000            | 1.5128                              | 130.1008 (281)             |
| Energy for lighting                         | 204.7908           | 1.5338                              | 314.1150 (282)             |
| Energy saving/generation technologies       |                    |                                     |                            |
| PV Unit electricity used in dwelling        | -843.8706          | 1.4977                              | -1263.8554                 |
| PV Unit electricity exported                | -1281.0179         | 0.4622                              | -592.1168                  |
| Total                                       |                    |                                     | -1855.9722 (283)           |
| Total Primary energy kWh/year               |                    |                                     | 5215.5125 (286)            |
| Target Primary Energy Rate (TPER)           |                    |                                     | 60.6600 (287)              |

# Full SAP Calculation Printout



|                                    |                                                          |               |        |                |            |
|------------------------------------|----------------------------------------------------------|---------------|--------|----------------|------------|
| Plot Reference                     | 4907-R823-9471-003                                       |               |        | Issued on Date | 21/07/2026 |
| Assessment Reference               | Plot 3                                                   | Plot Type Ref | Plot 3 |                |            |
| Plot Address                       | Plot 3, Beaconsfield-Semi, K, WC, B, ES, 1012            |               |        | SAP Version    | 10.2       |
| SAP Rating                         | 90 B                                                     | DER           | 11.23  | TER            | 11.61      |
| Environmental                      | 90 B                                                     | % DER < TER   |        | 3.27           |            |
| CO <sub>2</sub> Emissions (t/year) | 0.86                                                     | DFEE          | 35.32  | TFEE           | 37.71      |
| Compliance Check                   | See BREL                                                 | % DFEE < TFEE |        | 6.34           |            |
| % DPER < TPER                      | 0.39                                                     | DPER          | 60.42  | TPER           | 60.66      |
| Assessor Details                   | Mr. Daniel Harris                                        |               |        | Assessor ID    | R823-0001  |
| Client                             | Crest Nicholson Head Office, Crest Nicholson Head Office |               |        |                |            |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF ENERGY RATING

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)              | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|-----------------------------------|-----------------------------|
| Main dwelling                                          |                           |                                   |                             |
| Ground floor                                           | 42.9900 (1b)              | x 2.4600 (2b)                     | = 105.7554 (1b) - (3b)      |
| First floor                                            | 42.9900 (1c)              | x 2.7600 (2c)                     | = 118.6524 (1c) - (3c)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 85.9800                   |                                   | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 224.4078 (5)                |

## 2. Ventilation rate

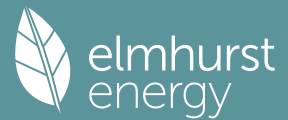
|                                                                                                    | m <sup>3</sup> per hour                 |
|----------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                    |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                    |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                    |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                    |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                    |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                    |
| Number of intermittent extract fans                                                                | 0 * 10 = 0.0000 (7a)                    |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)                    |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 0.0000 / (5) = 0.0000 (8)               |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 4.5000 (17)                             |
| Infiltration rate                                                                                  | 0.2250 (18)                             |
| Number of sides sheltered                                                                          | 2 (19)                                  |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 0.8500 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.1913 (21)        |

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor                                                                                             | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate                                                                                         | 0.2438 | 0.2391 | 0.2343 | 0.2104 | 0.2056 | 0.1817 | 0.1817 | 0.1769 | 0.1913 | 0.2056 | 0.2152 | 0.2247 (22b) |
| Mechanical extract ventilation - decentralised                                                          |        |        |        |        |        |        |        |        |        |        |        |              |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 (25)  |

## 3. Heat losses and heat loss parameter

| Element                                                      | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K   |
|--------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|-----------------|
| Main dwelling                                                |                         |                            |                           |                               |              |                                |                 |
| Front Door                                                   |                         |                            | 2.5500                    | 1.2000                        | 3.0600       |                                | (26)            |
| Windows                                                      |                         |                            | 10.2500                   | 1.2357                        | 12.6663      |                                | (27)            |
| French Doors                                                 |                         |                            | 3.3300                    | 1.2357                        | 4.1150       |                                | (27)            |
| GF SPVL 125TS P/A                                            |                         |                            | 42.9900                   | 0.1300                        | 5.5887       | 75.0000                        | 3224.2500 (28a) |
| EW Brick AAC011                                              | 97.2486                 | 16.1300                    | 81.1186                   | 0.1800                        | 14.6013      | 60.0000                        | 4867.1160 (29a) |
| PR 500mm MW044                                               | 42.9900                 |                            | 42.9900                   | 0.0900                        | 3.8691       | 9.0000                         | 386.9100 (30)   |
| Total net area of external elements Aum (A, m <sup>2</sup> ) |                         |                            | 183.2286                  |                               |              |                                | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                          |                         |                            | (26)...(30) + (32) =      |                               | 43.9005      |                                | (33)            |
| Main dwelling                                                |                         |                            |                           |                               |              |                                |                 |
| E-WM-30                                                      |                         |                            | 43.8000                   | 0.0000                        | 0.0000       | 45.0000                        | 1971.0000 (32)  |
| Timber - GF                                                  |                         |                            | 88.6100                   |                               |              | 9.0000                         | 797.4900 (32c)  |
| Timber - FF                                                  |                         |                            | 126.9000                  |                               |              | 9.0000                         | 1142.1000 (32c) |
| Internal Floor FF                                            |                         |                            | 42.9900                   |                               |              | 18.0000                        | 773.8200 (32d)  |
| Internal Ceiling GF                                          |                         |                            | 42.9900                   |                               |              | 9.0000                         | 386.9100 (32e)  |

# Full SAP Calculation Printout



Heat capacity  $C_m = \text{Sum}(A \times k)$   
Thermal mass parameter (TMP) =  $C_m / \text{TFA}$  in  $\text{kJ/m}^2\text{K}$   
List of Thermal Bridges

(28)...(30) + (32) + (32a)...(32e) = 13549.5960 (34)  
157.5901 (35)

|                                                      | Length  | Psi-value | Total  |
|------------------------------------------------------|---------|-----------|--------|
| K1 Element                                           |         |           |        |
| E2 Other lintels (including other steel lintels)     | 10.7800 | 0.0410    | 0.4420 |
| E3 Sill                                              | 9.2000  | 0.0220    | 0.2024 |
| E4 Jamb                                              | 21.1500 | 0.0190    | 0.4018 |
| E5 Ground floor (normal)                             | 10.2300 | 0.0928    | 0.9493 |
| E6 Intermediate floor within a dwelling              | 18.6300 | 0.0020    | 0.0373 |
| E10 Eaves (insulation at ceiling level)              | 10.2500 | 0.0390    | 0.3997 |
| E18 Party wall between dwellings                     | 10.4400 | 0.0330    | 0.3445 |
| E4 Jamb                                              | 4.8000  | 0.1000    | 0.4800 |
| E2 Other lintels (including other steel lintels)     | 1.0600  | 0.0410    | 0.0435 |
| P1 Party wall - Ground floor                         | 8.3900  | 0.1000    | 0.8390 |
| P2 Party wall - Intermediate floor within a dwelling | 8.3900  | 0.0000    | 0.0000 |
| P4 Party wall - Roof (insulation at ceiling level)   | 8.3900  | 0.0350    | 0.2937 |
| E5 Ground floor (normal)                             | 8.3900  | 0.0980    | 0.8222 |
| E12 Gable (insulation at ceiling level)              | 8.3900  | 0.0870    | 0.7299 |
| E16 Corner (normal)                                  | 10.4400 | 0.0420    | 0.4385 |

Thermal bridges (Sum(L x Psi) calculated using Appendix K)  
Point Thermal bridges (36a) = 0.0000  
Total fabric heat loss (33) + (36) + (36a) = 50.3244 (37)

| Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)\text{m} \times (5)$ | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |      |
|----------------------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| (38)m                                                                                  | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | (38) |
| Heat transfer coeff                                                                    | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | (39) |
| Average = Sum(39)m / 12 =                                                              |         |         |         |         |         |         |         |         |         |         |         | 87.3516 |      |
| HLP                                                                                    | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | (40) |
| HLP (average)                                                                          |         |         |         |         |         |         |         |         |         |         |         | 1.0160  |      |
| Days in mont                                                                           | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31      |      |

## 4. Water heating energy requirements (kWh/year)

|                                                                                |          |          |          |          |          |          |          |          |          |                    |          |           |             |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------------------|----------|-----------|-------------|
| Assumed occupancy                                                              |          |          |          |          |          |          |          |          |          |                    |          |           | 2.5666 (42) |
| Hot water usage for mixer showers                                              |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| 67.2533                                                                        | 66.2426  | 64.7698  | 61.9519  | 59.8724  | 57.5533  | 56.2352  | 57.6968  | 59.2990  | 61.7890  | 64.6674            | 66.9956  | (42a)     |             |
| Hot water usage for baths                                                      |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| 29.0443                                                                        | 28.6130  | 28.0055  | 26.8856  | 26.0469  | 25.1170  | 24.6147  | 25.2179  | 25.8746  | 26.8697  | 28.0127            | 28.9461  | (42b)     |             |
| Hot water usage for other uses                                                 |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| 40.9146                                                                        | 39.4268  | 37.9390  | 36.4512  | 34.9634  | 33.4756  | 33.4756  | 34.9634  | 36.4512  | 37.9390  | 39.4268            | 40.9146  | (42c)     |             |
| Average daily hot water use (litres/day)                                       |          |          |          |          |          |          |          |          |          |                    |          | 126.1290  | (43)        |
| Daily hot water use                                                            | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct                | Nov      | Dec       |             |
| 137.2122                                                                       | 134.2823 | 130.7143 | 125.2887 | 120.8827 | 116.1459 | 114.3255 | 117.8781 | 121.6248 | 126.5977 | 132.1069           | 136.8563 | (44)      |             |
| Energy content (annual)                                                        | 217.3105 | 191.2162 | 200.9030 | 171.5139 | 162.7313 | 142.8150 | 138.2667 | 145.9577 | 149.9756 | 171.7918           | 188.2105 | 214.2839  | (45)        |
| Distribution loss (46)m = 0.15 x (45)m                                         |          |          |          |          |          |          |          |          |          | Total = Sum(45)m = |          | 2094.9763 |             |
| 32.5966                                                                        | 28.6824  | 30.1355  | 25.7271  | 24.4097  | 21.4222  | 20.7400  | 21.8937  | 22.4963  | 25.7688  | 28.2316            | 32.1426  | (46)      |             |
| Water storage loss (or HIU loss):                                              |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| Total storage loss                                                             |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | (56)      |             |
| If cylinder contains dedicated solar storage                                   |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | (57)      |             |
| Primary loss                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | (59)      |             |
| Combi loss                                                                     | 11.9874  | 10.8167  | 11.9530  | 11.5193  | 11.8728  | 11.4590  | 11.8214  | 11.8376  | 11.4740  | 11.8918            | 11.5543  | (61)      |             |
| Total heat required for water heating calculated for each month                |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| 229.2979                                                                       | 202.0330 | 212.8560 | 183.0332 | 174.6042 | 154.2740 | 150.0882 | 157.7953 | 161.4496 | 183.6836 | 199.7649           | 226.2650 | (62)      |             |
| WWHRS                                                                          | -29.9438 | -26.4825 | -27.7310 | -22.9624 | -21.4001 | -18.3122 | -17.1648 | -18.2530 | -18.9465 | -22.3359           | -25.3038 | -29.3893  | (63a)       |
| PV diverter                                                                    | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000            | -0.0000  | -0.0000   | (63b)       |
| Solar input                                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | 0.0000    | (63c)       |
| FGHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | 0.0000    | (63d)       |
| Output from w/h                                                                |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| 199.3541                                                                       | 175.5504 | 185.1250 | 160.0708 | 153.2041 | 135.9618 | 132.9234 | 139.5422 | 142.5031 | 161.3478 | 174.4610           | 196.8757 | (64)      |             |
| Electric shower(s)                                                             |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | (64a)     |             |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |          |          |          |          |          |          |                    |          | 0.0000    | (64a)       |
| Heat gains from water heating, kWh/month                                       |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| 75.2526                                                                        | 66.2836  | 69.7885  | 59.9082  | 57.0764  | 50.3507  | 48.9291  | 51.4903  | 52.7354  | 60.0937  | 65.4686            | 74.2447  | (65)      |             |

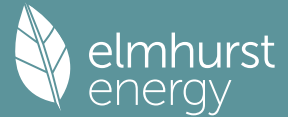
## 5. Internal gains (see Table 5 and 5a)

| Metabolic gains (Table 5), Watts                                                    |           |           |           |           |           |           |           |           |           |           |           |                |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
|                                                                                     | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec            |
| (66)m                                                                               | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     |           |           |           |           |           |           |           |           |           |           |           |                |
|                                                                                     | 26.7460   | 23.7556   | 19.3193   | 14.6260   | 10.9331   | 9.2302    | 9.9735    | 12.9640   | 17.4002   | 22.0936   | 25.7865   | 27.4894 (67)   |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 |           |           |           |           |           |           |           |           |           |           |           |                |
|                                                                                     | 345.4995  | 349.0847  | 340.0501  | 320.8165  | 296.5375  | 273.7188  | 258.4744  | 254.8892  | 263.9238  | 283.1574  | 307.4363  | 330.2551 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    |           |           |           |           |           |           |           |           |           |           |           |                |
|                                                                                     | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662 (69)   |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 3.0000    | 3.0000    | 3.0000 (70)    |
| Losses e.g. evaporation (negative values) (Table 5)                                 |           |           |           |           |           |           |           |           |           |           |           |                |
|                                                                                     | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 (71) |
| Water heating gains (Table 5)                                                       |           |           |           |           |           |           |           |           |           |           |           |                |
|                                                                                     | 101.1460  | 98.6363   | 93.8018   | 83.2058   | 76.7156   | 69.9316   | 65.7649   | 69.2074   | 73.2436   | 80.7712   | 90.9286   | 99.7912 (72)   |
| Total internal gains                                                                |           |           |           |           |           |           |           |           |           |           |           |                |
|                                                                                     | 580.6898  | 578.7749  | 560.4695  | 525.9466  | 491.4845  | 457.1788  | 438.5111  | 441.3589  | 458.8659  | 493.3204  | 531.4497  | 564.8340 (73)  |

## 6. Solar gains

| [Jan] | Area<br>m <sup>2</sup> | Solar flux<br>Table 6a<br>W/m <sup>2</sup> | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W  |
|-------|------------------------|--------------------------------------------|-----------------------------------|------------------------------------|------------------------------|-------------|
| North | 0.5200                 | 10.6334                                    | 0.4500                            | 0.0000                             | 0.7700                       | 1.9159 (74) |

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|      |  |  |        |  |         |  |        |  |        |  |        |  |              |
|------|--|--|--------|--|---------|--|--------|--|--------|--|--------|--|--------------|
| East |  |  | 4.1200 |  | 19.6403 |  | 0.4500 |  | 0.0000 |  | 0.7700 |  | 28.0380 (76) |
| West |  |  | 5.6100 |  | 19.6403 |  | 0.4500 |  | 0.0000 |  | 0.7700 |  | 38.1780 (80) |
| East |  |  | 3.3300 |  | 19.6403 |  | 0.4500 |  | 0.0000 |  | 0.7700 |  | 22.6618 (76) |

|             |          |          |          |          |           |          |          |          |          |          |          |               |
|-------------|----------|----------|----------|----------|-----------|----------|----------|----------|----------|----------|----------|---------------|
| Solar gains | 90.7938  | 177.5254 | 292.5509 | 427.5877 | 525.2396  | 538.3069 | 512.2248 | 439.1107 | 340.4932 | 210.6627 | 113.1838 | 74.6861 (83)  |
| Total gains | 671.4836 | 756.3003 | 853.0204 | 953.5343 | 1016.7241 | 995.4857 | 950.7359 | 880.4696 | 799.3592 | 703.9832 | 644.6335 | 639.5201 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |                           |         |         |              |             |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|--------------|-------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |                           |         |         | 21.0000 (85) |             |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |                           |         |         |              |             |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep                       | Oct     | Nov     | Dec          |             |
| tau                                                                         | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876                   | 43.0876 | 43.0876 | 43.0876      |             |
| alpha                                                                       | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725                    | 3.8725  | 3.8725  | 3.8725       |             |
| util living area                                                            | 0.9726  | 0.9560  | 0.9173  | 0.8335  | 0.6977  | 0.5335  | 0.3970  | 0.4442  | 0.6709                    | 0.8821  | 0.9577  | 0.9770 (86)  |             |
| MIT                                                                         | 19.3433 | 19.5949 | 20.0045 | 20.4610 | 20.7882 | 20.9426 | 20.9857 | 20.9780 | 20.8633                   | 20.4089 | 19.7727 | 19.2671 (87) |             |
| Th 2                                                                        | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701                   | 20.0701 | 20.0701 | 20.0701 (88) |             |
| util rest of house                                                          | 0.9673  | 0.9477  | 0.9018  | 0.8038  | 0.6486  | 0.4650  | 0.3162  | 0.3594  | 0.6028                    | 0.8535  | 0.9481  | 0.9724 (89)  |             |
| MIT 2                                                                       | 18.3657 | 18.6457 | 19.0960 | 19.5801 | 19.9023 | 20.0352 | 20.0643 | 20.0604 | 19.9773                   | 19.5400 | 18.8486 | 18.2806 (90) |             |
| Living area fraction                                                        |         |         |         |         |         |         |         |         | fLA = Living area / (4) = |         |         |              | 0.1933 (91) |
| MIT                                                                         | 18.5547 | 18.8292 | 19.2716 | 19.7504 | 20.0736 | 20.2106 | 20.2424 | 20.2378 | 20.1486                   | 19.7080 | 19.0272 | 18.4713 (92) |             |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |                           |         |         | 0.0000       |             |
| adjusted MIT                                                                | 18.5547 | 18.8292 | 19.2716 | 19.7504 | 20.0736 | 20.2106 | 20.2424 | 20.2378 | 20.1486                   | 19.7080 | 19.0272 | 18.4713 (93) |             |

## 8. Space heating requirement

|                                                                                | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov       | Dec       |       |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|---------------|-----------|-----------|-------|
| Utilisation                                                                    | 0.9557    | 0.9334    | 0.8859    | 0.7924   | 0.6488   | 0.4757   | 0.3314   | 0.3751   | 0.6090   | 0.8403        | 0.9343    | 0.9618    | (94)  |
| Useful gains                                                                   | 641.7069  | 705.9434  | 755.6759  | 755.5458 | 659.6935 | 473.5720 | 315.1001 | 330.2594 | 486.7815 | 591.5762      | 602.2535  | 615.0884  | (95)  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000    | 4.2000    | (96)  |
| Heat loss rate W                                                               | 1245.1695 | 1216.7383 | 1115.6187 | 947.8010 | 731.4454 | 490.0938 | 318.1677 | 335.2390 | 528.3527 | 795.5979      | 1041.8615 | 1246.6189 | (97)  |
| Space heating kWh                                                              | 448.9762  | 343.2542  | 267.7975  | 138.4237 | 53.3834  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 151.7922      | 316.5178  | 469.8587  | (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |          |          |          |          |          |          |               |           | 2190.0037 |       |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | 0.0000    | (98b) |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |          |          |          |          |          |          |               |           | 0.0000    |       |
| Space heating kWh                                                              | 448.9762  | 343.2542  | 267.7975  | 138.4237 | 53.3834  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 151.7922      | 316.5178  | 469.8587  | (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |          |          |          |          |          |          |               |           | 2190.0037 |       |
| Space heating per m2                                                           |           |           |           |          |          |          |          |          |          | (98c) / (4) = |           | 25.4711   | (99)  |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                                                              |          |          |          |          |          |          |          |          |          |          |          |                |                 |
|--------------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                        |          |          |          |          |          |          |          |          |          |          |          |                | 0.0000 (201)    |
| Fraction of space heat from main system(s)                                                                   |          |          |          |          |          |          |          |          |          |          |          |                | 1.0000 (202)    |
| Efficiency of main space heating system 1 (in %)                                                             |          |          |          |          |          |          |          |          |          |          |          |                | 91.7000 (206)   |
| Efficiency of main space heating system 2 (in %)                                                             |          |          |          |          |          |          |          |          |          |          |          |                | 0.0000 (207)    |
| Efficiency of secondary/supplementary heating system, %                                                      |          |          |          |          |          |          |          |          |          |          |          |                | 0.0000 (208)    |
|                                                                                                              | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec            |                 |
| Space heating requirement                                                                                    | 448.9762 | 343.2542 | 267.7975 | 138.4237 | 53.3834  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 151.7922 | 316.5178 | 469.8587 (98)  |                 |
| Space heating efficiency (main heating system 1)                                                             | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 91.7000  | 91.7000  | 91.7000 (210)  |                 |
| Space heating fuel (main heating system)                                                                     | 489.6142 | 374.3230 | 292.0365 | 150.9528 | 58.2153  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 165.5313 | 345.1666 | 512.3868 (211) |                 |
| Space heating efficiency (main heating system 2)                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)   |                 |
| Space heating fuel (main heating system 2)                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)   |                 |
| Space heating fuel (secondary)                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)   |                 |
| Water heating                                                                                                |          |          |          |          |          |          |          |          |          |          |          |                |                 |
| Water heating requirement                                                                                    | 199.3541 | 175.5504 | 185.1250 | 160.0708 | 153.2041 | 135.9618 | 132.9234 | 139.5422 | 142.5031 | 161.3478 | 174.4610 | 196.8757 (64)  |                 |
| Efficiency of water heater (217)m                                                                            | 88.1435  | 88.0781  | 87.9295  | 87.6614  | 87.2331  | 86.7000  | 86.7000  | 86.7000  | 86.7000  | 87.7054  | 88.0422  | 86.7000 (216)  |                 |
| Fuel for water heating, kWh/month                                                                            | 226.1699 | 199.3122 | 210.5380 | 182.6013 | 175.6261 | 156.8186 | 153.3142 | 160.9484 | 164.3635 | 183.9656 | 198.1560 | 223.2925 (219) |                 |
| Space cooling fuel requirement (221)m                                                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)   |                 |
| Pumps and Fa                                                                                                 | 10.9478  | 9.8883   | 10.9478  | 10.5947  | 10.9478  | 10.5947  | 10.9478  | 10.9478  | 10.5947  | 10.9478  | 10.5947  | 10.9478 (231)  |                 |
| Lighting                                                                                                     | 23.4106  | 18.7809  | 16.9101  | 12.3891  | 9.5697   | 7.8185   | 8.7298   | 11.3473  | 14.7390  | 19.3384  | 21.8427  | 24.0613 (232)  |                 |
| Electricity generated by PVs (Appendix M) (negative quantity) (233a)m                                        | -11.5165 | -19.1763 | -33.0031 | -43.5351 | -52.0099 | -50.4050 | -49.4409 | -43.7568 | -34.6383 | -24.0771 | -13.4902 | -9.5519 (233a) |                 |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)  |                 |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)  |                 |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)  |                 |
| Electricity generated by PVs (Appendix M) (negative quantity) (233b)m                                        | -2.7365  | -6.8505  | -16.7864 | -30.3061 | -44.7949 | -46.9105 | -45.6945 | -35.7548 | -22.5599 | -10.7273 | -3.8701  | -2.0623 (233b) |                 |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234b)  |                 |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)  |                 |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235d)  |                 |
| Annual totals kWh/year                                                                                       |          |          |          |          |          |          |          |          |          |          |          |                |                 |
| Space heating fuel - main system 1                                                                           |          |          |          |          |          |          |          |          |          |          |          |                | 2388.2265 (211) |
| Space heating fuel - main system 2                                                                           |          |          |          |          |          |          |          |          |          |          |          |                | 0.0000 (213)    |
| Space heating fuel - secondary                                                                               |          |          |          |          |          |          |          |          |          |          |          |                | 0.0000 (215)    |
| Efficiency of water heater                                                                                   |          |          |          |          |          |          |          |          |          |          |          |                | 86.7000         |
| Water heating fuel used                                                                                      |          |          |          |          |          |          |          |          |          |          |          |                | 2235.1064 (219) |

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|                                                                                                                            |                 |
|----------------------------------------------------------------------------------------------------------------------------|-----------------|
| Space cooling fuel                                                                                                         | 0.0000 (221)    |
| Electricity for pumps and fans:<br>(MEVDecentralised, Database: total watage = 5.7980, total flow = 37.0000, SFP = 0.1567) |                 |
| mechanical ventilation fans (SFP = 0.1567)                                                                                 | 42.9017 (230a)  |
| central heating pump                                                                                                       | 41.0000 (230c)  |
| main heating flue fan                                                                                                      | 45.0000 (230e)  |
| Total electricity for the above, kWh/year                                                                                  | 128.9017 (231)  |
| Electricity for lighting (calculated in Appendix L)                                                                        | 188.9373 (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                                              |                 |
| PV generation                                                                                                              | -653.6551 (233) |
| Wind generation                                                                                                            | 0.0000 (234)    |
| Hydro-electric generation (Appendix N)                                                                                     | 0.0000 (235a)   |
| Electricity generated - Micro CHP (Appendix N)                                                                             | 0.0000 (235)    |
| Appendix Q - special features                                                                                              |                 |
| Energy saved or generated                                                                                                  | -0.0000 (236)   |
| Energy used                                                                                                                | 0.0000 (237)    |
| Total delivered energy for all uses                                                                                        | 4287.5169 (238) |

## 10a. Fuel costs - using Table 12 prices

|                                             | Fuel<br>kWh/year | Fuel price<br>p/kWh | Fuel cost<br>£/year |
|---------------------------------------------|------------------|---------------------|---------------------|
| Space heating - main system 1               | 2388.2265        | 3.6400              | 86.9314 (240)       |
| Total CO2 associated with community systems |                  |                     | 0.0000 (473)        |
| Water heating (other fuel)                  | 2235.1064        | 3.6400              | 81.3579 (247)       |
| Energy for instantaneous electric shower(s) | 0.0000           | 16.4900             | 0.0000 (247a)       |
| Pumps, fans and electric keep-hot           | 128.9017         | 16.4900             | 21.2559 (249)       |
| Energy for lighting                         | 188.9373         | 16.4900             | 31.1558 (250)       |
| Additional standing charges                 |                  |                     | 92.0000 (251)       |
| Energy saving/generation technologies       |                  |                     |                     |
| PV Unit electricity used in dwelling        | -384.6011        | 16.4900             | -63.4207            |
| PV Unit electricity exported                | -269.0539        | 5.5900              | -15.0401            |
| Total                                       |                  |                     | -78.4608 (252)      |
| Total energy cost                           |                  |                     | 234.2401 (255)      |

## 11a. SAP rating - Individual heating systems

|                                  |              |
|----------------------------------|--------------|
| Energy cost deflator (Table 12): | 0.3600 (256) |
| Energy cost factor (ECF)         | 0.6438 (257) |
| SAP value                        | 89.5638      |
| SAP rating (Section 12)          | 90 (258)     |
| SAP band                         | B            |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|---------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1               | 2388.2265          | 0.2100                        | 501.5276 (261)           |
| Total CO2 associated with community systems |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                  | 2235.1064          | 0.2100                        | 469.3724 (264)           |
| Space and water heating                     |                    |                               | 970.8999 (265)           |
| Pumps, fans and electric keep-hot           | 128.9017           | 0.1387                        | 17.8803 (267)            |
| Energy for lighting                         | 188.9373           | 0.1443                        | 27.2695 (268)            |
| Energy saving/generation technologies       |                    |                               |                          |
| PV Unit electricity used in dwelling        | -384.6011          | 0.1316                        | -50.6173                 |
| PV Unit electricity exported                | -269.0539          | 0.1216                        | -32.7148                 |
| Total                                       |                    |                               | -83.3322 (269)           |
| Total CO2, kg/year                          |                    |                               | 932.7175 (272)           |
| CO2 emissions per m2                        |                    |                               | 10.8500 (273)            |
| EI value                                    |                    |                               | 90.4578                  |
| EI rating                                   |                    |                               | 90 (274)                 |
| EI band                                     |                    |                               | B                        |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m2) | Storey height<br>(m)              | Volume<br>(m3)         |
|--------------------------------------------------------|--------------|-----------------------------------|------------------------|
| Main dwelling                                          |              |                                   |                        |
| Ground floor                                           | 42.9900 (1b) | x 2.4600 (2b)                     | = 105.7554 (1b) - (3b) |
| First floor                                            | 42.9900 (1c) | x 2.7600 (2c)                     | = 118.6524 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 85.9800      |                                   | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 224.4078 (5)           |

## 2. Ventilation rate

|                                                    | m3 per hour          |
|----------------------------------------------------|----------------------|
| Number of open chimneys                            | 0 * 80 = 0.0000 (6a) |
| Number of open flues                               | 0 * 20 = 0.0000 (6b) |
| Number of chimneys / flues attached to closed fire | 0 * 10 = 0.0000 (6c) |

# Full SAP Calculation Printout



Number of flues attached to solid fuel boiler 0 \* 20 = 0.0000 (6d)  
Number of flues attached to other heater 0 \* 35 = 0.0000 (6e)  
Number of blocked chimneys 0 \* 20 = 0.0000 (6f)  
Number of intermittent extract fans 0 \* 10 = 0.0000 (7a)  
Number of passive vents 0 \* 10 = 0.0000 (7b)  
Number of flueless gas fires 0 \* 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 0.0000 / (5) = 0.0000 (8)  
Pressure test Yes  
Pressure Test Method Blower Door  
Measured/design AP50 4.5000 (17)  
Infiltration rate 0.2250 (18)  
Number of sides sheltered 2 (19)  
Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)  
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1913 (21)

|                                                                                                         |        |        |        |        |        |        |        |        |        |        |        |        |       |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|
|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |       |
| Wind speed                                                                                              | 4.2000 | 4.0000 | 4.0000 | 3.7000 | 3.7000 | 3.3000 | 3.4000 | 3.2000 | 3.3000 | 3.5000 | 3.5000 | 3.8000 | (22)  |
| Wind factor                                                                                             | 1.0500 | 1.0000 | 1.0000 | 0.9250 | 0.9250 | 0.8250 | 0.8500 | 0.8000 | 0.8250 | 0.8750 | 0.8750 | 0.9500 | (22a) |
| Adj infilt rate                                                                                         | 0.2008 | 0.1913 | 0.1913 | 0.1769 | 0.1769 | 0.1578 | 0.1626 | 0.1530 | 0.1578 | 0.1673 | 0.1673 | 0.1817 | (22b) |
| Mechanical extract ventilation - decentralised                                                          |        |        |        |        |        |        |        |        |        |        |        |        |       |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.5000 | (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.5000 | (23b) |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | (25)  |

## 3. Heat losses and heat loss parameter

| Element                                        | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K | A x U<br>W/K | K-value<br>kJ/m2K | A x K<br>kJ/K   |
|------------------------------------------------|-------------|----------------|---------------|------------------|--------------|-------------------|-----------------|
| Main dwelling                                  |             |                |               |                  |              |                   |                 |
| Front Door                                     |             |                | 2.5500        | 1.2000           | 3.0600       |                   | (26)            |
| Windows                                        |             |                | 10.2500       | 1.2357           | 12.6663      |                   | (27)            |
| French Doors                                   |             |                | 3.3300        | 1.2357           | 4.1150       |                   | (27)            |
| GF SPVL 125TS P/A                              |             |                | 42.9900       | 0.1300           | 5.5887       | 75.0000           | 3224.2500 (28a) |
| EW Brick AAC011                                | 97.2486     | 16.1300        | 81.1186       | 0.1800           | 14.6013      | 60.0000           | 4867.1160 (29a) |
| PR 500mm MW044                                 | 42.9900     |                | 42.9900       | 0.0900           | 3.8691       | 9.0000            | 386.9100 (30)   |
| Total net area of external elements Aum(A, m2) |             |                | 183.2286      |                  |              |                   | (31)            |
| Fabric heat loss, W/K = Sum (A x U)            |             |                |               |                  | 43.9005      |                   | (33)            |
| Main dwelling                                  |             |                |               |                  |              |                   |                 |
| E-WM-30                                        |             |                | 43.8000       | 0.0000           | 0.0000       | 45.0000           | 1971.0000 (32)  |
| Timber - GF                                    |             |                | 88.6100       |                  |              | 9.0000            | 797.4900 (32c)  |
| Timber - FF                                    |             |                | 126.9000      |                  |              | 9.0000            | 1142.1000 (32c) |
| Internal Floor FF                              |             |                | 42.9900       |                  |              | 18.0000           | 773.8200 (32d)  |
| Internal Ceiling GF                            |             |                | 42.9900       |                  |              | 9.0000            | 386.9100 (32e)  |

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13549.5960 (34)  
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 157.5901 (35)

List of Thermal Bridges

| K1 Element                                           | Length  | Psi-value | Total  |
|------------------------------------------------------|---------|-----------|--------|
| E2 Other lintels (including other steel lintels)     | 10.7800 | 0.0410    | 0.4420 |
| E3 Sill                                              | 9.2000  | 0.0220    | 0.2024 |
| E4 Jamb                                              | 21.1500 | 0.0190    | 0.4018 |
| E5 Ground floor (normal)                             | 10.2300 | 0.0928    | 0.9493 |
| E6 Intermediate floor within a dwelling              | 18.6300 | 0.0020    | 0.0373 |
| E10 Eaves (insulation at ceiling level)              | 10.2500 | 0.0390    | 0.3997 |
| E18 Party wall between dwellings                     | 10.4400 | 0.0330    | 0.3445 |
| E4 Jamb                                              | 4.8000  | 0.1000    | 0.4800 |
| E2 Other lintels (including other steel lintels)     | 1.0600  | 0.0410    | 0.0435 |
| P1 Party wall - Ground floor                         | 8.3900  | 0.1000    | 0.8390 |
| P2 Party wall - Intermediate floor within a dwelling | 8.3900  | 0.0000    | 0.0000 |
| P4 Party wall - Roof (insulation at ceiling level)   | 8.3900  | 0.0350    | 0.2937 |
| E5 Ground floor (normal)                             | 8.3900  | 0.0980    | 0.8222 |
| E12 Gable (insulation at ceiling level)              | 8.3900  | 0.0870    | 0.7299 |
| E16 Corner (normal)                                  | 10.4400 | 0.0420    | 0.4385 |

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.4238 (36)  
Point Thermal bridges (36a) = 0.0000  
Total fabric heat loss (33) + (36) + (36a) = 50.3244 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

|                           |         |         |         |         |         |         |         |         |         |         |         |         |      |
|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
|                           | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |      |
| (38)m                     | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | (38) |
| Heat transfer coeff       | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | (39) |
| Average = Sum(39)m / 12 = |         |         |         |         |         |         |         |         |         |         |         | 87.3516 |      |

|               |        |        |        |        |        |        |        |        |        |        |        |        |      |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
|               | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |      |
| HLP           | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | (40) |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 1.0160 |      |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31     |      |

## 4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5666 (42)

Hot water usage for mixer showers 67.2533 66.2426 64.7698 61.9519 59.8724 57.5533 56.2352 57.6968 59.2990 61.7890 64.6674 66.9956 (42a)

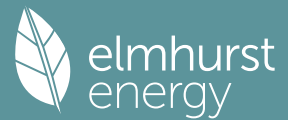
Hot water usage for baths 29.0443 28.6130 28.0055 26.8856 26.0469 25.1170 24.6147 25.2179 25.8746 26.8697 28.0127 28.9461 (42b)

Hot water usage for other uses 40.9146 39.4268 37.9390 36.4512 34.9634 33.4756 33.4756 34.9634 36.4512 37.9390 39.4268 40.9146 (42c)

Average daily hot water use (litres/day) 126.1290 (43)

|                                                                                                      |          |          |          |          |          |          |          |          |          |          |          |          |      |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
|                                                                                                      | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |      |
| Daily hot water use                                                                                  | 137.2122 | 134.2823 | 130.7143 | 125.2887 | 120.8827 | 116.1459 | 114.3255 | 117.8781 | 121.6248 | 126.5977 | 132.1069 | 136.8563 | (44) |
| Energy conte                                                                                         | 217.3105 | 191.2162 | 200.9030 | 171.5139 | 162.7313 | 142.8150 | 138.2667 | 145.9577 | 149.9756 | 171.7918 | 188.2105 | 214.2839 | (45) |
| Energy content (annual)                                                                              |          |          |          |          |          |          |          |          |          |          |          |          |      |
| Distribution loss (46)m = 0.15 x (45)m                                                               |          |          |          |          |          |          |          |          |          |          |          |          |      |
| 32.5966 28.6824 30.1355 25.7271 24.4097 21.4222 20.7400 21.8937 22.4963 25.7688 28.2316 32.1426 (46) |          |          |          |          |          |          |          |          |          |          |          |          |      |
| Water storage loss (or HIU loss):                                                                    |          |          |          |          |          |          |          |          |          |          |          |          |      |
| Total storage loss                                                                                   |          |          |          |          |          |          |          |          |          |          |          |          |      |

# Full SAP Calculation Printout



|                                                                                             |          |          |          |          |          |          |          |          |          |          |          |                |
|---------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| If cylinder contains dedicated solar storage                                                | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (56)    |
| Primary loss                                                                                | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (57)    |
| Combi loss                                                                                  | 11.9874  | 10.8167  | 11.9530  | 11.5193  | 11.8728  | 11.4590  | 11.8214  | 11.8376  | 11.4740  | 11.8918  | 11.5543  | 11.9811 (61)   |
| Total heat required for water heating calculated for each month                             | 229.2979 | 202.0330 | 212.8560 | 183.0332 | 174.6042 | 154.2740 | 150.0882 | 157.7953 | 161.4496 | 183.6836 | 199.7649 | 226.2650 (62)  |
| WWHRS                                                                                       | -29.9438 | -26.4825 | -27.7310 | -22.9624 | -21.4001 | -18.3122 | -17.1648 | -18.2530 | -18.9465 | -22.3359 | -25.3038 | -29.3893 (63a) |
| PV diverter                                                                                 | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000 (63b)  |
| Solar input                                                                                 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63c)   |
| FGHRS                                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63d)   |
| Output from w/h                                                                             | 199.3541 | 175.5504 | 185.1250 | 160.0708 | 153.2041 | 135.9618 | 132.9234 | 139.5422 | 142.5031 | 161.3478 | 174.4610 | 196.8757 (64)  |
| Electric shower(s)                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (64a)   |
| Heat gains from water heating, kWh/month                                                    | 75.2526  | 66.2836  | 69.7885  | 59.9082  | 57.0764  | 50.3507  | 48.9291  | 51.4903  | 52.7354  | 60.0937  | 65.4686  | 74.2447 (65)   |
| Total per year (kWh/year) = Sum(64)m = 1956.9195 (64)                                       |          |          |          |          |          |          |          |          |          |          |          |                |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a) |          |          |          |          |          |          |          |          |          |          |          |                |

## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |           |           |           |           |           |           |           |           |           |           |           |                |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
| Metabolic gains (Table 5), Watts                                                    | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec            |
| (66)m                                                                               | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 26.7460   | 23.7556   | 19.3193   | 14.6260   | 10.9331   | 9.2302    | 9.9735    | 12.9640   | 17.4002   | 22.0936   | 25.7865   | 27.4894 (67)   |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 345.4995  | 349.0847  | 340.0501  | 320.8165  | 296.5375  | 273.7188  | 258.4744  | 254.8892  | 263.9238  | 283.1574  | 307.4363  | 330.2551 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662 (69)   |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 3.0000    | 3.0000    | 3.0000 (70)    |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 (71) |
| Water heating gains (Table 5)                                                       | 101.1460  | 98.6363   | 93.8018   | 83.2058   | 76.7156   | 69.9316   | 65.7649   | 69.2074   | 73.2436   | 80.7712   | 90.9286   | 99.7912 (72)   |
| Total internal gains                                                                | 580.6898  | 578.7749  | 560.4695  | 525.9466  | 491.4845  | 457.1788  | 438.5111  | 441.3589  | 458.8659  | 493.3204  | 531.4497  | 564.8340 (73)  |

## 6. Solar gains

| [Jan]       |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W   |          |          |               |
|-------------|----------|----------|----------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|--------------|----------|----------|---------------|
| North       |          |          |          | 0.5200     | 11.9814                        | 0.4500                            | 0.0000                             | 0.7700                       | 2.1588 (74)  |          |          |               |
| East        |          |          |          | 4.1200     | 22.3313                        | 0.4500                            | 0.0000                             | 0.7700                       | 31.8797 (76) |          |          |               |
| West        |          |          |          | 5.6100     | 22.3313                        | 0.4500                            | 0.0000                             | 0.7700                       | 43.4091 (80) |          |          |               |
| East        |          |          |          | 3.3300     | 22.3313                        | 0.4500                            | 0.0000                             | 0.7700                       | 25.7669 (76) |          |          |               |
|             |          |          |          |            |                                |                                   |                                    |                              |              |          |          |               |
| Solar gains | 103.2145 | 181.5675 | 295.1032 | 443.3153   | 529.4853                       | 580.2956                          | 546.3815                           | 479.7107                     | 371.9166     | 229.9510 | 131.8216 | 84.0748 (83)  |
| Total gains | 683.9043 | 760.3424 | 855.5727 | 969.2619   | 1020.9698                      | 1037.4744                         | 984.8926                           | 921.0697                     | 830.7825     | 723.2714 | 663.2713 | 648.9089 (84) |

## 7. Mean internal temperature (heating season)

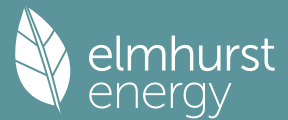
|                                                                             |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 (85) |
| tau                                                                         | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725       |
| alpha                                                                       | 0.9663  | 0.9491  | 0.9016  | 0.7949  | 0.6254  | 0.4123  | 0.2736  | 0.3014  | 0.5713  | 0.8419  | 0.9441  | 0.9713 (86)  |
| util living area                                                            | 19.5029 | 19.7178 | 20.1434 | 20.5905 | 20.8760 | 20.9815 | 20.9973 | 20.9960 | 20.9342 | 20.5637 | 19.9525 | 19.4401 (87) |
| MIT                                                                         | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 (88) |
| util rest of house                                                          | 0.9595  | 0.9392  | 0.8828  | 0.7588  | 0.5676  | 0.3391  | 0.1922  | 0.2148  | 0.4926  | 0.8037  | 0.9312  | 0.9655 (89)  |
| MIT 2                                                                       | 18.5450 | 18.7828 | 19.2473 | 19.7121 | 19.9808 | 20.0614 | 20.0695 | 20.0691 | 20.0322 | 19.6988 | 19.0477 | 18.4754 (90) |
| Living area fraction                                                        | 18.7301 | 18.9635 | 19.4205 | 19.8819 | 20.1539 | 20.2392 | 20.2488 | 20.2483 | 20.2066 | 19.8660 | 19.2226 | 18.6619 (92) |
| MIT                                                                         | 18.7301 | 18.9635 | 19.4205 | 19.8819 | 20.1539 | 20.2392 | 20.2488 | 20.2483 | 20.2066 | 19.8660 | 19.2226 | 18.6619 (93) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT                                                                | 18.7301 | 18.9635 | 19.4205 | 19.8819 | 20.1539 | 20.2392 | 20.2488 | 20.2483 | 20.2066 | 19.8660 | 19.2226 | 18.6619 (93) |

## 8. Space heating requirement

|                                                                                |           |           |           |          |          |          |          |          |          |          |          |                |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| Utilisation                                                                    | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec            |
| Useful gains                                                                   | 0.9467    | 0.9244    | 0.8673    | 0.7507   | 0.5730   | 0.3527   | 0.2079   | 0.2316   | 0.5047   | 0.7941   | 0.9163   | 0.9536 (94)    |
| Ext temp.                                                                      | 647.4500  | 702.8237  | 742.0226  | 727.6734 | 585.0358 | 365.8666 | 204.7979 | 213.2862 | 419.2810 | 574.3444 | 607.7491 | 618.7780 (95)  |
| Heat loss rate W                                                               | 5.1000    | 5.6000    | 7.4000    | 9.9000   | 13.0000  | 16.0000  | 17.9000  | 17.8000  | 15.2000  | 11.6000  | 8.0000   | 5.1000 (96)    |
| Space heating kWh                                                              | 1190.6151 | 1167.3270 | 1050.0123 | 871.9340 | 624.9009 | 370.3033 | 205.1717 | 213.8616 | 437.3330 | 722.0459 | 980.3109 | 1184.6518 (97) |
| Space heating requirement - total per year (kWh/year)                          | 404.1148  | 312.1462  | 229.1444  | 103.8676 | 29.6597  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 109.8899 | 268.2445 | 421.0101 (98a) |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         | 404.1148  | 312.1462  | 229.1444  | 103.8676 | 29.6597  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 109.8899 | 268.2445 | 421.0101 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |          |          |          |          |          |          |          |          | 1878.0772      |
| Space heating per m2                                                           |           |           |           |          |          |          |          |          |          |          |          | 21.8432 (99)   |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

# Full SAP Calculation Printout



|                                                                                                      |          |          |          |          |          |          |          |          |          |          |          |                 |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (201)    |
| Fraction of space heat from main system(s)                                                           |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (202)    |
| Efficiency of main space heating system 1 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 91.7000 (206)   |
| Efficiency of main space heating system 2 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)    |
| Efficiency of secondary/supplementary heating system, %                                              |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)    |
|                                                                                                      | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec             |
| Space heating requirement                                                                            | 404.1148 | 312.1462 | 229.1444 | 103.8676 | 29.6597  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 109.8899 | 268.2445 | 421.0101 (98)   |
| Space heating efficiency (main heating system 1)                                                     | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 91.7000  | 91.7000  | 91.7000 (210)   |
| Space heating fuel (main heating system)                                                             | 440.6923 | 340.3994 | 249.8848 | 113.2690 | 32.3442  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 119.8363 | 292.5240 | 459.1168 (211)  |
| Space heating efficiency (main heating system 2)                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)    |
| Space heating fuel (main heating system 2)                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)    |
| Space heating fuel (secondary)                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)    |
| Water heating                                                                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| Water heating requirement                                                                            | 199.3541 | 175.5504 | 185.1250 | 160.0708 | 153.2041 | 135.9618 | 132.9234 | 139.5422 | 142.5031 | 161.3478 | 174.4610 | 196.8757 (64)   |
| Efficiency of water heater                                                                           | 88.0951  | 88.0325  | 87.8491  | 87.5144  | 87.0338  | 86.7000  | 86.7000  | 86.7000  | 86.7000  | 87.5387  | 87.9604  | 86.7000 (216)   |
| Fuel for water heating, kWh/month                                                                    | 226.2942 | 199.4155 | 210.7306 | 182.9079 | 176.0282 | 156.8186 | 153.3142 | 160.9484 | 164.3635 | 184.3159 | 198.3404 | 88.1199 (217)   |
| Space cooling fuel requirement                                                                       |          |          |          |          |          |          |          |          |          |          |          |                 |
| (221)m                                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)    |
| Pumps and Fa                                                                                         | 10.9478  | 9.8883   | 10.9478  | 10.5947  | 10.9478  | 10.5947  | 10.9478  | 10.9478  | 10.5947  | 10.9478  | 10.5947  | 10.9478 (231)   |
| Lighting                                                                                             | 23.4106  | 18.7809  | 16.9101  | 12.3891  | 9.5697   | 7.8185   | 8.7298   | 11.3473  | 14.7390  | 19.3384  | 21.8427  | 24.0613 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| (233a)m                                                                                              | -12.9948 | -19.6788 | -33.4418 | -44.9288 | -52.5148 | -53.1453 | -51.7882 | -46.7161 | -37.1809 | -26.0128 | -15.5005 | -10.6965 (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |          |          |          |          |          |          |          |          |                 |
| (234a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |          |          |          |          |          |          |          |          |                 |
| (235a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |          |          |          |          |          |          |          |          |                 |
| (235c)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| (233b)m                                                                                              | -3.3366  | -7.1593  | -17.1881 | -32.1833 | -45.6724 | -52.3387 | -50.2796 | -40.7390 | -25.7852 | -12.2915 | -4.8814  | -2.4799 (233b)  |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |          |          |          |          |          |          |          |          |                 |
| (234b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234b)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |          |          |          |          |          |          |          |          |                 |
| (235b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |          |          |          |          |          |          |          |          |                 |
| (235d)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235d)   |
| Annual totals kWh/year                                                                               |          |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating fuel - main system 1                                                                   |          |          |          |          |          |          |          |          |          |          |          | 2048.0668 (211) |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)    |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)    |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          | 86.7000         |
| Water heating fuel used                                                                              |          |          |          |          |          |          |          |          |          |          |          | 2236.8953 (219) |
| Space cooling fuel                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (221)    |
| Electricity for pumps and fans:                                                                      |          |          |          |          |          |          |          |          |          |          |          |                 |
| (MEV)Decentralised, Database: total watage = 5.7980, total flow = 37.0000, SFP = 0.1567)             |          |          |          |          |          |          |          |          |          |          |          |                 |
| mechanical ventilation fans (SFP = 0.1567)                                                           |          |          |          |          |          |          |          |          |          |          |          | 42.9017 (230a)  |
| central heating pump                                                                                 |          |          |          |          |          |          |          |          |          |          |          | 41.0000 (230c)  |
| main heating flue fan                                                                                |          |          |          |          |          |          |          |          |          |          |          | 45.0000 (230e)  |
| Total electricity for the above, kWh/year                                                            |          |          |          |          |          |          |          |          |          |          |          | 128.9017 (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |          |          |          |          |          |          |          |          |          |          |          | 188.9373 (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| PV generation                                                                                        |          |          |          |          |          |          |          |          |          |          |          | -698.9344 (233) |
| Wind generation                                                                                      |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (234)    |
| Hydro-electric generation (Appendix N)                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (235a)   |
| Electricity generated - Micro CHP (Appendix N)                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (235)    |
| Appendix Q - special features                                                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| Energy saved or generated                                                                            |          |          |          |          |          |          |          |          |          |          |          | -0.0000 (236)   |
| Energy used                                                                                          |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (237)    |
| Total delivered energy for all uses                                                                  |          |          |          |          |          |          |          |          |          |          |          | 3903.8667 (238) |

## 10a. Fuel costs - using BEDF prices (596)

|                                             | Fuel kWh/year | Fuel price p/kWh | Fuel cost £/year |
|---------------------------------------------|---------------|------------------|------------------|
| Space heating - main system 1               | 2048.0668     | 7.3200           | 149.9185 (240)   |
| Total CO2 associated with community systems |               |                  | 0.0000 (473)     |
| Water heating (other fuel)                  | 2236.8953     | 7.3200           | 163.7407 (247)   |
| Energy for instantaneous electric shower(s) | 0.0000        | 27.6700          | 0.0000 (247a)    |
| Pumps, fans and electric keep-hot           | 128.9017      | 27.6700          | 35.6671 (249)    |
| Energy for lighting                         | 188.9373      | 27.6700          | 52.2789 (250)    |
| Additional standing charges                 |               |                  | 108.0000 (251)   |
| Energy saving/generation technologies       |               |                  |                  |
| PV Unit electricity used in dwelling        | -404.5993     | 27.6700          | -111.9526        |
| PV Unit electricity exported                | -294.3350     | 5.8100           | -17.1009         |
| Total                                       |               |                  | -129.0535 (252)  |
| Total energy cost                           |               |                  | 380.5518 (255)   |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                             | Energy kWh/year | Emission factor kg CO2/kWh | Emissions kg CO2/year |
|---------------------------------------------|-----------------|----------------------------|-----------------------|
| Space heating - main system 1               | 2048.0668       | 0.2100                     | 430.0940 (261)        |
| Total CO2 associated with community systems |                 |                            | 0.0000 (373)          |
| Water heating (other fuel)                  | 2236.8953       | 0.2100                     | 469.7480 (264)        |
| Space and water heating                     |                 |                            | 899.8420 (265)        |
| Pumps, fans and electric keep-hot           | 128.9017        | 0.1387                     | 17.8803 (267)         |
| Energy for lighting                         | 188.9373        | 0.1443                     | 27.2695 (268)         |
| Energy saving/generation technologies       |                 |                            |                       |
| PV Unit electricity used in dwelling        | -404.5993       | 0.1316                     | -53.2562              |
| PV Unit electricity exported                | -294.3350       | 0.1211                     | -35.6464              |

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Total  
Total CO2, kg/year

-88.9026 (269)  
856.0892 (272)

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy kWh/year | Primary energy factor kg CO2/kWh | Primary energy kWh/year |
|---------------------------------------------|-----------------|----------------------------------|-------------------------|
| Space heating - main system 1               | 2048.0668       | 1.1300                           | 2314.3155 (275)         |
| Total CO2 associated with community systems |                 |                                  | 0.0000 (473)            |
| Water heating (other fuel)                  | 2236.8953       | 1.1300                           | 2527.6917 (278)         |
| Space and water heating                     |                 |                                  | 4842.0072 (279)         |
| Pumps, fans and electric keep-hot           | 128.9017        | 1.5128                           | 195.0025 (281)          |
| Energy for lighting                         | 188.9373        | 1.5338                           | 289.7983 (282)          |
| Energy saving/generation technologies       |                 |                                  |                         |
| PV Unit electricity used in dwelling        | -404.5993       | 1.4863                           | -601.3523               |
| PV Unit electricity exported                | -294.3350       | 0.4442                           | -130.7519               |
| Total                                       |                 |                                  | -732.1042 (283)         |
| Total Primary energy kWh/year               |                 |                                  | 4594.7037 (286)         |

## SAP 10 EPC IMPROVEMENTS

Plot 3

Current energy efficiency rating: B 90  
Current environmental impact rating: B 90

|                                                         |            |             |                        |
|---------------------------------------------------------|------------|-------------|------------------------|
| N Solar water heating                                   |            |             | SAP increase too small |
| U Solar photovoltaic panels                             |            |             | Already installed      |
| V2 Wind turbine                                         |            |             | Not applicable         |
| Recommended measures:<br>(none)                         | SAP change | Cost change | CO2 change             |
| Measures omitted - SAP change or cost saving too small: |            |             |                        |
| N Solar water heating                                   | + 0.5      | -£ 31       | -140 kg (16.4%)        |

| Recommended measures<br>(none)         | Total annual savings | Energy efficiency | Environmental impact |
|----------------------------------------|----------------------|-------------------|----------------------|
|                                        | Total Savings £0     |                   | 0.00 kg/m²           |
| Potential energy efficiency rating:    |                      | B 90              |                      |
| Potential environmental impact rating: |                      |                   | B 90                 |

Fuel prices for cost data on this page from database revision number 596 TEST (30 Jun 2026)  
Recommendation texts revision number 6.1 (11 Jun 2019)

## Typical heating and lighting costs of this home (per year, Thames Valley):

|                          | Current    | Potential  | Saving     |
|--------------------------|------------|------------|------------|
| Electricity              | £88        | £88        | £0         |
| Mains gas                | £422       | £422       | £0         |
| Space heating            | £294       | £294       | £0         |
| Water heating            | £164       | £164       | £0         |
| Lighting                 | £52        | £52        | £0         |
| Generated (PV)           | -£129      | -£129      | £0         |
| Total cost of fuels      | £381       | £381       | £0         |
| Total cost of uses       | £381       | £381       | £0         |
| Delivered energy         | 45 kWh/m²  | 45 kWh/m²  | 0 kWh/m²   |
| Carbon dioxide emissions | 0.9 tonnes | 0.9 tonnes | 0.0 tonnes |
| CO2 emissions per m²     | 10 kg/m²   | 10 kg/m²   | 0 kg/m²    |
| Primary energy           | 53 kWh/m²  | 53 kWh/m²  | 0 kWh/m²   |

## SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

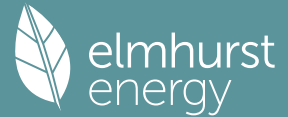
### 1. Overall dwelling characteristics

|                                                        | Area (m²)    | Storey height (m)               | Volume (m³)            |
|--------------------------------------------------------|--------------|---------------------------------|------------------------|
| Main dwelling                                          |              |                                 |                        |
| Ground floor                                           | 42.9900 (1b) | x 2.4600 (2b)                   | = 105.7554 (1b) - (3b) |
| First floor                                            | 42.9900 (1c) | x 2.7600 (2c)                   | = 118.6524 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 85.9800      |                                 | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 224.4078 (5)         |

### 2. Ventilation rate

|                         | m³ per hour          |
|-------------------------|----------------------|
| Number of open chimneys | 0 * 80 = 0.0000 (6a) |
| Number of open flues    | 0 * 20 = 0.0000 (6b) |

# Full SAP Calculation Printout



Number of chimneys / flues attached to closed fire 0 \* 10 = 0.0000 (6c)  
Number of flues attached to solid fuel boiler 0 \* 20 = 0.0000 (6d)  
Number of flues attached to other heater 0 \* 35 = 0.0000 (6e)  
Number of blocked chimneys 0 \* 20 = 0.0000 (6f)  
Number of intermittent extract fans 0 \* 10 = 0.0000 (7a)  
Number of passive vents 0 \* 10 = 0.0000 (7b)  
Number of flueless gas fires 0 \* 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 0.0000 / (5) = 0.0000 (8)  
Pressure test Yes  
Pressure Test Method Blower Door  
Measured/design AP50 4.5000 (17)  
Infiltration rate 0.2250 (18)  
Number of sides sheltered 2 (19)  
Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)  
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1913 (21)

|                                                                                                         |        |        |        |        |        |        |        |        |        |        |        |        |              |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |              |
|                                                                                                         | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 | (22)         |
| Wind factor                                                                                             | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 | (22a)        |
| Adj infilt rate                                                                                         |        |        |        |        |        |        |        |        |        |        |        |        |              |
|                                                                                                         | 0.2438 | 0.2391 | 0.2343 | 0.2104 | 0.2056 | 0.1817 | 0.1817 | 0.1769 | 0.1913 | 0.2056 | 0.2152 | 0.2247 | (22b)        |
| Mechanical extract ventilation - decentralised                                                          |        |        |        |        |        |        |        |        |        |        |        |        |              |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | (25)         |

### 3. Heat losses and heat loss parameter

| Element                                                    | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K     | A x U<br>W/K | K-value<br>kJ/m2K                    | A x K<br>kJ/K         |              |
|------------------------------------------------------------|-------------|----------------|---------------|----------------------|--------------|--------------------------------------|-----------------------|--------------|
| Main dwelling                                              |             |                |               |                      |              |                                      |                       |              |
| Front Door                                                 |             |                | 2.5500        | 1.2000               | 3.0600       |                                      |                       | (26)         |
| Windows                                                    |             |                | 10.2500       | 1.2357               | 12.6663      |                                      |                       | (27)         |
| French Doors                                               |             |                | 3.3300        | 1.2357               | 4.1150       |                                      |                       | (27)         |
| GF SPVL 125TS P/A                                          |             |                | 42.9900       | 0.1300               | 5.5887       | 75.0000                              | 3224.2500             | (28a)        |
| EW Brick AAC011                                            | 97.2486     | 16.1300        | 81.1186       | 0.1800               | 14.6013      | 60.0000                              | 4867.1160             | (29a)        |
| PR 500mm MW044                                             | 42.9900     |                | 42.9900       | 0.0900               | 3.8691       | 9.0000                               | 386.9100              | (30)         |
| Total net area of external elements Aum(A, m2)             |             |                | 183.2286      |                      |              |                                      |                       | (31)         |
| Fabric heat loss, W/K = Sum (A x U)                        |             |                |               | (26)...(30) + (32) = | 43.9005      |                                      |                       | (33)         |
| Main dwelling                                              |             |                |               |                      |              |                                      |                       |              |
| E-WM-30                                                    |             |                | 43.8000       | 0.0000               | 0.0000       | 45.0000                              | 1971.0000             | (32)         |
| Timber - GF                                                |             |                | 88.6100       |                      |              | 9.0000                               | 797.4900              | (32c)        |
| Timber - FF                                                |             |                | 126.9000      |                      |              | 9.0000                               | 1142.1000             | (32c)        |
| Internal Floor FF                                          |             |                | 42.9900       |                      |              | 18.0000                              | 773.8200              | (32d)        |
| Internal Ceiling GF                                        |             |                | 42.9900       |                      |              | 9.0000                               | 386.9100              | (32e)        |
| Heat capacity Cm = Sum(A x k)                              |             |                |               |                      |              | (28)...(30) + (32) + (32a)...(32e) = | 13549.5960            | (34)         |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K          |             |                |               |                      |              |                                      | 157.5901              | (35)         |
| List of Thermal Bridges                                    |             |                |               |                      |              |                                      |                       |              |
| K1 Element                                                 |             |                |               | Length               | Psi-value    | Total                                |                       |              |
| E2 Other lintels (including other steel lintels)           |             |                |               | 10.7800              | 0.0410       | 0.4420                               |                       |              |
| E3 Sill                                                    |             |                |               | 9.2000               | 0.0220       | 0.2024                               |                       |              |
| E4 Jamb                                                    |             |                |               | 21.1500              | 0.0190       | 0.4018                               |                       |              |
| E5 Ground floor (normal)                                   |             |                |               | 10.2300              | 0.0928       | 0.9493                               |                       |              |
| E6 Intermediate floor within a dwelling                    |             |                |               | 18.6300              | 0.0020       | 0.0373                               |                       |              |
| E10 Eaves (insulation at ceiling level)                    |             |                |               | 10.2500              | 0.0390       | 0.3997                               |                       |              |
| E18 Party wall between dwellings                           |             |                |               | 10.4400              | 0.0330       | 0.3445                               |                       |              |
| E4 Jamb                                                    |             |                |               | 4.8000               | 0.1000       | 0.4800                               |                       |              |
| E2 Other lintels (including other steel lintels)           |             |                |               | 1.0600               | 0.0410       | 0.0435                               |                       |              |
| P1 Party wall - Ground floor                               |             |                |               | 8.3900               | 0.1000       | 0.8390                               |                       |              |
| P2 Party wall - Intermediate floor within a dwelling       |             |                |               | 8.3900               | 0.0000       | 0.0000                               |                       |              |
| P4 Party wall - Roof (insulation at ceiling level)         |             |                |               | 8.3900               | 0.0350       | 0.2937                               |                       |              |
| E5 Ground floor (normal)                                   |             |                |               | 8.3900               | 0.0980       | 0.8222                               |                       |              |
| E12 Gable (insulation at ceiling level)                    |             |                |               | 8.3900               | 0.0870       | 0.7299                               |                       |              |
| E16 Corner (normal)                                        |             |                |               | 10.4400              | 0.0420       | 0.4385                               |                       |              |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |             |                |               |                      |              |                                      | 6.4238                | (36)         |
| Point Thermal bridges                                      |             |                |               |                      |              |                                      | (36a) =               | 0.0000       |
| Total fabric heat loss                                     |             |                |               |                      |              |                                      | (33) + (36) + (36a) = | 50.3244 (37) |

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

|                           |         |         |         |         |         |         |         |         |         |         |         |         |         |
|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| (38)m                     | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |         |
|                           | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | (38)    |
| Heat transfer coeff       |         |         |         |         |         |         |         |         |         |         |         |         |         |
|                           | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | (39)    |
| Average = Sum(39)m / 12 = |         |         |         |         |         |         |         |         |         |         |         |         | 87.3516 |

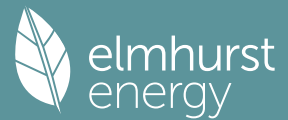
|               |        |        |        |        |        |        |        |        |        |        |        |        |        |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| HLP           | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |        |
|               | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | (40)   |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        |        | 1.0160 |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31     |        |

### 4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5666 (42)  
Hot water usage for mixer showers 67.2533 66.2426 64.7698 61.9519 59.8724 57.5533 56.2352 57.6968 59.2990 61.7890 64.6674 66.9956 (42a)  
Hot water usage for baths 29.0443 28.6130 28.0055 26.8856 26.0469 25.1170 24.6147 25.2179 25.8746 26.8697 28.0127 28.9461 (42b)  
Hot water usage for other uses 40.9146 39.4268 37.9390 36.4512 34.9634 33.4756 33.4756 34.9634 36.4512 37.9390 39.4268 40.9146 (42c)  
Average daily hot water use (litres/day) 126.1290 (43)

|                                        |          |          |          |          |          |          |          |          |          |                    |           |          |      |
|----------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------------------|-----------|----------|------|
| Daily hot water use                    | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct                | Nov       | Dec      |      |
|                                        | 137.2122 | 134.2823 | 130.7143 | 125.2887 | 120.8827 | 116.1459 | 114.3255 | 117.8781 | 121.6248 | 126.5977           | 132.1069  | 136.8563 | (44) |
| Energy conte                           | 217.3105 | 191.2162 | 200.9030 | 171.5139 | 162.7313 | 142.8150 | 138.2667 | 145.9577 | 149.9756 | 171.7918           | 188.2105  | 214.2839 | (45) |
| Energy content (annual)                |          |          |          |          |          |          |          |          |          | Total = Sum(45)m = | 2094.9763 |          |      |
| Distribution loss (46)m = 0.15 x (45)m |          |          |          |          |          |          |          |          |          |                    |           |          |      |
|                                        | 32.5966  | 28.6824  | 30.1355  | 25.7271  | 24.4097  | 21.4222  | 20.7400  | 21.8937  | 22.4963  | 25.7688            | 28.2316   | 32.1426  | (46) |
| Water storage loss (or HIU loss):      |          |          |          |          |          |          |          |          |          |                    |           |          |      |

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|                                                                 |                                                                                |          |          |          |          |          |          |          |          |          |          |                |
|-----------------------------------------------------------------|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| Total storage loss                                              | 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (56)    |
| If cylinder contains dedicated solar storage                    | 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (57)    |
| Primary loss                                                    | 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (59)    |
| Combi loss                                                      | 11.9874                                                                        | 10.8167  | 11.9530  | 11.5193  | 11.8728  | 11.4590  | 11.8214  | 11.8376  | 11.4740  | 11.8918  | 11.5543  | 11.9811 (61)   |
| Total heat required for water heating calculated for each month | 229.2979                                                                       | 202.0330 | 212.8560 | 183.0332 | 174.6042 | 154.2740 | 150.0882 | 157.7953 | 161.4496 | 183.6836 | 199.7649 | 226.2650 (62)  |
| WWHRS                                                           | -29.9438                                                                       | -26.4825 | -27.7310 | -22.9624 | -21.4001 | -18.3122 | -17.1648 | -18.2530 | -18.9465 | -22.3359 | -25.3038 | -29.3893 (63a) |
| PV diverter                                                     | -0.0000                                                                        | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000 (63b)  |
| Solar input                                                     | 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63c)   |
| FGHRS                                                           | 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63d)   |
| Output from w/h                                                 | 199.3541                                                                       | 175.5504 | 185.1250 | 160.0708 | 153.2041 | 135.9618 | 132.9234 | 139.5422 | 142.5031 | 161.3478 | 174.4610 | 196.8757 (64)  |
|                                                                 | Total per year (kWh/year) = Sum(64)m =                                         |          |          |          |          |          |          |          |          |          |          | 1956.9195 (64) |
| Electric shower(s)                                              | 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (64a)   |
|                                                                 | Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |          |          |          |          |          |          |          | 0.0000 (64a)   |
| Heat gains from water heating, kWh/month                        | 75.2526                                                                        | 66.2836  | 69.7885  | 59.9082  | 57.0764  | 50.3507  | 48.9291  | 51.4903  | 52.7354  | 60.0937  | 65.4686  | 74.2447 (65)   |

## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |           |           |           |           |           |           |           |           |           |           |           |           |      |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------|
| Metabolic gains (Table 5), Watts                                                    | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec       |      |
| (66)m                                                                               | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 26.7460   | 23.7556   | 19.3193   | 14.6260   | 10.9331   | 9.2302    | 9.9735    | 12.9640   | 17.4002   | 22.0936   | 25.7865   | 27.4894   | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 345.4995  | 349.0847  | 340.0501  | 320.8165  | 296.5375  | 273.7188  | 258.4744  | 254.8892  | 263.9238  | 283.1574  | 307.4363  | 330.2551  | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | (69) |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | (71) |
| Water heating gains (Table 5)                                                       | 101.1460  | 98.6363   | 93.8018   | 83.2058   | 76.7156   | 69.9316   | 65.7649   | 69.2074   | 73.2436   | 80.7712   | 90.9286   | 99.7912   | (72) |
| Total internal gains                                                                | 580.6898  | 578.7749  | 560.4695  | 525.9466  | 491.4845  | 457.1788  | 438.5111  | 441.3589  | 458.8659  | 493.3204  | 531.4497  | 564.8340  | (73) |

## 6. Solar gains

| [Jan]       |          |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c |          |          | Access<br>factor<br>Table 6d |               |  | Gains<br>W   |
|-------------|----------|----------|----------|----------|------------|--------------------------------|-----------------------------------|------------------------------------|----------|----------|------------------------------|---------------|--|--------------|
| North       |          |          |          |          | 0.5200     | 10.6334                        | 0.4500                            | 0.0000                             |          |          | 0.7700                       |               |  | 1.9159 (74)  |
| East        |          |          |          |          | 4.1200     | 19.6403                        | 0.4500                            | 0.0000                             |          |          | 0.7700                       |               |  | 28.0380 (76) |
| West        |          |          |          |          | 5.6100     | 19.6403                        | 0.4500                            | 0.0000                             |          |          | 0.7700                       |               |  | 38.1780 (80) |
| East        |          |          |          |          | 3.3300     | 19.6403                        | 0.4500                            | 0.0000                             |          |          | 0.7700                       |               |  | 22.6618 (76) |
|             |          |          |          |          |            |                                |                                   |                                    |          |          |                              |               |  |              |
| Solar gains | 90.7938  | 177.5254 | 292.5509 | 427.5877 | 525.2396   | 538.3069                       | 512.2248                          | 439.1107                           | 340.4932 | 210.6627 | 113.1838                     | 74.6861 (83)  |  |              |
| Total gains | 671.4836 | 756.3003 | 853.0204 | 953.5343 | 1016.7241  | 995.4857                       | 950.7359                          | 880.4696                           | 799.3592 | 703.9832 | 644.6335                     | 639.5201 (84) |  |              |

## 7. Mean internal temperature (heating season)

|                                                                             |                           |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |                           |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |                           |         |         |         |         |         |         |         |         |         |         |              |
|                                                                             | Jan                       | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| tau                                                                         | 43.0876                   | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876      |
| alpha                                                                       | 3.8725                    | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725       |
| util living area                                                            | 0.9726                    | 0.9560  | 0.9173  | 0.8335  | 0.6977  | 0.5335  | 0.3970  | 0.4442  | 0.6709  | 0.8821  | 0.9577  | 0.9770 (86)  |
| MIT                                                                         | 19.3433                   | 19.5949 | 20.0045 | 20.4610 | 20.7882 | 20.9426 | 20.9857 | 20.9780 | 20.8633 | 20.4089 | 19.7727 | 19.2671 (87) |
| Th 2                                                                        | 20.0701                   | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 (88) |
| util rest of house                                                          | 0.9673                    | 0.9477  | 0.9018  | 0.8038  | 0.6486  | 0.4650  | 0.3162  | 0.3594  | 0.6028  | 0.8535  | 0.9481  | 0.9724 (89)  |
| MIT 2                                                                       | 18.3657                   | 18.6457 | 19.0960 | 19.5801 | 19.9023 | 20.0352 | 20.0643 | 20.0604 | 19.9773 | 19.5400 | 18.8486 | 18.2806 (90) |
| Living area fraction                                                        | fLA = Living area / (4) = |         |         |         |         |         |         |         |         |         |         |              |
| MIT                                                                         | 18.5547                   | 18.8292 | 19.2716 | 19.7504 | 20.0736 | 20.2106 | 20.2424 | 20.2378 | 20.1486 | 19.7080 | 19.0272 | 18.4713 (91) |
| Temperature adjustment                                                      | 0.0000                    |         |         |         |         |         |         |         |         |         |         |              |
| adjusted MIT                                                                | 18.5547                   | 18.8292 | 19.2716 | 19.7504 | 20.0736 | 20.2106 | 20.2424 | 20.2378 | 20.1486 | 19.7080 | 19.0272 | 18.4713 (92) |
|                                                                             | 0.0000                    |         |         |         |         |         |         |         |         |         |         |              |
|                                                                             | 18.4713 (93)              |         |         |         |         |         |         |         |         |         |         |              |

## 8. Space heating requirement

|                                                                                |           |           |           |          |          |          |          |          |          |          |           |               |              |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|-----------|---------------|--------------|
| Utilisation                                                                    | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov       | Dec           |              |
|                                                                                | 0.9557    | 0.9334    | 0.8859    | 0.7924   | 0.6488   | 0.4757   | 0.3314   | 0.3751   | 0.6090   | 0.8403   | 0.9343    | 0.9618        | (94)         |
| Useful gains                                                                   | 641.7069  | 705.9434  | 755.6759  | 755.5458 | 659.6935 | 473.5720 | 315.1001 | 330.2594 | 486.7815 | 591.5762 | 602.2535  | 615.0884      | (95)         |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000  | 7.1000    | 4.2000        | (96)         |
| Heat loss rate W                                                               | 1245.1695 | 1216.7383 | 1115.6187 | 947.8010 | 731.4454 | 490.0938 | 318.1677 | 335.2390 | 528.3527 | 795.5979 | 1041.8615 | 1246.6189     | (97)         |
| Space heating kWh                                                              | 448.9762  | 343.2542  | 267.7975  | 138.4237 | 53.3834  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 151.7922 | 316.5178  | 469.8587      | (98a)        |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |          |          |          |          |          |          |          |           | 2190.0037     |              |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000        | (98b)        |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |          |          |          |          |          |          |          |           | 0.0000        |              |
| Space heating kWh                                                              | 448.9762  | 343.2542  | 267.7975  | 138.4237 | 53.3834  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 151.7922 | 316.5178  | 469.8587      | (98c)        |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |          |          |          |          |          |          |          |           | 2190.0037     |              |
| Space heating per m <sup>2</sup>                                               |           |           |           |          |          |          |          |          |          |          |           | (98c) / (4) = | 25.4711 (99) |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

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|                                                                                                      |          |           |            |                |          |          |          |          |          |          |          |                 |
|------------------------------------------------------------------------------------------------------|----------|-----------|------------|----------------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                |          |           |            |                |          |          |          |          |          |          |          | 0.0000 (201)    |
| Fraction of space heat from main system(s)                                                           |          |           |            |                |          |          |          |          |          |          |          | 1.0000 (202)    |
| Efficiency of main space heating system 1 (in %)                                                     |          |           |            |                |          |          |          |          |          |          |          | 91.7000 (206)   |
| Efficiency of main space heating system 2 (in %)                                                     |          |           |            |                |          |          |          |          |          |          |          | 0.0000 (207)    |
| Efficiency of secondary/supplementary heating system, %                                              |          |           |            |                |          |          |          |          |          |          |          | 0.0000 (208)    |
|                                                                                                      | Jan      | Feb       | Mar        | Apr            | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec             |
| Space heating requirement                                                                            | 448.9762 | 343.2542  | 267.7975   | 138.4237       | 53.3834  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 151.7922 | 316.5178 | 469.8587 (98)   |
| Space heating efficiency (main heating system 1)                                                     | 91.7000  | 91.7000   | 91.7000    | 91.7000        | 91.7000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 91.7000  | 91.7000  | 91.7000 (210)   |
| Space heating fuel (main heating system)                                                             | 489.6142 | 374.3230  | 292.0365   | 150.9528       | 58.2153  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 165.5313 | 345.1666 | 512.3868 (211)  |
| Space heating efficiency (main heating system 2)                                                     | 0.0000   | 0.0000    | 0.0000     | 0.0000         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)    |
| Space heating fuel (main heating system 2)                                                           | 0.0000   | 0.0000    | 0.0000     | 0.0000         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)    |
| Space heating fuel (secondary)                                                                       | 0.0000   | 0.0000    | 0.0000     | 0.0000         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)    |
| Water heating                                                                                        |          |           |            |                |          |          |          |          |          |          |          |                 |
| Water heating requirement                                                                            | 199.3541 | 175.5504  | 185.1250   | 160.0708       | 153.2041 | 135.9618 | 132.9234 | 139.5422 | 142.5031 | 161.3478 | 174.4610 | 196.8757 (64)   |
| Efficiency of water heater                                                                           | 88.1435  | 88.0781   | 87.9295    | 87.6614        | 87.2331  | 86.7000  | 86.7000  | 86.7000  | 86.7000  | 87.7054  | 88.0422  | 88.1694 (217)   |
| Fuel for water heating, kWh/month                                                                    | 226.1699 | 199.3122  | 210.5380   | 182.6013       | 175.6261 | 156.8186 | 153.3142 | 160.9484 | 164.3635 | 183.9656 | 198.1560 | 223.2925 (219)  |
| Space cooling fuel requirement                                                                       |          |           |            |                |          |          |          |          |          |          |          |                 |
| (221)m                                                                                               | 0.0000   | 0.0000    | 0.0000     | 0.0000         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)    |
| Pumps and Fa                                                                                         | 10.9478  | 9.8883    | 10.9478    | 10.5947        | 10.9478  | 10.5947  | 10.9478  | 10.9478  | 10.5947  | 10.9478  | 10.5947  | 10.9478 (231)   |
| Lighting                                                                                             | 23.4106  | 18.7809   | 16.9101    | 12.3891        | 9.5697   | 7.8185   | 8.7298   | 11.3473  | 14.7390  | 19.3384  | 21.8427  | 24.0613 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |           |            |                |          |          |          |          |          |          |          |                 |
| (233a)m                                                                                              | -11.5165 | -19.1763  | -33.0031   | -43.5351       | -52.0099 | -50.4050 | -49.4409 | -43.7568 | -34.6383 | -24.0771 | -13.4902 | -9.5519 (233a)  |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |           |            |                |          |          |          |          |          |          |          |                 |
| (234a)m                                                                                              | 0.0000   | 0.0000    | 0.0000     | 0.0000         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |           |            |                |          |          |          |          |          |          |          |                 |
| (235a)m                                                                                              | 0.0000   | 0.0000    | 0.0000     | 0.0000         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |           |            |                |          |          |          |          |          |          |          |                 |
| (235c)m                                                                                              | 0.0000   | 0.0000    | 0.0000     | 0.0000         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |           |            |                |          |          |          |          |          |          |          |                 |
| (233b)m                                                                                              | -2.7365  | -6.8505   | -16.7864   | -30.3061       | -44.7949 | -46.9105 | -45.6945 | -35.7548 | -22.5599 | -10.7273 | -3.8701  | -2.0623 (233b)  |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |           |            |                |          |          |          |          |          |          |          |                 |
| (234b)m                                                                                              | 0.0000   | 0.0000    | 0.0000     | 0.0000         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234b)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |           |            |                |          |          |          |          |          |          |          |                 |
| (235b)m                                                                                              | 0.0000   | 0.0000    | 0.0000     | 0.0000         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |           |            |                |          |          |          |          |          |          |          |                 |
| (235d)m                                                                                              | 0.0000   | 0.0000    | 0.0000     | 0.0000         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235d)   |
| Annual totals kWh/year                                                                               |          |           |            |                |          |          |          |          |          |          |          |                 |
| Space heating fuel - main system 1                                                                   |          |           |            |                |          |          |          |          |          |          |          | 2388.2265 (211) |
| Space heating fuel - main system 2                                                                   |          |           |            |                |          |          |          |          |          |          |          | 0.0000 (213)    |
| Space heating fuel - secondary                                                                       |          |           |            |                |          |          |          |          |          |          |          | 0.0000 (215)    |
| Efficiency of water heater                                                                           |          |           |            |                |          |          |          |          |          |          |          | 86.7000         |
| Water heating fuel used                                                                              |          |           |            |                |          |          |          |          |          |          |          | 2235.1064 (219) |
| Space cooling fuel                                                                                   |          |           |            |                |          |          |          |          |          |          |          | 0.0000 (221)    |
| Electricity for pumps and fans:                                                                      |          |           |            |                |          |          |          |          |          |          |          |                 |
| (MEV)Decentralised, Database: total watage = 5.7980, total flow = 37.0000, SFP = 0.1567)             |          |           |            |                |          |          |          |          |          |          |          |                 |
| mechanical ventilation fans (SFP = 0.1567)                                                           |          |           |            |                |          |          |          |          |          |          |          | 42.9017 (230a)  |
| central heating pump                                                                                 |          |           |            |                |          |          |          |          |          |          |          | 41.0000 (230c)  |
| main heating flue fan                                                                                |          |           |            |                |          |          |          |          |          |          |          | 45.0000 (230e)  |
| Total electricity for the above, kWh/year                                                            |          |           |            |                |          |          |          |          |          |          |          | 128.9017 (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |          |           |            |                |          |          |          |          |          |          |          | 188.9373 (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |           |            |                |          |          |          |          |          |          |          |                 |
| PV generation                                                                                        |          |           |            |                |          |          |          |          |          |          |          | -653.6551 (233) |
| Wind generation                                                                                      |          |           |            |                |          |          |          |          |          |          |          | 0.0000 (234)    |
| Hydro-electric generation (Appendix N)                                                               |          |           |            |                |          |          |          |          |          |          |          | 0.0000 (235a)   |
| Electricity generated - Micro CHP (Appendix N)                                                       |          |           |            |                |          |          |          |          |          |          |          | 0.0000 (235)    |
| Appendix Q - special features                                                                        |          |           |            |                |          |          |          |          |          |          |          |                 |
| Energy saved or generated                                                                            |          |           |            |                |          |          |          |          |          |          |          | -0.0000 (236)   |
| Energy used                                                                                          |          |           |            |                |          |          |          |          |          |          |          | 0.0000 (237)    |
| Total delivered energy for all uses                                                                  |          |           |            |                |          |          |          |          |          |          |          | 4287.5169 (238) |
| 10a. Fuel costs - using Table 12 prices                                                              |          |           |            |                |          |          |          |          |          |          |          |                 |
|                                                                                                      |          | Fuel      | Fuel price | Fuel cost      |          |          |          |          |          |          |          |                 |
|                                                                                                      |          | kWh/year  | p/kWh      | £/year         |          |          |          |          |          |          |          |                 |
| Space heating - main system 1                                                                        |          | 2388.2265 | 3.6400     | 86.9314 (240)  |          |          |          |          |          |          |          |                 |
| Total CO2 associated with community systems                                                          |          |           |            | 0.0000 (473)   |          |          |          |          |          |          |          |                 |
| Water heating (other fuel)                                                                           |          | 2235.1064 | 3.6400     | 81.3579 (247)  |          |          |          |          |          |          |          |                 |
| Energy for instantaneous electric shower(s)                                                          |          | 0.0000    | 16.4900    | 0.0000 (247a)  |          |          |          |          |          |          |          |                 |
| Pumps, fans and electric keep-hot                                                                    |          | 128.9017  | 16.4900    | 21.2559 (249)  |          |          |          |          |          |          |          |                 |
| Energy for lighting                                                                                  |          | 188.9373  | 16.4900    | 31.1558 (250)  |          |          |          |          |          |          |          |                 |
| Additional standing charges                                                                          |          |           |            | 92.0000 (251)  |          |          |          |          |          |          |          |                 |
| Energy saving/generation technologies                                                                |          |           |            |                |          |          |          |          |          |          |          |                 |
| PV Unit electricity used in dwelling                                                                 |          | -384.6011 | 16.4900    | -63.4207       |          |          |          |          |          |          |          |                 |
| PV Unit electricity exported                                                                         |          | -269.0539 | 5.5900     | -15.0401       |          |          |          |          |          |          |          |                 |
| Total                                                                                                |          |           |            | -78.4608 (252) |          |          |          |          |          |          |          |                 |
| Total energy cost                                                                                    |          |           |            | 234.2401 (255) |          |          |          |          |          |          |          |                 |
| 11a. SAP rating - Individual heating systems                                                         |          |           |            |                |          |          |          |          |          |          |          |                 |
| Energy cost deflator (Table 12):                                                                     |          |           |            | 0.3600 (256)   |          |          |          |          |          |          |          |                 |
| Energy cost factor (ECF)                                                                             |          |           |            | 0.6438 (257)   |          |          |          |          |          |          |          |                 |
| SAP value                                                                                            |          |           |            | 89.5638        |          |          |          |          |          |          |          |                 |
| SAP rating (Section 12)                                                                              |          |           |            | 90 (258)       |          |          |          |          |          |          |          |                 |
| SAP band                                                                                             |          |           |            | B              |          |          |          |          |          |          |          |                 |
| 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP                       |          |           |            |                |          |          |          |          |          |          |          |                 |

# Full SAP Calculation Printout



|                                             | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|---------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1               | 2388.2265          | 0.2100                        | 501.5276 (261)           |
| Total CO2 associated with community systems |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                  | 2235.1064          | 0.2100                        | 469.3724 (264)           |
| Space and water heating                     |                    |                               | 970.8999 (265)           |
| Pumps, fans and electric keep-hot           | 128.9017           | 0.1387                        | 17.8803 (267)            |
| Energy for lighting                         | 188.9373           | 0.1443                        | 27.2695 (268)            |
| Energy saving/generation technologies       |                    |                               |                          |
| PV Unit electricity used in dwelling        | -384.6011          | 0.1316                        | -50.6173                 |
| PV Unit electricity exported                | -269.0539          | 0.1216                        | -32.7148                 |
| Total                                       |                    |                               | -83.3322 (269)           |
| Total CO2, kg/year                          |                    |                               | 932.7175 (272)           |
| CO2 emissions per m2                        |                    |                               | 10.8500 (273)            |
| EI value                                    |                    |                               | 90.4578                  |
| EI rating                                   |                    |                               | 90 (274)                 |
| EI band                                     |                    |                               | B                        |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m2) | Storey height<br>(m)            | Volume<br>(m3)         |
|--------------------------------------------------------|--------------|---------------------------------|------------------------|
| Main dwelling                                          |              |                                 |                        |
| Ground floor                                           | 42.9900 (1b) | x 2.4600 (2b)                   | = 105.7554 (1b) - (3b) |
| First floor                                            | 42.9900 (1c) | x 2.7600 (2c)                   | = 118.6524 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 85.9800      |                                 | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 224.4078 (5)         |

## 2. Ventilation rate

|                                                                                                    | m3 per hour                             |
|----------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                    |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                    |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                    |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                    |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                    |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                    |
| Number of intermittent extract fans                                                                | 0 * 10 = 0.0000 (7a)                    |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)                    |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 0.0000 / (5) = 0.0000 (8)               |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 4.5000 (17)                             |
| Infiltration rate                                                                                  | 0.2250 (18)                             |
| Number of sides sheltered                                                                          | 2 (19)                                  |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 0.8500 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.1913 (21)        |

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | 4.2000 | 4.0000 | 4.0000 | 3.7000 | 3.7000 | 3.3000 | 3.4000 | 3.2000 | 3.3000 | 3.5000 | 3.5000 | 3.8000 (22)  |
| Wind factor                                                                                             | 1.0500 | 1.0000 | 1.0000 | 0.9250 | 0.9250 | 0.8250 | 0.8500 | 0.8000 | 0.8250 | 0.8750 | 0.8750 | 0.9500 (22a) |
| Adj infilt rate                                                                                         | 0.2008 | 0.1913 | 0.1913 | 0.1769 | 0.1769 | 0.1578 | 0.1626 | 0.1530 | 0.1578 | 0.1673 | 0.1673 | 0.1817 (22b) |
| Mechanical extract ventilation - decentralised                                                          |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 (25)  |

## 3. Heat losses and heat loss parameter

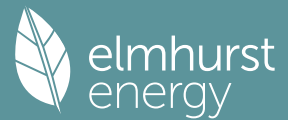
| Element                                           | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2        | U-value<br>W/m2K | A x U<br>W/K | K-value<br>kJ/m2K                    | A x K<br>kJ/K   |
|---------------------------------------------------|-------------|----------------|----------------------|------------------|--------------|--------------------------------------|-----------------|
| Main dwelling                                     |             |                |                      |                  |              |                                      |                 |
| Front Door                                        |             |                | 2.5500               | 1.2000           | 3.0600       |                                      | (26)            |
| Windows                                           |             |                | 10.2500              | 1.2357           | 12.6663      |                                      | (27)            |
| French Doors                                      |             |                | 3.3300               | 1.2357           | 4.1150       |                                      | (27)            |
| GF SPVL 125TS P/A                                 |             |                | 42.9900              | 0.1300           | 5.5887       | 75.0000                              | 3224.2500 (28a) |
| EW Brick AAC011                                   | 97.2486     | 16.1300        | 81.1186              | 0.1800           | 14.6013      | 60.0000                              | 4867.1160 (29a) |
| PR 500mm MW044                                    | 42.9900     |                | 42.9900              | 0.0900           | 3.8691       | 9.0000                               | 386.9100 (30)   |
| Total net area of external elements Aum(A, m2)    |             |                | 183.2286             |                  |              |                                      | (31)            |
| Fabric heat loss, W/K = Sum (A x U)               |             |                | (26)...(30) + (32) = | 43.9005          |              |                                      | (33)            |
| Main dwelling                                     |             |                |                      |                  |              |                                      |                 |
| E-WM-30                                           |             |                | 43.8000              | 0.0000           | 0.0000       | 45.0000                              | 1971.0000 (32)  |
| Timber - GF                                       |             |                | 88.6100              |                  |              | 9.0000                               | 797.4900 (32c)  |
| Timber - FF                                       |             |                | 126.9000             |                  |              | 9.0000                               | 1142.1000 (32c) |
| Internal Floor FF                                 |             |                | 42.9900              |                  |              | 18.0000                              | 773.8200 (32d)  |
| Internal Ceiling GF                               |             |                | 42.9900              |                  |              | 9.0000                               | 386.9100 (32e)  |
| Heat capacity Cm = Sum(A x k)                     |             |                |                      |                  |              | (28)...(30) + (32) + (32a)...(32e) = | 13549.5960 (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K |             |                |                      |                  |              |                                      | 157.5901 (35)   |
| List of Thermal Bridges                           |             |                |                      |                  |              |                                      |                 |
| K1 Element                                        |             |                |                      | Length           | Psi-value    | Total                                |                 |
| E2 Other lintels (including other steel lintels)  |             |                |                      | 10.7800          | 0.0410       | 0.4420                               |                 |

# Full SAP Calculation Printout



|                                                                                     |           |           |           |            |               |           |           |               |           |                                        |           |                |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|------------|---------------|-----------|-----------|---------------|-----------|----------------------------------------|-----------|----------------|
| E3 Sill                                                                             |           |           |           |            |               |           |           | 9.2000        | 0.0220    | 0.2024                                 |           |                |
| E4 Jamb                                                                             |           |           |           |            |               |           |           | 21.1500       | 0.0190    | 0.4018                                 |           |                |
| E5 Ground floor (normal)                                                            |           |           |           |            |               |           |           | 10.2300       | 0.0928    | 0.9493                                 |           |                |
| E6 Intermediate floor within a dwelling                                             |           |           |           |            |               |           |           | 18.6300       | 0.0020    | 0.0373                                 |           |                |
| E10 Eaves (insulation at ceiling level)                                             |           |           |           |            |               |           |           | 10.2500       | 0.0390    | 0.3997                                 |           |                |
| E18 Party wall between dwellings                                                    |           |           |           |            |               |           |           | 10.4400       | 0.0330    | 0.3445                                 |           |                |
| E4 Jamb                                                                             |           |           |           |            |               |           |           | 4.8000        | 0.1000    | 0.4800                                 |           |                |
| E2 Other lintels (including other steel lintels)                                    |           |           |           |            |               |           |           | 1.0600        | 0.0410    | 0.0435                                 |           |                |
| P1 Party wall - Ground floor                                                        |           |           |           |            |               |           |           | 8.3900        | 0.1000    | 0.8390                                 |           |                |
| P2 Party wall - Intermediate floor within a dwelling                                |           |           |           |            |               |           |           | 8.3900        | 0.0000    | 0.0000                                 |           |                |
| P4 Party wall - Roof (insulation at ceiling level)                                  |           |           |           |            |               |           |           | 8.3900        | 0.0350    | 0.2937                                 |           |                |
| E5 Ground floor (normal)                                                            |           |           |           |            |               |           |           | 8.3900        | 0.0980    | 0.8222                                 |           |                |
| E12 Gable (insulation at ceiling level)                                             |           |           |           |            |               |           |           | 8.3900        | 0.0870    | 0.7299                                 |           |                |
| E16 Corner (normal)                                                                 |           |           |           |            |               |           |           | 10.4400       | 0.0420    | 0.4385                                 |           |                |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)                          |           |           |           |            |               |           |           |               |           |                                        | 6.4238    | (36)           |
| Point Thermal bridges                                                               |           |           |           |            |               |           |           |               |           |                                        | (36a) =   | 0.0000         |
| Total fabric heat loss                                                              |           |           |           |            |               |           |           |               |           | (33) + (36) + (36a) =                  |           | 50.3244 (37)   |
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)                 |           |           |           |            |               |           |           |               |           |                                        |           |                |
| (38)m                                                                               | Jan       | Feb       | Mar       | Apr        | May           | Jun       | Jul       | Aug           | Sep       | Oct                                    | Nov       | Dec            |
| Heat transfer coeff                                                                 | 37.0273   | 37.0273   | 37.0273   | 37.0273    | 37.0273       | 37.0273   | 37.0273   | 37.0273       | 37.0273   | 37.0273                                | 37.0273   | 37.0273 (38)   |
| Average = Sum(39)m / 12 =                                                           | 87.3516   | 87.3516   | 87.3516   | 87.3516    | 87.3516       | 87.3516   | 87.3516   | 87.3516       | 87.3516   | 87.3516                                | 87.3516   | 87.3516 (39)   |
|                                                                                     |           |           |           |            |               |           |           |               |           |                                        |           | 87.3516        |
| HLP                                                                                 | Jan       | Feb       | Mar       | Apr        | May           | Jun       | Jul       | Aug           | Sep       | Oct                                    | Nov       | Dec            |
| HLP (average)                                                                       | 1.0160    | 1.0160    | 1.0160    | 1.0160     | 1.0160        | 1.0160    | 1.0160    | 1.0160        | 1.0160    | 1.0160                                 | 1.0160    | 1.0160 (40)    |
| Days in mont                                                                        | 31        | 28        | 31        | 30         | 31            | 30        | 31        | 31            | 30        | 31                                     | 30        | 31             |
| -----                                                                               |           |           |           |            |               |           |           |               |           |                                        |           |                |
| 4. Water heating energy requirements (kWh/year)                                     |           |           |           |            |               |           |           |               |           |                                        |           |                |
| -----                                                                               |           |           |           |            |               |           |           |               |           |                                        |           |                |
| Assumed occupancy                                                                   |           |           |           |            |               |           |           |               |           |                                        |           | 2.5666 (42)    |
| Hot water usage for mixer showers                                                   |           |           |           |            |               |           |           |               |           |                                        |           |                |
|                                                                                     | 67.2533   | 66.2426   | 64.7698   | 61.9519    | 59.8724       | 57.5533   | 56.2352   | 57.6968       | 59.2990   | 61.7890                                | 64.6674   | 66.9956 (42a)  |
| Hot water usage for baths                                                           |           |           |           |            |               |           |           |               |           |                                        |           |                |
|                                                                                     | 29.0443   | 28.6130   | 28.0055   | 26.8856    | 26.0469       | 25.1170   | 24.6147   | 25.2179       | 25.8746   | 26.8697                                | 28.0127   | 28.9461 (42b)  |
| Hot water usage for other uses                                                      |           |           |           |            |               |           |           |               |           |                                        |           |                |
|                                                                                     | 40.9146   | 39.4268   | 37.9390   | 36.4512    | 34.9634       | 33.4756   | 33.4756   | 34.9634       | 36.4512   | 37.9390                                | 39.4268   | 40.9146 (42c)  |
| Average daily hot water use (litres/day)                                            |           |           |           |            |               |           |           |               |           |                                        |           | 126.1290 (43)  |
|                                                                                     |           |           |           |            |               |           |           |               |           |                                        |           |                |
| Daily hot water use                                                                 | Jan       | Feb       | Mar       | Apr        | May           | Jun       | Jul       | Aug           | Sep       | Oct                                    | Nov       | Dec            |
|                                                                                     | 137.2122  | 134.2823  | 130.7143  | 125.2887   | 120.8827      | 116.1459  | 114.3255  | 117.8781      | 121.6248  | 126.5977                               | 132.1069  | 136.8563 (44)  |
| Energy conte                                                                        | 217.3105  | 191.2162  | 200.9030  | 171.5139   | 162.7313      | 142.8150  | 138.2667  | 145.9577      | 149.9756  | 171.7918                               | 188.2105  | 214.2839 (45)  |
| Energy content (annual)                                                             |           |           |           |            |               |           |           |               |           | Total = Sum(45)m =                     |           | 2094.9763      |
| Distribution loss (46)m = 0.15 x (45)m                                              |           |           |           |            |               |           |           |               |           |                                        |           |                |
|                                                                                     | 32.5966   | 28.6824   | 30.1355   | 25.7271    | 24.4097       | 21.4222   | 20.7400   | 21.8937       | 22.4963   | 25.7688                                | 28.2316   | 32.1426 (46)   |
| Water storage loss (or HIU loss):                                                   |           |           |           |            |               |           |           |               |           |                                        |           |                |
| Total storage loss                                                                  | 0.0000    | 0.0000    | 0.0000    | 0.0000     | 0.0000        | 0.0000    | 0.0000    | 0.0000        | 0.0000    | 0.0000                                 | 0.0000    | 0.0000 (56)    |
| If cylinder contains dedicated solar storage                                        |           |           |           |            |               |           |           |               |           |                                        |           |                |
|                                                                                     | 0.0000    | 0.0000    | 0.0000    | 0.0000     | 0.0000        | 0.0000    | 0.0000    | 0.0000        | 0.0000    | 0.0000                                 | 0.0000    | 0.0000 (57)    |
| Primary loss                                                                        | 0.0000    | 0.0000    | 0.0000    | 0.0000     | 0.0000        | 0.0000    | 0.0000    | 0.0000        | 0.0000    | 0.0000                                 | 0.0000    | 0.0000 (59)    |
| Combi loss                                                                          | 11.9874   | 10.8167   | 11.9530   | 11.5193    | 11.8728       | 11.4590   | 11.8214   | 11.8376       | 11.4740   | 11.8918                                | 11.5543   | 11.9811 (61)   |
| Total heat required for water heating calculated for each month                     |           |           |           |            |               |           |           |               |           |                                        |           |                |
|                                                                                     | 229.2979  | 202.0330  | 212.8560  | 183.0332   | 174.6042      | 154.2740  | 150.0882  | 157.7953      | 161.4496  | 183.6836                               | 199.7649  | 226.2650 (62)  |
| WWHRS                                                                               | -29.9438  | -26.4825  | -27.7310  | -22.9624   | -21.4001      | -18.3122  | -17.1648  | -18.2530      | -18.9465  | -22.3359                               | -25.3038  | -29.3893 (63a) |
| PV diverter                                                                         | -0.0000   | -0.0000   | -0.0000   | -0.0000    | -0.0000       | -0.0000   | -0.0000   | -0.0000       | -0.0000   | -0.0000                                | -0.0000   | -0.0000 (63b)  |
| Solar input                                                                         | 0.0000    | 0.0000    | 0.0000    | 0.0000     | 0.0000        | 0.0000    | 0.0000    | 0.0000        | 0.0000    | 0.0000                                 | 0.0000    | 0.0000 (63c)   |
| FGHRS                                                                               | 0.0000    | 0.0000    | 0.0000    | 0.0000     | 0.0000        | 0.0000    | 0.0000    | 0.0000        | 0.0000    | 0.0000                                 | 0.0000    | 0.0000 (63d)   |
| Output from w/h                                                                     | 199.3541  | 175.5504  | 185.1250  | 160.0708   | 153.2041      | 135.9618  | 132.9234  | 139.5422      | 142.5031  | 161.3478                               | 174.4610  | 196.8757 (64)  |
|                                                                                     |           |           |           |            |               |           |           |               |           | Total per year (kWh/year) = Sum(64)m = |           | 1956.9195 (64) |
| Electric shower(s)                                                                  | 0.0000    | 0.0000    | 0.0000    | 0.0000     | 0.0000        | 0.0000    | 0.0000    | 0.0000        | 0.0000    | 0.0000                                 | 0.0000    | 0.0000 (64a)   |
|                                                                                     |           |           |           |            |               |           |           |               |           |                                        |           | 0.0000 (64a)   |
| Heat gains from water heating, kWh/month                                            | 75.2526   | 66.2836   | 69.7885   | 59.9082    | 57.0764       | 50.3507   | 48.9291   | 51.4903       | 52.7354   | 60.0937                                | 65.4686   | 74.2447 (65)   |
| -----                                                                               |           |           |           |            |               |           |           |               |           |                                        |           |                |
| 5. Internal gains (see Table 5 and 5a)                                              |           |           |           |            |               |           |           |               |           |                                        |           |                |
| -----                                                                               |           |           |           |            |               |           |           |               |           |                                        |           |                |
| Metabolic gains (Table 5), Watts                                                    |           |           |           |            |               |           |           |               |           |                                        |           |                |
| (66)m                                                                               | Jan       | Feb       | Mar       | Apr        | May           | Jun       | Jul       | Aug           | Sep       | Oct                                    | Nov       | Dec            |
|                                                                                     | 153.9962  | 153.9962  | 153.9962  | 153.9962   | 153.9962      | 153.9962  | 153.9962  | 153.9962      | 153.9962  | 153.9962                               | 153.9962  | 153.9962 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     |           |           |           |            |               |           |           |               |           |                                        |           |                |
|                                                                                     | 26.7460   | 23.7556   | 19.3193   | 14.6260    | 10.9331       | 9.2302    | 9.9735    | 12.9640       | 17.4002   | 22.0936                                | 25.7865   | 27.4894 (67)   |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 |           |           |           |            |               |           |           |               |           |                                        |           |                |
|                                                                                     | 345.4995  | 349.0847  | 340.0501  | 320.8165   | 296.5375      | 273.7188  | 258.4744  | 254.8892      | 263.9238  | 283.1574                               | 307.4363  | 330.2551 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    |           |           |           |            |               |           |           |               |           |                                        |           |                |
|                                                                                     | 52.9662   | 52.9662   | 52.9662   | 52.9662    | 52.9662       | 52.9662   | 52.9662   | 52.9662       | 52.9662   | 52.9662                                | 52.9662   | 52.9662 (69)   |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000     | 3.0000        | 3.0000    | 3.0000    | 3.0000        | 3.0000    | 3.0000                                 | 3.0000    | 3.0000 (70)    |
| Losses e.g. evaporation (negative values) (Table 5)                                 |           |           |           |            |               |           |           |               |           |                                        |           |                |
|                                                                                     | -102.6642 | -102.6642 | -102.6642 | -102.6642  | -102.6642     | -102.6642 | -102.6642 | -102.6642     | -102.6642 | -102.6642                              | -102.6642 | -102.6642 (71) |
| Water heating gains (Table 5)                                                       |           |           |           |            |               |           |           |               |           |                                        |           |                |
|                                                                                     | 101.1460  | 98.6363   | 93.8018   | 83.2058    | 76.7156       | 69.9316   | 65.7649   | 69.2074       | 73.2436   | 80.7712                                | 90.9286   | 99.7912 (72)   |
| Total internal gains                                                                | 580.6898  | 578.7749  | 560.4695  | 525.9466   | 491.4845      | 457.1788  | 438.5111  | 441.3589      | 458.8659  | 493.3204                               | 531.4497  | 564.8340 (73)  |
| -----                                                                               |           |           |           |            |               |           |           |               |           |                                        |           |                |
| 6. Solar gains                                                                      |           |           |           |            |               |           |           |               |           |                                        |           |                |
| -----                                                                               |           |           |           |            |               |           |           |               |           |                                        |           |                |
| [Jan]                                                                               |           |           | Area      | Solar flux | g             |           |           | FF            |           | Access                                 |           | Gains          |
|                                                                                     |           |           | m2        | Table 6a   | Specific data |           |           | Specific data |           | factor                                 |           | W              |
|                                                                                     |           |           |           | W/m2       | or Table 6b   |           |           | or Table 6c   |           | Table 6d                               |           |                |
| North                                                                               |           |           | 0.5200    | 11.9814    | 0.4500        |           |           | 0.0000        |           | 0.7700                                 |           | 2.1588 (74)    |
| East                                                                                |           |           | 4.1200    | 22.3313    | 0.4500        |           |           | 0.0000        |           | 0.7700                                 |           | 31.8797 (76)   |
| West                                                                                |           |           | 5.6100    | 22.3313    | 0.4500        |           |           | 0.0000        |           | 0.7700                                 |           | 43.4091 (80)   |
| East                                                                                |           |           | 3.3300    | 22.3313    | 0.4500        |           |           | 0.0000        |           | 0.7700                                 |           | 25.7669 (76)   |

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|             |          |          |          |          |           |           |          |          |          |          |          |               |
|-------------|----------|----------|----------|----------|-----------|-----------|----------|----------|----------|----------|----------|---------------|
| Solar gains | 103.2145 | 181.5675 | 295.1032 | 443.3153 | 529.4853  | 580.2956  | 546.3815 | 479.7107 | 371.9166 | 229.9510 | 131.8216 | 84.0748 (83)  |
| Total gains | 683.9043 | 760.3424 | 855.5727 | 969.2619 | 1020.9698 | 1037.4744 | 984.8926 | 921.0697 | 830.7825 | 723.2714 | 663.2713 | 648.9089 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |         |         |         |              |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| tau                                                                         | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876      |
| alpha                                                                       | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725       |
| util living area                                                            | 0.9663  | 0.9491  | 0.9016  | 0.7949  | 0.6254  | 0.4123  | 0.2736  | 0.3014  | 0.5713  | 0.8419  | 0.9441  | 0.9713 (86)  |
| MIT                                                                         | 19.5029 | 19.7178 | 20.1434 | 20.5905 | 20.8760 | 20.9815 | 20.9973 | 20.9960 | 20.9342 | 20.5637 | 19.9525 | 19.4401 (87) |
| Th 2                                                                        | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 (88) |
| util rest of house                                                          | 0.9595  | 0.9392  | 0.8828  | 0.7588  | 0.5676  | 0.3391  | 0.1922  | 0.2148  | 0.4926  | 0.8037  | 0.9312  | 0.9655 (89)  |
| MIT 2                                                                       | 18.5450 | 18.7828 | 19.2473 | 19.7121 | 19.9808 | 20.0614 | 20.0695 | 20.0691 | 20.0322 | 19.6988 | 19.0477 | 18.4754 (90) |
| Living area fraction                                                        |         |         |         |         |         |         |         |         |         |         |         | 0.1933 (91)  |
| MIT                                                                         | 18.7301 | 18.9635 | 19.4205 | 19.8819 | 20.1539 | 20.2392 | 20.2488 | 20.2483 | 20.2066 | 19.8660 | 19.2226 | 18.6619 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT                                                                | 18.7301 | 18.9635 | 19.4205 | 19.8819 | 20.1539 | 20.2392 | 20.2488 | 20.2483 | 20.2066 | 19.8660 | 19.2226 | 18.6619 (93) |

## 8. Space heating requirement

|                                                                                |           |           |           |          |          |          |          |          |          |               |          |                |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|---------------|----------|----------------|
|                                                                                | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov      | Dec            |
| Utilisation                                                                    | 0.9467    | 0.9244    | 0.8673    | 0.7507   | 0.5730   | 0.3527   | 0.2079   | 0.2316   | 0.5047   | 0.7941        | 0.9163   | 0.9536 (94)    |
| Useful gains                                                                   | 647.4500  | 702.8237  | 742.0226  | 727.6734 | 585.0358 | 365.8666 | 204.7979 | 213.2862 | 419.2810 | 574.3444      | 607.7491 | 618.7780 (95)  |
| Ext temp.                                                                      | 5.1000    | 5.6000    | 7.4000    | 9.9000   | 13.0000  | 16.0000  | 17.9000  | 17.8000  | 15.2000  | 11.6000       | 8.0000   | 5.1000 (96)    |
| Heat loss rate W                                                               | 1190.6151 | 1167.3270 | 1050.0123 | 871.9340 | 624.9009 | 370.3033 | 205.1717 | 213.8616 | 437.3330 | 722.0459      | 980.3109 | 1184.6518 (97) |
| Space heating kWh                                                              | 404.1148  | 312.1462  | 229.1444  | 103.8676 | 29.6597  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 109.8899      | 268.2445 | 421.0101 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |          |          |          |          |          |          |               |          | 1878.0772      |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000   | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |          |          |          |          |          |          |               |          | 0.0000         |
| Space heating kWh                                                              | 404.1148  | 312.1462  | 229.1444  | 103.8676 | 29.6597  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 109.8899      | 268.2445 | 421.0101 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |          |          |          |          |          |          |               |          | 1878.0772      |
| Space heating per m2                                                           |           |           |           |          |          |          |          |          |          | (98c) / (4) = |          | 21.8432 (99)   |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                                                      |          |          |          |          |          |          |          |          |          |          |          |                 |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (201)    |
| Fraction of space heat from main system(s)                                                           |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (202)    |
| Efficiency of main space heating system 1 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 91.7000 (206)   |
| Efficiency of main space heating system 2 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)    |
| Efficiency of secondary/supplementary heating system, %                                              |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)    |
|                                                                                                      | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec             |
| Space heating requirement                                                                            | 404.1148 | 312.1462 | 229.1444 | 103.8676 | 29.6597  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 109.8899 | 268.2445 | 421.0101 (98)   |
| Space heating efficiency (main heating system 1)                                                     | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 91.7000  | 91.7000  | 91.7000 (210)   |
| Space heating fuel (main heating system)                                                             | 440.6923 | 340.3994 | 249.8848 | 113.2690 | 32.3442  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 119.8363 | 292.5240 | 459.1168 (211)  |
| Space heating efficiency (main heating system 2)                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)    |
| Space heating fuel (main heating system 2)                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)    |
| Space heating fuel (secondary)                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)    |
| Water heating                                                                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| Water heating requirement                                                                            | 199.3541 | 175.5504 | 185.1250 | 160.0708 | 153.2041 | 135.9618 | 132.9234 | 139.5422 | 142.5031 | 161.3478 | 174.4610 | 196.8757 (64)   |
| Efficiency of water heater                                                                           | 88.0951  | 88.0325  | 87.8491  | 87.5144  | 87.0338  | 86.7000  | 86.7000  | 86.7000  | 86.7000  | 87.5387  | 87.9604  | 86.7000 (216)   |
| Fuel for water heating, kWh/month                                                                    | 226.2942 | 199.4155 | 210.7306 | 182.9079 | 176.0282 | 156.8186 | 153.3142 | 160.9484 | 164.3635 | 184.3159 | 198.3404 | 223.4179 (219)  |
| Space cooling fuel requirement                                                                       |          |          |          |          |          |          |          |          |          |          |          |                 |
| (221)m                                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)    |
| Pumps and Fa                                                                                         | 10.9478  | 9.8883   | 10.9478  | 10.5947  | 10.9478  | 10.5947  | 10.9478  | 10.9478  | 10.5947  | 10.9478  | 10.5947  | 10.9478 (231)   |
| Lighting                                                                                             | 23.4106  | 18.7809  | 16.9101  | 12.3891  | 9.5697   | 7.8185   | 8.7298   | 11.3473  | 14.7390  | 19.3384  | 21.8427  | 24.0613 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | -12.9948 | -19.6788 | -33.4418 | -44.9288 | -52.5148 | -53.1453 | -51.7882 | -46.7161 | -37.1809 | -26.0128 | -15.5005 | -10.6965 (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | -3.3366  | -7.1593  | -17.1881 | -32.1833 | -45.6724 | -52.3387 | -50.2796 | -40.7390 | -25.7852 | -12.2915 | -4.8814  | -2.4799 (233b)  |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234b)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235d)   |
| Annual totals kWh/year                                                                               |          |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating fuel - main system 1                                                                   |          |          |          |          |          |          |          |          |          |          |          | 2048.0668 (211) |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)    |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)    |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          | 86.7000         |
| Water heating fuel used                                                                              |          |          |          |          |          |          |          |          |          |          |          | 2236.8953 (219) |
| Space cooling fuel                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (221)    |

|                                                                                          |  |  |  |  |  |  |  |  |  |  |  |                |
|------------------------------------------------------------------------------------------|--|--|--|--|--|--|--|--|--|--|--|----------------|
| Electricity for pumps and fans:                                                          |  |  |  |  |  |  |  |  |  |  |  |                |
| (MEV)Decentralised, Database: total watage = 5.7980, total flow = 37.0000, SFP = 0.1567) |  |  |  |  |  |  |  |  |  |  |  |                |
| mechanical ventilation fans (SFP = 0.1567)                                               |  |  |  |  |  |  |  |  |  |  |  | 42.9017 (230a) |

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|                                                     |                |
|-----------------------------------------------------|----------------|
| central heating pump                                | 41.0000 (230c) |
| main heating flue fan                               | 45.0000 (230e) |
| Total electricity for the above, kWh/year           | 128.9017 (231) |
| Electricity for lighting (calculated in Appendix L) | 188.9373 (232) |

|                                                               |                 |
|---------------------------------------------------------------|-----------------|
| Energy saving/generation technologies (Appendices M ,N and Q) |                 |
| PV generation                                                 | -698.9344 (233) |
| Wind generation                                               | 0.0000 (234)    |
| Hydro-electric generation (Appendix N)                        | 0.0000 (235a)   |
| Electricity generated - Micro CHP (Appendix N)                | 0.0000 (235)    |
| Appendix Q - special features                                 |                 |
| Energy saved or generated                                     | -0.0000 (236)   |
| Energy used                                                   | 0.0000 (237)    |
| Total delivered energy for all uses                           | 3903.8667 (238) |

## 10a. Fuel costs - using BEDF prices (596)

|                                             | Fuel<br>kWh/year | Fuel price<br>p/kWh | Fuel cost<br>£/year |
|---------------------------------------------|------------------|---------------------|---------------------|
| Space heating - main system 1               | 2048.0668        | 7.3200              | 149.9185 (240)      |
| Total CO2 associated with community systems |                  |                     | 0.0000 (473)        |
| Water heating (other fuel)                  | 2236.8953        | 7.3200              | 163.7407 (247)      |
| Energy for instantaneous electric shower(s) | 0.0000           | 27.6700             | 0.0000 (247a)       |
| Pumps, fans and electric keep-hot           | 128.9017         | 27.6700             | 35.6671 (249)       |
| Energy for lighting                         | 188.9373         | 27.6700             | 52.2789 (250)       |
| Additional standing charges                 |                  |                     | 108.0000 (251)      |
| Energy saving/generation technologies       |                  |                     |                     |
| PV Unit electricity used in dwelling        | -404.5993        | 27.6700             | -111.9526           |
| PV Unit electricity exported                | -294.3350        | 5.8100              | -17.1009            |
| Total                                       |                  |                     | -129.0535 (252)     |
| Total energy cost                           |                  |                     | 380.5518 (255)      |

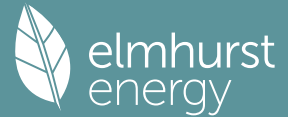
## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|---------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1               | 2048.0668          | 0.2100                        | 430.0940 (261)           |
| Total CO2 associated with community systems |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                  | 2236.8953          | 0.2100                        | 469.7480 (264)           |
| Space and water heating                     |                    |                               | 899.8420 (265)           |
| Pumps, fans and electric keep-hot           | 128.9017           | 0.1387                        | 17.8803 (267)            |
| Energy for lighting                         | 188.9373           | 0.1443                        | 27.2695 (268)            |
| Energy saving/generation technologies       |                    |                               |                          |
| PV Unit electricity used in dwelling        | -404.5993          | 0.1316                        | -53.2562                 |
| PV Unit electricity exported                | -294.3350          | 0.1211                        | -35.6464                 |
| Total                                       |                    |                               | -88.9026 (269)           |
| Total CO2, kg/year                          |                    |                               | 856.0892 (272)           |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1               | 2048.0668          | 1.1300                              | 2314.3155 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 2236.8953          | 1.1300                              | 2527.6917 (278)            |
| Space and water heating                     |                    |                                     | 4842.0072 (279)            |
| Pumps, fans and electric keep-hot           | 128.9017           | 1.5128                              | 195.0025 (281)             |
| Energy for lighting                         | 188.9373           | 1.5338                              | 289.7983 (282)             |
| Energy saving/generation technologies       |                    |                                     |                            |
| PV Unit electricity used in dwelling        | -404.5993          | 1.4863                              | -601.3523                  |
| PV Unit electricity exported                | -294.3350          | 0.4442                              | -130.7519                  |
| Total                                       |                    |                                     | -732.1042 (283)            |
| Total Primary energy kWh/year               |                    |                                     | 4594.7037 (286)            |

# Full SAP Calculation Printout



|                                    |                                                          |               |        |      |                |            |
|------------------------------------|----------------------------------------------------------|---------------|--------|------|----------------|------------|
| Plot Reference                     | 4907-R823-9471-004                                       |               |        |      | Issued on Date | 21/07/2026 |
| Assessment Reference               | Plot 4                                                   | Plot Type Ref | Plot 4 |      |                |            |
| Plot Address                       | Plot 4, Bosworth Det, K, WC, B, ES, 1012                 |               |        |      | SAP Version    | 10.2       |
|                                    |                                                          |               |        |      |                |            |
| SAP Rating                         | 90 B                                                     | DER           | 11.94  | TER  | 12.37          |            |
| Environmental                      | 90 B                                                     | % DER < TER   |        |      |                | 3.48       |
| CO <sub>2</sub> Emissions (t/year) | 0.99                                                     | DFEE          | 40.71  | TFEE | 43.39          |            |
| Compliance Check                   | See BREL                                                 | % DFEE < TFEE |        |      |                | 6.20       |
| % DPER < TPER                      | 1.19                                                     | DPER          | 63.99  | TPER | 64.76          |            |
|                                    |                                                          |               |        |      |                |            |
| Assessor Details                   | Mr. Daniel Harris                                        |               |        |      | Assessor ID    | R823-0001  |
| Client                             | Crest Nicholson Head Office, Crest Nicholson Head Office |               |        |      |                |            |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)            | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Main dwelling                                          |                           |                                 |                             |
| Ground floor                                           | 47.4100 (1b)              | x 2.4600 (2b)                   | = 116.6286 (1b) - (3b)      |
| First floor                                            | 47.4100 (1c)              | x 2.7600 (2c)                   | = 130.8516 (1c) - (3c)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 94.8200                   |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 247.4802 (5)              |

## 2. Ventilation rate

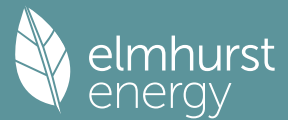
|                                                                                                    | m <sup>3</sup> per hour                 |
|----------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                    |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                    |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                    |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                    |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                    |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                    |
| Number of intermittent extract fans                                                                | 0 * 10 = 0.0000 (7a)                    |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)                    |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 0.0000 / (5) = 0.0000 (8)               |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 4.5000 (17)                             |
| Infiltration rate                                                                                  | 0.2250 (18)                             |
| Number of sides sheltered                                                                          | 1 (19)                                  |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 0.9250 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.2081 (21)        |

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor                                                                                             | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate                                                                                         | 0.2654 | 0.2602 | 0.2550 | 0.2289 | 0.2237 | 0.1977 | 0.1977 | 0.1925 | 0.2081 | 0.2237 | 0.2341 | 0.2445 (22b) |
| Mechanical extract ventilation - decentralised                                                          |        |        |        |        |        |        |        |        |        |        |        |              |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| Effective ac                                                                                            | 0.5154 | 0.5102 | 0.5050 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 (25)  |

## 3. Heat losses and heat loss parameter

| Element                                                      | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K   |
|--------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|-----------------|
| Main dwelling                                                |                         |                            |                           |                               |              |                                |                 |
| Front Door                                                   |                         |                            | 2.2300                    | 1.2000                        | 2.6760       |                                | (26)            |
| Windows                                                      |                         |                            | 10.7600                   | 1.2357                        | 13.2966      |                                | (27)            |
| French Doors                                                 |                         |                            | 5.2200                    | 1.2357                        | 6.4506       |                                | (27)            |
| GF SPVL 125TS P/A                                            |                         |                            | 47.4100                   | 0.1300                        | 6.1633       | 75.0000                        | 3555.7500 (28a) |
| EW Brick AAC011                                              | 151.6400                | 18.2100                    | 133.4300                  | 0.1800                        | 24.0174      | 60.0000                        | 8005.8000 (29a) |
| PR 500mm MW044                                               | 47.4100                 |                            | 47.4100                   | 0.0900                        | 4.2669       | 9.0000                         | 426.6900 (30)   |
| Total net area of external elements Aum (A, m <sup>2</sup> ) |                         |                            | 246.4600                  |                               |              |                                | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                          |                         |                            |                           | (26)...(30) + (32) =          | 56.8707      |                                | (33)            |
| Main dwelling                                                |                         |                            |                           |                               |              |                                |                 |
| Timber - GF                                                  |                         |                            | 24.2600                   |                               |              | 9.0000                         | 218.3400 (32c)  |
| Timber - FF                                                  |                         |                            | 140.7000                  |                               |              | 9.0000                         | 1266.3000 (32c) |
| Masonry GF                                                   |                         |                            | 51.5100                   |                               |              | 100.0000                       | 5151.0000 (32c) |
| Internal Floor FF                                            |                         |                            | 47.4100                   |                               |              | 18.0000                        | 853.3800 (32d)  |
| Internal Ceiling GF                                          |                         |                            | 47.4100                   |                               |              | 9.0000                         | 426.6900 (32e)  |

# Full SAP Calculation Printout



Heat capacity Cm = Sum(A x k)  
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K  
List of Thermal Bridges

(28)...(30) + (32) + (32a)...(32e) = 19903.9500 (34)  
209.9130 (35)

|                                                                  |         |           |         |
|------------------------------------------------------------------|---------|-----------|---------|
| K1 Element                                                       | Length  | Psi-value | Total   |
| E2 Other lintels (including other steel lintels)                 | 11.9100 | 0.0410    | 0.4883  |
| E3 Sill                                                          | 9.4200  | 0.0220    | 0.2072  |
| E4 Jamb                                                          | 22.0500 | 0.0190    | 0.4189  |
| E5 Ground floor (normal)                                         | 12.0200 | 0.0928    | 1.1155  |
| E6 Intermediate floor within a dwelling                          | 29.0500 | 0.0020    | 0.0581  |
| E10 Eaves (insulation at ceiling level)                          | 9.1500  | 0.0390    | 0.3569  |
| E18 Party wall between dwellings                                 | 0.0000  | 0.0300    | 0.0000  |
| E4 Jamb                                                          | 4.2000  | 0.1000    | 0.4200  |
| E2 Other lintels (including other steel lintels)                 | 1.0600  | 0.0410    | 0.0435  |
| P1 Party wall - Ground floor                                     | 0.0000  | 0.1000    | 0.0000  |
| P2 Party wall - Intermediate floor within a dwelling             | 0.0000  | 0.0000    | 0.0000  |
| P4 Party wall - Roof (insulation at ceiling level)               | 0.0000  | 0.0350    | 0.0000  |
| E5 Ground floor (normal)                                         | 17.0300 | 0.0980    | 1.6689  |
| E12 Gable (insulation at ceiling level)                          | 19.9000 | 0.0870    | 1.7313  |
| E16 Corner (normal)                                              | 26.1000 | 0.0420    | 1.0962  |
| E17 Corner (inverted - internal area greater than external area) | 5.2200  | -0.0820   | -0.4280 |

Thermal bridges (Sum(L x Psi) calculated using Appendix K)  
Point Thermal bridges  
Total fabric heat loss

(33) + (36) + (36a) = 64.0475 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

|                           |          |          |          |          |          |          |          |          |          |          |          |          |
|---------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| (38)m                     | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |
| Heat transfer coeff       | 42.0886  | 41.6637  | 41.2387  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  |
| Average = Sum(39)m / 12 = | 106.1361 | 105.7112 | 105.2863 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 |

|               |        |        |        |        |        |        |        |        |        |        |        |        |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| HLP           | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |
| HLP (average) | 1.1193 | 1.1149 | 1.1104 | 1.1061 | 1.1061 | 1.1061 | 1.1061 | 1.1061 | 1.1061 | 1.1061 | 1.1061 | 1.1061 |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31     |

## 4. Water heating energy requirements (kWh/year)

|                                                                 |                |          |          |          |          |          |          |          |          |          |          |          |
|-----------------------------------------------------------------|----------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| Assumed occupancy                                               | 2.6861 (42)    |          |          |          |          |          |          |          |          |          |          |          |
| Hot water usage for mixer showers                               | 69.2572        | 68.2164  | 66.6997  | 63.7979  | 61.6564  | 59.2683  | 57.9108  | 59.4160  | 61.0660  | 63.6301  | 66.5943  | 68.9918  |
| Hot water usage for baths                                       | 29.9061        | 29.4619  | 28.8365  | 27.6833  | 26.8197  | 25.8622  | 25.3450  | 25.9661  | 26.6424  | 27.6669  | 28.8439  | 29.8050  |
| Hot water usage for other uses                                  | 42.1386        | 40.6063  | 39.0739  | 37.5416  | 36.0093  | 34.4770  | 34.4770  | 36.0093  | 37.5416  | 39.0739  | 40.6063  | 42.1386  |
| Average daily hot water use (litres/day)                        | 129.8883 (43)  |          |          |          |          |          |          |          |          |          |          |          |
| Daily hot water use                                             | Jan            | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |
| Energy conte                                                    | 141.3019       | 138.2846 | 134.6102 | 129.0228 | 124.4855 | 119.6075 | 117.7329 | 121.3914 | 125.2500 | 130.3710 | 136.0444 | 140.9354 |
| Energy content (annual)                                         | 223.7876       | 196.9154 | 206.8908 | 176.6258 | 167.5814 | 147.0714 | 142.3877 | 150.3080 | 154.4457 | 176.9122 | 193.8202 | 220.6708 |
| Distribution loss (46)m = 0.15 x (45)m                          | 33.5681        | 29.5373  | 31.0336  | 26.4939  | 25.1372  | 22.0607  | 21.3582  | 22.5462  | 23.1669  | 26.5368  | 29.0730  | 33.1006  |
| Water storage loss (or HIU loss):                               | 0.0000         |          |          |          |          |          |          |          |          |          |          |          |
| Total storage loss                                              | 0.0000         |          |          |          |          |          |          |          |          |          |          |          |
| If cylinder contains dedicated solar storage                    | 0.0000         |          |          |          |          |          |          |          |          |          |          |          |
| Primary loss                                                    | 0.0000         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   |
| Combi loss                                                      | 12.0010        | 10.8287  | 11.9655  | 11.5300  | 11.8830  | 11.4679  | 11.8301  | 11.8467  | 11.4834  | 11.9026  | 11.5661  | 11.9945  |
| Total heat required for water heating calculated for each month | 235.7886       | 207.7441 | 218.8564 | 188.1558 | 179.4644 | 158.5393 | 154.2178 | 162.1547 | 165.9291 | 188.8148 | 205.3864 | 232.6653 |
| WWHRS                                                           | -30.8360       | -27.2716 | -28.5573 | -23.6466 | -22.0378 | -18.8579 | -17.6762 | -18.7969 | -19.5111 | -23.0014 | -26.0578 | -30.2650 |
| PV diverter                                                     | -0.0000        | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  |
| Solar input                                                     | 0.0000         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   |
| FGHRS                                                           | 0.0000         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   |
| Output from w/h                                                 | 204.9526       | 180.4725 | 190.2991 | 164.5092 | 157.4266 | 139.6815 | 136.5416 | 143.3578 | 146.4181 | 165.8134 | 179.3286 | 202.4003 |
| 12Total per year (kWh/year)                                     | 2011.2011 (64) |          |          |          |          |          |          |          |          |          |          |          |
| Electric shower(s)                                              | 0.0000         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   |
| Heat gains from water heating, kWh/month                        | 77.4096        | 68.1815  | 71.7826  | 61.6106  | 58.6916  | 51.7682  | 50.3014  | 52.9391  | 54.2241  | 61.7990  | 67.3368  | 76.3717  |

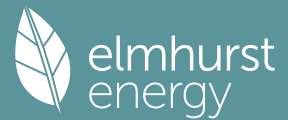
## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |           |           |           |           |           |           |           |           |           |           |           |           |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| Metabolic gains (Table 5), Watts                                                    | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec       |
| (66)m                                                                               | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 129.0440  | 142.8702  | 129.0440  | 133.3455  | 129.0440  | 133.3455  | 129.0440  | 129.0440  | 133.3455  | 129.0440  | 133.3455  | 129.0440  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 247.6715  | 250.2415  | 243.7651  | 229.9774  | 212.5731  | 196.2154  | 185.2875  | 182.7174  | 189.1939  | 202.9815  | 220.3859  | 236.7435  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 3.0000    | 3.0000    | 3.0000    |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 |
| Water heating gains (Table 5)                                                       | 104.0452  | 101.4606  | 96.4820   | 85.5702   | 78.8865   | 71.9003   | 67.6095   | 71.1547   | 75.3112   | 83.0631   | 93.5233   | 102.6501  |
| Total internal gains                                                                | 547.0525  | 560.8642  | 535.5829  | 515.1850  | 486.7955  | 464.7531  | 445.2328  | 446.2080  | 461.1424  | 481.3805  | 513.5465  | 534.7295  |

## 6. Solar gains

|       |            |                                |                                   |                                    |                              |            |
|-------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|------------|
| [Jan] | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W |
|-------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|------------|

# Full SAP Calculation Printout



|       |        |         |        |        |        |              |
|-------|--------|---------|--------|--------|--------|--------------|
| North | 1.3900 | 10.6334 | 0.4500 | 0.0000 | 0.7700 | 5.1214 (74)  |
| East  | 4.1200 | 19.6403 | 0.4500 | 0.0000 | 0.7700 | 28.0380 (76) |
| West  | 5.2500 | 19.6403 | 0.4500 | 0.0000 | 0.7700 | 35.7281 (80) |
| East  | 5.2200 | 19.6403 | 0.4500 | 0.0000 | 0.7700 | 35.5239 (76) |

|             |          |          |          |           |           |           |           |          |          |          |          |               |
|-------------|----------|----------|----------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|---------------|
| Solar gains | 104.4115 | 204.0197 | 336.5042 | 493.2296  | 607.7185  | 623.7941  | 593.1680  | 507.1627 | 392.0216 | 242.1237 | 130.1210 | 85.9208 (83)  |
| Total gains | 651.4640 | 764.8839 | 872.0871 | 1008.4146 | 1094.5140 | 1088.5471 | 1038.4009 | 953.3707 | 853.1640 | 723.5041 | 643.6675 | 620.6503 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |         |         |         |              |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| tau                                                                         | 52.0923 | 52.3017 | 52.5128 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153      |
| alpha                                                                       | 4.4728  | 4.4868  | 4.5009  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144       |
| util living area                                                            | 0.9928  | 0.9846  | 0.9638  | 0.8988  | 0.7686  | 0.5880  | 0.4380  | 0.4942  | 0.7456  | 0.9411  | 0.9859  | 0.9942 (86)  |
| MIT                                                                         | 19.3468 | 19.6052 | 19.9905 | 20.4658 | 20.8024 | 20.9541 | 20.9902 | 20.9834 | 20.8710 | 20.3964 | 19.7876 | 19.3138 (87) |
| Th 2                                                                        | 19.9851 | 19.9887 | 19.9924 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 (88) |
| util rest of house                                                          | 0.9908  | 0.9804  | 0.9539  | 0.8720  | 0.7144  | 0.5065  | 0.3412  | 0.3919  | 0.6686  | 0.9195  | 0.9813  | 0.9925 (89)  |
| MIT 2                                                                       | 18.2809 | 18.5743 | 19.0063 | 19.5190 | 19.8480 | 19.9714 | 19.9927 | 19.9900 | 19.9155 | 19.4590 | 18.7872 | 18.2510 (90) |
| Living area fraction                                                        | 18.4812 | 18.7681 | 19.1912 | 19.6969 | 20.0273 | 20.1561 | 20.1802 | 20.1767 | 20.0951 | 19.6351 | 18.9752 | 18.4508 (92) |
| MIT                                                                         | 18.4812 | 18.7681 | 19.1912 | 19.6969 | 20.0273 | 20.1561 | 20.1802 | 20.1767 | 20.0951 | 19.6351 | 18.9752 | 18.4508 (93) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT                                                                | 18.4812 | 18.7681 | 19.1912 | 19.6969 | 20.0273 | 20.1561 | 20.1802 | 20.1767 | 20.0951 | 19.6351 | 18.9752 | 18.4508 (93) |

## 8. Space heating requirement

|                                                                                |           |           |           |           |          |          |          |          |          |               |           |                |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|---------------|-----------|----------------|
|                                                                                | Jan       | Feb       | Mar       | Apr       | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov       | Dec            |
| Utilisation                                                                    | 0.9865    | 0.9734    | 0.9437    | 0.8627    | 0.7162   | 0.5200   | 0.3593   | 0.4108   | 0.6770   | 0.9096        | 0.9748    | 0.9888 (94)    |
| Useful gains                                                                   | 642.6460  | 744.5621  | 823.0082  | 869.9498  | 783.9067 | 566.0755 | 373.0560 | 391.6799 | 577.5549 | 658.1335      | 627.4430  | 613.7295 (95)  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000    | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000    | 4.2000 (96)    |
| Heat loss rate W                                                               | 1505.1360 | 1466.0106 | 1336.2137 | 1132.4011 | 873.3856 | 582.7321 | 375.4939 | 396.1063 | 628.7741 | 947.6209      | 1245.4934 | 1494.6444 (97) |
| Space heating kWh                                                              | 641.6925  | 484.8134  | 381.8250  | 188.9650  | 66.5723  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 215.3786      | 444.9962  | 655.4007 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |          |          |          |          |          |               |           | 3079.6436      |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |           |          |          |          |          |          |               |           | 0.0000         |
| Space heating kWh                                                              | 641.6925  | 484.8134  | 381.8250  | 188.9650  | 66.5723  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 215.3786      | 444.9962  | 655.4007 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |          |          |          |          |          |               |           | 3079.6436      |
| Space heating per m2                                                           |           |           |           |           |          |          |          |          |          | (98c) / (4) = |           | 32.4788 (99)   |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                                                      |          |          |          |          |          |          |          |          |          |          |          |                 |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (201)    |
| Fraction of space heat from main system(s)                                                           |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (202)    |
| Efficiency of main space heating system 1 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 91.7000 (206)   |
| Efficiency of main space heating system 2 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)    |
| Efficiency of secondary/supplementary heating system, %                                              |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)    |
|                                                                                                      | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec             |
| Space heating requirement                                                                            | 641.6925 | 484.8134 | 381.8250 | 188.9650 | 66.5723  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 215.3786 | 444.9962 | 655.4007 (98)   |
| Space heating efficiency (main heating system 1)                                                     | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 91.7000  | 91.7000  | 91.7000 (210)   |
| Space heating fuel (main heating system)                                                             | 699.7738 | 528.6951 | 416.3849 | 206.0686 | 72.5979  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 234.8730 | 485.2740 | 714.7227 (211)  |
| Space heating efficiency (main heating system 2)                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)    |
| Space heating fuel (main heating system 2)                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)    |
| Space heating fuel (secondary)                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)    |
| Water heating                                                                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| Water heating requirement                                                                            | 204.9526 | 180.4725 | 190.2991 | 164.5092 | 157.4266 | 139.6815 | 136.5416 | 143.3578 | 146.4181 | 165.8134 | 179.3286 | 202.4003 (64)   |
| Efficiency of water heater (217)m                                                                    | 88.2824  | 88.2203  | 88.0903  | 87.8101  | 87.3137  | 86.7000  | 86.7000  | 86.7000  | 86.7000  | 87.8742  | 88.1865  | 86.7000 (216)   |
| Fuel for water heating, kWh/month                                                                    | 232.1558 | 204.5701 | 216.0273 | 187.3465 | 180.3001 | 161.1090 | 157.4874 | 165.3492 | 168.8790 | 188.6941 | 203.3516 | 229.2309 (219)  |
| Space cooling fuel requirement                                                                       |          |          |          |          |          |          |          |          |          |          |          |                 |
| (221)m                                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)    |
| Pumps and Fa                                                                                         | 11.2600  | 10.1703  | 11.2600  | 10.8967  | 11.2600  | 10.8967  | 11.2600  | 11.2600  | 10.8967  | 11.2600  | 10.8967  | 11.2600 (231)   |
| Lighting                                                                                             | 24.7371  | 19.8450  | 17.8683  | 13.0911  | 10.1119  | 8.2615   | 9.2244   | 11.9903  | 15.5742  | 20.4341  | 23.0803  | 25.4247 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | -13.8577 | -22.9196 | -39.1412 | -51.1890 | -60.7330 | -58.6935 | -57.5786 | -51.1723 | -40.7967 | -28.6393 | -16.1851 | -11.5083 (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | -3.5626  | -8.8909  | -21.7125 | -39.0614 | -57.5840 | -60.2478 | -58.6981 | -46.0086 | -29.1122 | -13.8994 | -5.0330  | -2.6869 (233b)  |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234b)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235d)   |
| Annual totals kWh/year                                                                               |          |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating fuel - main system 1                                                                   |          |          |          |          |          |          |          |          |          |          |          | 3358.3900 (211) |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)    |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)    |

# Full SAP Calculation Printout



|                                                                                         |           |        |
|-----------------------------------------------------------------------------------------|-----------|--------|
| Efficiency of water heater                                                              | 86.7000   |        |
| Water heating fuel used                                                                 | 2294.5009 | (219)  |
| Space cooling fuel                                                                      | 0.0000    | (221)  |
| Electricity for pumps and fans:                                                         |           |        |
| (MEVDecentralised, Database: total watage = 6.9420, total flow = 45.0000, SFP = 0.1543) |           |        |
| mechanical ventilation fans (SFP = 0.1543)                                              | 46.5771   | (230a) |
| central heating pump                                                                    | 41.0000   | (230c) |
| main heating flue fan                                                                   | 45.0000   | (230e) |
| Total electricity for the above, kWh/year                                               | 132.5771  | (231)  |
| Electricity for lighting (calculated in Appendix L)                                     | 199.6429  | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                           |           |        |
| PV generation                                                                           | -798.9117 | (233)  |
| Wind generation                                                                         | 0.0000    | (234)  |
| Hydro-electric generation (Appendix N)                                                  | 0.0000    | (235a) |
| Electricity generated - Micro CHP (Appendix N)                                          | 0.0000    | (235)  |
| Appendix Q - special features                                                           |           |        |
| Energy saved or generated                                                               | -0.0000   | (236)  |
| Energy used                                                                             | 0.0000    | (237)  |
| Total delivered energy for all uses                                                     | 5186.1992 | (238)  |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                                 | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|-------------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1                   | 3358.3900          | 0.2100                        | 705.2619 (261)           |
| Total CO2 associated with community systems     |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                      | 2294.5009          | 0.2100                        | 481.8452 (264)           |
| Space and water heating                         |                    |                               | 1187.1071 (265)          |
| Pumps, fans and electric keep-hot               | 132.5771           | 0.1387                        | 18.3901 (267)            |
| Energy for lighting                             | 199.6429           | 0.1443                        | 28.8146 (268)            |
| Energy saving/generation technologies           |                    |                               |                          |
| PV Unit electricity used in dwelling            | -452.4142          | 0.1318                        | -59.6090                 |
| PV Unit electricity exported                    | -346.4975          | 0.1217                        | -42.1576                 |
| Total                                           |                    |                               | -101.7666 (269)          |
| Total CO2, kg/year                              |                    |                               | 1132.5452 (272)          |
| EPC Dwelling Carbon Dioxide Emission Rate (DER) |                    |                               | 11.9400 (273)            |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1               | 3358.3900          | 1.1300                              | 3794.9807 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 2294.5009          | 1.1300                              | 2592.7861 (278)            |
| Space and water heating                     |                    |                                     | 6387.7668 (279)            |
| Pumps, fans and electric keep-hot           | 132.5771           | 1.5128                              | 200.5626 (281)             |
| Energy for lighting                         | 199.6429           | 1.5338                              | 306.2189 (282)             |
| Energy saving/generation technologies       |                    |                                     |                            |
| PV Unit electricity used in dwelling        | -452.4142          | 1.4868                              | -672.6467                  |
| PV Unit electricity exported                | -346.4975          | 0.4464                              | -154.6730                  |
| Total                                       |                    |                                     | -827.3197 (283)            |
| Total Primary energy kWh/year               |                    |                                     | 6067.2286 (286)            |
| Dwelling Primary energy Rate (DPER)         |                    |                                     | 63.9900 (287)              |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF TARGET EMISSIONS

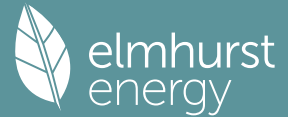
## 1. Overall dwelling characteristics

|                                                        | Area<br>(m2) | Storey height<br>(m)            | Volume<br>(m3)         |
|--------------------------------------------------------|--------------|---------------------------------|------------------------|
| Main dwelling                                          |              |                                 |                        |
| Ground floor                                           | 47.4100 (1b) | x 2.4600 (2b)                   | = 116.6286 (1b) - (3b) |
| First floor                                            | 47.4100 (1c) | x 2.7600 (2c)                   | = 130.8516 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 94.8200      |                                 | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 247.4802 (5)         |

## 2. Ventilation rate

|                                                                                                    | m3 per hour                |
|----------------------------------------------------------------------------------------------------|----------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)       |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)       |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)       |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)       |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)       |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)       |
| Number of intermittent extract fans                                                                | 3 * 10 = 30.0000 (7a)      |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)       |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)       |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 30.0000 / (5) = 0.1212 (8) |
| Pressure test                                                                                      | Yes                        |
| Pressure Test Method                                                                               | Blower Door                |
| Measured/design AP50                                                                               | 5.0000 (17)                |
| Infiltration rate                                                                                  | 0.3712 (18)                |

# Full SAP Calculation Printout



Number of sides sheltered

1 (19)

Shelter factor

$$(20) = 1 - [0.075 \times (19)] = 0.9250 \quad (20)$$

Infiltration rate adjusted to include shelter factor

$$(21) = (18) \times (20) = 0.3434 \quad (21)$$

|                 | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |       |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|
| Wind speed      | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 | (22)  |
| Wind factor     | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 | (22a) |
| Adj infilt rate |        |        |        |        |        |        |        |        |        |        |        |        |       |
| Effective ac    | 0.4378 | 0.4292 | 0.4206 | 0.3777 | 0.3691 | 0.3262 | 0.3262 | 0.3176 | 0.3434 | 0.3691 | 0.3863 | 0.4035 | (22b) |
|                 | 0.5958 | 0.5921 | 0.5885 | 0.5713 | 0.5681 | 0.5532 | 0.5532 | 0.5504 | 0.5590 | 0.5681 | 0.5746 | 0.5814 | (25)  |

### 3. Heat losses and heat loss parameter

| Element                                        | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K | A x U<br>W/K         | K-value<br>kJ/m2K | A x K<br>kJ/K |       |
|------------------------------------------------|-------------|----------------|---------------|------------------|----------------------|-------------------|---------------|-------|
| Main dwelling                                  |             |                |               |                  |                      |                   |               |       |
| TER Opaque door                                |             |                | 2.2300        | 1.0000           | 2.2300               |                   |               | (26)  |
| TER Opening Type                               |             |                | 15.9800       | 1.1450           | 18.2977              |                   |               | (27)  |
| GF SPVL 125TS P/A                              |             |                | 47.4100       | 0.1300           | 6.1633               |                   |               | (28a) |
| EW Brick AAC011                                | 151.6400    | 18.2100        | 133.4300      | 0.1800           | 24.0174              |                   |               | (29a) |
| PR 500mm MW044                                 | 47.4100     |                | 47.4100       | 0.1100           | 5.2151               |                   |               | (30)  |
| Total net area of external elements Aum(A, m2) |             |                | 246.4600      |                  |                      |                   |               | (31)  |
| Fabric heat loss, W/K = Sum (A x U)            |             |                |               |                  | (26)...(30) + (32) = | 55.9235           |               | (33)  |

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

209.9130 (35)

List of Thermal Bridges

| K1 Element                                                       | Length  | Psi-value | Total   |  |
|------------------------------------------------------------------|---------|-----------|---------|--|
| E2 Other lintels (including other steel lintels)                 | 11.9100 | 0.0500    | 0.5955  |  |
| E3 Sill                                                          | 9.4200  | 0.0500    | 0.4710  |  |
| E4 Jamb                                                          | 22.0500 | 0.0500    | 1.1025  |  |
| E5 Ground floor (normal)                                         | 12.0200 | 0.1600    | 1.9232  |  |
| E6 Intermediate floor within a dwelling                          | 29.0500 | 0.0000    | 0.0000  |  |
| E10 Eaves (insulation at ceiling level)                          | 9.1500  | 0.0600    | 0.5490  |  |
| E18 Party wall between dwellings                                 | 0.0000  | 0.0600    | 0.0000  |  |
| E4 Jamb                                                          | 4.2000  | 0.0500    | 0.2100  |  |
| E2 Other lintels (including other steel lintels)                 | 1.0600  | 0.0500    | 0.0530  |  |
| P1 Party wall - Ground floor                                     | 0.0000  | 0.0800    | 0.0000  |  |
| P2 Party wall - Intermediate floor within a dwelling             | 0.0000  | 0.0000    | 0.0000  |  |
| P4 Party wall - Roof (insulation at ceiling level)               | 0.0000  | 0.1200    | 0.0000  |  |
| E5 Ground floor (normal)                                         | 17.0300 | 0.1600    | 2.7248  |  |
| E12 Gable (insulation at ceiling level)                          | 19.9000 | 0.0600    | 1.1940  |  |
| E16 Corner (normal)                                              | 26.1000 | 0.0900    | 2.3490  |  |
| E17 Corner (inverted - internal area greater than external area) | 5.2200  | -0.0900   | -0.4698 |  |

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

10.7022 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

$$(33) + (36) + (36a) = 66.6257 \quad (37)$$

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

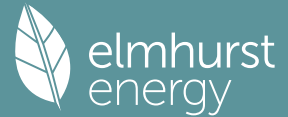
|                           | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |      |
|---------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| (38)m                     | 48.6612  | 48.3573  | 48.0594  | 46.6601  | 46.3983  | 45.1796  | 45.1796  | 44.9539  | 45.6490  | 46.3983  | 46.9279  | 47.4816  | (38) |
| Heat transfer coeff       | 115.2869 | 114.9830 | 114.6851 | 113.2858 | 113.0240 | 111.8053 | 111.8053 | 111.5796 | 112.2747 | 113.0240 | 113.5536 | 114.1073 | (39) |
| Average = Sum(39)m / 12 = |          |          |          |          |          |          |          |          |          |          |          | 113.2846 |      |

|               | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |      |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| HLP           | 1.2159 | 1.2126 | 1.2095 | 1.1947 | 1.1920 | 1.1791 | 1.1791 | 1.1768 | 1.1841 | 1.1920 | 1.1976 | 1.2034 | (40) |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 1.1947 |      |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31     |      |

### 4. Water heating energy requirements (kWh/year)

|                                                                                |          |          |          |          |          |          |          |          |          |                    |           |           |             |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------------------|-----------|-----------|-------------|
| Assumed occupancy                                                              |          |          |          |          |          |          |          |          |          |                    |           |           | 2.6861 (42) |
| Hot water usage for mixer showers                                              |          |          |          |          |          |          |          |          |          |                    |           |           |             |
| 69.2572                                                                        | 68.2164  | 66.6997  | 63.7979  | 61.6564  | 59.2683  | 57.9108  | 59.4160  | 61.0660  | 63.6301  | 66.5943            | 68.9918   | 68.9918   | (42a)       |
| Hot water usage for baths                                                      |          |          |          |          |          |          |          |          |          |                    |           |           |             |
| 29.9061                                                                        | 29.4619  | 28.8365  | 27.6833  | 26.8197  | 25.8622  | 25.3450  | 25.9661  | 26.6424  | 27.6669  | 28.8439            | 29.8050   | 29.8050   | (42b)       |
| Hot water usage for other uses                                                 |          |          |          |          |          |          |          |          |          |                    |           |           |             |
| 42.1386                                                                        | 40.6063  | 39.0739  | 37.5416  | 36.0093  | 34.4770  | 34.4770  | 36.0093  | 37.5416  | 39.0739  | 40.6063            | 42.1386   | 42.1386   | (42c)       |
| Average daily hot water use (litres/day)                                       |          |          |          |          |          |          |          |          |          |                    |           | 129.8883  | (43)        |
| Daily hot water use                                                            |          |          |          |          |          |          |          |          |          |                    |           |           |             |
| 141.3019                                                                       | 138.2846 | 134.6102 | 129.0228 | 124.4855 | 119.6075 | 117.7329 | 121.3914 | 125.2500 | 130.3710 | 136.0444           | 140.9354  | 140.9354  | (44)        |
| Energy conte                                                                   | 223.7876 | 196.9154 | 206.8908 | 176.6258 | 167.5814 | 147.0714 | 142.3877 | 150.3080 | 154.4457 | 176.9122           | 193.8202  | 220.6708  | (45)        |
| Energy content (annual)                                                        |          |          |          |          |          |          |          |          |          | Total = Sum(45)m = | 2157.4171 |           |             |
| Distribution loss (46)m = 0.15 x (45)m                                         |          |          |          |          |          |          |          |          |          |                    |           |           |             |
| 33.5681                                                                        | 29.5373  | 31.0336  | 26.4939  | 25.1372  | 22.0607  | 21.3582  | 22.5462  | 23.1669  | 26.5368  | 29.0730            | 33.1006   | 33.1006   | (46)        |
| Water storage loss (or HIU loss):                                              |          |          |          |          |          |          |          |          |          |                    |           |           |             |
| Total storage loss                                                             |          |          |          |          |          |          |          |          |          |                    |           |           |             |
| 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000    | 0.0000    | (56)        |
| If cylinder contains dedicated solar storage                                   |          |          |          |          |          |          |          |          |          |                    |           |           |             |
| 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000    | 0.0000    | (57)        |
| Primary loss                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000    | 0.0000    | (59)        |
| Combi loss                                                                     | 50.9589  | 46.0274  | 50.9589  | 49.3151  | 50.9589  | 49.3151  | 50.9589  | 50.9589  | 49.3151  | 50.9589            | 49.3151   | 50.9589   | (61)        |
| Total heat required for water heating calculated for each month                |          |          |          |          |          |          |          |          |          |                    |           |           |             |
| 274.7465                                                                       | 242.9428 | 257.8497 | 225.9408 | 218.5403 | 196.3865 | 193.3466 | 201.2669 | 203.7608 | 227.8711 | 243.1353           | 271.6297  | 271.6297  | (62)        |
| WWHRS                                                                          | -31.6615 | -28.0017 | -29.3218 | -24.2796 | -22.6277 | -19.3627 | -18.1494 | -19.3001 | -20.0334 | -23.6171           | -26.7553  | -31.0752  | (63a)       |
| PV diverter                                                                    | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000            | -0.0000   | -0.0000   | (63b)       |
| Solar input                                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000    | 0.0000    | (63c)       |
| FGHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000    | 0.0000    | (63d)       |
| Output from w/h                                                                |          |          |          |          |          |          |          |          |          |                    |           |           |             |
| 243.0850                                                                       | 214.9411 | 228.5280 | 201.6613 | 195.9126 | 177.0238 | 175.1972 | 181.9668 | 183.7274 | 204.2540 | 216.3800           | 240.5545  | 240.5545  | (64)        |
| 12Total per year (kWh/year)                                                    |          |          |          |          |          |          |          |          |          |                    |           | 2463.2317 | (64)        |
| Electric shower(s)                                                             |          |          |          |          |          |          |          |          |          |                    |           | 2463      | (64)        |
| 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000    | 0.0000    | (64a)       |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |          |          |          |          |          |          |                    |           | 0.0000    | (64a)       |
| Heat gains from water heating, kWh/month                                       |          |          |          |          |          |          |          |          |          |                    |           |           |             |
| 87.1491                                                                        | 76.9812  | 81.5309  | 71.0568  | 68.4605  | 61.2300  | 60.0836  | 62.7171  | 63.6820  | 71.5630  | 76.7740            | 86.1128   | 86.1128   | (65)        |

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## 5. Internal gains (see Table 5 and 5a)

| Metabolic gains (Table 5), Watts                                                    | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec       |      |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------|
| (66)m                                                                               | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 129.0440  | 142.8702  | 129.0440  | 133.3455  | 129.0440  | 133.3455  | 129.0440  | 129.0440  | 133.3455  | 129.0440  | 133.3455  | 129.0440  | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 247.6715  | 250.2415  | 243.7651  | 229.9774  | 212.5731  | 196.2154  | 185.2875  | 182.7174  | 189.1939  | 202.9815  | 220.3859  | 236.7435  | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | (69) |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 3.0000    | 3.0000    | 3.0000    | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | (71) |
| Water heating gains (Table 5)                                                       | 117.1359  | 114.5554  | 109.5846  | 98.6901   | 92.0169   | 85.0417   | 80.7576   | 84.2972   | 88.4472   | 96.1869   | 106.6306  | 115.7430  | (72) |
| Total internal gains                                                                | 560.1432  | 573.9589  | 548.6855  | 528.3048  | 499.9258  | 477.8944  | 458.3809  | 459.3505  | 474.2784  | 494.5042  | 526.6538  | 547.8224  | (73) |

## 6. Solar gains

| [Jan]       |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W   |          |          |               |
|-------------|----------|----------|----------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|--------------|----------|----------|---------------|
| North       |          |          |          | 1.3900     | 10.6334                        | 0.6300                            | 0.7000                             | 0.7700                       | 4.5171 (74)  |          |          |               |
| East        |          |          |          | 9.3400     | 19.6403                        | 0.6300                            | 0.7000                             | 0.7700                       | 56.0617 (76) |          |          |               |
| West        |          |          |          | 5.2500     | 19.6403                        | 0.6300                            | 0.7000                             | 0.7700                       | 31.5122 (80) |          |          |               |
| Solar gains | 92.0909  | 179.9454 | 296.7967 | 435.0285   | 536.0078                       | 550.1864                          | 523.1742                           | 447.3175                     | 345.7630     | 213.5531 | 114.7667 | 75.7821 (83)  |
| Total gains | 652.2342 | 753.9043 | 845.4822 | 963.3333   | 1035.9336                      | 1028.0808                         | 981.5552                           | 906.6680                     | 820.0414     | 708.0573 | 641.4205 | 623.6045 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |              |
| tau                                                                         | 47.9575 | 48.0843 | 48.2092 | 48.8047 | 48.9177 | 49.4509 | 49.4509 | 49.5510 | 49.2442 | 48.9177 | 48.6896 | 48.4533 |              |
| alpha                                                                       | 4.1972  | 4.2056  | 4.2139  | 4.2536  | 4.2612  | 4.2967  | 4.2967  | 4.3034  | 4.2829  | 4.2612  | 4.2460  | 4.2302  |              |
| util living area                                                            | 0.9929  | 0.9863  | 0.9707  | 0.9214  | 0.8158  | 0.6438  | 0.4880  | 0.5438  | 0.7870  | 0.9507  | 0.9869  | 0.9941  | (86)         |
| MIT                                                                         | 19.3683 | 19.5845 | 19.9230 | 20.3803 | 20.7356 | 20.9309 | 20.9833 | 20.9739 | 20.8337 | 20.3554 | 19.7881 | 19.3393 | (87)         |
| Th 2                                                                        | 19.9073 | 19.9099 | 19.9124 | 19.9242 | 19.9264 | 19.9367 | 19.9367 | 19.9386 | 19.9328 | 19.9264 | 19.9219 | 19.9173 | (88)         |
| util rest of house                                                          | 0.9909  | 0.9825  | 0.9622  | 0.8982  | 0.7638  | 0.5555  | 0.3764  | 0.4285  | 0.7103  | 0.9313  | 0.9825  | 0.9925  | (89)         |
| MIT 2                                                                       | 18.0179 | 18.2943 | 18.7232 | 19.2928 | 19.6982 | 19.8944 | 19.9307 | 19.9282 | 19.8133 | 19.2764 | 18.5636 | 17.9876 | (90)         |
| Living area fraction                                                        | 18.2717 | 18.5368 | 18.9487 | 19.4972 | 19.8932 | 20.0892 | 20.1285 | 20.1248 | 20.0051 | 19.4792 | 18.7937 | 18.2416 | (91)         |
| MIT                                                                         | 18.2717 | 18.5368 | 18.9487 | 19.4972 | 19.8932 | 20.0892 | 20.1285 | 20.1248 | 20.0051 | 19.4792 | 18.7937 | 18.2416 | (92)         |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | 0.0000  |              |
| adjusted MIT                                                                | 18.2717 | 18.5368 | 18.9487 | 19.4972 | 19.8932 | 20.0892 | 20.1285 | 20.1248 | 20.0051 | 19.4792 | 18.7937 | 18.2416 | (93)         |

## 8. Space heating requirement

|                                                                                |           |           |           |           |          |          |          |          |          |               |           |           |       |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|---------------|-----------|-----------|-------|
| Utilisation                                                                    | Jan       | Feb       | Mar       | Apr       | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov       | Dec       |       |
|                                                                                | 0.9865    | 0.9756    | 0.9520    | 0.8870    | 0.7620   | 0.5689   | 0.3971   | 0.4496   | 0.7162   | 0.9207        | 0.9759    | 0.9886    | (94)  |
| Useful gains                                                                   | 643.4229  | 735.5034  | 804.9312  | 854.4499  | 789.3456 | 584.8952 | 389.7733 | 407.6353 | 587.2840 | 651.9340      | 625.9866  | 616.5201  | (95)  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000    | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000    | 4.2000    | (96)  |
| Heat loss rate W                                                               | 1610.7491 | 1568.0006 | 1427.6811 | 1200.5072 | 926.0264 | 613.7245 | 394.5093 | 415.6064 | 662.9922 | 1003.5610     | 1327.8668 | 1602.2489 | (97)  |
| Space heating kWh                                                              | 719.6907  | 559.4382  | 463.3259  | 249.1612  | 101.6905 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 261.6104      | 505.3537  | 733.3822  | (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |          |          |          |          |          |               |           | 3593.6529 |       |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | 0.0000    | (98b) |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |           |          |          |          |          |          |               |           | 0.0000    |       |
| Space heating kWh                                                              | 719.6907  | 559.4382  | 463.3259  | 249.1612  | 101.6905 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 261.6104      | 505.3537  | 733.3822  | (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |          |          |          |          |          |               |           | 3593.6529 |       |
| Space heating per m2                                                           |           |           |           |           |          |          |          |          |          | (98c) / (4) = |           | 37.8997   | (99)  |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                       |          |          |          |          |          |          |          |          |          |          |          |          |               |
|-----------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Fraction of space heat from secondary/supplementary system (Table 11) |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (201)  |
| Fraction of space heat from main system(s)                            |          |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (202)  |
| Efficiency of main space heating system 1 (in %)                      |          |          |          |          |          |          |          |          |          |          |          |          | 92.4000 (206) |
| Efficiency of main space heating system 2 (in %)                      |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)  |
| Efficiency of secondary/supplementary heating system, %               |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)  |
| Space heating requirement                                             | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |               |
|                                                                       | 719.6907 | 559.4382 | 463.3259 | 249.1612 | 101.6905 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 261.6104 | 505.3537 | 733.3822 | (98)          |
| Space heating efficiency (main heating system 1)                      | 92.4000  | 92.4000  | 92.4000  | 92.4000  | 92.4000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 92.4000  | 92.4000  | 92.4000  | (210)         |
| Space heating fuel (main heating system)                              | 778.8860 | 605.4525 | 501.4350 | 269.6550 | 110.0547 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 283.1282 | 546.9196 | 793.7037 | (211)         |
| Space heating efficiency (main heating system 2)                      | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (212)         |
| Space heating fuel (main heating system 2)                            | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (213)         |
| Space heating fuel (secondary)                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (215)         |
| Water heating                                                         |          |          |          |          |          |          |          |          |          |          |          |          |               |
| Water heating requirement                                             | 243.0850 | 214.9411 | 228.5280 | 201.6613 | 195.9126 | 177.0238 | 175.1972 | 181.9668 | 183.7274 | 204.2540 | 216.3800 | 240.5545 | (64)          |
| Efficiency of water heater                                            |          |          |          |          |          |          |          |          |          |          |          | 80.3000  | (216)         |

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|                                                                                                      |          |          |           |           |           |           |           |           |           |          |          |            |        |
|------------------------------------------------------------------------------------------------------|----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|----------|------------|--------|
| (217)m                                                                                               | 86.5594  | 86.3336  | 85.8625   | 84.8358   | 83.0451   | 80.3000   | 80.3000   | 80.3000   | 80.3000   | 84.9128  | 86.1343  | 86.6090    | (217)  |
| Fuel for water heating, kWh/month                                                                    | 280.8303 | 248.9659 | 266.1557  | 237.7079  | 235.9112  | 220.4530  | 218.1783  | 226.6087  | 228.8013  | 240.5455 | 251.2122 | 277.7478   | (219)  |
| Space cooling fuel requirement                                                                       |          |          |           |           |           |           |           |           |           |          |          |            |        |
| (221)m                                                                                               | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (221)  |
| Pumps and Fa                                                                                         | 7.3041   | 6.5973   | 7.3041    | 7.0685    | 7.3041    | 7.0685    | 7.3041    | 7.0685    | 7.3041    | 7.0685   | 7.3041   | 7.0685     | (231)  |
| Lighting                                                                                             | 26.8128  | 21.5102  | 19.3676   | 14.1895   | 10.9604   | 8.9547    | 9.9984    | 12.9963   | 16.8810   | 22.1487  | 25.0169  | 27.5580    | (232)  |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |           |           |           |           |           |           |           |          |          |            |        |
| (233a)m                                                                                              | -43.5998 | -61.0812 | -87.2451  | -97.4418  | -104.5021 | -97.3059  | -96.0664  | -90.9480  | -81.8609  | -69.5024 | -47.7811 | -37.7370   | (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |           |           |           |           |           |           |           |          |          |            |        |
| (234a)m                                                                                              | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (234a) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |           |           |           |           |           |           |           |          |          |            |        |
| (235a)m                                                                                              | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (235a) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |           |           |           |           |           |           |           |          |          |            |        |
| (235c)m                                                                                              | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (235c) |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |           |           |           |           |           |           |           |          |          |            |        |
| (233b)m                                                                                              | -25.8178 | -54.1746 | -107.4389 | -161.0389 | -212.6397 | -213.5772 | -211.0977 | -178.8993 | -131.3221 | -77.4059 | -34.4448 | -20.4294   | (233b) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |           |           |           |           |           |           |           |          |          |            |        |
| (234b)m                                                                                              | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (234b) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |           |           |           |           |           |           |           |          |          |            |        |
| (235b)m                                                                                              | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (235b) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |           |           |           |           |           |           |           |          |          |            |        |
| (235d)m                                                                                              | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (235d) |
| Annual totals kWh/year                                                                               |          |          |           |           |           |           |           |           |           |          |          |            |        |
| Space heating fuel - main system 1                                                                   |          |          |           |           |           |           |           |           |           |          |          | 3889.2348  | (211)  |
| Space heating fuel - main system 2                                                                   |          |          |           |           |           |           |           |           |           |          |          | 0.0000     | (213)  |
| Space heating fuel - secondary                                                                       |          |          |           |           |           |           |           |           |           |          |          | 0.0000     | (215)  |
| Efficiency of water heater                                                                           |          |          |           |           |           |           |           |           |           |          |          | 80.3000    |        |
| Water heating fuel used                                                                              |          |          |           |           |           |           |           |           |           |          |          | 2933.1177  | (219)  |
| Space cooling fuel                                                                                   |          |          |           |           |           |           |           |           |           |          |          | 0.0000     | (221)  |
| Electricity for pumps and fans:                                                                      |          |          |           |           |           |           |           |           |           |          |          |            |        |
| Total electricity for the above, kWh/year                                                            |          |          |           |           |           |           |           |           |           |          |          | 86.0000    | (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |          |          |           |           |           |           |           |           |           |          |          | 216.3947   | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |          |           |           |           |           |           |           |           |          |          |            |        |
| PV generation                                                                                        |          |          |           |           |           |           |           |           |           |          |          | -2343.3580 | (233)  |
| Wind generation                                                                                      |          |          |           |           |           |           |           |           |           |          |          | 0.0000     | (234)  |
| Hydro-electric generation (Appendix N)                                                               |          |          |           |           |           |           |           |           |           |          |          | 0.0000     | (235a) |
| Electricity generated - Micro CHP (Appendix N)                                                       |          |          |           |           |           |           |           |           |           |          |          | 0.0000     | (235)  |
| Appendix Q - special features                                                                        |          |          |           |           |           |           |           |           |           |          |          |            |        |
| Energy saved or generated                                                                            |          |          |           |           |           |           |           |           |           |          |          | -0.0000    | (236)  |
| Energy used                                                                                          |          |          |           |           |           |           |           |           |           |          |          | 0.0000     | (237)  |
| Total delivered energy for all uses                                                                  |          |          |           |           |           |           |           |           |           |          |          | 4781.3892  | (238)  |

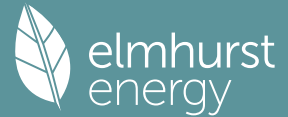
## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                               | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|-----------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1                 | 3889.2348          | 0.2100                        | 816.7393 (261)           |
| Total CO2 associated with community systems   |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                    | 2933.1177          | 0.2100                        | 615.9547 (264)           |
| Space and water heating                       |                    |                               | 1432.6940 (265)          |
| Pumps, fans and electric keep-hot             | 86.0000            | 0.1387                        | 11.9293 (267)            |
| Energy for lighting                           | 216.3947           | 0.1443                        | 31.2324 (268)            |
| Energy saving/generation technologies         |                    |                               |                          |
| PV Unit electricity used in dwelling          | -915.0717          | 0.1347                        | -123.2884                |
| PV Unit electricity exported                  | -1428.2863         | 0.1260                        | -179.8958                |
| Total                                         |                    |                               | -303.1842 (269)          |
| Total CO2, kg/year                            |                    |                               | 1172.6716 (272)          |
| EPC Target Carbon Dioxide Emission Rate (TER) |                    |                               | 12.3700 (273)            |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1               | 3889.2348          | 1.1300                              | 4394.8353 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 2933.1177          | 1.1300                              | 3314.4231 (278)            |
| Space and water heating                     |                    |                                     | 7709.2584 (279)            |
| Pumps, fans and electric keep-hot           | 86.0000            | 1.5128                              | 130.1008 (281)             |
| Energy for lighting                         | 216.3947           | 1.5338                              | 331.9134 (282)             |
| Energy saving/generation technologies       |                    |                                     |                            |
| PV Unit electricity used in dwelling        | -915.0717          | 1.4980                              | -1370.7323                 |
| PV Unit electricity exported                | -1428.2863         | 0.4623                              | -660.3444                  |
| Total                                       |                    |                                     | -2031.0766 (283)           |
| Total Primary energy kWh/year               |                    |                                     | 6140.1959 (286)            |
| Target Primary Energy Rate (TPER)           |                    |                                     | 64.7600 (287)              |

# Full SAP Calculation Printout



|                                    |                                                          |               |        |      |                |            |
|------------------------------------|----------------------------------------------------------|---------------|--------|------|----------------|------------|
| Plot Reference                     | 4907-R823-9471-004                                       |               |        |      | Issued on Date | 21/07/2026 |
| Assessment Reference               | Plot 4                                                   | Plot Type Ref | Plot 4 |      |                |            |
| Plot Address                       | Plot 4, Bosworth Det, K, WC, B, ES, 1012                 |               |        |      | SAP Version    | 10.2       |
|                                    |                                                          |               |        |      |                |            |
| SAP Rating                         | 90 B                                                     | DER           | 11.94  | TER  | 12.37          |            |
| Environmental                      | 90 B                                                     | % DER < TER   |        |      |                | 3.48       |
| CO <sub>2</sub> Emissions (t/year) | 0.99                                                     | DFEE          | 40.71  | TFEE | 43.39          |            |
| Compliance Check                   | See BREL                                                 | % DFEE < TFEE |        |      |                | 6.20       |
| % DPER < TPER                      | 1.19                                                     | DPER          | 63.99  | TPER | 64.76          |            |
|                                    |                                                          |               |        |      |                |            |
| Assessor Details                   | Mr. Daniel Harris                                        |               |        |      | Assessor ID    | R823-0001  |
| Client                             | Crest Nicholson Head Office, Crest Nicholson Head Office |               |        |      |                |            |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF FABRIC ENERGY EFFICIENCY

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)            | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Main dwelling                                          |                           |                                 |                             |
| Ground floor                                           | 47.4100 (1b)              | x 2.4600 (2b)                   | = 116.6286 (1b) - (3b)      |
| First floor                                            | 47.4100 (1c)              | x 2.7600 (2c)                   | = 130.8516 (1c) - (3c)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 94.8200                   |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 247.4802 (5)              |

## 2. Ventilation rate

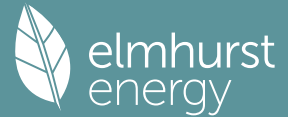
|                                                                                                    | m <sup>3</sup> per hour                            |
|----------------------------------------------------------------------------------------------------|----------------------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                               |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                               |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                               |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                               |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                               |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                               |
| Number of intermittent extract fans                                                                | 3 * 10 = 30.0000 (7a)                              |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)                               |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)                               |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | Air changes per hour<br>30.0000 / (5) = 0.1212 (8) |
| Pressure test                                                                                      | Yes                                                |
| Pressure Test Method                                                                               | Blower Door                                        |
| Measured/design AP50                                                                               | 4.5000 (17)                                        |
| Infiltration rate                                                                                  | 0.3462 (18)                                        |
| Number of sides sheltered                                                                          | 1 (19)                                             |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 0.9250 (20)            |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.3203 (21)                   |

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor                                                                                             | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate                                                                                         | 0.4083 | 0.4003 | 0.3923 | 0.3523 | 0.3443 | 0.3042 | 0.3042 | 0.2962 | 0.3203 | 0.3443 | 0.3603 | 0.3763 (22b) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.0000 (23b) |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =            |        |        |        |        |        |        |        |        |        |        |        | 0.0000 (23c) |
| Effective ac                                                                                            | 0.5834 | 0.5801 | 0.5770 | 0.5621 | 0.5593 | 0.5463 | 0.5463 | 0.5439 | 0.5513 | 0.5593 | 0.5649 | 0.5708 (25)  |

## 3. Heat losses and heat loss parameter

| Element                                                        | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K       | A x K<br>kJ/K   |
|----------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------------|-----------------|
| Main dwelling                                                  |                         |                            |                           |                               |              |                                      |                 |
| Front Door                                                     |                         |                            | 2.2300                    | 1.2000                        | 2.6760       |                                      | (26)            |
| Windows                                                        |                         |                            | 10.7600                   | 1.2357                        | 13.2966      |                                      | (27)            |
| French Doors                                                   |                         |                            | 5.2200                    | 1.2357                        | 6.4506       |                                      | (27)            |
| GF SPVL 125TS P/A                                              |                         |                            | 47.4100                   | 0.1300                        | 6.1633       | 75.0000                              | 3555.7500 (28a) |
| EW Brick AAC011                                                | 151.6400                | 18.2100                    | 133.4300                  | 0.1800                        | 24.0174      | 60.0000                              | 8005.8000 (29a) |
| PR 500mm MW044                                                 | 47.4100                 |                            | 47.4100                   | 0.0900                        | 4.2669       | 9.0000                               | 426.6900 (30)   |
| Total net area of external elements Aum(A, m <sup>2</sup> )    |                         |                            | 246.4600                  |                               |              |                                      | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                            |                         |                            |                           | (26)...(30) + (32) =          | 56.8707      |                                      | (33)            |
| Main dwelling                                                  |                         |                            |                           |                               |              |                                      |                 |
| Timber - GF                                                    |                         |                            | 24.2600                   |                               |              | 9.0000                               | 218.3400 (32c)  |
| Timber - FF                                                    |                         |                            | 140.7000                  |                               |              | 9.0000                               | 1266.3000 (32c) |
| Masonry GF                                                     |                         |                            | 51.5100                   |                               |              | 100.0000                             | 5151.0000 (32c) |
| Internal Floor FF                                              |                         |                            | 47.4100                   |                               |              | 18.0000                              | 853.3800 (32d)  |
| Internal Ceiling GF                                            |                         |                            | 47.4100                   |                               |              | 9.0000                               | 426.6900 (32e)  |
| Heat capacity Cm = Sum(A x k)                                  |                         |                            |                           |                               |              | (28)...(30) + (32) + (32a)...(32e) = | 19903.9500 (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K |                         |                            |                           |                               |              |                                      | 209.9130 (35)   |

# Full SAP Calculation Printout



## List of Thermal Bridges

|                                                                  | Length  | Psi-value | Total                              |
|------------------------------------------------------------------|---------|-----------|------------------------------------|
| K1 Element                                                       |         |           |                                    |
| E2 Other lintels (including other steel lintels)                 | 11.9100 | 0.0410    | 0.4883                             |
| E3 Sill                                                          | 9.4200  | 0.0220    | 0.2072                             |
| E4 Jamb                                                          | 22.0500 | 0.0190    | 0.4189                             |
| E5 Ground floor (normal)                                         | 12.0200 | 0.0928    | 1.1155                             |
| E6 Intermediate floor within a dwelling                          | 29.0500 | 0.0020    | 0.0581                             |
| E10 Eaves (insulation at ceiling level)                          | 9.1500  | 0.0390    | 0.3569                             |
| E18 Party wall between dwellings                                 | 0.0000  | 0.0300    | 0.0000                             |
| E4 Jamb                                                          | 4.2000  | 0.1000    | 0.4200                             |
| E2 Other lintels (including other steel lintels)                 | 1.0600  | 0.0410    | 0.0435                             |
| P1 Party wall - Ground floor                                     | 0.0000  | 0.1000    | 0.0000                             |
| P2 Party wall - Intermediate floor within a dwelling             | 0.0000  | 0.0000    | 0.0000                             |
| P4 Party wall - Roof (insulation at ceiling level)               | 0.0000  | 0.0350    | 0.0000                             |
| E5 Ground floor (normal)                                         | 17.0300 | 0.0980    | 1.6689                             |
| E12 Gable (insulation at ceiling level)                          | 19.9000 | 0.0870    | 1.7313                             |
| E16 Corner (normal)                                              | 26.1000 | 0.0420    | 1.0962                             |
| E17 Corner (inverted - internal area greater than external area) | 5.2200  | -0.0820   | -0.4280                            |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)       |         |           | 7.1768 (36)                        |
| Point Thermal bridges                                            |         |           | (36a) = 0.0000                     |
| Total fabric heat loss                                           |         |           | (33) + (36) + (36a) = 64.0475 (37) |

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

|                           | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
|---------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| (38)m                     | 47.6425  | 47.3781  | 47.1190  | 45.9018  | 45.6741  | 44.6140  | 44.6140  | 44.4177  | 45.0223  | 45.6741  | 46.1348  | 46.6164 (38)  |
| Heat transfer coeff       | 111.6900 | 111.4256 | 111.1665 | 109.9493 | 109.7216 | 108.6615 | 108.6615 | 108.4652 | 109.0698 | 109.7216 | 110.1823 | 110.6639 (39) |
| Average = Sum(39)m / 12 = |          |          |          |          |          |          |          |          |          |          |          | 109.9483      |
| HLP                       | 1.1779   | 1.1751   | 1.1724   | 1.1596   | 1.1572   | 1.1460   | 1.1460   | 1.1439   | 1.1503   | 1.1572   | 1.1620   | 1.1671 (40)   |
| HLP (average)             |          |          |          |          |          |          |          |          |          |          |          | 1.1595        |
| Days in mont              | 31       | 28       | 31       | 30       | 31       | 30       | 31       | 31       | 30       | 31       | 30       | 31            |

## 4. Water heating energy requirements (kWh/year)

|                                                                 |          |         |          |         |         |         |         |         |         |                                        |         |               |
|-----------------------------------------------------------------|----------|---------|----------|---------|---------|---------|---------|---------|---------|----------------------------------------|---------|---------------|
| Assumed occupancy                                               |          |         |          |         |         |         |         |         |         |                                        |         | 2.6861 (42)   |
| Hot water usage for mixer showers                               |          |         |          |         |         |         |         |         |         |                                        |         |               |
| 0.0000                                                          | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | (42a)         |
| Hot water usage for baths                                       |          |         |          |         |         |         |         |         |         |                                        |         |               |
| 29.9061                                                         | 29.4619  | 28.8365 | 27.6833  | 26.8197 | 25.8622 | 25.3450 | 25.9661 | 26.6424 | 27.6669 | 28.8439                                | 29.8050 | (42b)         |
| Hot water usage for other uses                                  |          |         |          |         |         |         |         |         |         |                                        |         |               |
| 42.1386                                                         | 40.6063  | 39.0739 | 37.5416  | 36.0093 | 34.4770 | 34.4770 | 36.0093 | 37.5416 | 39.0739 | 40.6063                                | 42.1386 | (42c)         |
| Average daily hot water use (litres/day)                        |          |         |          |         |         |         |         |         |         |                                        |         | 66.0354 (43)  |
| Daily hot water use                                             |          |         |          |         |         |         |         |         |         |                                        |         |               |
| 72.0447                                                         | 70.0682  | 67.9104 | 65.2249  | 62.8291 | 60.3393 | 59.8221 | 61.9754 | 64.1840 | 66.7409 | 69.4502                                | 71.9436 | (44)          |
| Energy conte                                                    | 114.1011 | 99.7762 | 104.3758 | 89.2896 | 84.5800 | 74.1941 | 72.3496 | 76.7385 | 79.1453 | 90.5667                                | 98.9445 | 112.6462 (45) |
| Energy content (annual)                                         |          |         |          |         |         |         |         |         |         | Total = Sum(45)m =                     |         | 1096.7078     |
| Distribution loss (46)m = 0.15 x (45)m                          |          |         |          |         |         |         |         |         |         |                                        |         |               |
| 0.0000                                                          | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | (46)          |
| Water storage loss (or HIU loss):                               |          |         |          |         |         |         |         |         |         |                                        |         |               |
| Total storage loss                                              |          |         |          |         |         |         |         |         |         |                                        |         |               |
| 0.0000                                                          | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | (56)          |
| If cylinder contains dedicated solar storage                    |          |         |          |         |         |         |         |         |         |                                        |         |               |
| 0.0000                                                          | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | (57)          |
| Primary loss                                                    | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | (59)          |
| Combi loss                                                      | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | (61)          |
| Total heat required for water heating calculated for each month |          |         |          |         |         |         |         |         |         |                                        |         |               |
| 96.9860                                                         | 84.8098  | 88.7194 | 75.8962  | 71.8930 | 63.0650 | 61.4972 | 65.2278 | 67.2735 | 76.9817 | 84.1028                                | 95.7493 | (62)          |
| WWHRS                                                           | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | (63a)         |
| PV diverter                                                     | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | (63b)         |
| Solar input                                                     | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | (63c)         |
| FGHRS                                                           | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | (63d)         |
| Output from w/h                                                 |          |         |          |         |         |         |         |         |         |                                        |         |               |
| 96.9860                                                         | 84.8098  | 88.7194 | 75.8962  | 71.8930 | 63.0650 | 61.4972 | 65.2278 | 67.2735 | 76.9817 | 84.1028                                | 95.7493 | (64)          |
| 12Total per year (kWh/year)                                     |          |         |          |         |         |         |         |         |         | Total per year (kWh/year) = Sum(64)m = |         | 932.2016 (64) |
| Electric shower(s)                                              |          |         |          |         |         |         |         |         |         |                                        |         | 932 (64)      |
| 55.4635                                                         | 49.4184  | 53.9630 | 51.4962  | 52.4626 | 50.0442 | 51.7123 | 52.4626 | 51.4962 | 53.9630 | 52.9483                                | 55.4635 | (64a)         |
| Heat gains from water heating, kWh/month                        |          |         |          |         |         |         |         |         |         |                                        |         |               |
| 38.1124                                                         | 33.5570  | 35.6706 | 31.8481  | 31.0889 | 28.2773 | 28.3024 | 29.4226 | 29.6924 | 32.7362 | 34.2628                                | 37.8032 | (65)          |

## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |           |           |           |           |           |           |           |           |           |           |           |      |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------|
| Metabolic gains (Table 5), Watts                                                    |           |           |           |           |           |           |           |           |           |           |           |      |
| (66)m                                                                               | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     |           |           |           |           |           |           |           |           |           |           |           |      |
| 129.0440                                                                            | 142.8702  | 129.0440  | 133.3455  | 129.0440  | 133.3455  | 129.0440  | 133.3455  | 129.0440  | 133.3455  | 129.0440  | 133.3455  | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 |           |           |           |           |           |           |           |           |           |           |           |      |
| 247.6715                                                                            | 250.2415  | 243.7651  | 229.9774  | 212.5731  | 196.2154  | 185.2875  | 182.7174  | 189.1939  | 202.9815  | 220.3859  | 236.7435  | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    |           |           |           |           |           |           |           |           |           |           |           |      |
| 36.4306                                                                             | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | (69) |
| Pumps, fans                                                                         | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 |           |           |           |           |           |           |           |           |           |           |           |      |
| -107.4449                                                                           | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | (71) |
| Water heating gains (Table 5)                                                       |           |           |           |           |           |           |           |           |           |           |           |      |
| 51.2263                                                                             | 49.9361   | 47.9444   | 44.2335   | 41.7861   | 39.2740   | 38.0408   | 39.5465   | 41.2395   | 44.0002   | 47.5872   | 50.8107   | (72) |
| Total internal gains                                                                |           |           |           |           |           |           |           |           |           |           |           |      |
| 491.2336                                                                            | 506.3396  | 484.0453  | 470.8483  | 446.6951  | 432.1268  | 415.6642  | 414.5998  | 427.0707  | 439.3176  | 464.6104  | 479.8901  | (73) |

## 6. Solar gains

| [Jan] | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W  |
|-------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|-------------|
| North | 1.3900     | 10.6334                        | 0.4500                            | 0.0000                             | 0.7700                       | 5.1214 (74) |

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|      |        |         |        |        |        |              |
|------|--------|---------|--------|--------|--------|--------------|
| East | 4.1200 | 19.6403 | 0.4500 | 0.0000 | 0.7700 | 28.0380 (76) |
| West | 5.2500 | 19.6403 | 0.4500 | 0.0000 | 0.7700 | 35.7281 (80) |
| East | 5.2200 | 19.6403 | 0.4500 | 0.0000 | 0.7700 | 35.5239 (76) |

|             |          |          |          |          |           |           |           |          |          |          |          |               |
|-------------|----------|----------|----------|----------|-----------|-----------|-----------|----------|----------|----------|----------|---------------|
| Solar gains | 104.4115 | 204.0197 | 336.5042 | 493.2296 | 607.7185  | 623.7941  | 593.1680  | 507.1627 | 392.0216 | 242.1237 | 130.1210 | 85.9208 (83)  |
| Total gains | 595.6451 | 710.3593 | 820.5495 | 964.0779 | 1054.4136 | 1055.9208 | 1008.8322 | 921.7625 | 819.0923 | 681.4413 | 594.7314 | 565.8109 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |         |         |         |              |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| tau                                                                         | 49.5020 | 49.6194 | 49.7351 | 50.2857 | 50.3900 | 50.8816 | 50.8816 | 50.9737 | 50.6911 | 50.3900 | 50.1793 | 49.9609      |
| alpha                                                                       | 4.3001  | 4.3080  | 4.3157  | 4.3524  | 4.3593  | 4.3921  | 4.3921  | 4.3982  | 4.3794  | 4.3593  | 4.3453  | 4.3307       |
| util living area                                                            | 0.9950  | 0.9888  | 0.9726  | 0.9175  | 0.7998  | 0.6185  | 0.4644  | 0.5240  | 0.7781  | 0.9546  | 0.9899  | 0.9960 (86)  |
| MIT                                                                         | 19.3620 | 19.5942 | 19.9513 | 20.4239 | 20.7711 | 20.9451 | 20.9875 | 20.9793 | 20.8508 | 20.3658 | 19.7825 | 19.3286 (87) |
| Th 2                                                                        | 19.9377 | 19.9399 | 19.9421 | 19.9525 | 19.9544 | 19.9635 | 19.9635 | 19.9651 | 19.9600 | 19.9544 | 19.9505 | 19.9464 (88) |
| util rest of house                                                          | 0.9935  | 0.9856  | 0.9646  | 0.8938  | 0.7469  | 0.5330  | 0.3596  | 0.4141  | 0.7018  | 0.9366  | 0.9865  | 0.9948 (89)  |
| MIT 2                                                                       | 18.4513 | 18.6833 | 19.0365 | 19.4957 | 19.8017 | 19.9375 | 19.9600 | 19.9587 | 19.8767 | 19.4526 | 18.8797 | 18.4246 (90) |
| Living area fraction                                                        | 18.6225 | 18.8545 | 19.2084 | 19.6701 | 19.9839 | 20.1269 | 20.1531 | 20.1505 | 20.0598 | 19.6243 | 19.0493 | 18.5945 (92) |
| MIT                                                                         | 18.6225 | 18.8545 | 19.2084 | 19.6701 | 19.9839 | 20.1269 | 20.1531 | 20.1505 | 20.0598 | 19.6243 | 19.0493 | 18.5945 (93) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT                                                                | 18.6225 | 18.8545 | 19.2084 | 19.6701 | 19.9839 | 20.1269 | 20.1531 | 20.1505 | 20.0598 | 19.6243 | 19.0493 | 18.5945 (93) |

## 8. Space heating requirement

|                                                                                |           |           |           |           |          |          |          |          |          |               |           |                |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|---------------|-----------|----------------|
|                                                                                | Jan       | Feb       | Mar       | Apr       | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov       | Dec            |
| Utilisation                                                                    | 0.9910    | 0.9811    | 0.9574    | 0.8862    | 0.7486   | 0.5472   | 0.3792   | 0.4345   | 0.7100   | 0.9293        | 0.9824    | 0.9927 (94)    |
| Useful gains                                                                   | 590.2739  | 696.9447  | 785.6305  | 854.3568  | 789.2861 | 577.7510 | 382.5538 | 400.4988 | 581.5321 | 633.2630      | 584.2632  | 561.6705 (95)  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000    | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000    | 4.2000 (96)    |
| Heat loss rate W                                                               | 1599.6773 | 1554.8887 | 1412.7499 | 1184.1704 | 908.9219 | 600.5603 | 386.0816 | 406.7995 | 650.0324 | 990.1555      | 1316.6052 | 1592.9484 (97) |
| Space heating kWh                                                              | 750.9961  | 576.5384  | 466.5768  | 237.4658  | 89.0090  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 265.5281      | 527.2862  | 767.2708 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |          |          |          |          |          |               |           | 3680.6712      |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |           |          |          |          |          |          |               |           | 0.0000         |
| Space heating kWh                                                              | 750.9961  | 576.5384  | 466.5768  | 237.4658  | 89.0090  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 265.5281      | 527.2862  | 767.2708 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |          |          |          |          |          |               |           | 3680.6712      |
| Space heating per m2                                                           |           |           |           |           |          |          |          |          |          | (98c) / (4) = |           | 38.8175 (99)   |

## 8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

|                                  |        |        |        |        |         |           |           |           |                          |         |        |                |
|----------------------------------|--------|--------|--------|--------|---------|-----------|-----------|-----------|--------------------------|---------|--------|----------------|
|                                  | Jan    | Feb    | Mar    | Apr    | May     | Jun       | Jul       | Aug       | Sep                      | Oct     | Nov    | Dec            |
| Ext. temp.                       | 4.3000 | 4.9000 | 6.5000 | 8.9000 | 11.7000 | 14.6000   | 16.6000   | 16.4000   | 14.1000                  | 10.6000 | 7.1000 | 4.2000         |
| Heat loss rate W                 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 1021.4181 | 804.0951  | 824.3354  | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (100)   |
| Utilisation                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 0.8682    | 0.9225    | 0.8924    | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (101)   |
| Useful loss                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 886.7646  | 741.7892  | 735.6280  | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (102)   |
| Total gains                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 1180.0589 | 1127.6280 | 1028.4301 | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (103)   |
| Space cooling kWh                | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 211.1719  | 287.0641  | 217.8448  | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (104)   |
| Cooled fraction                  |        |        |        |        |         |           |           |           | fc = cooled area / (4) = |         |        | 1.0000 (105)   |
| Intermittency factor (Table 10b) | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500  | 0.2500    | 0.2500    | 0.2500    | 0.2500                   | 0.2500  | 0.2500 | 0.2500 (106)   |
| Space cooling kWh                | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 52.7930   | 71.7660   | 54.4612   | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (107)   |
| Space cooling requirement        |        |        |        |        |         |           |           |           |                          |         |        | 179.0202 (107) |
| Energy for space heating         |        |        |        |        |         |           |           |           |                          |         |        | 38.8175 (99)   |
| Energy for space cooling         |        |        |        |        |         |           |           |           |                          |         |        | 1.8880 (108)   |
| Total                            |        |        |        |        |         |           |           |           |                          |         |        | 40.7055 (109)  |
| Fabric Energy Efficiency (DFEE)  |        |        |        |        |         |           |           |           |                          |         |        | 40.7 (109)     |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

## 1. Overall dwelling characteristics

|                                                         |              |                                    |                        |
|---------------------------------------------------------|--------------|------------------------------------|------------------------|
| Main dwelling                                           | Area (m2)    | Storey height (m)                  | Volume (m3)            |
| Ground floor                                            | 47.4100 (1b) | x 2.4600 (2b)                      | = 116.6286 (1b) - (3b) |
| First floor                                             | 47.4100 (1c) | x 2.7600 (2c)                      | = 130.8516 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)... (1n) | 94.8200      |                                    | (4)                    |
| Dwelling volume                                         |              | (3a)+(3b)+(3c)+(3d)+(3e)... (3n) = | 247.4802 (5)           |

## 2. Ventilation rate

m3 per hour

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|                                                    |          |              |
|----------------------------------------------------|----------|--------------|
| Number of open chimneys                            | 0 * 80 = | 0.0000 (6a)  |
| Number of open flues                               | 0 * 20 = | 0.0000 (6b)  |
| Number of chimneys / flues attached to closed fire | 0 * 10 = | 0.0000 (6c)  |
| Number of flues attached to solid fuel boiler      | 0 * 20 = | 0.0000 (6d)  |
| Number of flues attached to other heater           | 0 * 35 = | 0.0000 (6e)  |
| Number of blocked chimneys                         | 0 * 20 = | 0.0000 (6f)  |
| Number of intermittent extract fans                | 3 * 10 = | 30.0000 (7a) |
| Number of passive vents                            | 0 * 10 = | 0.0000 (7b)  |
| Number of flueless gas fires                       | 0 * 40 = | 0.0000 (7c)  |

|                                                      |                                                       |         |                      |             |
|------------------------------------------------------|-------------------------------------------------------|---------|----------------------|-------------|
| Infiltration due to chimneys, flues and fans         | = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 30.0000 | Air changes per hour | 0.1212 (8)  |
| Pressure test                                        |                                                       |         | Yes                  |             |
| Pressure Test Method                                 |                                                       |         | Blower Door          |             |
| Measured/design AP50                                 |                                                       |         |                      | 5.0000 (17) |
| Infiltration rate                                    |                                                       |         |                      | 0.3712 (18) |
| Number of sides sheltered                            |                                                       |         |                      | 1 (19)      |
| Shelter factor                                       | (20) = 1 - [0.075 x (19)] =                           |         |                      | 0.9250 (20) |
| Infiltration rate adjusted to include shelter factor | (21) = (18) x (20) =                                  |         |                      | 0.3434 (21) |

|                                                                                                         |        |        |        |        |        |        |        |        |        |        |        |        |       |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|
| Wind speed                                                                                              | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |       |
| Wind factor                                                                                             | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 | (22)  |
| Adj infilt rate                                                                                         | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 | (22a) |
|                                                                                                         | 0.4378 | 0.4292 | 0.4206 | 0.3777 | 0.3691 | 0.3262 | 0.3262 | 0.3176 | 0.3434 | 0.3691 | 0.3863 | 0.4035 | (22b) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.0000 | (23b) |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =            |        |        |        |        |        |        |        |        |        |        |        | 0.0000 | (23c) |
| Effective ac                                                                                            | 0.5958 | 0.5921 | 0.5885 | 0.5713 | 0.5681 | 0.5532 | 0.5532 | 0.5504 | 0.5590 | 0.5681 | 0.5746 | 0.5814 | (25)  |

### 3. Heat losses and heat loss parameter

| Element                                        | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K | A x U<br>W/K | K-value<br>kJ/m2K | A x K<br>kJ/K |
|------------------------------------------------|-------------|----------------|---------------|------------------|--------------|-------------------|---------------|
| Main dwelling                                  |             |                |               |                  |              |                   |               |
| TER Opaque door                                |             |                | 2.2300        | 1.0000           | 2.2300       |                   | (26)          |
| TER Opening Type                               |             |                | 15.9800       | 1.1450           | 18.2977      |                   | (27)          |
| GF SPVL 125TS P/A                              |             |                | 47.4100       | 0.1300           | 6.1633       |                   | (28a)         |
| EW Brick AAC011                                | 151.6400    | 18.2100        | 133.4300      | 0.1800           | 24.0174      |                   | (29a)         |
| PR 500mm MW044                                 | 47.4100     |                | 47.4100       | 0.1100           | 5.2151       |                   | (30)          |
| Total net area of external elements Aum(A, m2) |             |                | 246.4600      |                  |              |                   | (31)          |
| Fabric heat loss, W/K = Sum (A x U)            |             |                |               |                  | 55.9235      |                   | (33)          |

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 209.9130 (35)

#### List of Thermal Bridges

|                                                                  | Length  | Psi-value | Total   |
|------------------------------------------------------------------|---------|-----------|---------|
| K1 Element                                                       | 11.9100 | 0.0500    | 0.5955  |
| E2 Other lintels (including other steel lintels)                 | 9.4200  | 0.0500    | 0.4710  |
| E3 Sill                                                          | 22.0500 | 0.0500    | 1.1025  |
| E4 Jamb                                                          | 12.0200 | 0.1600    | 1.9232  |
| E5 Ground floor (normal)                                         | 29.0500 | 0.0000    | 0.0000  |
| E6 Intermediate floor within a dwelling                          | 9.1500  | 0.0600    | 0.5490  |
| E10 Eaves (insulation at ceiling level)                          | 0.0000  | 0.0600    | 0.0000  |
| E18 Party wall between dwellings                                 | 4.2000  | 0.0500    | 0.2100  |
| E4 Jamb                                                          | 1.0600  | 0.0500    | 0.0530  |
| E2 Other lintels (including other steel lintels)                 | 0.0000  | 0.0800    | 0.0000  |
| P1 Party wall - Ground floor                                     | 0.0000  | 0.0000    | 0.0000  |
| P2 Party wall - Intermediate floor within a dwelling             | 0.0000  | 0.1200    | 0.0000  |
| P4 Party wall - Roof (insulation at ceiling level)               | 17.0300 | 0.1600    | 2.7248  |
| E5 Ground floor (normal)                                         | 19.9000 | 0.0600    | 1.1940  |
| E12 Gable (insulation at ceiling level)                          | 26.1000 | 0.0900    | 2.3490  |
| E16 Corner (normal)                                              | 5.2200  | -0.0900   | -0.4698 |
| E17 Corner (inverted - internal area greater than external area) |         |           |         |

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.7022 (36)

#### Point Thermal Bridges

Total fabric heat loss (33) + (36) + (36a) = 66.6257 (37)

|                                                                     |          |          |          |          |          |          |          |          |          |          |          |          |      |
|---------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) |          |          |          |          |          |          |          |          |          |          |          |          |      |
| (38)m                                                               | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |      |
| Heat transfer coeff                                                 | 48.6612  | 48.3573  | 48.0594  | 46.6601  | 46.3983  | 45.1796  | 45.1796  | 44.9539  | 45.6490  | 46.3983  | 46.9279  | 47.4816  | (38) |
| Average = Sum(39)m / 12 =                                           | 115.2869 | 114.9830 | 114.6851 | 113.2858 | 113.0240 | 111.8053 | 111.8053 | 111.5796 | 112.2747 | 113.0240 | 113.5536 | 114.1073 | (39) |

|               |        |        |        |        |        |        |        |        |        |        |        |        |      |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| HLP           | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |      |
| HLP (average) | 1.2159 | 1.2126 | 1.2095 | 1.1947 | 1.1920 | 1.1791 | 1.1791 | 1.1768 | 1.1841 | 1.1920 | 1.1976 | 1.2034 | (40) |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31     |      |

### 4. Water heating energy requirements (kWh/year)

|                                                                 |          |         |          |         |         |         |         |         |         |         |         |          |              |
|-----------------------------------------------------------------|----------|---------|----------|---------|---------|---------|---------|---------|---------|---------|---------|----------|--------------|
| Assumed occupancy                                               |          |         |          |         |         |         |         |         |         |         |         |          | 2.6861 (42)  |
| Hot water usage for mixer showers                               | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000   | (42a)        |
| Hot water usage for baths                                       | 29.9061  | 29.4619 | 28.8365  | 27.6833 | 26.8197 | 25.8622 | 25.3450 | 25.9661 | 26.6424 | 27.6669 | 28.8439 | 29.8050  | (42b)        |
| Hot water usage for other uses                                  | 42.1386  | 40.6063 | 39.0739  | 37.5416 | 36.0093 | 34.4770 | 34.4770 | 36.0093 | 37.5416 | 39.0739 | 40.6063 | 42.1386  | (42c)        |
| Average daily hot water use (litres/day)                        |          |         |          |         |         |         |         |         |         |         |         |          | 66.0354 (43) |
| Daily hot water use                                             | Jan      | Feb     | Mar      | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec      |              |
| Energy conte                                                    | 72.0447  | 70.0682 | 67.9104  | 65.2249 | 62.8291 | 60.3393 | 59.8221 | 61.9754 | 64.1840 | 66.7409 | 69.4502 | 71.9436  | (44)         |
| Energy content (annual)                                         | 114.1011 | 99.7762 | 104.3758 | 89.2896 | 84.5800 | 74.1941 | 72.3496 | 76.7385 | 79.1453 | 90.5667 | 98.9445 | 112.6462 | (45)         |
| Distribution loss (46)m = 0.15 x (45)m                          | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000   | (46)         |
| Water storage loss (or HIU loss):                               |          |         |          |         |         |         |         |         |         |         |         |          |              |
| Total storage loss                                              | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000   | (56)         |
| If cylinder contains dedicated solar storage                    |          |         |          |         |         |         |         |         |         |         |         |          |              |
| Primary loss                                                    | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000   | (57)         |
| Combi loss                                                      | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000   | (59)         |
| Total heat required for water heating calculated for each month |          |         |          |         |         |         |         |         |         |         |         |          | (61)         |



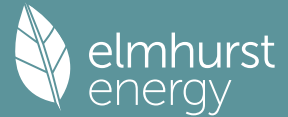
| 8c. Space cooling requirement                       |        |        |        |        |         |           |          |          |         |         |        |              |
|-----------------------------------------------------|--------|--------|--------|--------|---------|-----------|----------|----------|---------|---------|--------|--------------|
| Calculated for June, July and August. See Table 10b |        |        |        |        |         |           |          |          |         |         |        |              |
|                                                     | Jan    | Feb    | Mar    | Apr    | May     | Jun       | Jul      | Aug      | Sep     | Oct     | Nov    | Dec          |
| Ext. temp.                                          | 4.3000 | 4.9000 | 6.5000 | 8.9000 | 11.7000 | 14.6000   | 16.6000  | 16.4000  | 14.1000 | 10.6000 | 7.1000 | 4.2000       |
| Heat loss rate W                                    |        |        |        |        |         |           |          |          |         |         |        |              |
| Utilisation                                         | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 1050.9695 | 827.3590 | 848.0048 | 0.0000  | 0.0000  | 0.0000 | 0.0000 (100) |
|                                                     | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | -0.8271   | -0.8926  | -0.8575  | 0.0000  | 0.0000  | 0.0000 | 0.0000 (101) |

# Full SAP Calculation Printout



|                                  |        |        |        |        |        |           |           |          |                          |        |        |                |
|----------------------------------|--------|--------|--------|--------|--------|-----------|-----------|----------|--------------------------|--------|--------|----------------|
| Useful loss                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 869.2787  | 738.5342  | 727.2038 | 0.0000                   | 0.0000 | 0.0000 | 0.0000 (102)   |
| Total gains                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1094.0240 | 1045.8171 | 958.4812 | 0.0000                   | 0.0000 | 0.0000 | 0.0000 (103)   |
| Space cooling kWh                |        |        |        |        |        |           |           |          |                          |        |        |                |
|                                  | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 161.8166  | 228.6184  | 172.0704 | 0.0000                   | 0.0000 | 0.0000 | 0.0000 (104)   |
| Cooled fraction                  |        |        |        |        |        |           |           |          | fC = cooled area / (4) = |        |        | 1.0000 (105)   |
| Intermittency factor (Table 10b) |        |        |        |        |        |           |           |          |                          |        |        |                |
|                                  | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500    | 0.2500    | 0.2500   | 0.2500                   | 0.2500 | 0.2500 | 0.2500 (106)   |
| Space cooling kWh                |        |        |        |        |        |           |           |          |                          |        |        |                |
|                                  | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 40.4542   | 57.1546   | 43.0176  | 0.0000                   | 0.0000 | 0.0000 | 0.0000 (107)   |
| Space cooling requirement        |        |        |        |        |        |           |           |          |                          |        |        | 140.6264 (107) |
| Energy for space heating         |        |        |        |        |        |           |           |          |                          |        |        | 41.9107 (99)   |
| Energy for space cooling         |        |        |        |        |        |           |           |          |                          |        |        | 1.4831 (108)   |
| Total                            |        |        |        |        |        |           |           |          |                          |        |        | 43.3937 (109)  |
| Fabric Energy Efficiency (TFEE)  |        |        |        |        |        |           |           |          |                          |        |        | 43.4 (109)     |

# Full SAP Calculation Printout



|                                    |                                                          |               |        |      |                |            |
|------------------------------------|----------------------------------------------------------|---------------|--------|------|----------------|------------|
| Plot Reference                     | 4907-R823-9471-004                                       |               |        |      | Issued on Date | 21/07/2026 |
| Assessment Reference               | Plot 4                                                   | Plot Type Ref | Plot 4 |      |                |            |
| Plot Address                       | Plot 4, Bosworth Det, K, WC, B, ES, 1012                 |               |        |      | SAP Version    | 10.2       |
|                                    |                                                          |               |        |      |                |            |
| SAP Rating                         | 90 B                                                     | DER           | 11.94  | TER  | 12.37          |            |
| Environmental                      | 90 B                                                     | % DER < TER   |        |      |                | 3.48       |
| CO <sub>2</sub> Emissions (t/year) | 0.99                                                     | DFEE          | 40.71  | TFEE | 43.39          |            |
| Compliance Check                   | See BREL                                                 | % DFEE < TFEE |        |      |                | 6.20       |
| % DPER < TPER                      | 1.19                                                     | DPER          | 63.99  | TPER | 64.76          |            |
|                                    |                                                          |               |        |      |                |            |
| Assessor Details                   | Mr. Daniel Harris                                        |               |        |      | Assessor ID    | R823-0001  |
| Client                             | Crest Nicholson Head Office, Crest Nicholson Head Office |               |        |      |                |            |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)            | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Main dwelling                                          |                           |                                 |                             |
| Ground floor                                           | 47.4100 (1b)              | x 2.4600 (2b)                   | = 116.6286 (1b) - (3b)      |
| First floor                                            | 47.4100 (1c)              | x 2.7600 (2c)                   | = 130.8516 (1c) - (3c)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 94.8200                   |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 247.4802 (5)              |

## 2. Ventilation rate

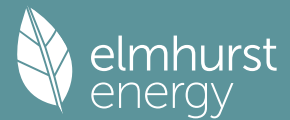
|                                                                                                    | m <sup>3</sup> per hour                 |
|----------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                    |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                    |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                    |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                    |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                    |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                    |
| Number of intermittent extract fans                                                                | 0 * 10 = 0.0000 (7a)                    |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)                    |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 0.0000 / (5) = 0.0000 (8)               |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 4.5000 (17)                             |
| Infiltration rate                                                                                  | 0.2250 (18)                             |
| Number of sides sheltered                                                                          | 1 (19)                                  |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 0.9250 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.2081 (21)        |

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor                                                                                             | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate                                                                                         | 0.2654 | 0.2602 | 0.2550 | 0.2289 | 0.2237 | 0.1977 | 0.1977 | 0.1925 | 0.2081 | 0.2237 | 0.2341 | 0.2445 (22b) |
| Mechanical extract ventilation - decentralised                                                          |        |        |        |        |        |        |        |        |        |        |        |              |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| Effective ac                                                                                            | 0.5154 | 0.5102 | 0.5050 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 (25)  |

## 3. Heat losses and heat loss parameter

| Element                                                      | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K   |
|--------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|-----------------|
| Main dwelling                                                |                         |                            |                           |                               |              |                                |                 |
| Front Door                                                   |                         |                            | 2.2300                    | 1.2000                        | 2.6760       |                                | (26)            |
| Windows                                                      |                         |                            | 10.7600                   | 1.2357                        | 13.2966      |                                | (27)            |
| French Doors                                                 |                         |                            | 5.2200                    | 1.2357                        | 6.4506       |                                | (27)            |
| GF SPVL 125TS P/A                                            |                         |                            | 47.4100                   | 0.1300                        | 6.1633       | 75.0000                        | 3555.7500 (28a) |
| EW Brick AAC011                                              | 151.6400                | 18.2100                    | 133.4300                  | 0.1800                        | 24.0174      | 60.0000                        | 8005.8000 (29a) |
| PR 500mm MW044                                               | 47.4100                 |                            | 47.4100                   | 0.0900                        | 4.2669       | 9.0000                         | 426.6900 (30)   |
| Total net area of external elements Aum (A, m <sup>2</sup> ) |                         |                            | 246.4600                  |                               |              |                                | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                          |                         |                            |                           | (26)...(30) + (32) =          | 56.8707      |                                | (33)            |
| Main dwelling                                                |                         |                            |                           |                               |              |                                |                 |
| Timber - GF                                                  |                         |                            | 24.2600                   |                               |              | 9.0000                         | 218.3400 (32c)  |
| Timber - FF                                                  |                         |                            | 140.7000                  |                               |              | 9.0000                         | 1266.3000 (32c) |
| Masonry GF                                                   |                         |                            | 51.5100                   |                               |              | 100.0000                       | 5151.0000 (32c) |
| Internal Floor FF                                            |                         |                            | 47.4100                   |                               |              | 18.0000                        | 853.3800 (32d)  |
| Internal Ceiling GF                                          |                         |                            | 47.4100                   |                               |              | 9.0000                         | 426.6900 (32e)  |

# Full SAP Calculation Printout



Heat capacity Cm = Sum(A x k)  
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K  
List of Thermal Bridges

(28)...(30) + (32) + (32a)...(32e) = 19903.9500 (34)  
209.9130 (35)

|                                                                  |         |           |         |
|------------------------------------------------------------------|---------|-----------|---------|
| K1 Element                                                       | Length  | Psi-value | Total   |
| E2 Other lintels (including other steel lintels)                 | 11.9100 | 0.0410    | 0.4883  |
| E3 Sill                                                          | 9.4200  | 0.0220    | 0.2072  |
| E4 Jamb                                                          | 22.0500 | 0.0190    | 0.4189  |
| E5 Ground floor (normal)                                         | 12.0200 | 0.0928    | 1.1155  |
| E6 Intermediate floor within a dwelling                          | 29.0500 | 0.0020    | 0.0581  |
| E10 Eaves (insulation at ceiling level)                          | 9.1500  | 0.0390    | 0.3569  |
| E18 Party wall between dwellings                                 | 0.0000  | 0.0300    | 0.0000  |
| E4 Jamb                                                          | 4.2000  | 0.1000    | 0.4200  |
| E2 Other lintels (including other steel lintels)                 | 1.0600  | 0.0410    | 0.0435  |
| P1 Party wall - Ground floor                                     | 0.0000  | 0.1000    | 0.0000  |
| P2 Party wall - Intermediate floor within a dwelling             | 0.0000  | 0.0000    | 0.0000  |
| P4 Party wall - Roof (insulation at ceiling level)               | 0.0000  | 0.0350    | 0.0000  |
| E5 Ground floor (normal)                                         | 17.0300 | 0.0980    | 1.6689  |
| E12 Gable (insulation at ceiling level)                          | 19.9000 | 0.0870    | 1.7313  |
| E16 Corner (normal)                                              | 26.1000 | 0.0420    | 1.0962  |
| E17 Corner (inverted - internal area greater than external area) | 5.2200  | -0.0820   | -0.4280 |

Thermal bridges (Sum(L x Psi) calculated using Appendix K)  
Point Thermal bridges  
Total fabric heat loss

(33) + (36) + (36a) = 64.0475 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

|                           |          |          |          |          |          |          |          |          |          |          |          |          |
|---------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| (38)m                     | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |
| Heat transfer coeff       | 42.0886  | 41.6637  | 41.2387  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  |
| Average = Sum(39)m / 12 = | 106.1361 | 105.7112 | 105.2863 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 |

|               |        |        |        |        |        |        |        |        |        |        |        |        |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| HLP           | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |
| HLP (average) | 1.1193 | 1.1149 | 1.1104 | 1.1061 | 1.1061 | 1.1061 | 1.1061 | 1.1061 | 1.1061 | 1.1061 | 1.1061 | 1.1061 |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31     |

## 4. Water heating energy requirements (kWh/year)

|                                                                 |                |          |          |          |          |          |          |          |          |          |          |          |
|-----------------------------------------------------------------|----------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| Assumed occupancy                                               | 2.6861 (42)    |          |          |          |          |          |          |          |          |          |          |          |
| Hot water usage for mixer showers                               | 69.2572        | 68.2164  | 66.6997  | 63.7979  | 61.6564  | 59.2683  | 57.9108  | 59.4160  | 61.0660  | 63.6301  | 66.5943  | 68.9918  |
| Hot water usage for baths                                       | 29.9061        | 29.4619  | 28.8365  | 27.6833  | 26.8197  | 25.8622  | 25.3450  | 25.9661  | 26.6424  | 27.6669  | 28.8439  | 29.8050  |
| Hot water usage for other uses                                  | 42.1386        | 40.6063  | 39.0739  | 37.5416  | 36.0093  | 34.4770  | 34.4770  | 36.0093  | 37.5416  | 39.0739  | 40.6063  | 42.1386  |
| Average daily hot water use (litres/day)                        | 129.8883 (43)  |          |          |          |          |          |          |          |          |          |          |          |
| Daily hot water use                                             | Jan            | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |
| Energy conte                                                    | 141.3019       | 138.2846 | 134.6102 | 129.0228 | 124.4855 | 119.6075 | 117.7329 | 121.3914 | 125.2500 | 130.3710 | 136.0444 | 140.9354 |
| Energy content (annual)                                         | 223.7876       | 196.9154 | 206.8908 | 176.6258 | 167.5814 | 147.0714 | 142.3877 | 150.3080 | 154.4457 | 176.9122 | 193.8202 | 220.6708 |
| Distribution loss (46)m = 0.15 x (45)m                          | 33.5681        | 29.5373  | 31.0336  | 26.4939  | 25.1372  | 22.0607  | 21.3582  | 22.5462  | 23.1669  | 26.5368  | 29.0730  | 33.1006  |
| Water storage loss (or HIU loss):                               | 0.0000         |          |          |          |          |          |          |          |          |          |          |          |
| Total storage loss                                              | 0.0000         |          |          |          |          |          |          |          |          |          |          |          |
| If cylinder contains dedicated solar storage                    | 0.0000         |          |          |          |          |          |          |          |          |          |          |          |
| Primary loss                                                    | 0.0000         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   |
| Combi loss                                                      | 12.0010        | 10.8287  | 11.9655  | 11.5300  | 11.8830  | 11.4679  | 11.8301  | 11.8467  | 11.4834  | 11.9026  | 11.5661  | 11.9945  |
| Total heat required for water heating calculated for each month | 235.7886       | 207.7441 | 218.8564 | 188.1558 | 179.4644 | 158.5393 | 154.2178 | 162.1547 | 165.9291 | 188.8148 | 205.3864 | 232.6653 |
| WWHRS                                                           | -30.8360       | -27.2716 | -28.5573 | -23.6466 | -22.0378 | -18.8579 | -17.6762 | -18.7969 | -19.5111 | -23.0014 | -26.0578 | -30.2650 |
| PV diverter                                                     | -0.0000        | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  |
| Solar input                                                     | 0.0000         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   |
| FGHRS                                                           | 0.0000         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   |
| Output from w/h                                                 | 204.9526       | 180.4725 | 190.2991 | 164.5092 | 157.4266 | 139.6815 | 136.5416 | 143.3578 | 146.4181 | 165.8134 | 179.3286 | 202.4003 |
| 12Total per year (kWh/year)                                     | 2011.2011 (64) |          |          |          |          |          |          |          |          |          |          |          |
| Electric shower(s)                                              | 0.0000         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   |
| Heat gains from water heating, kWh/month                        | 77.4096        | 68.1815  | 71.7826  | 61.6106  | 58.6916  | 51.7682  | 50.3014  | 52.9391  | 54.2241  | 61.7990  | 67.3368  | 76.3717  |

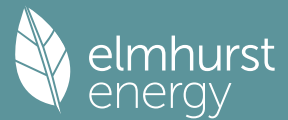
## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |           |           |           |           |           |           |           |           |           |           |           |           |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| Metabolic gains (Table 5), Watts                                                    | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec       |
| (66)m                                                                               | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 129.0440  | 142.8702  | 129.0440  | 133.3455  | 129.0440  | 133.3455  | 129.0440  | 129.0440  | 133.3455  | 129.0440  | 133.3455  | 129.0440  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 247.6715  | 250.2415  | 243.7651  | 229.9774  | 212.5731  | 196.2154  | 185.2875  | 182.7174  | 189.1939  | 202.9815  | 220.3859  | 236.7435  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 3.0000    | 3.0000    | 3.0000    |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 |
| Water heating gains (Table 5)                                                       | 104.0452  | 101.4606  | 96.4820   | 85.5702   | 78.8865   | 71.9003   | 67.6095   | 71.1547   | 75.3112   | 83.0631   | 93.5233   | 102.6501  |
| Total internal gains                                                                | 547.0525  | 560.8642  | 535.5829  | 515.1850  | 486.7955  | 464.7531  | 445.2328  | 446.2080  | 461.1424  | 481.3805  | 513.5465  | 534.7295  |

## 6. Solar gains

|       |      |            |               |               |          |       |
|-------|------|------------|---------------|---------------|----------|-------|
| [Jan] | Area | Solar flux | g             | FF            | Access   | Gains |
|       | m2   | Table 6a   | Specific data | Specific data | factor   | W     |
|       |      | W/m2       | or Table 6b   | or Table 6c   | Table 6d |       |

# Full SAP Calculation Printout



|       |        |         |        |        |        |              |
|-------|--------|---------|--------|--------|--------|--------------|
| North | 1.3900 | 10.6334 | 0.4500 | 0.0000 | 0.7700 | 5.1214 (74)  |
| East  | 4.1200 | 19.6403 | 0.4500 | 0.0000 | 0.7700 | 28.0380 (76) |
| West  | 5.2500 | 19.6403 | 0.4500 | 0.0000 | 0.7700 | 35.7281 (80) |
| East  | 5.2200 | 19.6403 | 0.4500 | 0.0000 | 0.7700 | 35.5239 (76) |

|             |          |          |          |           |           |           |           |          |          |          |          |               |
|-------------|----------|----------|----------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|---------------|
| Solar gains | 104.4115 | 204.0197 | 336.5042 | 493.2296  | 607.7185  | 623.7941  | 593.1680  | 507.1627 | 392.0216 | 242.1237 | 130.1210 | 85.9208 (83)  |
| Total gains | 651.4640 | 764.8839 | 872.0871 | 1008.4146 | 1094.5140 | 1088.5471 | 1038.4009 | 953.3707 | 853.1640 | 723.5041 | 643.6675 | 620.6503 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |         |         |         |              |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| tau                                                                         | 52.0923 | 52.3017 | 52.5128 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153      |
| alpha                                                                       | 4.4728  | 4.4868  | 4.5009  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144       |
| util living area                                                            | 0.9928  | 0.9846  | 0.9638  | 0.8988  | 0.7686  | 0.5880  | 0.4380  | 0.4942  | 0.7456  | 0.9411  | 0.9859  | 0.9942 (86)  |
| MIT                                                                         | 19.3468 | 19.6052 | 19.9905 | 20.4658 | 20.8024 | 20.9541 | 20.9902 | 20.9834 | 20.8710 | 20.3964 | 19.7876 | 19.3138 (87) |
| Th 2                                                                        | 19.9851 | 19.9887 | 19.9924 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 (88) |
| util rest of house                                                          | 0.9908  | 0.9804  | 0.9539  | 0.8720  | 0.7144  | 0.5065  | 0.3412  | 0.3919  | 0.6686  | 0.9195  | 0.9813  | 0.9925 (89)  |
| MIT 2                                                                       | 18.2809 | 18.5743 | 19.0063 | 19.5190 | 19.8480 | 19.9714 | 19.9927 | 19.9900 | 19.9155 | 19.4590 | 18.7872 | 18.2510 (90) |
| Living area fraction                                                        | 18.4812 | 18.7681 | 19.1912 | 19.6969 | 20.0273 | 20.1561 | 20.1802 | 20.1767 | 20.0951 | 19.6351 | 18.9752 | 18.4508 (92) |
| MIT                                                                         | 18.4812 | 18.7681 | 19.1912 | 19.6969 | 20.0273 | 20.1561 | 20.1802 | 20.1767 | 20.0951 | 19.6351 | 18.9752 | 18.4508 (93) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT                                                                | 18.4812 | 18.7681 | 19.1912 | 19.6969 | 20.0273 | 20.1561 | 20.1802 | 20.1767 | 20.0951 | 19.6351 | 18.9752 | 18.4508 (93) |

## 8. Space heating requirement

|                                                                                |           |           |           |           |          |          |          |          |          |               |           |                |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|---------------|-----------|----------------|
|                                                                                | Jan       | Feb       | Mar       | Apr       | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov       | Dec            |
| Utilisation                                                                    | 0.9865    | 0.9734    | 0.9437    | 0.8627    | 0.7162   | 0.5200   | 0.3593   | 0.4108   | 0.6770   | 0.9096        | 0.9748    | 0.9888 (94)    |
| Useful gains                                                                   | 642.6460  | 744.5621  | 823.0082  | 869.9498  | 783.9067 | 566.0755 | 373.0560 | 391.6799 | 577.5549 | 658.1335      | 627.4430  | 613.7295 (95)  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000    | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000    | 4.2000 (96)    |
| Heat loss rate W                                                               | 1505.1360 | 1466.0106 | 1336.2137 | 1132.4011 | 873.3856 | 582.7321 | 375.4939 | 396.1063 | 628.7741 | 947.6209      | 1245.4934 | 1494.6444 (97) |
| Space heating kWh                                                              | 641.6925  | 484.8134  | 381.8250  | 188.9650  | 66.5723  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 215.3786      | 444.9962  | 655.4007 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |          |          |          |          |          |               |           | 3079.6436      |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |           |          |          |          |          |          |               |           | 0.0000         |
| Space heating kWh                                                              | 641.6925  | 484.8134  | 381.8250  | 188.9650  | 66.5723  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 215.3786      | 444.9962  | 655.4007 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |          |          |          |          |          |               |           | 3079.6436      |
| Space heating per m2                                                           |           |           |           |           |          |          |          |          |          | (98c) / (4) = |           | 32.4788 (99)   |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                                                      |          |          |          |          |          |          |          |          |          |          |          |                 |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (201)    |
| Fraction of space heat from main system(s)                                                           |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (202)    |
| Efficiency of main space heating system 1 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 91.7000 (206)   |
| Efficiency of main space heating system 2 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)    |
| Efficiency of secondary/supplementary heating system, %                                              |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)    |
|                                                                                                      | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec             |
| Space heating requirement                                                                            | 641.6925 | 484.8134 | 381.8250 | 188.9650 | 66.5723  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 215.3786 | 444.9962 | 655.4007 (98)   |
| Space heating efficiency (main heating system 1)                                                     | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 91.7000  | 91.7000  | 91.7000 (210)   |
| Space heating fuel (main heating system)                                                             | 699.7738 | 528.6951 | 416.3849 | 206.0686 | 72.5979  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 234.8730 | 485.2740 | 714.7227 (211)  |
| Space heating efficiency (main heating system 2)                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)    |
| Space heating fuel (main heating system 2)                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)    |
| Space heating fuel (secondary)                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)    |
| Water heating                                                                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| Water heating requirement                                                                            | 204.9526 | 180.4725 | 190.2991 | 164.5092 | 157.4266 | 139.6815 | 136.5416 | 143.3578 | 146.4181 | 165.8134 | 179.3286 | 202.4003 (64)   |
| Efficiency of water heater (217)m                                                                    | 88.2824  | 88.2203  | 88.0903  | 87.8101  | 87.3137  | 86.7000  | 86.7000  | 86.7000  | 86.7000  | 87.8742  | 88.1865  | 86.7000 (216)   |
| Fuel for water heating, kWh/month                                                                    | 232.1558 | 204.5701 | 216.0273 | 187.3465 | 180.3001 | 161.1090 | 157.4874 | 165.3492 | 168.8790 | 188.6941 | 203.3516 | 229.2309 (219)  |
| Space cooling fuel requirement                                                                       |          |          |          |          |          |          |          |          |          |          |          |                 |
| (221)m                                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)    |
| Pumps and Fa                                                                                         | 11.2600  | 10.1703  | 11.2600  | 10.8967  | 11.2600  | 10.8967  | 11.2600  | 11.2600  | 10.8967  | 11.2600  | 10.8967  | 11.2600 (231)   |
| Lighting                                                                                             | 24.7371  | 19.8450  | 17.8683  | 13.0911  | 10.1119  | 8.2615   | 9.2244   | 11.9903  | 15.5742  | 20.4341  | 23.0803  | 25.4247 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | -13.8577 | -22.9196 | -39.1412 | -51.1890 | -60.7330 | -58.6935 | -57.5786 | -51.1723 | -40.7967 | -28.6393 | -16.1851 | -11.5083 (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | -3.5626  | -8.8909  | -21.7125 | -39.0614 | -57.5840 | -60.2478 | -58.6981 | -46.0086 | -29.1122 | -13.8994 | -5.0330  | -2.6869 (233b)  |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234b)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235d)   |
| Annual totals kWh/year                                                                               |          |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating fuel - main system 1                                                                   |          |          |          |          |          |          |          |          |          |          |          | 3358.3900 (211) |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)    |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)    |

# Full SAP Calculation Printout



|                                                                                         |           |        |
|-----------------------------------------------------------------------------------------|-----------|--------|
| Efficiency of water heater                                                              | 86.7000   |        |
| Water heating fuel used                                                                 | 2294.5009 | (219)  |
| Space cooling fuel                                                                      | 0.0000    | (221)  |
| Electricity for pumps and fans:                                                         |           |        |
| (MEVDecentralised, Database: total watage = 6.9420, total flow = 45.0000, SFP = 0.1543) |           |        |
| mechanical ventilation fans (SFP = 0.1543)                                              | 46.5771   | (230a) |
| central heating pump                                                                    | 41.0000   | (230c) |
| main heating flue fan                                                                   | 45.0000   | (230e) |
| Total electricity for the above, kWh/year                                               | 132.5771  | (231)  |
| Electricity for lighting (calculated in Appendix L)                                     | 199.6429  | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                           |           |        |
| PV generation                                                                           | -798.9117 | (233)  |
| Wind generation                                                                         | 0.0000    | (234)  |
| Hydro-electric generation (Appendix N)                                                  | 0.0000    | (235a) |
| Electricity generated - Micro CHP (Appendix N)                                          | 0.0000    | (235)  |
| Appendix Q - special features                                                           |           |        |
| Energy saved or generated                                                               | -0.0000   | (236)  |
| Energy used                                                                             | 0.0000    | (237)  |
| Total delivered energy for all uses                                                     | 5186.1992 | (238)  |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                                 | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|-------------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1                   | 3358.3900          | 0.2100                        | 705.2619 (261)           |
| Total CO2 associated with community systems     |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                      | 2294.5009          | 0.2100                        | 481.8452 (264)           |
| Space and water heating                         |                    |                               | 1187.1071 (265)          |
| Pumps, fans and electric keep-hot               | 132.5771           | 0.1387                        | 18.3901 (267)            |
| Energy for lighting                             | 199.6429           | 0.1443                        | 28.8146 (268)            |
| Energy saving/generation technologies           |                    |                               |                          |
| PV Unit electricity used in dwelling            | -452.4142          | 0.1318                        | -59.6090                 |
| PV Unit electricity exported                    | -346.4975          | 0.1217                        | -42.1576                 |
| Total                                           |                    |                               | -101.7666 (269)          |
| Total CO2, kg/year                              |                    |                               | 1132.5452 (272)          |
| EPC Dwelling Carbon Dioxide Emission Rate (DER) |                    |                               | 11.9400 (273)            |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1               | 3358.3900          | 1.1300                              | 3794.9807 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 2294.5009          | 1.1300                              | 2592.7861 (278)            |
| Space and water heating                     |                    |                                     | 6387.7668 (279)            |
| Pumps, fans and electric keep-hot           | 132.5771           | 1.5128                              | 200.5626 (281)             |
| Energy for lighting                         | 199.6429           | 1.5338                              | 306.2189 (282)             |
| Energy saving/generation technologies       |                    |                                     |                            |
| PV Unit electricity used in dwelling        | -452.4142          | 1.4868                              | -672.6467                  |
| PV Unit electricity exported                | -346.4975          | 0.4464                              | -154.6730                  |
| Total                                       |                    |                                     | -827.3197 (283)            |
| Total Primary energy kWh/year               |                    |                                     | 6067.2286 (286)            |
| Dwelling Primary energy Rate (DPER)         |                    |                                     | 63.9900 (287)              |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF TARGET EMISSIONS

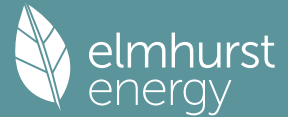
## 1. Overall dwelling characteristics

|                                                        | Area<br>(m2) | Storey height<br>(m)            | Volume<br>(m3)         |
|--------------------------------------------------------|--------------|---------------------------------|------------------------|
| Main dwelling                                          |              |                                 |                        |
| Ground floor                                           | 47.4100 (1b) | x 2.4600 (2b)                   | = 116.6286 (1b) - (3b) |
| First floor                                            | 47.4100 (1c) | x 2.7600 (2c)                   | = 130.8516 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 94.8200      |                                 | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 247.4802 (5)         |

## 2. Ventilation rate

|                                                                                                    | m3 per hour                |
|----------------------------------------------------------------------------------------------------|----------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)       |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)       |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)       |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)       |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)       |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)       |
| Number of intermittent extract fans                                                                | 3 * 10 = 30.0000 (7a)      |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)       |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)       |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 30.0000 / (5) = 0.1212 (8) |
| Pressure test                                                                                      | Yes                        |
| Pressure Test Method                                                                               | Blower Door                |
| Measured/design AP50                                                                               | 5.0000 (17)                |
| Infiltration rate                                                                                  | 0.3712 (18)                |

# Full SAP Calculation Printout



Number of sides sheltered

1 (19)

Shelter factor

$$(20) = 1 - [0.075 \times (19)] = 0.9250 \quad (20)$$

Infiltration rate adjusted to include shelter factor

$$(21) = (18) \times (20) = 0.3434 \quad (21)$$

|                 | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |       |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|
| Wind speed      | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 | (22)  |
| Wind factor     | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 | (22a) |
| Adj infilt rate | 0.4378 | 0.4292 | 0.4206 | 0.3777 | 0.3691 | 0.3262 | 0.3262 | 0.3176 | 0.3434 | 0.3691 | 0.3863 | 0.4035 | (22b) |
| Effective ac    | 0.5958 | 0.5921 | 0.5885 | 0.5713 | 0.5681 | 0.5532 | 0.5532 | 0.5504 | 0.5590 | 0.5681 | 0.5746 | 0.5814 | (25)  |

### 3. Heat losses and heat loss parameter

| Element                                        | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K | A x U<br>W/K         | K-value<br>kJ/m2K | A x K<br>kJ/K |       |
|------------------------------------------------|-------------|----------------|---------------|------------------|----------------------|-------------------|---------------|-------|
| Main dwelling                                  |             |                |               |                  |                      |                   |               |       |
| TER Opaque door                                |             |                | 2.2300        | 1.0000           | 2.2300               |                   |               | (26)  |
| TER Opening Type                               |             |                | 15.9800       | 1.1450           | 18.2977              |                   |               | (27)  |
| GF SPVL 125TS P/A                              |             |                | 47.4100       | 0.1300           | 6.1633               |                   |               | (28a) |
| EW Brick AAC011                                | 151.6400    | 18.2100        | 133.4300      | 0.1800           | 24.0174              |                   |               | (29a) |
| PR 500mm MW044                                 | 47.4100     |                | 47.4100       | 0.1100           | 5.2151               |                   |               | (30)  |
| Total net area of external elements Aum(A, m2) |             |                | 246.4600      |                  |                      |                   |               | (31)  |
| Fabric heat loss, W/K = Sum (A x U)            |             |                |               |                  | (26)...(30) + (32) = | 55.9235           |               | (33)  |

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

209.9130 (35)

List of Thermal Bridges

| K1 Element                                                       | Length  | Psi-value | Total   |  |
|------------------------------------------------------------------|---------|-----------|---------|--|
| E2 Other lintels (including other steel lintels)                 | 11.9100 | 0.0500    | 0.5955  |  |
| E3 Sill                                                          | 9.4200  | 0.0500    | 0.4710  |  |
| E4 Jamb                                                          | 22.0500 | 0.0500    | 1.1025  |  |
| E5 Ground floor (normal)                                         | 12.0200 | 0.1600    | 1.9232  |  |
| E6 Intermediate floor within a dwelling                          | 29.0500 | 0.0000    | 0.0000  |  |
| E10 Eaves (insulation at ceiling level)                          | 9.1500  | 0.0600    | 0.5490  |  |
| E18 Party wall between dwellings                                 | 0.0000  | 0.0600    | 0.0000  |  |
| E4 Jamb                                                          | 4.2000  | 0.0500    | 0.2100  |  |
| E2 Other lintels (including other steel lintels)                 | 1.0600  | 0.0500    | 0.0530  |  |
| P1 Party wall - Ground floor                                     | 0.0000  | 0.0800    | 0.0000  |  |
| P2 Party wall - Intermediate floor within a dwelling             | 0.0000  | 0.0000    | 0.0000  |  |
| P4 Party wall - Roof (insulation at ceiling level)               | 0.0000  | 0.1200    | 0.0000  |  |
| E5 Ground floor (normal)                                         | 17.0300 | 0.1600    | 2.7248  |  |
| E12 Gable (insulation at ceiling level)                          | 19.9000 | 0.0600    | 1.1940  |  |
| E16 Corner (normal)                                              | 26.1000 | 0.0900    | 2.3490  |  |
| E17 Corner (inverted - internal area greater than external area) | 5.2200  | -0.0900   | -0.4698 |  |

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

10.7022 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

$$(33) + (36) + (36a) = 66.6257 \quad (37)$$

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

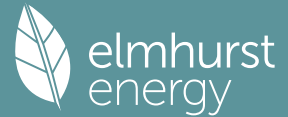
|                           | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |      |
|---------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| (38)m                     | 48.6612  | 48.3573  | 48.0594  | 46.6601  | 46.3983  | 45.1796  | 45.1796  | 44.9539  | 45.6490  | 46.3983  | 46.9279  | 47.4816  | (38) |
| Heat transfer coeff       | 115.2869 | 114.9830 | 114.6851 | 113.2858 | 113.0240 | 111.8053 | 111.8053 | 111.5796 | 112.2747 | 113.0240 | 113.5536 | 114.1073 | (39) |
| Average = Sum(39)m / 12 = |          |          |          |          |          |          |          |          |          |          |          | 113.2846 |      |

|               | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |      |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| HLP           | 1.2159 | 1.2126 | 1.2095 | 1.1947 | 1.1920 | 1.1791 | 1.1791 | 1.1768 | 1.1841 | 1.1920 | 1.1976 | 1.2034 | (40) |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 1.1947 |      |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31     |      |

### 4. Water heating energy requirements (kWh/year)

|                                                                                |          |          |          |          |          |          |          |          |          |                    |           |           |             |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------------------|-----------|-----------|-------------|
| Assumed occupancy                                                              |          |          |          |          |          |          |          |          |          |                    |           |           | 2.6861 (42) |
| Hot water usage for mixer showers                                              |          |          |          |          |          |          |          |          |          |                    |           |           |             |
| 69.2572                                                                        | 68.2164  | 66.6997  | 63.7979  | 61.6564  | 59.2683  | 57.9108  | 59.4160  | 61.0660  | 63.6301  | 66.5943            | 68.9918   | 68.9918   | (42a)       |
| Hot water usage for baths                                                      |          |          |          |          |          |          |          |          |          |                    |           |           |             |
| 29.9061                                                                        | 29.4619  | 28.8365  | 27.6833  | 26.8197  | 25.8622  | 25.3450  | 25.9661  | 26.6424  | 27.6669  | 28.8439            | 29.8050   | 29.8050   | (42b)       |
| Hot water usage for other uses                                                 |          |          |          |          |          |          |          |          |          |                    |           |           |             |
| 42.1386                                                                        | 40.6063  | 39.0739  | 37.5416  | 36.0093  | 34.4770  | 34.4770  | 36.0093  | 37.5416  | 39.0739  | 40.6063            | 42.1386   | 42.1386   | (42c)       |
| Average daily hot water use (litres/day)                                       |          |          |          |          |          |          |          |          |          |                    |           | 129.8883  | (43)        |
| Daily hot water use                                                            |          |          |          |          |          |          |          |          |          |                    |           |           |             |
| 141.3019                                                                       | 138.2846 | 134.6102 | 129.0228 | 124.4855 | 119.6075 | 117.7329 | 121.3914 | 125.2500 | 130.3710 | 136.0444           | 140.9354  | 140.9354  | (44)        |
| Energy conte                                                                   | 223.7876 | 196.9154 | 206.8908 | 176.6258 | 167.5814 | 147.0714 | 142.3877 | 150.3080 | 154.4457 | 176.9122           | 193.8202  | 220.6708  | (45)        |
| Energy content (annual)                                                        |          |          |          |          |          |          |          |          |          | Total = Sum(45)m = | 2157.4171 |           |             |
| Distribution loss (46)m = 0.15 x (45)m                                         |          |          |          |          |          |          |          |          |          |                    |           |           |             |
| 33.5681                                                                        | 29.5373  | 31.0336  | 26.4939  | 25.1372  | 22.0607  | 21.3582  | 22.5462  | 23.1669  | 26.5368  | 29.0730            | 33.1006   | 33.1006   | (46)        |
| Water storage loss (or HIU loss):                                              |          |          |          |          |          |          |          |          |          |                    |           |           |             |
| Total storage loss                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000    | 0.0000    | (56)        |
| If cylinder contains dedicated solar storage                                   |          |          |          |          |          |          |          |          |          |                    |           |           |             |
| 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000    | 0.0000    | (57)        |
| Primary loss                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000    | 0.0000    | (59)        |
| Combi loss                                                                     | 50.9589  | 46.0274  | 50.9589  | 49.3151  | 50.9589  | 49.3151  | 50.9589  | 50.9589  | 49.3151  | 50.9589            | 49.3151   | 50.9589   | (61)        |
| Total heat required for water heating calculated for each month                |          |          |          |          |          |          |          |          |          |                    |           |           |             |
| 274.7465                                                                       | 242.9428 | 257.8497 | 225.9408 | 218.5403 | 196.3865 | 193.3466 | 201.2669 | 203.7608 | 227.8711 | 243.1353           | 271.6297  | 271.6297  | (62)        |
| WWHRS                                                                          | -31.6615 | -28.0017 | -29.3218 | -24.2796 | -22.6277 | -19.3627 | -18.1494 | -19.3001 | -20.0334 | -23.6171           | -26.7553  | -31.0752  | (63a)       |
| PV diverter                                                                    | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000            | -0.0000   | -0.0000   | (63b)       |
| Solar input                                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000    | 0.0000    | (63c)       |
| FGHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000    | 0.0000    | (63d)       |
| Output from w/h                                                                | 243.0850 | 214.9411 | 228.5280 | 201.6613 | 195.9126 | 177.0238 | 175.1972 | 181.9668 | 183.7274 | 204.2540           | 216.3800  | 240.5545  | (64)        |
| 12Total per year (kWh/year)                                                    |          |          |          |          |          |          |          |          |          |                    |           | 2463.2317 | (64)        |
| Electric shower(s)                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000    | 0.0000    | (64a)       |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |          |          |          |          |          |          |                    |           | 0.0000    | (64a)       |
| Heat gains from water heating, kWh/month                                       | 87.1491  | 76.9812  | 81.5309  | 71.0568  | 68.4605  | 61.2300  | 60.0836  | 62.7171  | 63.6820  | 71.5630            | 76.7740   | 86.1128   | (65)        |

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## 5. Internal gains (see Table 5 and 5a)

| Metabolic gains (Table 5), Watts                                                    | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec       |      |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------|
| (66)m                                                                               | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | 134.3061  | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 129.0440  | 142.8702  | 129.0440  | 133.3455  | 129.0440  | 133.3455  | 129.0440  | 129.0440  | 133.3455  | 129.0440  | 133.3455  | 129.0440  | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 247.6715  | 250.2415  | 243.7651  | 229.9774  | 212.5731  | 196.2154  | 185.2875  | 182.7174  | 189.1939  | 202.9815  | 220.3859  | 236.7435  | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | 36.4306   | (69) |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 3.0000    | 3.0000    | 3.0000    | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | (71) |
| Water heating gains (Table 5)                                                       | 117.1359  | 114.5554  | 109.5846  | 98.6901   | 92.0169   | 85.0417   | 80.7576   | 84.2972   | 88.4472   | 96.1869   | 106.6306  | 115.7430  | (72) |
| Total internal gains                                                                | 560.1432  | 573.9589  | 548.6855  | 528.3048  | 499.9258  | 477.8944  | 458.3809  | 459.3505  | 474.2784  | 494.5042  | 526.6538  | 547.8224  | (73) |

## 6. Solar gains

| [Jan]       |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W   |          |          |               |
|-------------|----------|----------|----------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|--------------|----------|----------|---------------|
| North       |          |          |          | 1.3900     | 10.6334                        | 0.6300                            | 0.7000                             | 0.7700                       | 4.5171 (74)  |          |          |               |
| East        |          |          |          | 9.3400     | 19.6403                        | 0.6300                            | 0.7000                             | 0.7700                       | 56.0617 (76) |          |          |               |
| West        |          |          |          | 5.2500     | 19.6403                        | 0.6300                            | 0.7000                             | 0.7700                       | 31.5122 (80) |          |          |               |
| Solar gains | 92.0909  | 179.9454 | 296.7967 | 435.0285   | 536.0078                       | 550.1864                          | 523.1742                           | 447.3175                     | 345.7630     | 213.5531 | 114.7667 | 75.7821 (83)  |
| Total gains | 652.2342 | 753.9043 | 845.4822 | 963.3333   | 1035.9336                      | 1028.0808                         | 981.5552                           | 906.6680                     | 820.0414     | 708.0573 | 641.4205 | 623.6045 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |              |
| tau                                                                         | 47.9575 | 48.0843 | 48.2092 | 48.8047 | 48.9177 | 49.4509 | 49.4509 | 49.5510 | 49.2442 | 48.9177 | 48.6896 | 48.4533 |              |
| alpha                                                                       | 4.1972  | 4.2056  | 4.2139  | 4.2536  | 4.2612  | 4.2967  | 4.2967  | 4.3034  | 4.2829  | 4.2612  | 4.2460  | 4.2302  |              |
| util living area                                                            | 0.9929  | 0.9863  | 0.9707  | 0.9214  | 0.8158  | 0.6438  | 0.4880  | 0.5438  | 0.7870  | 0.9507  | 0.9869  | 0.9941  | (86)         |
| MIT                                                                         | 19.3683 | 19.5845 | 19.9230 | 20.3803 | 20.7356 | 20.9309 | 20.9833 | 20.9739 | 20.8337 | 20.3554 | 19.7881 | 19.3393 | (87)         |
| Th 2                                                                        | 19.9073 | 19.9099 | 19.9124 | 19.9242 | 19.9264 | 19.9367 | 19.9367 | 19.9386 | 19.9328 | 19.9264 | 19.9219 | 19.9173 | (88)         |
| util rest of house                                                          | 0.9909  | 0.9825  | 0.9622  | 0.8982  | 0.7638  | 0.5555  | 0.3764  | 0.4285  | 0.7103  | 0.9313  | 0.9825  | 0.9925  | (89)         |
| MIT 2                                                                       | 18.0179 | 18.2943 | 18.7232 | 19.2928 | 19.6982 | 19.8944 | 19.9307 | 19.9282 | 19.8133 | 19.2764 | 18.5636 | 17.9876 | (90)         |
| Living area fraction                                                        | 18.2717 | 18.5368 | 18.9487 | 19.4972 | 19.8932 | 20.0892 | 20.1285 | 20.1248 | 20.0051 | 19.4792 | 18.7937 | 18.2416 | (91)         |
| MIT                                                                         | 18.2717 | 18.5368 | 18.9487 | 19.4972 | 19.8932 | 20.0892 | 20.1285 | 20.1248 | 20.0051 | 19.4792 | 18.7937 | 18.2416 | (92)         |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | 0.0000  |              |
| adjusted MIT                                                                | 18.2717 | 18.5368 | 18.9487 | 19.4972 | 19.8932 | 20.0892 | 20.1285 | 20.1248 | 20.0051 | 19.4792 | 18.7937 | 18.2416 | (93)         |

## 8. Space heating requirement

|                                                                                |           |           |           |           |          |          |          |          |          |               |           |           |       |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|---------------|-----------|-----------|-------|
| Utilisation                                                                    | Jan       | Feb       | Mar       | Apr       | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov       | Dec       |       |
|                                                                                | 0.9865    | 0.9756    | 0.9520    | 0.8870    | 0.7620   | 0.5689   | 0.3971   | 0.4496   | 0.7162   | 0.9207        | 0.9759    | 0.9886    | (94)  |
| Useful gains                                                                   | 643.4229  | 735.5034  | 804.9312  | 854.4499  | 789.3456 | 584.8952 | 389.7733 | 407.6353 | 587.2840 | 651.9340      | 625.9866  | 616.5201  | (95)  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000    | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000    | 4.2000    | (96)  |
| Heat loss rate W                                                               | 1610.7491 | 1568.0006 | 1427.6811 | 1200.5072 | 926.0264 | 613.7245 | 394.5093 | 415.6064 | 662.9922 | 1003.5610     | 1327.8668 | 1602.2489 | (97)  |
| Space heating kWh                                                              | 719.6907  | 559.4382  | 463.3259  | 249.1612  | 101.6905 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 261.6104      | 505.3537  | 733.3822  | (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |          |          |          |          |          |               |           | 3593.6529 |       |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | 0.0000    | (98b) |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |           |          |          |          |          |          |               |           | 0.0000    |       |
| Space heating kWh                                                              | 719.6907  | 559.4382  | 463.3259  | 249.1612  | 101.6905 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 261.6104      | 505.3537  | 733.3822  | (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |          |          |          |          |          |               |           | 3593.6529 |       |
| Space heating per m2                                                           |           |           |           |           |          |          |          |          |          | (98c) / (4) = |           | 37.8997   | (99)  |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                       |          |          |          |          |          |          |          |          |          |          |          |          |               |
|-----------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Fraction of space heat from secondary/supplementary system (Table 11) |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (201)  |
| Fraction of space heat from main system(s)                            |          |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (202)  |
| Efficiency of main space heating system 1 (in %)                      |          |          |          |          |          |          |          |          |          |          |          |          | 92.4000 (206) |
| Efficiency of main space heating system 2 (in %)                      |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)  |
| Efficiency of secondary/supplementary heating system, %               |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)  |
| Space heating requirement                                             | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |               |
|                                                                       | 719.6907 | 559.4382 | 463.3259 | 249.1612 | 101.6905 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 261.6104 | 505.3537 | 733.3822 | (98)          |
| Space heating efficiency (main heating system 1)                      | 92.4000  | 92.4000  | 92.4000  | 92.4000  | 92.4000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 92.4000  | 92.4000  | 92.4000  | (210)         |
| Space heating fuel (main heating system)                              | 778.8860 | 605.4525 | 501.4350 | 269.6550 | 110.0547 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 283.1282 | 546.9196 | 793.7037 | (211)         |
| Space heating efficiency (main heating system 2)                      | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (212)         |
| Space heating fuel (main heating system 2)                            | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (213)         |
| Space heating fuel (secondary)                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (215)         |
| Water heating                                                         |          |          |          |          |          |          |          |          |          |          |          |          |               |
| Water heating requirement                                             | 243.0850 | 214.9411 | 228.5280 | 201.6613 | 195.9126 | 177.0238 | 175.1972 | 181.9668 | 183.7274 | 204.2540 | 216.3800 | 240.5545 | (64)          |
| Efficiency of water heater                                            |          |          |          |          |          |          |          |          |          |          |          | 80.3000  | (216)         |

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|                                                                                                      |          |          |           |           |           |           |           |           |           |          |          |            |        |
|------------------------------------------------------------------------------------------------------|----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|----------|------------|--------|
| (217)m                                                                                               | 86.5594  | 86.3336  | 85.8625   | 84.8358   | 83.0451   | 80.3000   | 80.3000   | 80.3000   | 80.3000   | 84.9128  | 86.1343  | 86.6090    | (217)  |
| Fuel for water heating, kWh/month                                                                    | 280.8303 | 248.9659 | 266.1557  | 237.7079  | 235.9112  | 220.4530  | 218.1783  | 226.6087  | 228.8013  | 240.5455 | 251.2122 | 277.7478   | (219)  |
| Space cooling fuel requirement                                                                       |          |          |           |           |           |           |           |           |           |          |          |            |        |
| (221)m                                                                                               | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (221)  |
| Pumps and Fa                                                                                         | 7.3041   | 6.5973   | 7.3041    | 7.0685    | 7.3041    | 7.0685    | 7.3041    | 7.0685    | 7.3041    | 7.0685   | 7.3041   | 7.0685     | (231)  |
| Lighting                                                                                             | 26.8128  | 21.5102  | 19.3676   | 14.1895   | 10.9604   | 8.9547    | 9.9984    | 12.9963   | 16.8810   | 22.1487  | 25.0169  | 27.5580    | (232)  |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |           |           |           |           |           |           |           |          |          |            |        |
| (233a)m                                                                                              | -43.5998 | -61.0812 | -87.2451  | -97.4418  | -104.5021 | -97.3059  | -96.0664  | -90.9480  | -81.8609  | -69.5024 | -47.7811 | -37.7370   | (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |           |           |           |           |           |           |           |          |          |            |        |
| (234a)m                                                                                              | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (234a) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |           |           |           |           |           |           |           |          |          |            |        |
| (235a)m                                                                                              | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (235a) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |           |           |           |           |           |           |           |          |          |            |        |
| (235c)m                                                                                              | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (235c) |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |           |           |           |           |           |           |           |          |          |            |        |
| (233b)m                                                                                              | -25.8178 | -54.1746 | -107.4389 | -161.0389 | -212.6397 | -213.5772 | -211.0977 | -178.8993 | -131.3221 | -77.4059 | -34.4448 | -20.4294   | (233b) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |           |           |           |           |           |           |           |          |          |            |        |
| (234b)m                                                                                              | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (234b) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |           |           |           |           |           |           |           |          |          |            |        |
| (235b)m                                                                                              | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (235b) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |           |           |           |           |           |           |           |          |          |            |        |
| (235d)m                                                                                              | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (235d) |
| Annual totals kWh/year                                                                               |          |          |           |           |           |           |           |           |           |          |          |            |        |
| Space heating fuel - main system 1                                                                   |          |          |           |           |           |           |           |           |           |          |          | 3889.2348  | (211)  |
| Space heating fuel - main system 2                                                                   |          |          |           |           |           |           |           |           |           |          |          | 0.0000     | (213)  |
| Space heating fuel - secondary                                                                       |          |          |           |           |           |           |           |           |           |          |          | 0.0000     | (215)  |
| Efficiency of water heater                                                                           |          |          |           |           |           |           |           |           |           |          |          | 80.3000    |        |
| Water heating fuel used                                                                              |          |          |           |           |           |           |           |           |           |          |          | 2933.1177  | (219)  |
| Space cooling fuel                                                                                   |          |          |           |           |           |           |           |           |           |          |          | 0.0000     | (221)  |
| Electricity for pumps and fans:                                                                      |          |          |           |           |           |           |           |           |           |          |          |            |        |
| Total electricity for the above, kWh/year                                                            |          |          |           |           |           |           |           |           |           |          |          | 86.0000    | (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |          |          |           |           |           |           |           |           |           |          |          | 216.3947   | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |          |           |           |           |           |           |           |           |          |          |            |        |
| PV generation                                                                                        |          |          |           |           |           |           |           |           |           |          |          | -2343.3580 | (233)  |
| Wind generation                                                                                      |          |          |           |           |           |           |           |           |           |          |          | 0.0000     | (234)  |
| Hydro-electric generation (Appendix N)                                                               |          |          |           |           |           |           |           |           |           |          |          | 0.0000     | (235a) |
| Electricity generated - Micro CHP (Appendix N)                                                       |          |          |           |           |           |           |           |           |           |          |          | 0.0000     | (235)  |
| Appendix Q - special features                                                                        |          |          |           |           |           |           |           |           |           |          |          |            |        |
| Energy saved or generated                                                                            |          |          |           |           |           |           |           |           |           |          |          | -0.0000    | (236)  |
| Energy used                                                                                          |          |          |           |           |           |           |           |           |           |          |          | 0.0000     | (237)  |
| Total delivered energy for all uses                                                                  |          |          |           |           |           |           |           |           |           |          |          | 4781.3892  | (238)  |

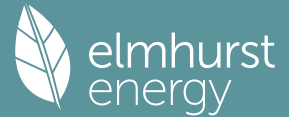
## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                               | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|-----------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1                 | 3889.2348          | 0.2100                        | 816.7393 (261)           |
| Total CO2 associated with community systems   |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                    | 2933.1177          | 0.2100                        | 615.9547 (264)           |
| Space and water heating                       |                    |                               | 1432.6940 (265)          |
| Pumps, fans and electric keep-hot             | 86.0000            | 0.1387                        | 11.9293 (267)            |
| Energy for lighting                           | 216.3947           | 0.1443                        | 31.2324 (268)            |
| Energy saving/generation technologies         |                    |                               |                          |
| PV Unit electricity used in dwelling          | -915.0717          | 0.1347                        | -123.2884                |
| PV Unit electricity exported                  | -1428.2863         | 0.1260                        | -179.8958                |
| Total                                         |                    |                               | -303.1842 (269)          |
| Total CO2, kg/year                            |                    |                               | 1172.6716 (272)          |
| EPC Target Carbon Dioxide Emission Rate (TER) |                    |                               | 12.3700 (273)            |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1               | 3889.2348          | 1.1300                              | 4394.8353 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 2933.1177          | 1.1300                              | 3314.4231 (278)            |
| Space and water heating                     |                    |                                     | 7709.2584 (279)            |
| Pumps, fans and electric keep-hot           | 86.0000            | 1.5128                              | 130.1008 (281)             |
| Energy for lighting                         | 216.3947           | 1.5338                              | 331.9134 (282)             |
| Energy saving/generation technologies       |                    |                                     |                            |
| PV Unit electricity used in dwelling        | -915.0717          | 1.4980                              | -1370.7323                 |
| PV Unit electricity exported                | -1428.2863         | 0.4623                              | -660.3444                  |
| Total                                       |                    |                                     | -2031.0766 (283)           |
| Total Primary energy kWh/year               |                    |                                     | 6140.1959 (286)            |
| Target Primary Energy Rate (TPER)           |                    |                                     | 64.7600 (287)              |

# Full SAP Calculation Printout



|                                    |                                                          |               |        |                |            |
|------------------------------------|----------------------------------------------------------|---------------|--------|----------------|------------|
| Plot Reference                     | 4907-R823-9471-004                                       |               |        | Issued on Date | 21/07/2026 |
| Assessment Reference               | Plot 4                                                   | Plot Type Ref | Plot 4 |                |            |
| Plot Address                       | Plot 4, Bosworth Det, K, WC, B, ES, 1012                 |               |        | SAP Version    | 10.2       |
| SAP Rating                         | 90 B                                                     | DER           | 11.94  | TER            | 12.37      |
| Environmental                      | 90 B                                                     | % DER < TER   |        |                | 3.48       |
| CO <sub>2</sub> Emissions (t/year) | 0.99                                                     | DFEE          | 40.71  | TFEE           | 43.39      |
| Compliance Check                   | See BREL                                                 | % DFEE < TFEE |        |                | 6.20       |
| % DPER < TPER                      | 1.19                                                     | DPER          | 63.99  | TPER           | 64.76      |
| Assessor Details                   | Mr. Daniel Harris                                        |               |        | Assessor ID    | R823-0001  |
| Client                             | Crest Nicholson Head Office, Crest Nicholson Head Office |               |        |                |            |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF ENERGY RATING

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)              | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|-----------------------------------|-----------------------------|
| Main dwelling                                          |                           |                                   |                             |
| Ground floor                                           | 47.4100 (1b)              | x 2.4600 (2b)                     | = 116.6286 (1b) - (3b)      |
| First floor                                            | 47.4100 (1c)              | x 2.7600 (2c)                     | = 130.8516 (1c) - (3c)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 94.8200                   |                                   | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 247.4802 (5)                |

## 2. Ventilation rate

|                                                                                                    | m <sup>3</sup> per hour                 |
|----------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                    |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                    |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                    |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                    |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                    |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                    |
| Number of intermittent extract fans                                                                | 0 * 10 = 0.0000 (7a)                    |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)                    |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 0.0000 / (5) = 0.0000 (8)               |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 4.5000 (17)                             |
| Infiltration rate                                                                                  | 0.2250 (18)                             |
| Number of sides sheltered                                                                          | 1 (19)                                  |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 0.9250 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.2081 (21)        |

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor                                                                                             | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate                                                                                         | 0.2654 | 0.2602 | 0.2550 | 0.2289 | 0.2237 | 0.1977 | 0.1977 | 0.1925 | 0.2081 | 0.2237 | 0.2341 | 0.2445 (22b) |
| Mechanical extract ventilation - decentralised                                                          |        |        |        |        |        |        |        |        |        |        |        |              |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| Effective ac                                                                                            | 0.5154 | 0.5102 | 0.5050 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 (25)  |

## 3. Heat losses and heat loss parameter

| Element                                                     | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K   |
|-------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|-----------------|
| Main dwelling                                               |                         |                            |                           |                               |              |                                |                 |
| Front Door                                                  |                         |                            | 2.2300                    | 1.2000                        | 2.6760       |                                | (26)            |
| Windows                                                     |                         |                            | 10.7600                   | 1.2357                        | 13.2966      |                                | (27)            |
| French Doors                                                |                         |                            | 5.2200                    | 1.2357                        | 6.4506       |                                | (27)            |
| GF SPVL 125TS P/A                                           |                         |                            | 47.4100                   | 0.1300                        | 6.1633       | 75.0000                        | 3555.7500 (28a) |
| EW Brick AAC011                                             | 151.6400                | 18.2100                    | 133.4300                  | 0.1800                        | 24.0174      | 60.0000                        | 8005.8000 (29a) |
| PR 500mm MW044                                              | 47.4100                 |                            | 47.4100                   | 0.0900                        | 4.2669       | 9.0000                         | 426.6900 (30)   |
| Total net area of external elements Aum(A, m <sup>2</sup> ) |                         |                            | 246.4600                  |                               |              |                                | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                         |                         |                            |                           | (26)...(30) + (32) =          | 56.8707      |                                | (33)            |
| Main dwelling                                               |                         |                            |                           |                               |              |                                |                 |
| Timber - GF                                                 |                         |                            | 24.2600                   |                               |              | 9.0000                         | 218.3400 (32c)  |
| Timber - FF                                                 |                         |                            | 140.7000                  |                               |              | 9.0000                         | 1266.3000 (32c) |
| Masonry GF                                                  |                         |                            | 51.5100                   |                               |              | 100.0000                       | 5151.0000 (32c) |
| Internal Floor FF                                           |                         |                            | 47.4100                   |                               |              | 18.0000                        | 853.3800 (32d)  |
| Internal Ceiling GF                                         |                         |                            | 47.4100                   |                               |              | 9.0000                         | 426.6900 (32e)  |

# Full SAP Calculation Printout



Heat capacity  $C_m = \text{Sum}(A \times k)$   
Thermal mass parameter (TMP =  $C_m / \text{TFA}$ ) in  $\text{kJ/m}^2\text{K}$  (28)...(30) + (32) + (32a)...(32e) = 19903.9500 (34)  
List of Thermal Bridges 209.9130 (35)

|                                                                  | Length  | Psi-value | Total   |
|------------------------------------------------------------------|---------|-----------|---------|
| K1 Element                                                       |         |           |         |
| E2 Other lintels (including other steel lintels)                 | 11.9100 | 0.0410    | 0.4883  |
| E3 Sill                                                          | 9.4200  | 0.0220    | 0.2072  |
| E4 Jamb                                                          | 22.0500 | 0.0190    | 0.4189  |
| E5 Ground floor (normal)                                         | 12.0200 | 0.0928    | 1.1155  |
| E6 Intermediate floor within a dwelling                          | 29.0500 | 0.0020    | 0.0581  |
| E10 Eaves (insulation at ceiling level)                          | 9.1500  | 0.0390    | 0.3569  |
| E18 Party wall between dwellings                                 | 0.0000  | 0.0300    | 0.0000  |
| E4 Jamb                                                          | 4.2000  | 0.1000    | 0.4200  |
| E2 Other lintels (including other steel lintels)                 | 1.0600  | 0.0410    | 0.0435  |
| P1 Party wall - Ground floor                                     | 0.0000  | 0.1000    | 0.0000  |
| P2 Party wall - Intermediate floor within a dwelling             | 0.0000  | 0.0000    | 0.0000  |
| P4 Party wall - Roof (insulation at ceiling level)               | 0.0000  | 0.0350    | 0.0000  |
| E5 Ground floor (normal)                                         | 17.0300 | 0.0980    | 1.6689  |
| E12 Gable (insulation at ceiling level)                          | 19.9000 | 0.0870    | 1.7313  |
| E16 Corner (normal)                                              | 26.1000 | 0.0420    | 1.0962  |
| E17 Corner (inverted - internal area greater than external area) | 5.2200  | -0.0820   | -0.4280 |

Thermal bridges ( $\text{Sum}(L \times \text{Psi})$ ) calculated using Appendix K) 7.1768 (36)  
Point Thermal bridges (36a) = 0.0000  
Total fabric heat loss (33) + (36) + (36a) = 64.0475 (37)

|                                                                                        |          |          |          |          |          |          |          |          |          |          |          |          |
|----------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)\text{m} \times (5)$ |          |          |          |          |          |          |          |          |          |          |          |          |
| (38)m                                                                                  | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |
| Heat transfer coeff                                                                    | 42.0886  | 41.6637  | 41.2387  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  |
| Average = $\text{Sum}(39)\text{m} / 12 =$                                              | 106.1361 | 105.7112 | 105.2863 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 |
|                                                                                        | 105.0891 |          |          |          |          |          |          |          |          |          |          |          |
| HLP                                                                                    | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |
| HLP (average)                                                                          | 1.1193   | 1.1149   | 1.1104   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   |
| Days in mont                                                                           | 31       | 28       | 31       | 30       | 31       | 30       | 31       | 31       | 30       | 31       | 30       | 31       |

## 4. Water heating energy requirements (kWh/year)

|                                                                                                |          |          |          |          |          |          |          |          |          |          |          |          |               |
|------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Assumed occupancy                                                                              |          |          |          |          |          |          |          |          |          |          |          |          | 2.6861 (42)   |
| Hot water usage for mixer showers                                                              | 69.2572  | 68.2164  | 66.6997  | 63.7979  | 61.6564  | 59.2683  | 57.9108  | 59.4160  | 61.0660  | 63.6301  | 66.5943  | 68.9918  | (42a)         |
| Hot water usage for baths                                                                      | 29.9061  | 29.4619  | 28.8365  | 27.6833  | 26.8197  | 25.8622  | 25.3450  | 25.9661  | 26.6424  | 27.6669  | 28.8439  | 29.8050  | (42b)         |
| Hot water usage for other uses                                                                 | 42.1386  | 40.6063  | 39.0739  | 37.5416  | 36.0093  | 34.4770  | 34.4770  | 36.0093  | 37.5416  | 39.0739  | 40.6063  | 42.1386  | (42c)         |
| Average daily hot water use (litres/day)                                                       |          |          |          |          |          |          |          |          |          |          |          |          | 129.8883 (43) |
| Daily hot water use                                                                            | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |               |
| Energy conte                                                                                   | 141.3019 | 138.2846 | 134.6102 | 129.0228 | 124.4855 | 119.6075 | 117.7329 | 121.3914 | 125.2500 | 130.3710 | 136.0444 | 140.9354 | (44)          |
| Energy content (annual)                                                                        | 223.7876 | 196.9154 | 206.8908 | 176.6258 | 167.5814 | 147.0714 | 142.3877 | 150.3080 | 154.4457 | 176.9122 | 193.8202 | 220.6708 | (45)          |
| Distribution loss (46)m = $0.15 \times (45)\text{m}$                                           | 33.5681  | 29.5373  | 31.0336  | 26.4939  | 25.1372  | 22.0607  | 21.3582  | 22.5462  | 23.1669  | 26.5368  | 29.0730  | 33.1006  | (46)          |
| Water storage loss (or HIU loss):                                                              |          |          |          |          |          |          |          |          |          |          |          |          |               |
| Total storage loss                                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (56)          |
| If cylinder contains dedicated solar storage                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (57)          |
| Primary loss                                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (59)          |
| Combi loss                                                                                     | 12.0010  | 10.8287  | 11.9655  | 11.5300  | 11.8830  | 11.4679  | 11.8301  | 11.8467  | 11.4834  | 11.9026  | 11.5661  | 11.9945  | (61)          |
| Total heat required for water heating calculated for each month                                | 235.7886 | 207.7441 | 218.8564 | 188.1558 | 179.4644 | 158.5393 | 154.2178 | 162.1547 | 165.9291 | 188.8148 | 205.3864 | 232.6653 | (62)          |
| WWHRS                                                                                          | -30.8360 | -27.2716 | -28.5573 | -23.6466 | -22.0378 | -18.8579 | -17.6762 | -18.7969 | -19.5111 | -23.0014 | -26.0578 | -30.2650 | (63a)         |
| PV diverter                                                                                    | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | (63b)         |
| Solar input                                                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (63c)         |
| FGHRS                                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (63d)         |
| Output from w/h                                                                                | 204.9526 | 180.4725 | 190.2991 | 164.5092 | 157.4266 | 139.6815 | 136.5416 | 143.3578 | 146.4181 | 165.8134 | 179.3286 | 202.4003 | (64)          |
| Electric shower(s)                                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (64a)         |
| Heat gains from water heating, kWh/month                                                       | 77.4096  | 68.1815  | 71.7826  | 61.6106  | 58.6916  | 51.7682  | 50.3014  | 52.9391  | 54.2241  | 61.7990  | 67.3368  | 76.3717  | (65)          |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = $\text{Sum}(64a)\text{m} =$ |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (64a)  |

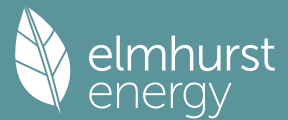
## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |           |           |           |           |           |           |           |           |           |           |           |           |      |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------|
| Metabolic gains (Table 5), Watts                                                    | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec       |      |
| (66)m                                                                               | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 28.2615   | 25.1016   | 20.4140   | 15.4547   | 11.5526   | 9.7532    | 10.5387   | 13.6985   | 18.3862   | 23.3454   | 27.2476   | 29.0470   | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 369.6589  | 373.4948  | 363.8284  | 343.2499  | 317.2732  | 292.8588  | 276.5485  | 272.7126  | 282.3789  | 302.9575  | 328.9341  | 353.3486  | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | (69) |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 3.0000    | 3.0000    | 3.0000    | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | (71) |
| Water heating gains (Table 5)                                                       | 104.0452  | 101.4606  | 96.4820   | 85.5702   | 78.8865   | 71.9003   | 67.6095   | 71.1547   | 75.3112   | 83.0631   | 93.5233   | 102.6501  | (72) |
| Total internal gains                                                                | 612.4909  | 610.5823  | 591.2497  | 554.8002  | 518.2376  | 482.0376  | 462.2219  | 465.0911  | 483.6016  | 519.8913  | 560.2303  | 595.5709  | (73) |

## 6. Solar gains

| [Jan] | Area<br>m <sup>2</sup> | Solar flux<br>Table 6a<br>W/m <sup>2</sup> | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W |
|-------|------------------------|--------------------------------------------|-----------------------------------|------------------------------------|------------------------------|------------|
|-------|------------------------|--------------------------------------------|-----------------------------------|------------------------------------|------------------------------|------------|

# Full SAP Calculation Printout



|       |  |  |        |  |         |  |        |  |        |  |        |  |              |
|-------|--|--|--------|--|---------|--|--------|--|--------|--|--------|--|--------------|
| North |  |  | 1.3900 |  | 10.6334 |  | 0.4500 |  | 0.0000 |  | 0.7700 |  | 5.1214 (74)  |
| East  |  |  | 4.1200 |  | 19.6403 |  | 0.4500 |  | 0.0000 |  | 0.7700 |  | 28.0380 (76) |
| West  |  |  | 5.2500 |  | 19.6403 |  | 0.4500 |  | 0.0000 |  | 0.7700 |  | 35.7281 (80) |
| East  |  |  | 5.2200 |  | 19.6403 |  | 0.4500 |  | 0.0000 |  | 0.7700 |  | 35.5239 (76) |

|             |          |          |          |           |           |           |           |          |          |          |          |  |               |
|-------------|----------|----------|----------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|--|---------------|
| Solar gains | 104.4115 | 204.0197 | 336.5042 | 493.2296  | 607.7185  | 623.7941  | 593.1680  | 507.1627 | 392.0216 | 242.1237 | 130.1210 |  | 85.9208 (83)  |
| Total gains | 716.9024 | 814.6021 | 927.7539 | 1048.0298 | 1125.9562 | 1105.8317 | 1055.3899 | 972.2538 | 875.6232 | 762.0150 | 690.3513 |  | 681.4917 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |                           |         |         |              |             |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|--------------|-------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |                           |         |         | 21.0000 (85) |             |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |                           |         |         |              |             |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep                       | Oct     | Nov     | Dec          |             |
| tau                                                                         | 52.0923 | 52.3017 | 52.5128 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153                   | 52.7153 | 52.7153 | 52.7153      |             |
| alpha                                                                       | 4.4728  | 4.4868  | 4.5009  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144                    | 4.5144  | 4.5144  | 4.5144       |             |
| util living area                                                            | 0.9895  | 0.9805  | 0.9554  | 0.8874  | 0.7555  | 0.5802  | 0.4313  | 0.4854  | 0.7332                    | 0.9307  | 0.9817  | 0.9915 (86)  |             |
| MIT                                                                         | 19.4388 | 19.6723 | 20.0580 | 20.5007 | 20.8163 | 20.9564 | 20.9908 | 20.9845 | 20.8797                   | 20.4381 | 19.8511 | 19.4003 (87) |             |
| Th 2                                                                        | 19.9851 | 19.9887 | 19.9924 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958                   | 19.9958 | 19.9958 | 19.9958 (88) |             |
| util rest of house                                                          | 0.9867  | 0.9754  | 0.9436  | 0.8587  | 0.7005  | 0.4993  | 0.3358  | 0.3846  | 0.6556                    | 0.9063  | 0.9759  | 0.9892 (89)  |             |
| MIT 2                                                                       | 18.3844 | 18.6491 | 19.0792 | 19.5536 | 19.8594 | 19.9728 | 19.9929 | 19.9904 | 19.9216                   | 19.5015 | 18.8577 | 18.3485 (90) |             |
| Living area fraction                                                        |         |         |         |         |         |         |         |         | fLA = Living area / (4) = |         |         |              | 0.1879 (91) |
| MIT                                                                         | 18.5825 | 18.8414 | 19.2632 | 19.7316 | 20.0392 | 20.1576 | 20.1804 | 20.1773 | 20.1017                   | 19.6775 | 19.0444 | 18.5462 (92) |             |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |                           |         |         | 0.0000       |             |
| adjusted MIT                                                                | 18.5825 | 18.8414 | 19.2632 | 19.7316 | 20.0392 | 20.1576 | 20.1804 | 20.1773 | 20.1017                   | 19.6775 | 19.0444 | 18.5462 (93) |             |

## 8. Space heating requirement

|                                                                                |           |           |           |           |          |          |          |          |          |               |           |           |       |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|---------------|-----------|-----------|-------|
|                                                                                | Jan       | Feb       | Mar       | Apr       | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov       | Dec       |       |
| Utilisation                                                                    | 0.9812    | 0.9675    | 0.9328    | 0.8500    | 0.7030   | 0.5128   | 0.3536   | 0.4032   | 0.6645   | 0.8967        | 0.9683    | 0.9845    | (94)  |
| Useful gains                                                                   | 703.4126  | 788.0945  | 865.4259  | 890.8556  | 791.5842 | 567.1238 | 373.2358 | 392.0586 | 581.8743 | 683.2845      | 668.4980  | 670.9181  | (95)  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000    | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000    | 4.2000    | (96)  |
| Heat loss rate W                                                               | 1515.8941 | 1473.7586 | 1343.7850 | 1136.0369 | 874.6314 | 582.8930 | 375.5223 | 396.1655 | 629.4641 | 952.0649      | 1252.7501 | 1504.6519 | (97)  |
| Space heating kWh                                                              | 604.4862  | 460.7663  | 355.8992  | 176.5305  | 61.7871  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 199.9726      | 420.6615  | 620.2980  | (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |          |          |          |          |          |               |           | 2900.4015 |       |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | 0.0000    | (98b) |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |           |          |          |          |          |          |               |           | 0.0000    |       |
| Space heating kWh                                                              | 604.4862  | 460.7663  | 355.8992  | 176.5305  | 61.7871  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 199.9726      | 420.6615  | 620.2980  | (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |          |          |          |          |          |               |           | 2900.4015 |       |
| Space heating per m2                                                           |           |           |           |           |          |          |          |          |          | (98c) / (4) = |           | 30.5885   | (99)  |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                                                              |          |          |          |          |          |          |          |          |          |          |          |           |               |
|--------------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|---------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                        |          |          |          |          |          |          |          |          |          |          |          |           | 0.0000 (201)  |
| Fraction of space heat from main system(s)                                                                   |          |          |          |          |          |          |          |          |          |          |          |           | 1.0000 (202)  |
| Efficiency of main space heating system 1 (in %)                                                             |          |          |          |          |          |          |          |          |          |          |          |           | 91.7000 (206) |
| Efficiency of main space heating system 2 (in %)                                                             |          |          |          |          |          |          |          |          |          |          |          |           | 0.0000 (207)  |
| Efficiency of secondary/supplementary heating system, %                                                      |          |          |          |          |          |          |          |          |          |          |          |           | 0.0000 (208)  |
|                                                                                                              | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec       |               |
| Space heating requirement                                                                                    | 604.4862 | 460.7663 | 355.8992 | 176.5305 | 61.7871  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 199.9726 | 420.6615 | 620.2980  | (98)          |
| Space heating efficiency (main heating system 1)                                                             | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 91.7000  | 91.7000  | 91.7000   | (210)         |
| Space heating fuel (main heating system)                                                                     | 659.1998 | 502.4715 | 388.1126 | 192.5088 | 67.3796  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 218.0726 | 458.7366 | 676.4427  | (211)         |
| Space heating efficiency (main heating system 2)                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (212)         |
| Space heating fuel (main heating system 2)                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (213)         |
| Space heating fuel (secondary)                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (215)         |
| Water heating                                                                                                |          |          |          |          |          |          |          |          |          |          |          |           |               |
| Water heating requirement                                                                                    | 204.9526 | 180.4725 | 190.2991 | 164.5092 | 157.4266 | 139.6815 | 136.5416 | 143.3578 | 146.4181 | 165.8134 | 179.3286 | 202.4003  | (64)          |
| Efficiency of water heater (217)m                                                                            | 88.2587  | 88.1988  | 88.0569  | 87.7745  | 87.2818  | 86.7000  | 86.7000  | 86.7000  | 86.7000  | 87.8356  | 88.1618  | 88.2740   | (216)         |
| Fuel for water heating, kWh/month                                                                            | 232.2180 | 204.6202 | 216.1092 | 187.4227 | 180.3660 | 161.1090 | 157.4874 | 165.3492 | 168.8790 | 188.7770 | 203.4086 | 229.2864  | (219)         |
| Space cooling fuel requirement (221)m                                                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (221)         |
| Pumps and Fa                                                                                                 | 11.2600  | 10.1703  | 11.2600  | 10.8967  | 11.2600  | 10.8967  | 11.2600  | 11.2600  | 10.8967  | 11.2600  | 10.8967  | 11.2600   | (231)         |
| Lighting                                                                                                     | 24.7371  | 19.8450  | 17.8683  | 13.0911  | 10.1119  | 8.2615   | 9.2244   | 11.9903  | 15.5742  | 20.4341  | 23.0803  | 25.4247   | (232)         |
| Electricity generated by PVs (Appendix M) (negative quantity) (233a)m                                        | -13.8577 | -22.9196 | -39.1412 | -51.1890 | -60.7330 | -58.6935 | -57.5786 | -51.1723 | -40.7967 | -28.6393 | -16.1851 | -11.5083  | (233a)        |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (234a)        |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235a)        |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235c)        |
| Electricity generated by PVs (Appendix M) (negative quantity) (233b)m                                        | -3.5626  | -8.8909  | -21.7125 | -39.0614 | -57.5840 | -60.2478 | -58.6981 | -46.0086 | -29.1122 | -13.8994 | -5.0330  | -2.6869   | (233b)        |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (234b)        |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235b)        |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235d)        |
| Annual totals kWh/year                                                                                       |          |          |          |          |          |          |          |          |          |          |          |           |               |
| Space heating fuel - main system 1                                                                           |          |          |          |          |          |          |          |          |          |          |          | 3162.9242 | (211)         |
| Space heating fuel - main system 2                                                                           |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (213)         |
| Space heating fuel - secondary                                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (215)         |
| Efficiency of water heater                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 86.7000   |               |

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Water heating fuel used 2295.0326 (219)  
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:  
(MEVDecentralised, Database: total watage = 6.9420, total flow = 45.0000, SFP = 0.1543)  
mechanical ventilation fans (SFP = 0.1543) 46.5771 (230a)  
central heating pump 41.0000 (230c)  
main heating flue fan 45.0000 (230e)  
Total electricity for the above, kWh/year 132.5771 (231)  
Electricity for lighting (calculated in Appendix L) 199.6429 (232)

Energy saving/generation technologies (Appendices M ,N and Q)  
PV generation -798.9117 (233)  
Wind generation 0.0000 (234)  
Hydro-electric generation (Appendix N) 0.0000 (235a)  
Electricity generated - Micro CHP (Appendix N) 0.0000 (235)  
Appendix Q - special features  
Energy saved or generated -0.0000 (236)  
Energy used 0.0000 (237)  
Total delivered energy for all uses 4991.2650 (238)

## 10a. Fuel costs - using Table 12 prices

|                                             | Fuel<br>kWh/year | Fuel price<br>p/kWh | Fuel cost<br>£/year |
|---------------------------------------------|------------------|---------------------|---------------------|
| Space heating - main system 1               | 3162.9242        | 3.6400              | 115.1304 (240)      |
| Total CO2 associated with community systems |                  |                     | 0.0000 (473)        |
| Water heating (other fuel)                  | 2295.0326        | 3.6400              | 83.5392 (247)       |
| Energy for instantaneous electric shower(s) | 0.0000           | 16.4900             | 0.0000 (247a)       |
| Pumps, fans and electric keep-hot           | 132.5771         | 16.4900             | 21.8620 (249)       |
| Energy for lighting                         | 199.6429         | 16.4900             | 32.9211 (250)       |
| Additional standing charges                 |                  |                     | 92.0000 (251)       |
| Energy saving/generation technologies       |                  |                     |                     |
| PV Unit electricity used in dwelling        | -452.4142        | 16.4900             | -74.6031            |
| PV Unit electricity exported                | -346.4975        | 5.5900              | -19.3692            |
| Total                                       |                  |                     | -93.9723 (252)      |
| Total energy cost                           |                  |                     | 251.4804 (255)      |

## 11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12): 0.3600 (256)  
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] = 0.6475 (257)  
SAP value 89.5041  
SAP rating (Section 12) 90 (258)  
SAP band B

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|---------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1               | 3162.9242          | 0.2100                        | 664.2141 (261)           |
| Total CO2 associated with community systems |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                  | 2295.0326          | 0.2100                        | 481.9569 (264)           |
| Space and water heating                     |                    |                               | 1146.1709 (265)          |
| Pumps, fans and electric keep-hot           | 132.5771           | 0.1387                        | 18.3901 (267)            |
| Energy for lighting                         | 199.6429           | 0.1443                        | 28.8146 (268)            |
| Energy saving/generation technologies       |                    |                               |                          |
| PV Unit electricity used in dwelling        | -452.4142          | 0.1318                        | -59.6090                 |
| PV Unit electricity exported                | -346.4975          | 0.1217                        | -42.1576                 |
| Total                                       |                    |                               | -101.7666 (269)          |
| Total CO2, kg/year                          |                    |                               | 1091.6090 (272)          |
| CO2 emissions per m2                        |                    |                               | 11.5100 (273)            |
| EI value                                    |                    |                               | 89.5383                  |
| EI rating                                   |                    |                               | 90 (274)                 |
| EI band                                     |                    |                               | B                        |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

## 1. Overall dwelling characteristics

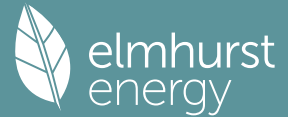
|                                                        | Area<br>(m2) | Storey height<br>(m)            | Volume<br>(m3)         |
|--------------------------------------------------------|--------------|---------------------------------|------------------------|
| Main dwelling                                          |              |                                 |                        |
| Ground floor                                           | 47.4100 (1b) | x 2.4600 (2b)                   | = 116.6286 (1b) - (3b) |
| First floor                                            | 47.4100 (1c) | x 2.7600 (2c)                   | = 130.8516 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 94.8200      |                                 | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 247.4802 (5)         |

## 2. Ventilation rate

m3 per hour

|                         |          |             |
|-------------------------|----------|-------------|
| Number of open chimneys | 0 * 80 = | 0.0000 (6a) |
| Number of open flues    | 0 * 20 = | 0.0000 (6b) |

# Full SAP Calculation Printout



|                                                    |          |             |
|----------------------------------------------------|----------|-------------|
| Number of chimneys / flues attached to closed fire | 0 * 10 = | 0.0000 (6c) |
| Number of flues attached to solid fuel boiler      | 0 * 20 = | 0.0000 (6d) |
| Number of flues attached to other heater           | 0 * 35 = | 0.0000 (6e) |
| Number of blocked chimneys                         | 0 * 20 = | 0.0000 (6f) |
| Number of intermittent extract fans                | 0 * 10 = | 0.0000 (7a) |
| Number of passive vents                            | 0 * 10 = | 0.0000 (7b) |
| Number of flueless gas fires                       | 0 * 40 = | 0.0000 (7c) |

|                                                      |                                                       |                |             |
|------------------------------------------------------|-------------------------------------------------------|----------------|-------------|
| Infiltration due to chimneys, flues and fans         | = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 0.0000 / (5) = | 0.0000 (8)  |
| Pressure test                                        |                                                       |                | Yes         |
| Pressure Test Method                                 |                                                       |                | Blower Door |
| Measured/design AP50                                 |                                                       |                | 4.5000 (17) |
| Infiltration rate                                    |                                                       |                | 0.2250 (18) |
| Number of sides sheltered                            |                                                       |                | 1 (19)      |
| Shelter factor                                       | (20) = 1 - [0.075 x (19)] =                           |                | 0.9250 (20) |
| Infiltration rate adjusted to include shelter factor | (21) = (18) x (20) =                                  |                | 0.2081 (21) |

|                                                                                                         |        |        |        |        |        |        |        |        |        |        |        |        |       |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|
| Wind speed                                                                                              | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |       |
|                                                                                                         | 4.2000 | 4.0000 | 4.0000 | 3.7000 | 3.7000 | 3.3000 | 3.4000 | 3.2000 | 3.3000 | 3.5000 | 3.5000 | 3.8000 | (22)  |
| Wind factor                                                                                             | 1.0500 | 1.0000 | 1.0000 | 0.9250 | 0.9250 | 0.8250 | 0.8500 | 0.8000 | 0.8250 | 0.8750 | 0.8750 | 0.9500 | (22a) |
| Adj infilt rate                                                                                         |        |        |        |        |        |        |        |        |        |        |        |        |       |
|                                                                                                         | 0.2185 | 0.2081 | 0.2081 | 0.1925 | 0.1925 | 0.1717 | 0.1769 | 0.1665 | 0.1717 | 0.1821 | 0.1821 | 0.1977 | (22b) |
| Mechanical extract ventilation - decentralised                                                          |        |        |        |        |        |        |        |        |        |        |        |        |       |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.5000 | (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.5000 | (23b) |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | (25)  |

## 3. Heat losses and heat loss parameter

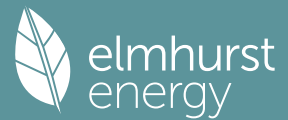
| Element                                                          | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K     | A x U<br>W/K | K-value<br>kJ/m2K                    | A x K<br>kJ/K         |              |
|------------------------------------------------------------------|-------------|----------------|---------------|----------------------|--------------|--------------------------------------|-----------------------|--------------|
| Main dwelling                                                    |             |                |               |                      |              |                                      |                       |              |
| Front Door                                                       |             |                | 2.2300        | 1.2000               | 2.6760       |                                      |                       | (26)         |
| Windows                                                          |             |                | 10.7600       | 1.2357               | 13.2966      |                                      |                       | (27)         |
| French Doors                                                     |             |                | 5.2200        | 1.2357               | 6.4506       |                                      |                       | (27)         |
| GF SPVL 125TS P/A                                                |             |                | 47.4100       | 0.1300               | 6.1633       | 75.0000                              | 3555.7500             | (28a)        |
| EW Brick AAC011                                                  | 151.6400    | 18.2100        | 133.4300      | 0.1800               | 24.0174      | 60.0000                              | 8005.8000             | (29a)        |
| PR 500mm MW044                                                   | 47.4100     |                | 47.4100       | 0.0900               | 4.2669       | 9.0000                               | 426.6900              | (30)         |
| Total net area of external elements Aum(A, m2)                   |             |                | 246.4600      |                      |              |                                      |                       | (31)         |
| Fabric heat loss, W/K = Sum (A x U)                              |             |                |               | (26)...(30) + (32) = | 56.8707      |                                      |                       | (33)         |
| Main dwelling                                                    |             |                |               |                      |              |                                      |                       |              |
| Timber - GF                                                      |             |                | 24.2600       |                      |              | 9.0000                               | 218.3400              | (32c)        |
| Timber - FF                                                      |             |                | 140.7000      |                      |              | 9.0000                               | 1266.3000             | (32c)        |
| Masonry GF                                                       |             |                | 51.5100       |                      |              | 100.0000                             | 5151.0000             | (32c)        |
| Internal Floor FF                                                |             |                | 47.4100       |                      |              | 18.0000                              | 853.3800              | (32d)        |
| Internal Ceiling GF                                              |             |                | 47.4100       |                      |              | 9.0000                               | 426.6900              | (32e)        |
| Heat capacity Cm = Sum(A x k)                                    |             |                |               |                      |              | (28)...(30) + (32) + (32a)...(32e) = | 19903.9500            | (34)         |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K                |             |                |               |                      |              |                                      | 209.9130              | (35)         |
| List of Thermal Bridges                                          |             |                |               |                      |              |                                      |                       |              |
| K1 Element                                                       |             |                |               | Length               | Psi-value    | Total                                |                       |              |
| E2 Other lintels (including other steel lintels)                 |             |                |               | 11.9100              | 0.0410       | 0.4883                               |                       |              |
| E3 Sill                                                          |             |                |               | 9.4200               | 0.0220       | 0.2072                               |                       |              |
| E4 Jamb                                                          |             |                |               | 22.0500              | 0.0190       | 0.4189                               |                       |              |
| E5 Ground floor (normal)                                         |             |                |               | 12.0200              | 0.0928       | 1.1155                               |                       |              |
| E6 Intermediate floor within a dwelling                          |             |                |               | 29.0500              | 0.0020       | 0.0581                               |                       |              |
| E10 Eaves (insulation at ceiling level)                          |             |                |               | 9.1500               | 0.0390       | 0.3569                               |                       |              |
| E18 Party wall between dwellings                                 |             |                |               | 0.0000               | 0.0300       | 0.0000                               |                       |              |
| E4 Jamb                                                          |             |                |               | 4.2000               | 0.1000       | 0.4200                               |                       |              |
| E2 Other lintels (including other steel lintels)                 |             |                |               | 1.0600               | 0.0410       | 0.0435                               |                       |              |
| P1 Party wall - Ground floor                                     |             |                |               | 0.0000               | 0.1000       | 0.0000                               |                       |              |
| P2 Party wall - Intermediate floor within a dwelling             |             |                |               | 0.0000               | 0.0000       | 0.0000                               |                       |              |
| P4 Party wall - Roof (insulation at ceiling level)               |             |                |               | 0.0000               | 0.0350       | 0.0000                               |                       |              |
| E5 Ground floor (normal)                                         |             |                |               | 17.0300              | 0.0980       | 1.6689                               |                       |              |
| E12 Gable (insulation at ceiling level)                          |             |                |               | 19.9000              | 0.0870       | 1.7313                               |                       |              |
| E16 Corner (normal)                                              |             |                |               | 26.1000              | 0.0420       | 1.0962                               |                       |              |
| E17 Corner (inverted - internal area greater than external area) |             |                |               | 5.2200               | -0.0820      | -0.4280                              |                       |              |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)       |             |                |               |                      |              |                                      | 7.1768                | (36)         |
| Point Thermal bridges                                            |             |                |               |                      |              |                                      | (36a) =               | 0.0000       |
| Total fabric heat loss                                           |             |                |               |                      |              |                                      | (33) + (36) + (36a) = | 64.0475 (37) |

|                                                                     |          |          |          |          |          |          |          |          |          |          |          |          |          |
|---------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) |          |          |          |          |          |          |          |          |          |          |          |          |          |
| (38)m                                                               | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |          |
|                                                                     | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | (38)     |
| Heat transfer coeff                                                 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | (39)     |
| Average = Sum(39)m / 12 =                                           |          |          |          |          |          |          |          |          |          |          |          |          | 104.8817 |
| HLP                                                                 | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |          |
| HLP (average)                                                       | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | (40)     |
| Days in mont                                                        | 31       | 28       | 31       | 30       | 31       | 30       | 31       | 31       | 30       | 31       | 30       | 31       |          |

## 4. Water heating energy requirements (kWh/year)

|                                          |          |          |          |          |          |          |          |          |          |          |          |          |                              |
|------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------------------------------|
| Assumed occupancy                        |          |          |          |          |          |          |          |          |          |          |          |          | 2.6861 (42)                  |
| Hot water usage for mixer showers        |          |          |          |          |          |          |          |          |          |          |          |          |                              |
|                                          | 69.2572  | 68.2164  | 66.6997  | 63.7979  | 61.6564  | 59.2683  | 57.9108  | 59.4160  | 61.0660  | 63.6301  | 66.5943  | 68.9918  | (42a)                        |
| Hot water usage for baths                |          |          |          |          |          |          |          |          |          |          |          |          |                              |
|                                          | 29.9061  | 29.4619  | 28.8365  | 27.6833  | 26.8197  | 25.8622  | 25.3450  | 25.9661  | 26.6424  | 27.6669  | 28.8439  | 29.8050  | (42b)                        |
| Hot water usage for other uses           |          |          |          |          |          |          |          |          |          |          |          |          |                              |
|                                          | 42.1386  | 40.6063  | 39.0739  | 37.5416  | 36.0093  | 34.4770  | 34.4770  | 36.0093  | 37.5416  | 39.0739  | 40.6063  | 42.1386  | (42c)                        |
| Average daily hot water use (litres/day) |          |          |          |          |          |          |          |          |          |          |          |          | 129.8883 (43)                |
| Daily hot water use                      | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |                              |
|                                          | 141.3019 | 138.2846 | 134.6102 | 129.0228 | 124.4855 | 119.6075 | 117.7329 | 121.3914 | 125.2500 | 130.3710 | 136.0444 | 140.9354 | (44)                         |
| Energy conte                             | 223.7876 | 196.9154 | 206.8908 | 176.6258 | 167.5814 | 147.0714 | 142.3877 | 150.3080 | 154.4457 | 176.9122 | 193.8202 | 220.6708 | (45)                         |
| Energy content (annual)                  |          |          |          |          |          |          |          |          |          |          |          |          | Total = Sum(45)m = 2157.4171 |
| Distribution loss (46)m = 0.15 x (45)m   |          |          |          |          |          |          |          |          |          |          |          |          |                              |
|                                          | 33.5681  | 29.5373  | 31.0336  | 26.4939  | 25.1372  | 22.0607  | 21.3582  | 22.5462  | 23.1669  | 26.5368  | 29.0730  | 33.1006  | (46)                         |

# Full SAP Calculation Printout



|                                                                                |          |          |          |          |          |          |          |          |          |          |                 |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Water storage loss (or HIU loss):                                              |          |          |          |          |          |          |          |          |          |          |                 |
| Total storage loss                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (56)     |
| If cylinder contains dedicated solar storage                                   |          |          |          |          |          |          |          |          |          |          |                 |
| Primary loss                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (57)     |
| Combi loss                                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (59)     |
| Total heat required for water heating calculated for each month                | 12.0010  | 10.8287  | 11.9655  | 11.5300  | 11.8830  | 11.4679  | 11.8301  | 11.8467  | 11.4834  | 11.9026  | 11.5661 (61)    |
| WWHRS                                                                          | 235.7886 | 207.7441 | 218.8564 | 188.1558 | 179.4644 | 158.5393 | 154.2178 | 162.1547 | 165.9291 | 188.8148 | 205.3864 (62)   |
| PV diverter                                                                    | -30.8360 | -27.2716 | -28.5573 | -23.6466 | -22.0378 | -18.8579 | -17.6762 | -18.7969 | -19.5111 | -23.0014 | -26.0578 (63a)  |
| Solar input                                                                    | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000 (63b)   |
| FGHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63c)    |
| Output from w/h                                                                | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63d)    |
| Total per year (kWh/year) = Sum(64)m =                                         | 204.9526 | 180.4725 | 190.2991 | 164.5092 | 157.4266 | 139.6815 | 136.5416 | 143.3578 | 146.4181 | 165.8134 | 179.3286 (64)   |
| Electric shower(s)                                                             | 204.9526 | 180.4725 | 190.2991 | 164.5092 | 157.4266 | 139.6815 | 136.5416 | 143.3578 | 146.4181 | 165.8134 | 202.4003 (64)   |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = | 204.9526 | 180.4725 | 190.2991 | 164.5092 | 157.4266 | 139.6815 | 136.5416 | 143.3578 | 146.4181 | 165.8134 | 2011.2011 (64a) |
| Heat gains from water heating, kWh/month                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (64a)    |
|                                                                                | 77.4096  | 68.1815  | 71.7826  | 61.6106  | 58.6916  | 51.7682  | 50.3014  | 52.9391  | 54.2241  | 61.7990  | 76.3717 (65)    |

## 5. Internal gains (see Table 5 and 5a)

| Metabolic gains (Table 5), Watts                                                    |           |           |           |           |           |           |           |           |           |           |           |                |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
|                                                                                     | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec            |
| (66)m                                                                               | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 28.2615   | 25.1016   | 20.4140   | 15.4547   | 11.5526   | 9.7532    | 10.5387   | 13.6985   | 18.3862   | 23.3454   | 27.2476   | 29.0470 (67)   |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 369.6589  | 373.4948  | 363.8284  | 343.2499  | 317.2732  | 292.8588  | 276.5485  | 272.7126  | 282.3789  | 302.9575  | 328.9341  | 353.3486 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029 (69)   |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 3.0000    | 3.0000    | 3.0000 (70)    |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 (71) |
| Water heating gains (Table 5)                                                       | 104.0452  | 101.4606  | 96.4820   | 85.5702   | 78.8865   | 71.9003   | 67.6095   | 71.1547   | 75.3112   | 83.0631   | 93.5233   | 102.6501 (72)  |
| Total internal gains                                                                | 612.4909  | 610.5823  | 591.2497  | 554.8002  | 518.2376  | 482.0376  | 462.2219  | 465.0911  | 483.6016  | 519.8913  | 560.2303  | 595.5709 (73)  |

## 6. Solar gains

| [Jan]       |          |          |          |           | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 |           | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d |          | Gains<br>W    |
|-------------|----------|----------|----------|-----------|------------|--------------------------------|-----------|-----------------------------------|------------------------------------|------------------------------|----------|---------------|
| North       |          |          |          |           | 1.3900     | 11.9814                        |           | 0.4500                            | 0.0000                             | 0.7700                       |          | 5.7707 (74)   |
| East        |          |          |          |           | 4.1200     | 22.3313                        |           | 0.4500                            | 0.0000                             | 0.7700                       |          | 31.8797 (76)  |
| West        |          |          |          |           | 5.2500     | 22.3313                        |           | 0.4500                            | 0.0000                             | 0.7700                       |          | 40.6235 (80)  |
| East        |          |          |          |           | 5.2200     | 22.3313                        |           | 0.4500                            | 0.0000                             | 0.7700                       |          | 40.3913 (76)  |
| <hr/>       |          |          |          |           |            |                                |           |                                   |                                    |                              |          |               |
| Solar gains | 118.6652 | 208.6660 | 339.5574 | 511.6799  | 613.0465   | 672.9016                       | 633.1510  | 554.4153                          | 428.4009                           | 264.3288                     | 151.5207 | 96.6906 (83)  |
| Total gains | 731.1561 | 819.2483 | 930.8072 | 1066.4801 | 1131.2842  | 1154.9392                      | 1095.3729 | 1019.5064                         | 912.0025                           | 784.2201                     | 711.7510 | 692.2615 (84) |

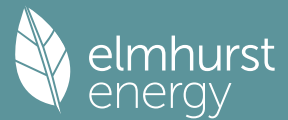
## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |         |         |         |              |
| tau                                                                         | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| alpha                                                                       | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153      |
| util living area                                                            | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144       |
|                                                                             | 0.9863  | 0.9764  | 0.9441  | 0.8526  | 0.6801  | 0.4469  | 0.2960  | 0.3277  | 0.6270  | 0.8985  | 0.9739  | 0.9889 (86)  |
| MIT                                                                         | 19.6061 | 19.7994 | 20.1936 | 20.6246 | 20.8974 | 20.9879 | 20.9986 | 20.9978 | 20.9463 | 20.5857 | 20.0129 | 19.5523 (87) |
| Th 2                                                                        | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 (88) |
| util rest of house                                                          | 0.9825  | 0.9700  | 0.9289  | 0.8157  | 0.6130  | 0.3605  | 0.2006  | 0.2257  | 0.5340  | 0.8627  | 0.9653  | 0.9857 (89)  |
| MIT 2                                                                       | 18.5808 | 18.7968 | 19.2305 | 19.6791 | 19.9284 | 19.9912 | 19.9956 | 19.9955 | 19.9691 | 19.6537 | 19.0384 | 18.5205 (90) |
| Living area fraction                                                        | 18.7735 | 18.9852 | 19.4115 | 19.8568 | 20.1105 | 20.1785 | 20.1841 | 20.1839 | 20.1527 | 19.8289 | 19.2215 | 18.7144 (91) |
| MIT                                                                         | 18.7735 | 18.9852 | 19.4115 | 19.8568 | 20.1105 | 20.1785 | 20.1841 | 20.1839 | 20.1527 | 19.8289 | 19.2215 | 18.7144 (92) |
| Temperature adjustment                                                      | 18.7735 | 18.9852 | 19.4115 | 19.8568 | 20.1105 | 20.1785 | 20.1841 | 20.1839 | 20.1527 | 19.8289 | 19.2215 | 0.0000       |
| adjusted MIT                                                                | 18.7735 | 18.9852 | 19.4115 | 19.8568 | 20.1105 | 20.1785 | 20.1841 | 20.1839 | 20.1527 | 19.8289 | 19.2215 | 18.7144 (93) |

## 8. Space heating requirement

|                                                                                |           |           |           |           |           |           |           |           |           |           |           |                |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
| Utilisation                                                                    | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec            |
| Useful gains                                                                   | 0.9760    | 0.9614    | 0.9179    | 0.8099    | 0.6212    | 0.3765    | 0.2185    | 0.2449    | 0.5493    | 0.8555    | 0.9565    | 0.9800 (94)    |
| Ext temp.                                                                      | 713.6053  | 787.6341  | 854.4125  | 863.7867  | 702.7023  | 434.8098  | 239.3672  | 249.6911  | 501.0070  | 670.9366  | 680.7650  | 678.4296 (95)  |
| Heat loss rate W                                                               | 5.1000    | 5.6000    | 7.4000    | 9.9000    | 13.0000   | 16.0000   | 17.9000   | 17.8000   | 15.2000   | 11.6000   | 8.0000    | 5.1000 (96)    |
| Space heating kWh                                                              | 1434.1030 | 1403.8641 | 1259.7883 | 1044.2844 | 745.7652  | 438.2515  | 239.5632  | 250.0225  | 519.4504  | 863.0595  | 1176.9311 | 1427.9061 (97) |
| Space heating requirement - total per year (kWh/year)                          | 536.0503  | 414.1066  | 301.5996  | 129.9584  | 32.0388   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 142.9395  | 357.2396  | 557.6105 (98a) |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         | 536.0503  | 414.1066  | 301.5996  | 129.9584  | 32.0388   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 142.9395  | 357.2396  | 557.6105 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000 (98d)   |
| Space heating per m2                                                           | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000 (98e)   |
|                                                                                | 2471.5431 | 2471.5431 | 2471.5431 | 2471.5431 | 2471.5431 | 2471.5431 | 2471.5431 | 2471.5431 | 2471.5431 | 2471.5431 | 2471.5431 | 2471.5431 (99) |

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## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                                                      |          |          |          |          |          |          |          |          |          |          |          |           |        |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|--------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (201)  |
| Fraction of space heat from main system(s)                                                           |          |          |          |          |          |          |          |          |          |          |          | 1.0000    | (202)  |
| Efficiency of main space heating system 1 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 91.7000   | (206)  |
| Efficiency of main space heating system 2 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (207)  |
| Efficiency of secondary/supplementary heating system, %                                              |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (208)  |
|                                                                                                      | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec       |        |
| Space heating requirement                                                                            | 536.0503 | 414.1066 | 301.5996 | 129.9584 | 32.0388  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 142.9395 | 357.2396 | 557.6105  | (98)   |
| Space heating efficiency (main heating system 1)                                                     | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 91.7000  | 91.7000  | 91.7000   | (210)  |
| Space heating fuel (main heating system)                                                             | 584.5695 | 451.5884 | 328.8981 | 141.7212 | 34.9387  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 155.8773 | 389.5742 | 608.0813  | (211)  |
| Space heating efficiency (main heating system 2)                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (212)  |
| Space heating fuel (main heating system 2)                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (213)  |
| Space heating fuel (secondary)                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (215)  |
| Water heating                                                                                        |          |          |          |          |          |          |          |          |          |          |          |           |        |
| Water heating requirement                                                                            | 204.9526 | 180.4725 | 190.2991 | 164.5092 | 157.4266 | 139.6815 | 136.5416 | 143.3578 | 146.4181 | 165.8134 | 179.3286 | 202.4003  | (64)   |
| Efficiency of water heater                                                                           | 88.2091  | 88.1519  | 87.9756  | 87.6144  | 87.0481  | 86.7000  | 86.7000  | 86.7000  | 86.7000  | 87.6597  | 88.0869  | 88.2309   | (216)  |
| Fuel for water heating, kWh/month                                                                    | 232.3487 | 204.7289 | 216.3089 | 187.7650 | 180.8502 | 161.1090 | 157.4874 | 165.3492 | 168.8790 | 189.1557 | 203.5814 | 229.3985  | (219)  |
| Space cooling fuel requirement                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (221)  |
| Pumps and Fa                                                                                         | 11.2600  | 10.1703  | 11.2600  | 10.8967  | 11.2600  | 10.8967  | 11.2600  | 11.2600  | 10.8967  | 11.2600  | 10.8967  | 11.2600   | (231)  |
| Lighting                                                                                             | 24.7371  | 19.8450  | 17.8683  | 13.0911  | 10.1119  | 8.2615   | 9.2244   | 11.9903  | 15.5742  | 20.4341  | 23.0803  | 25.4247   | (232)  |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | -15.6190 | -23.5119 | -39.6513 | -52.7819 | -61.3023 | -61.7585 | -60.2056 | -54.5131 | -43.7099 | -30.8996 | -18.5675 | -12.8750  | (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (234a) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235a) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235c) |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | -4.3417  | -9.2903  | -22.2296 | -41.4662 | -58.7043 | -67.1664 | -64.5439 | -52.3765 | -33.2487 | -15.9167 | -6.3436  | -3.2295   | (233b) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (234b) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235b) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235d) |
| Annual totals kWh/year                                                                               |          |          |          |          |          |          |          |          |          |          |          |           |        |
| Space heating fuel - main system 1                                                                   |          |          |          |          |          |          |          |          |          |          |          | 2695.2488 | (211)  |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (213)  |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (215)  |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          | 86.7000   |        |
| Water heating fuel used                                                                              |          |          |          |          |          |          |          |          |          |          |          | 2296.9618 | (219)  |
| Space cooling fuel                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (221)  |
| Electricity for pumps and fans:                                                                      |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (MEV)Decentralised, Database: total watage = 6.9420, total flow = 45.0000, SFP = 0.1543)             |          |          |          |          |          |          |          |          |          |          |          |           |        |
| mechanical ventilation fans (SFP = 0.1543)                                                           |          |          |          |          |          |          |          |          |          |          |          | 46.5771   | (230a) |
| central heating pump                                                                                 |          |          |          |          |          |          |          |          |          |          |          | 41.0000   | (230c) |
| main heating flue fan                                                                                |          |          |          |          |          |          |          |          |          |          |          | 45.0000   | (230e) |
| Total electricity for the above, kWh/year                                                            |          |          |          |          |          |          |          |          |          |          |          | 132.5771  | (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |          |          |          |          |          |          |          |          |          |          |          | 199.6429  | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |          |          |          |          |          |          |          |          |          |          |           |        |
| PV generation                                                                                        |          |          |          |          |          |          |          |          |          |          |          | -854.2531 | (233)  |
| Wind generation                                                                                      |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (234)  |
| Hydro-electric generation (Appendix N)                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (235a) |
| Electricity generated - Micro CHP (Appendix N)                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (235)  |
| Appendix Q - special features                                                                        |          |          |          |          |          |          |          |          |          |          |          |           |        |
| Energy saved or generated                                                                            |          |          |          |          |          |          |          |          |          |          |          | -0.0000   | (236)  |
| Energy used                                                                                          |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (237)  |
| Total delivered energy for all uses                                                                  |          |          |          |          |          |          |          |          |          |          |          | 4470.1774 | (238)  |

## 10a. Fuel costs - using BEDF prices (596)

|                                             | Fuel<br>kWh/year | Fuel price<br>p/kWh | Fuel cost<br>£/year |
|---------------------------------------------|------------------|---------------------|---------------------|
| Space heating - main system 1               | 2695.2488        | 7.3200              | 197.2922 (240)      |
| Total CO2 associated with community systems |                  |                     | 0.0000 (473)        |
| Water heating (other fuel)                  | 2296.9618        | 7.3200              | 168.1376 (247)      |
| Energy for instantaneous electric shower(s) | 0.0000           | 27.6700             | 0.0000 (247a)       |
| Pumps, fans and electric keep-hot           | 132.5771         | 27.6700             | 36.6841 (249)       |
| Energy for lighting                         | 199.6429         | 27.6700             | 55.2412 (250)       |
| Additional standing charges                 |                  |                     | 108.0000 (251)      |
| Energy saving/generation technologies       |                  |                     |                     |
| PV Unit electricity used in dwelling        | -475.3956        | 27.6700             | -131.5419           |
| PV Unit electricity exported                | -378.8575        | 5.8100              | -22.0116            |
| Total                                       |                  |                     | -153.5536 (252)     |
| Total energy cost                           |                  |                     | 411.8015 (255)      |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|---------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1               | 2695.2488          | 0.2100                        | 566.0022 (261)           |
| Total CO2 associated with community systems |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                  | 2296.9618          | 0.2100                        | 482.3620 (264)           |
| Space and water heating                     |                    |                               | 1048.3642 (265)          |
| Pumps, fans and electric keep-hot           | 132.5771           | 0.1387                        | 18.3901 (267)            |
| Energy for lighting                         | 199.6429           | 0.1443                        | 28.8146 (268)            |
| Energy saving/generation technologies       |                    |                               |                          |

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|                                      |           |        |                 |
|--------------------------------------|-----------|--------|-----------------|
| PV Unit electricity used in dwelling | -475.3956 | 0.1318 | -62.6507        |
| PV Unit electricity exported         | -378.8575 | 0.1212 | -45.9143        |
| Total                                |           |        | -108.5651 (269) |
| Total CO2, kg/year                   |           |        | 987.0038 (272)  |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy kWh/year | Primary energy factor kg CO2/kWh | Primary energy kWh/year |
|---------------------------------------------|-----------------|----------------------------------|-------------------------|
| Space heating - main system 1               | 2695.2488       | 1.1300                           | 3045.6311 (275)         |
| Total CO2 associated with community systems |                 |                                  | 0.0000 (473)            |
| Water heating (other fuel)                  | 2296.9618       | 1.1300                           | 2595.5668 (278)         |
| Space and water heating                     |                 |                                  | 5641.1979 (279)         |
| Pumps, fans and electric keep-hot           | 132.5771        | 1.5128                           | 200.5626 (281)          |
| Energy for lighting                         | 199.6429        | 1.5338                           | 306.2189 (282)          |
| Energy saving/generation technologies       |                 |                                  |                         |
| PV Unit electricity used in dwelling        | -475.3956       | 1.4869                           | -706.8613               |
| PV Unit electricity exported                | -378.8575       | 0.4445                           | -168.4174               |
| Total                                       |                 |                                  | -875.2787 (283)         |
| Total Primary energy kWh/year               |                 |                                  | 5272.7008 (286)         |

## SAP 10 EPC IMPROVEMENTS

Plot 4

|                                      |      |
|--------------------------------------|------|
| Current energy efficiency rating:    | B 90 |
| Current environmental impact rating: | B 90 |

|                             |                        |
|-----------------------------|------------------------|
| N Solar water heating       | SAP increase too small |
| U Solar photovoltaic panels | Already installed      |
| V2 Wind turbine             | Not applicable         |

| Recommended measures: | SAP change | Cost change | CO2 change |
|-----------------------|------------|-------------|------------|
| (none)                |            |             |            |

|                                                         |                             |
|---------------------------------------------------------|-----------------------------|
| Measures omitted - SAP change or cost saving too small: |                             |
| N Solar water heating                                   | + 0.5 -£ 32 -141 kg (14.3%) |

| Recommended measures | Typical annual savings | Energy efficiency | Environmental impact |
|----------------------|------------------------|-------------------|----------------------|
| (none)               |                        |                   |                      |
| Total Savings        | £0                     | 0.00 kg/m²        |                      |

|                                        |      |
|----------------------------------------|------|
| Potential energy efficiency rating:    | B 90 |
| Potential environmental impact rating: | B 90 |

Fuel prices for cost data on this page from database revision number 596 TEST (30 Jun 2026)  
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Thames Valley):

|                          | Current    | Potential  | Saving     |
|--------------------------|------------|------------|------------|
| Electricity              | £92        | £92        | £0         |
| Mains gas                | £473       | £473       | £0         |
| Space heating            | £342       | £342       | £0         |
| Water heating            | £168       | £168       | £0         |
| Lighting                 | £55        | £55        | £0         |
| Generated (PV)           | -£154      | -£154      | £0         |
| Total cost of fuels      | £411       | £411       | £0         |
| Total cost of uses       | £411       | £411       | £0         |
| Delivered energy         | 47 kWh/m²  | 47 kWh/m²  | 0 kWh/m²   |
| Carbon dioxide emissions | 1.0 tonnes | 1.0 tonnes | 0.0 tonnes |
| CO2 emissions per m²     | 10 kg/m²   | 10 kg/m²   | 0 kg/m²    |
| Primary energy           | 56 kWh/m²  | 56 kWh/m²  | 0 kWh/m²   |

## SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

### 1. Overall dwelling characteristics

| Main dwelling                                           | Area (m2)    | Storey height (m)                | Volume (m3)            |
|---------------------------------------------------------|--------------|----------------------------------|------------------------|
| Ground floor                                            | 47.4100 (1b) | x 2.4600 (2b)                    | = 116.6286 (1b) - (3b) |
| First floor                                             | 47.4100 (1c) | x 2.7600 (2c)                    | = 130.8516 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)... (1n) | 94.8200      |                                  | (4)                    |
| Dwelling volume                                         |              | (3a)+(3b)+(3c)+(3d)+(3e)... (3n) | = 247.4802 (5)         |

### 2. Ventilation rate

m3 per hour

# Full SAP Calculation Printout



|                                                    |          |             |
|----------------------------------------------------|----------|-------------|
| Number of open chimneys                            | 0 * 80 = | 0.0000 (6a) |
| Number of open flues                               | 0 * 20 = | 0.0000 (6b) |
| Number of chimneys / flues attached to closed fire | 0 * 10 = | 0.0000 (6c) |
| Number of flues attached to solid fuel boiler      | 0 * 20 = | 0.0000 (6d) |
| Number of flues attached to other heater           | 0 * 35 = | 0.0000 (6e) |
| Number of blocked chimneys                         | 0 * 20 = | 0.0000 (6f) |
| Number of intermittent extract fans                | 0 * 10 = | 0.0000 (7a) |
| Number of passive vents                            | 0 * 10 = | 0.0000 (7b) |
| Number of flueless gas fires                       | 0 * 40 = | 0.0000 (7c) |

|                                                      |                                                       |        |                      |            |
|------------------------------------------------------|-------------------------------------------------------|--------|----------------------|------------|
| Infiltration due to chimneys, flues and fans         | = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 0.0000 | Air changes per hour | 0.0000 (8) |
| Pressure test                                        |                                                       |        | Yes                  |            |
| Pressure Test Method                                 |                                                       |        | Blower Door          |            |
| Measured/design AP50                                 |                                                       |        | 4.5000               | (17)       |
| Infiltration rate                                    |                                                       |        | 0.2250               | (18)       |
| Number of sides sheltered                            |                                                       |        | 1                    | (19)       |
| Shelter factor                                       | (20) = 1 - [0.075 x (19)] =                           | 0.9250 |                      | (20)       |
| Infiltration rate adjusted to include shelter factor | (21) = (18) x (20) =                                  | 0.2081 |                      | (21)       |

|                                                                                                         |        |        |        |        |        |        |        |        |        |        |        |        |              |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |              |
| Wind factor                                                                                             | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 | (22)         |
| Adj infilt rate                                                                                         | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 | (22a)        |
|                                                                                                         | 0.2654 | 0.2602 | 0.2550 | 0.2289 | 0.2237 | 0.1977 | 0.1977 | 0.1925 | 0.2081 | 0.2237 | 0.2341 | 0.2445 | (22b)        |
| Mechanical extract ventilation - decentralised                                                          |        |        |        |        |        |        |        |        |        |        |        |        |              |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| Effective ac                                                                                            | 0.5154 | 0.5102 | 0.5050 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | (25)         |

## 3. Heat losses and heat loss parameter

| Element                                        | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K     | A x U<br>W/K | K-value<br>kJ/m2K | A x K<br>kJ/K |       |
|------------------------------------------------|-------------|----------------|---------------|----------------------|--------------|-------------------|---------------|-------|
| Main dwelling                                  |             |                |               |                      |              |                   |               |       |
| Front Door                                     |             |                | 2.2300        | 1.2000               | 2.6760       |                   |               | (26)  |
| Windows                                        |             |                | 10.7600       | 1.2357               | 13.2966      |                   |               | (27)  |
| French Doors                                   |             |                | 5.2200        | 1.2357               | 6.4506       |                   |               | (27)  |
| GF SPVL 125TS P/A                              |             |                | 47.4100       | 0.1300               | 6.1633       | 75.0000           | 3555.7500     | (28a) |
| EW Brick AAC011                                | 151.6400    | 18.2100        | 133.4300      | 0.1800               | 24.0174      | 60.0000           | 8005.8000     | (29a) |
| PR 500mm MW044                                 | 47.4100     |                | 47.4100       | 0.0900               | 4.2669       | 9.0000            | 426.6900      | (30)  |
| Total net area of external elements Aum(A, m2) |             |                | 246.4600      |                      |              |                   |               | (31)  |
| Fabric heat loss, W/K = Sum (A x U)            |             |                |               | (26)...(30) + (32) = | 56.8707      |                   |               | (33)  |
| Main dwelling                                  |             |                |               |                      |              |                   |               |       |
| Timber - GF                                    |             |                | 24.2600       |                      |              | 9.0000            | 218.3400      | (32c) |
| Timber - FF                                    |             |                | 140.7000      |                      |              | 9.0000            | 1266.3000     | (32c) |
| Masonry GF                                     |             |                | 51.5100       |                      |              | 100.0000          | 5151.0000     | (32c) |
| Internal Floor FF                              |             |                | 47.4100       |                      |              | 18.0000           | 853.3800      | (32d) |
| Internal Ceiling GF                            |             |                | 47.4100       |                      |              | 9.0000            | 426.6900      | (32e) |

|                                                   |                                      |                 |
|---------------------------------------------------|--------------------------------------|-----------------|
| Heat capacity Cm = Sum(A x k)                     | (28)...(30) + (32) + (32a)...(32e) = | 19903.9500 (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K |                                      | 209.9130 (35)   |

## List of Thermal Bridges

| K1 Element                                                       | Length  | Psi-value | Total   |  |
|------------------------------------------------------------------|---------|-----------|---------|--|
| E2 Other lintels (including other steel lintels)                 | 11.9100 | 0.0410    | 0.4883  |  |
| E3 Sill                                                          | 9.4200  | 0.0220    | 0.2072  |  |
| E4 Jamb                                                          | 22.0500 | 0.0190    | 0.4189  |  |
| E5 Ground floor (normal)                                         | 12.0200 | 0.0928    | 1.1155  |  |
| E6 Intermediate floor within a dwelling                          | 29.0500 | 0.0020    | 0.0581  |  |
| E10 Eaves (insulation at ceiling level)                          | 9.1500  | 0.0390    | 0.3569  |  |
| E18 Party wall between dwellings                                 | 0.0000  | 0.0300    | 0.0000  |  |
| E4 Jamb                                                          | 4.2000  | 0.1000    | 0.4200  |  |
| E2 Other lintels (including other steel lintels)                 | 1.0600  | 0.0410    | 0.0435  |  |
| P1 Party wall - Ground floor                                     | 0.0000  | 0.1000    | 0.0000  |  |
| P2 Party wall - Intermediate floor within a dwelling             | 0.0000  | 0.0000    | 0.0000  |  |
| P4 Party wall - Roof (insulation at ceiling level)               | 0.0000  | 0.0350    | 0.0000  |  |
| E5 Ground floor (normal)                                         | 17.0300 | 0.0980    | 1.6689  |  |
| E12 Gable (insulation at ceiling level)                          | 19.9000 | 0.0870    | 1.7313  |  |
| E16 Corner (normal)                                              | 26.1000 | 0.0420    | 1.0962  |  |
| E17 Corner (inverted - internal area greater than external area) | 5.2200  | -0.0820   | -0.4280 |  |

|                                                            |                       |              |
|------------------------------------------------------------|-----------------------|--------------|
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |                       | 7.1768 (36)  |
| Point Thermal bridges                                      | (36a) =               | 0.0000       |
| Total fabric heat loss                                     | (33) + (36) + (36a) = | 64.0475 (37) |

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

|                           |          |          |          |          |          |          |          |          |          |          |          |          |      |
|---------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| (38)m                     | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |      |
| Heat transfer coeff       | 42.0886  | 41.6637  | 41.2387  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | (38) |
| Average = Sum(39)m / 12 = | 106.1361 | 105.7112 | 105.2863 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | (39) |

|               |        |        |        |        |        |        |        |        |        |        |        |        |      |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| HLP           | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |      |
| HLP (average) | 1.1193 | 1.1149 | 1.1104 | 1.1061 | 1.1061 | 1.1061 | 1.1061 | 1.1061 | 1.1061 | 1.1061 | 1.1061 | 1.1061 | (40) |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31     |      |

## 4. Water heating energy requirements (kWh/year)

|                                          |                    |          |          |          |          |          |          |          |          |          |          |               |
|------------------------------------------|--------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Assumed occupancy                        |                    |          |          |          |          |          |          |          |          |          |          | 2.6861 (42)   |
| Hot water usage for mixer showers        |                    |          |          |          |          |          |          |          |          |          |          |               |
|                                          | 69.2572            | 68.2164  | 66.6997  | 63.7979  | 61.6564  | 59.2683  | 57.9108  | 59.4160  | 61.0660  | 63.6301  | 66.5943  | 68.9918 (42a) |
| Hot water usage for baths                |                    |          |          |          |          |          |          |          |          |          |          |               |
|                                          | 29.9061            | 29.4619  | 28.8365  | 27.6833  | 26.8197  | 25.8622  | 25.3450  | 25.9661  | 26.6424  | 27.6669  | 28.8439  | 29.8050 (42b) |
| Hot water usage for other uses           |                    |          |          |          |          |          |          |          |          |          |          |               |
|                                          | 42.1386            | 40.6063  | 39.0739  | 37.5416  | 36.0093  | 34.4770  | 34.4770  | 36.0093  | 37.5416  | 39.0739  | 40.6063  | 42.1386 (42c) |
| Average daily hot water use (litres/day) |                    |          |          |          |          |          |          |          |          |          |          | 129.8883 (43) |
|                                          | Jan                | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
| Daily hot water use                      | 141.3019           | 138.2846 | 134.6102 | 129.0228 | 124.4855 | 119.6075 | 117.7329 | 121.3914 | 125.2500 | 130.3710 | 136.0444 | 140.9354 (44) |
| Energy content                           | 223.7876           | 196.9154 | 206.8908 | 176.6258 | 167.5814 | 147.0714 | 142.3877 | 150.3080 | 154.4457 | 176.9122 | 193.8202 | 220.6708 (45) |
| Energy content (annual)                  | Total = Sum(45)m = |          |          |          |          |          |          |          |          |          |          | 2157.4171     |

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|                                                                                     |                                                                                |           |           |            |               |               |           |           |           |           |           |                            |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|-----------|-----------|------------|---------------|---------------|-----------|-----------|-----------|-----------|-----------|----------------------------|
| Distribution loss (46)m = 0.15 x (45)m                                              | 33.5681                                                                        | 29.5373   | 31.0336   | 26.4939    | 25.1372       | 22.0607       | 21.3582   | 22.5462   | 23.1669   | 26.5368   | 29.0730   | 33.1006 (46)               |
| Water storage loss (or HIU loss):                                                   |                                                                                |           |           |            |               |               |           |           |           |           |           |                            |
| Total storage loss                                                                  | 0.0000                                                                         | 0.0000    | 0.0000    | 0.0000     | 0.0000        | 0.0000        | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000 (56)                |
| If cylinder contains dedicated solar storage                                        | 0.0000                                                                         | 0.0000    | 0.0000    | 0.0000     | 0.0000        | 0.0000        | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000 (57)                |
| Primary loss                                                                        | 0.0000                                                                         | 0.0000    | 0.0000    | 0.0000     | 0.0000        | 0.0000        | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000 (59)                |
| Combi loss                                                                          | 12.0010                                                                        | 10.8287   | 11.9655   | 11.5300    | 11.8830       | 11.4679       | 11.8301   | 11.8467   | 11.4834   | 11.9026   | 11.5661   | 11.9945 (61)               |
| Total heat required for water heating calculated for each month                     | 235.7886                                                                       | 207.7441  | 218.8564  | 188.1558   | 179.4644      | 158.5393      | 154.2178  | 162.1547  | 165.9291  | 188.8148  | 205.3864  | 232.6653 (62)              |
| WWHRS                                                                               | -30.8360                                                                       | -27.2716  | -28.5573  | -23.6466   | -22.0378      | -18.8579      | -17.6762  | -18.7969  | -19.5111  | -23.0014  | -26.0578  | -30.2650 (63a)             |
| PV diverter                                                                         | -0.0000                                                                        | -0.0000   | -0.0000   | -0.0000    | -0.0000       | -0.0000       | -0.0000   | -0.0000   | -0.0000   | -0.0000   | -0.0000   | -0.0000 (63b)              |
| Solar input                                                                         | 0.0000                                                                         | 0.0000    | 0.0000    | 0.0000     | 0.0000        | 0.0000        | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000 (63c)               |
| FGHRS                                                                               | 0.0000                                                                         | 0.0000    | 0.0000    | 0.0000     | 0.0000        | 0.0000        | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000 (63d)               |
| Output from w/h                                                                     | 204.9526                                                                       | 180.4725  | 190.2991  | 164.5092   | 157.4266      | 139.6815      | 136.5416  | 143.3578  | 146.4181  | 165.8134  | 179.3286  | 202.4003 (64)              |
|                                                                                     | Total per year (kWh/year) = Sum(64)m =                                         |           |           |            |               |               |           |           |           |           |           | 2011.2011 (64)             |
| Electric shower(s)                                                                  | 0.0000                                                                         | 0.0000    | 0.0000    | 0.0000     | 0.0000        | 0.0000        | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000 (64a)               |
|                                                                                     | Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |           |           |            |               |               |           |           |           |           |           | 0.0000 (64a)               |
| Heat gains from water heating, kWh/month                                            | 77.4096                                                                        | 68.1815   | 71.7826   | 61.6106    | 58.6916       | 51.7682       | 50.3014   | 52.9391   | 54.2241   | 61.7990   | 67.3368   | 76.3717 (65)               |
| -----                                                                               |                                                                                |           |           |            |               |               |           |           |           |           |           |                            |
| 5. Internal gains (see Table 5 and 5a)                                              |                                                                                |           |           |            |               |               |           |           |           |           |           |                            |
| -----                                                                               |                                                                                |           |           |            |               |               |           |           |           |           |           |                            |
| Metabolic gains (Table 5), Watts                                                    |                                                                                |           |           |            |               |               |           |           |           |           |           |                            |
| (66)m                                                                               | 161.1673                                                                       | 161.1673  | 161.1673  | 161.1673   | 161.1673      | 161.1673      | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673 (66)              |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 28.2615                                                                        | 25.1016   | 20.4140   | 15.4547    | 11.5526       | 9.7532        | 10.5387   | 13.6985   | 18.3862   | 23.3454   | 27.2476   | 29.0470 (67)               |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 369.6589                                                                       | 373.4948  | 363.8284  | 343.2499   | 317.2732      | 292.8588      | 276.5485  | 272.7126  | 282.3789  | 302.9575  | 328.9341  | 353.3486 (68)              |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 53.8029                                                                        | 53.8029   | 53.8029   | 53.8029    | 53.8029       | 53.8029       | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029 (69)               |
| Pumps, fans                                                                         | 3.0000                                                                         | 3.0000    | 3.0000    | 3.0000     | 3.0000        | 0.0000        | 0.0000    | 0.0000    | 0.0000    | 3.0000    | 3.0000    | 3.0000 (70)                |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -107.4449                                                                      | -107.4449 | -107.4449 | -107.4449  | -107.4449     | -107.4449     | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 (71)             |
| Water heating gains (Table 5)                                                       | 104.0452                                                                       | 101.4606  | 96.4820   | 85.5702    | 78.8865       | 71.9003       | 67.6095   | 71.1547   | 75.3112   | 83.0631   | 93.5233   | 102.6501 (72)              |
| Total internal gains                                                                | 612.4909                                                                       | 610.5823  | 591.2497  | 554.8002   | 518.2376      | 482.0376      | 462.2219  | 465.0911  | 483.6016  | 519.8913  | 560.2303  | 595.5709 (73)              |
| -----                                                                               |                                                                                |           |           |            |               |               |           |           |           |           |           |                            |
| 6. Solar gains                                                                      |                                                                                |           |           |            |               |               |           |           |           |           |           |                            |
| -----                                                                               |                                                                                |           |           |            |               |               |           |           |           |           |           |                            |
| [Jan]                                                                               |                                                                                |           | Area      | Solar flux | g             | FF            |           | Access    |           |           |           | Gains                      |
|                                                                                     |                                                                                |           | m2        | Table 6a   | Specific data | Specific data |           | factor    |           |           |           | W                          |
|                                                                                     |                                                                                |           |           | W/m2       | or Table 6b   | or Table 6c   |           | Table 6d  |           |           |           |                            |
| North                                                                               |                                                                                |           | 1.3900    | 10.6334    | 0.4500        | 0.0000        |           | 0.7700    |           |           |           | 5.1214 (74)                |
| East                                                                                |                                                                                |           | 4.1200    | 19.6403    | 0.4500        | 0.0000        |           | 0.7700    |           |           |           | 28.0380 (76)               |
| West                                                                                |                                                                                |           | 5.2500    | 19.6403    | 0.4500        | 0.0000        |           | 0.7700    |           |           |           | 35.7281 (80)               |
| East                                                                                |                                                                                |           | 5.2200    | 19.6403    | 0.4500        | 0.0000        |           | 0.7700    |           |           |           | 35.5239 (76)               |
| -----                                                                               |                                                                                |           |           |            |               |               |           |           |           |           |           |                            |
| Solar gains                                                                         | 104.4115                                                                       | 204.0197  | 336.5042  | 493.2296   | 607.7185      | 623.7941      | 593.1680  | 507.1627  | 392.0216  | 242.1237  | 130.1210  | 85.9208 (83)               |
| Total gains                                                                         | 716.9024                                                                       | 814.6021  | 927.7539  | 1048.0298  | 1125.9562     | 1105.8317     | 1055.3899 | 972.2538  | 875.6232  | 762.0150  | 690.3513  | 681.4917 (84)              |
| -----                                                                               |                                                                                |           |           |            |               |               |           |           |           |           |           |                            |
| 7. Mean internal temperature (heating season)                                       |                                                                                |           |           |            |               |               |           |           |           |           |           |                            |
| -----                                                                               |                                                                                |           |           |            |               |               |           |           |           |           |           |                            |
| Temperature during heating periods in the living area from Table 9, Th1 (C)         |                                                                                |           |           |            |               |               |           |           |           |           |           | 21.0000 (85)               |
| Utilisation factor for gains for living area, nil,m (see Table 9a)                  |                                                                                |           |           |            |               |               |           |           |           |           |           |                            |
| tau                                                                                 | 52.0923                                                                        | 52.3017   | 52.5128   | 52.7153    | 52.7153       | 52.7153       | 52.7153   | 52.7153   | 52.7153   | 52.7153   | 52.7153   | 52.7153                    |
| alpha                                                                               | 4.4728                                                                         | 4.4868    | 4.5009    | 4.5144     | 4.5144        | 4.5144        | 4.5144    | 4.5144    | 4.5144    | 4.5144    | 4.5144    | 4.5144                     |
| util living area                                                                    | 0.9895                                                                         | 0.9805    | 0.9554    | 0.8874     | 0.7555        | 0.5802        | 0.4313    | 0.4854    | 0.7332    | 0.9307    | 0.9817    | 0.9915 (86)                |
| MIT                                                                                 | 19.4388                                                                        | 19.6723   | 20.0580   | 20.5007    | 20.8163       | 20.9564       | 20.9908   | 20.9845   | 20.8797   | 20.4381   | 19.8511   | 19.4003 (87)               |
| Th 2                                                                                | 19.9851                                                                        | 19.9887   | 19.9924   | 19.9958    | 19.9958       | 19.9958       | 19.9958   | 19.9958   | 19.9958   | 19.9958   | 19.9958   | 19.9958 (88)               |
| util rest of house                                                                  | 0.9867                                                                         | 0.9754    | 0.9436    | 0.8587     | 0.7005        | 0.4993        | 0.3358    | 0.3846    | 0.6556    | 0.9063    | 0.9759    | 0.9892 (89)                |
| MIT 2                                                                               | 18.3844                                                                        | 18.6491   | 19.0792   | 19.5536    | 19.8594       | 19.9728       | 19.9929   | 19.9904   | 19.9216   | 19.5015   | 18.8577   | 18.3485 (90)               |
| Living area fraction                                                                |                                                                                |           |           |            |               |               |           |           |           |           |           | 0.1879 (91)                |
| MIT                                                                                 | 18.5825                                                                        | 18.8414   | 19.2632   | 19.7316    | 20.0392       | 20.1576       | 20.1804   | 20.1773   | 20.1017   | 19.6775   | 19.0444   | 18.5462 (92)               |
| Temperature adjustment                                                              |                                                                                |           |           |            |               |               |           |           |           |           |           | 0.0000                     |
| adjusted MIT                                                                        | 18.5825                                                                        | 18.8414   | 19.2632   | 19.7316    | 20.0392       | 20.1576       | 20.1804   | 20.1773   | 20.1017   | 19.6775   | 19.0444   | 18.5462 (93)               |
| -----                                                                               |                                                                                |           |           |            |               |               |           |           |           |           |           |                            |
| 8. Space heating requirement                                                        |                                                                                |           |           |            |               |               |           |           |           |           |           |                            |
| -----                                                                               |                                                                                |           |           |            |               |               |           |           |           |           |           |                            |
| Utilisation                                                                         | 0.9812                                                                         | 0.9675    | 0.9328    | 0.8500     | 0.7030        | 0.5128        | 0.3536    | 0.4032    | 0.6645    | 0.8967    | 0.9683    | 0.9845 (94)                |
| Useful gains                                                                        | 703.4126                                                                       | 788.0945  | 865.4259  | 890.8556   | 791.5842      | 567.1238      | 373.2358  | 392.0586  | 581.8743  | 683.2845  | 668.4980  | 670.9181 (95)              |
| Ext temp.                                                                           | 4.3000                                                                         | 4.9000    | 6.5000    | 8.9000     | 11.7000       | 14.6000       | 16.6000   | 16.4000   | 14.1000   | 10.6000   | 7.1000    | 4.2000 (96)                |
| Heat loss rate W                                                                    | 1515.8941                                                                      | 1473.7586 | 1343.7850 | 1136.0369  | 874.6314      | 582.8930      | 375.5223  | 396.1655  | 629.4641  | 952.0649  | 1252.7501 | 1504.6519 (97)             |
| Space heating kWh                                                                   | 604.4862                                                                       | 460.7663  | 355.8992  | 176.5305   | 61.7871       | 0.0000        | 0.0000    | 0.0000    | 0.0000    | 199.9726  | 420.6615  | 620.2980 (98a)             |
| Space heating requirement - total per year (kWh/year)                               |                                                                                |           |           |            |               |               |           |           |           |           |           | 2900.4015                  |
| Solar heating kWh                                                                   | 0.0000                                                                         | 0.0000    | 0.0000    | 0.0000     | 0.0000        | 0.0000        | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000 (98b)               |
| Solar heating contribution - total per year (kWh/year)                              |                                                                                |           |           |            |               |               |           |           |           |           |           | 0.0000                     |
| Space heating kWh                                                                   | 604.4862                                                                       | 460.7663  | 355.8992  | 176.5305   | 61.7871       | 0.0000        | 0.0000    | 0.0000    | 0.0000    | 199.9726  | 420.6615  | 620.2980 (98c)             |
| Space heating requirement after solar contribution - total per year (kWh/year)      |                                                                                |           |           |            |               |               |           |           |           |           |           | 2900.4015                  |
| Space heating per m2                                                                |                                                                                |           |           |            |               |               |           |           |           |           |           | (98c) / (4) = 30.5885 (99) |

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## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                                                      |          |          |          |          |          |          |          |          |          |          |          |                 |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (201)    |
| Fraction of space heat from main system(s)                                                           |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (202)    |
| Efficiency of main space heating system 1 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 91.7000 (206)   |
| Efficiency of main space heating system 2 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)    |
| Efficiency of secondary/supplementary heating system, %                                              |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)    |
|                                                                                                      | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec             |
| Space heating requirement                                                                            | 604.4862 | 460.7663 | 355.8992 | 176.5305 | 61.7871  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 199.9726 | 420.6615 | 620.2980 (98)   |
| Space heating efficiency (main heating system 1)                                                     | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 91.7000  | 91.7000  | 91.7000 (210)   |
| Space heating fuel (main heating system)                                                             | 659.1998 | 502.4715 | 388.1126 | 192.5088 | 67.3796  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 218.0726 | 458.7366 | 676.4427 (211)  |
| Space heating efficiency (main heating system 2)                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)    |
| Space heating fuel (main heating system 2)                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)    |
| Space heating fuel (secondary)                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)    |
| Water heating                                                                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| Water heating requirement                                                                            | 204.9526 | 180.4725 | 190.2991 | 164.5092 | 157.4266 | 139.6815 | 136.5416 | 143.3578 | 146.4181 | 165.8134 | 179.3286 | 202.4003 (64)   |
| Efficiency of water heater (217)m                                                                    | 88.2587  | 88.1988  | 88.0569  | 87.7745  | 87.2818  | 86.7000  | 86.7000  | 86.7000  | 86.7000  | 87.8356  | 88.1618  | 88.2740 (217)   |
| Fuel for water heating, kWh/month                                                                    | 232.2180 | 204.6202 | 216.1092 | 187.4227 | 180.3660 | 161.1090 | 157.4874 | 165.3492 | 168.8790 | 188.7770 | 203.4086 | 229.2864 (219)  |
| Space cooling fuel requirement                                                                       |          |          |          |          |          |          |          |          |          |          |          |                 |
| (221)m                                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)    |
| Pumps and Fa                                                                                         | 11.2600  | 10.1703  | 11.2600  | 10.8967  | 11.2600  | 10.8967  | 11.2600  | 11.2600  | 10.8967  | 11.2600  | 10.8967  | 11.2600 (231)   |
| Lighting                                                                                             | 24.7371  | 19.8450  | 17.8683  | 13.0911  | 10.1119  | 8.2615   | 9.2244   | 11.9903  | 15.5742  | 20.4341  | 23.0803  | 25.4247 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| (233a)m                                                                                              | -13.8577 | -22.9196 | -39.1412 | -51.1890 | -60.7330 | -58.6935 | -57.5786 | -51.1723 | -40.7967 | -28.6393 | -16.1851 | -11.5083 (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |          |          |          |          |          |          |          |          |                 |
| (234a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |          |          |          |          |          |          |          |          |                 |
| (235a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |          |          |          |          |          |          |          |          |                 |
| (235c)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| (233b)m                                                                                              | -3.5626  | -8.8909  | -21.7125 | -39.0614 | -57.5840 | -60.2478 | -58.6981 | -46.0086 | -29.1122 | -13.8994 | -5.0330  | -2.6869 (233b)  |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |          |          |          |          |          |          |          |          |                 |
| (234b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234b)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |          |          |          |          |          |          |          |          |                 |
| (235b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |          |          |          |          |          |          |          |          |                 |
| (235d)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235d)   |
| Annual totals kWh/year                                                                               |          |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating fuel - main system 1                                                                   |          |          |          |          |          |          |          |          |          |          |          | 3162.9242 (211) |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)    |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)    |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          | 86.7000         |
| Water heating fuel used                                                                              |          |          |          |          |          |          |          |          |          |          |          | 2295.0326 (219) |
| Space cooling fuel                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (221)    |
| Electricity for pumps and fans:                                                                      |          |          |          |          |          |          |          |          |          |          |          |                 |
| (MEV)Decentralised, Database: total watage = 6.9420, total flow = 45.0000, SFP = 0.1543)             |          |          |          |          |          |          |          |          |          |          |          |                 |
| mechanical ventilation fans (SFP = 0.1543)                                                           |          |          |          |          |          |          |          |          |          |          |          | 46.5771 (230a)  |
| central heating pump                                                                                 |          |          |          |          |          |          |          |          |          |          |          | 41.0000 (230c)  |
| main heating flue fan                                                                                |          |          |          |          |          |          |          |          |          |          |          | 45.0000 (230e)  |
| Total electricity for the above, kWh/year                                                            |          |          |          |          |          |          |          |          |          |          |          | 132.5771 (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |          |          |          |          |          |          |          |          |          |          |          | 199.6429 (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| PV generation                                                                                        |          |          |          |          |          |          |          |          |          |          |          | -798.9117 (233) |
| Wind generation                                                                                      |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (234)    |
| Hydro-electric generation (Appendix N)                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (235a)   |
| Electricity generated - Micro CHP (Appendix N)                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (235)    |
| Appendix Q - special features                                                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| Energy saved or generated                                                                            |          |          |          |          |          |          |          |          |          |          |          | -0.0000 (236)   |
| Energy used                                                                                          |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (237)    |
| Total delivered energy for all uses                                                                  |          |          |          |          |          |          |          |          |          |          |          | 4991.2650 (238) |

## 10a. Fuel costs - using Table 12 prices

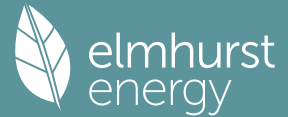
|                                             | Fuel kWh/year | Fuel price p/kWh | Fuel cost £/year |
|---------------------------------------------|---------------|------------------|------------------|
| Space heating - main system 1               | 3162.9242     | 3.6400           | 115.1304 (240)   |
| Total CO2 associated with community systems |               |                  | 0.0000 (473)     |
| Water heating (other fuel)                  | 2295.0326     | 3.6400           | 83.5392 (247)    |
| Energy for instantaneous electric shower(s) | 0.0000        | 16.4900          | 0.0000 (247a)    |
| Pumps, fans and electric keep-hot           | 132.5771      | 16.4900          | 21.8620 (249)    |
| Energy for lighting                         | 199.6429      | 16.4900          | 32.9211 (250)    |
| Additional standing charges                 |               |                  | 92.0000 (251)    |
| Energy saving/generation technologies       |               |                  |                  |
| PV Unit electricity used in dwelling        | -452.4142     | 16.4900          | -74.6031         |
| PV Unit electricity exported                | -346.4975     | 5.5900           | -19.3692         |
| Total                                       |               |                  | -93.9723 (252)   |
| Total energy cost                           |               |                  | 251.4804 (255)   |

## 11a. SAP rating - Individual heating systems

|                                  |  |              |
|----------------------------------|--|--------------|
| Energy cost deflator (Table 12): |  | 0.3600 (256) |
| Energy cost factor (ECF)         |  | 0.6475 (257) |
| SAP value                        |  | 89.5041      |
| SAP rating (Section 12)          |  | 90 (258)     |
| SAP band                         |  | B            |

$$[(255) \times (256)] / [(4) + 45.0] =$$

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## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|---------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1               | 3162.9242          | 0.2100                        | 664.2141 (261)           |
| Total CO2 associated with community systems |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                  | 2295.0326          | 0.2100                        | 481.9569 (264)           |
| Space and water heating                     |                    |                               | 1146.1709 (265)          |
| Pumps, fans and electric keep-hot           | 132.5771           | 0.1387                        | 18.3901 (267)            |
| Energy for lighting                         | 199.6429           | 0.1443                        | 28.8146 (268)            |
| Energy saving/generation technologies       |                    |                               |                          |
| PV Unit electricity used in dwelling        | -452.4142          | 0.1318                        | -59.6090                 |
| PV Unit electricity exported                | -346.4975          | 0.1217                        | -42.1576                 |
| Total                                       |                    |                               | -101.7666 (269)          |
| Total CO2, kg/year                          |                    |                               | 1091.6090 (272)          |
| CO2 emissions per m2                        |                    |                               | 11.5100 (273)            |
| EI value                                    |                    |                               | 89.5383                  |
| EI rating                                   |                    |                               | 90 (274)                 |
| EI band                                     |                    |                               | B                        |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m2) | Storey height<br>(m)              | Volume<br>(m3)         |
|--------------------------------------------------------|--------------|-----------------------------------|------------------------|
| Main dwelling                                          |              |                                   |                        |
| Ground floor                                           | 47.4100 (1b) | x 2.4600 (2b)                     | = 116.6286 (1b) - (3b) |
| First floor                                            | 47.4100 (1c) | x 2.7600 (2c)                     | = 130.8516 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 94.8200      |                                   | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 247.4802 (5)           |

## 2. Ventilation rate

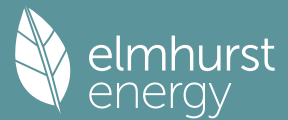
|                                                                                                    | m3 per hour                             |
|----------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                    |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                    |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                    |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                    |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                    |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                    |
| Number of intermittent extract fans                                                                | 0 * 10 = 0.0000 (7a)                    |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)                    |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 0.0000 / (5) = 0.0000 (8)               |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 4.5000 (17)                             |
| Infiltration rate                                                                                  | 0.2250 (18)                             |
| Number of sides sheltered                                                                          | 1 (19)                                  |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 0.9250 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.2081 (21)        |

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | 4.2000 | 4.0000 | 4.0000 | 3.7000 | 3.7000 | 3.3000 | 3.4000 | 3.2000 | 3.3000 | 3.5000 | 3.5000 | 3.8000 (22)  |
| Wind factor                                                                                             | 1.0500 | 1.0000 | 1.0000 | 0.9250 | 0.9250 | 0.8250 | 0.8500 | 0.8000 | 0.8250 | 0.8750 | 0.8750 | 0.9500 (22a) |
| Adj infilt rate                                                                                         | 0.2185 | 0.2081 | 0.2081 | 0.1925 | 0.1925 | 0.1717 | 0.1769 | 0.1665 | 0.1717 | 0.1821 | 0.1821 | 0.1977 (22b) |
| Mechanical extract ventilation - decentralised                                                          |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        |              |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 (25)  |

## 3. Heat losses and heat loss parameter

| Element                                           | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K | A x U<br>W/K         | K-value<br>kJ/m2K | A x K<br>kJ/K                                        |
|---------------------------------------------------|-------------|----------------|---------------|------------------|----------------------|-------------------|------------------------------------------------------|
| Main dwelling                                     |             |                |               |                  |                      |                   |                                                      |
| Front Door                                        |             |                | 2.2300        | 1.2000           | 2.6760               |                   | (26)                                                 |
| Windows                                           |             |                | 10.7600       | 1.2357           | 13.2966              |                   | (27)                                                 |
| French Doors                                      |             |                | 5.2200        | 1.2357           | 6.4506               |                   | (27)                                                 |
| GF SPVL 125TS P/A                                 |             |                | 47.4100       | 0.1300           | 6.1633               | 75.0000           | 3555.7500 (28a)                                      |
| EW Brick AAC011                                   | 151.6400    | 18.2100        | 133.4300      | 0.1800           | 24.0174              | 60.0000           | 8005.8000 (29a)                                      |
| PR 500mm MW044                                    | 47.4100     |                | 47.4100       | 0.0900           | 4.2669               | 9.0000            | 426.6900 (30)                                        |
| Total net area of external elements Aum(A, m2)    |             |                | 246.4600      |                  |                      |                   | (31)                                                 |
| Fabric heat loss, W/K = Sum (A x U)               |             |                |               |                  | (26)...(30) + (32) = | 56.8707           | (33)                                                 |
| Main dwelling                                     |             |                |               |                  |                      |                   |                                                      |
| Timber - GF                                       |             |                | 24.2600       |                  |                      | 9.0000            | 218.3400 (32c)                                       |
| Timber - FF                                       |             |                | 140.7000      |                  |                      | 9.0000            | 1266.3000 (32c)                                      |
| Masonry GF                                        |             |                | 51.5100       |                  |                      | 100.0000          | 5151.0000 (32c)                                      |
| Internal Floor FF                                 |             |                | 47.4100       |                  |                      | 18.0000           | 853.3800 (32d)                                       |
| Internal Ceiling GF                               |             |                | 47.4100       |                  |                      | 9.0000            | 426.6900 (32e)                                       |
| Heat capacity Cm = Sum(A x k)                     |             |                |               |                  |                      |                   | (28)...(30) + (32) + (32a)...(32e) = 19903.9500 (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K |             |                |               |                  |                      |                   | 209.9130 (35)                                        |

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## List of Thermal Bridges

|                                                                  | Length  | Psi-value             | Total          |
|------------------------------------------------------------------|---------|-----------------------|----------------|
| K1 Element                                                       |         |                       |                |
| E2 Other lintels (including other steel lintels)                 | 11.9100 | 0.0410                | 0.4883         |
| E3 Sill                                                          | 9.4200  | 0.0220                | 0.2072         |
| E4 Jamb                                                          | 22.0500 | 0.0190                | 0.4189         |
| E5 Ground floor (normal)                                         | 12.0200 | 0.0928                | 1.1155         |
| E6 Intermediate floor within a dwelling                          | 29.0500 | 0.0020                | 0.0581         |
| E10 Eaves (insulation at ceiling level)                          | 9.1500  | 0.0390                | 0.3569         |
| E18 Party wall between dwellings                                 | 0.0000  | 0.0300                | 0.0000         |
| E4 Jamb                                                          | 4.2000  | 0.1000                | 0.4200         |
| E2 Other lintels (including other steel lintels)                 | 1.0600  | 0.0410                | 0.0435         |
| P1 Party wall - Ground floor                                     | 0.0000  | 0.1000                | 0.0000         |
| P2 Party wall - Intermediate floor within a dwelling             | 0.0000  | 0.0000                | 0.0000         |
| P4 Party wall - Roof (insulation at ceiling level)               | 0.0000  | 0.0350                | 0.0000         |
| E5 Ground floor (normal)                                         | 17.0300 | 0.0980                | 1.6689         |
| E12 Gable (insulation at ceiling level)                          | 19.9000 | 0.0870                | 1.7313         |
| E16 Corner (normal)                                              | 26.1000 | 0.0420                | 1.0962         |
| E17 Corner (inverted - internal area greater than external area) | 5.2200  | -0.0820               | -0.4280        |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)       |         |                       | 7.1768 (36)    |
| Point Thermal bridges                                            |         |                       | (36a) = 0.0000 |
| Total fabric heat loss                                           |         | (33) + (36) + (36a) = | 64.0475 (37)   |

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

|                           | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |          |
|---------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| (38)m                     | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | 40.8342  | (38)     |
| Heat transfer coeff       | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | 104.8817 | (39)     |
| Average = Sum(39)m / 12 = |          |          |          |          |          |          |          |          |          |          |          |          | 104.8817 |
| HLP                       | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | 1.1061   | (40)     |
| HLP (average)             |          |          |          |          |          |          |          |          |          |          |          |          | 1.1061   |
| Days in mont              | 31       | 28       | 31       | 30       | 31       | 30       | 31       | 31       | 30       | 31       | 30       | 31       |          |

## 4. Water heating energy requirements (kWh/year)

|                                                                                |          |          |          |          |          |          |          |          |          |          |          |          |               |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Assumed occupancy                                                              |          |          |          |          |          |          |          |          |          |          |          |          | 2.6861 (42)   |
| Hot water usage for mixer showers                                              |          |          |          |          |          |          |          |          |          |          |          |          |               |
| 69.2572                                                                        | 68.2164  | 66.6997  | 63.7979  | 61.6564  | 59.2683  | 57.9108  | 59.4160  | 61.0660  | 63.6301  | 66.5943  | 68.9918  | 68.9918  | (42a)         |
| Hot water usage for baths                                                      |          |          |          |          |          |          |          |          |          |          |          |          |               |
| 29.9061                                                                        | 29.4619  | 28.8365  | 27.6833  | 26.8197  | 25.8622  | 25.3450  | 25.9661  | 26.6424  | 27.6669  | 28.8439  | 29.8050  | 29.8050  | (42b)         |
| Hot water usage for other uses                                                 |          |          |          |          |          |          |          |          |          |          |          |          |               |
| 42.1386                                                                        | 40.6063  | 39.0739  | 37.5416  | 36.0093  | 34.4770  | 34.4770  | 36.0093  | 37.5416  | 39.0739  | 40.6063  | 42.1386  | 42.1386  | (42c)         |
| Average daily hot water use (litres/day)                                       |          |          |          |          |          |          |          |          |          |          |          |          | 129.8883 (43) |
| Daily hot water use                                                            |          |          |          |          |          |          |          |          |          |          |          |          |               |
| 141.3019                                                                       | 138.2846 | 134.6102 | 129.0228 | 124.4855 | 119.6075 | 117.7329 | 121.3914 | 125.2500 | 130.3710 | 136.0444 | 140.9354 | 140.9354 | (44)          |
| Energy conte                                                                   | 223.7876 | 196.9154 | 206.8908 | 176.6258 | 167.5814 | 147.0714 | 150.3080 | 154.4457 | 176.9122 | 193.8202 | 220.6708 | 220.6708 | (45)          |
| Energy content (annual)                                                        |          |          |          |          |          |          |          |          |          |          |          |          |               |
| Distribution loss (46)m = 0.15 x (45)m                                         |          |          |          |          |          |          |          |          |          |          |          |          |               |
| 33.5681                                                                        | 29.5373  | 31.0336  | 26.4939  | 25.1372  | 22.0607  | 21.3582  | 22.5462  | 23.1669  | 26.5368  | 29.0730  | 33.1006  | 33.1006  | (46)          |
| Water storage loss (or HIU loss):                                              |          |          |          |          |          |          |          |          |          |          |          |          |               |
| Total storage loss                                                             |          |          |          |          |          |          |          |          |          |          |          |          |               |
| 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (56)          |
| If cylinder contains dedicated solar storage                                   |          |          |          |          |          |          |          |          |          |          |          |          |               |
| 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (57)          |
| Primary loss                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (59)          |
| Combi loss                                                                     | 12.0010  | 10.8287  | 11.9655  | 11.5300  | 11.8830  | 11.4679  | 11.8301  | 11.8467  | 11.4834  | 11.9026  | 11.5661  | 11.9945  | (61)          |
| Total heat required for water heating calculated for each month                |          |          |          |          |          |          |          |          |          |          |          |          |               |
| 235.7886                                                                       | 207.7441 | 218.8564 | 188.1558 | 179.4644 | 158.5393 | 154.2178 | 162.1547 | 165.9291 | 188.8148 | 205.3864 | 232.6653 | 232.6653 | (62)          |
| WWHRS                                                                          | -30.8360 | -27.2716 | -28.5573 | -23.6466 | -22.0378 | -18.8579 | -17.6762 | -18.7969 | -19.5111 | -23.0014 | -26.0578 | -30.2650 | (63a)         |
| PV diverter                                                                    | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | (63b)         |
| Solar input                                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (63c)         |
| FGHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (63d)         |
| Output from w/h                                                                |          |          |          |          |          |          |          |          |          |          |          |          |               |
| 204.9526                                                                       | 180.4725 | 190.2991 | 164.5092 | 157.4266 | 139.6815 | 136.5416 | 143.3578 | 146.4181 | 165.8134 | 179.3286 | 202.4003 | 202.4003 | (64)          |
| Electric shower(s)                                                             |          |          |          |          |          |          |          |          |          |          |          |          |               |
| 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (64a)         |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (64a)  |
| Heat gains from water heating, kWh/month                                       |          |          |          |          |          |          |          |          |          |          |          |          |               |
| 77.4096                                                                        | 68.1815  | 71.7826  | 61.6106  | 58.6916  | 51.7682  | 50.3014  | 52.9391  | 54.2241  | 61.7990  | 67.3368  | 76.3717  | 76.3717  | (65)          |

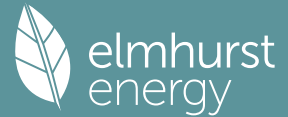
## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |           |           |           |           |           |           |           |           |           |           |           |           |      |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------|
| Metabolic gains (Table 5), Watts                                                    |           |           |           |           |           |           |           |           |           |           |           |           |      |
| (66)m                                                                               | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | 161.1673  | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     |           |           |           |           |           |           |           |           |           |           |           |           |      |
| 28.2615                                                                             | 25.1016   | 20.4140   | 15.4547   | 11.5526   | 9.7532    | 10.5387   | 13.6985   | 18.3862   | 23.3454   | 27.2476   | 29.0470   | 29.0470   | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 |           |           |           |           |           |           |           |           |           |           |           |           |      |
| 369.6589                                                                            | 373.4948  | 363.8284  | 343.2499  | 317.2732  | 292.8588  | 276.5485  | 272.7126  | 282.3789  | 302.9575  | 328.9341  | 353.3486  | 353.3486  | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    |           |           |           |           |           |           |           |           |           |           |           |           |      |
| 53.8029                                                                             | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | 53.8029   | (69) |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 3.0000    | 3.0000    | 3.0000    | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 |           |           |           |           |           |           |           |           |           |           |           |           |      |
| -107.4449                                                                           | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | -107.4449 | (71) |
| Water heating gains (Table 5)                                                       |           |           |           |           |           |           |           |           |           |           |           |           |      |
| 104.0452                                                                            | 101.4606  | 96.4820   | 85.5702   | 78.8865   | 71.9003   | 67.6095   | 71.1547   | 75.3112   | 83.0631   | 93.5233   | 102.6501  | 102.6501  | (72) |
| Total internal gains                                                                |           |           |           |           |           |           |           |           |           |           |           |           |      |
| 612.4909                                                                            | 610.5823  | 591.2497  | 554.8002  | 518.2376  | 482.0376  | 462.2219  | 465.0911  | 483.6016  | 519.8913  | 560.2303  | 595.5709  | 595.5709  | (73) |

## 6. Solar gains

| [Jan] | Area<br>m <sup>2</sup> | Solar flux<br>Table 6a<br>W/m <sup>2</sup> | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W   |
|-------|------------------------|--------------------------------------------|-----------------------------------|------------------------------------|------------------------------|--------------|
| North | 1.3900                 | 11.9814                                    | 0.4500                            | 0.0000                             | 0.7700                       | 5.7707 (74)  |
| East  | 4.1200                 | 22.3313                                    | 0.4500                            | 0.0000                             | 0.7700                       | 31.8797 (76) |

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|      |        |         |        |        |        |              |
|------|--------|---------|--------|--------|--------|--------------|
| West | 5.2500 | 22.3313 | 0.4500 | 0.0000 | 0.7700 | 40.6235 (80) |
| East | 5.2200 | 22.3313 | 0.4500 | 0.0000 | 0.7700 | 40.3913 (76) |

|             |          |          |          |           |           |           |           |           |          |          |          |               |
|-------------|----------|----------|----------|-----------|-----------|-----------|-----------|-----------|----------|----------|----------|---------------|
| Solar gains | 118.6652 | 208.6660 | 339.5574 | 511.6799  | 613.0465  | 672.9016  | 633.1510  | 554.4153  | 428.4009 | 264.3288 | 151.5207 | 96.6906 (83)  |
| Total gains | 731.1561 | 819.2483 | 930.8072 | 1066.4801 | 1131.2842 | 1154.9392 | 1095.3729 | 1019.5064 | 912.0025 | 784.2201 | 711.7510 | 692.2615 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |                           |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |                           |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |                           |         |         |              |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep                       | Oct     | Nov     | Dec          |
| tau                                                                         | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153 | 52.7153                   | 52.7153 | 52.7153 | 52.7153      |
| alpha                                                                       | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144  | 4.5144                    | 4.5144  | 4.5144  | 4.5144       |
| util living area                                                            | 0.9863  | 0.9764  | 0.9441  | 0.8526  | 0.6801  | 0.4469  | 0.2960  | 0.3277  | 0.6270                    | 0.8985  | 0.9739  | 0.9889 (86)  |
| MIT                                                                         | 19.6061 | 19.7994 | 20.1936 | 20.6246 | 20.8974 | 20.9879 | 20.9986 | 20.9978 | 20.9463                   | 20.5857 | 20.0129 | 19.5523 (87) |
| Th 2                                                                        | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958 | 19.9958                   | 19.9958 | 19.9958 | 19.9958 (88) |
| util rest of house                                                          | 0.9825  | 0.9700  | 0.9289  | 0.8157  | 0.6130  | 0.3605  | 0.2006  | 0.2257  | 0.5340                    | 0.8627  | 0.9653  | 0.9857 (89)  |
| MIT 2                                                                       | 18.5808 | 18.7968 | 19.2305 | 19.6791 | 19.9284 | 19.9912 | 19.9956 | 19.9955 | 19.9691                   | 19.6537 | 19.0384 | 18.5205 (90) |
| Living area fraction                                                        |         |         |         |         |         |         |         |         | fLA = Living area / (4) = |         |         | 0.1879 (91)  |
| MIT                                                                         | 18.7735 | 18.9852 | 19.4115 | 19.8568 | 20.1105 | 20.1785 | 20.1841 | 20.1839 | 20.1527                   | 19.8289 | 19.2215 | 18.7144 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |                           |         |         | 0.0000       |
| adjusted MIT                                                                | 18.7735 | 18.9852 | 19.4115 | 19.8568 | 20.1105 | 20.1785 | 20.1841 | 20.1839 | 20.1527                   | 19.8289 | 19.2215 | 18.7144 (93) |

## 8. Space heating requirement

|                                                                                |           |           |           |           |          |          |          |          |          |               |           |                 |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|---------------|-----------|-----------------|
| Utilisation                                                                    | 0.9760    | 0.9614    | 0.9179    | 0.8099    | 0.6212   | 0.3765   | 0.2185   | 0.2449   | 0.5493   | 0.8555        | 0.9565    | Dec 0.9800 (94) |
| Useful gains                                                                   | 713.6053  | 787.6341  | 854.4125  | 863.7867  | 702.7023 | 434.8098 | 239.3672 | 249.6911 | 501.0070 | 670.9366      | 680.7650  | 678.4296 (95)   |
| Ext temp.                                                                      | 5.1000    | 5.6000    | 7.4000    | 9.9000    | 13.0000  | 16.0000  | 17.9000  | 17.8000  | 15.2000  | 11.6000       | 8.0000    | 5.1000 (96)     |
| Heat loss rate W                                                               | 1434.1030 | 1403.8641 | 1259.7883 | 1044.2844 | 745.7652 | 438.2515 | 239.5632 | 250.0225 | 519.4504 | 863.0595      | 1176.9311 | 1427.9061 (97)  |
| Space heating kWh                                                              | 536.0503  | 414.1066  | 301.5996  | 129.9584  | 32.0388  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 142.9395      | 357.2396  | 557.6105 (98a)  |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |          |          |          |          |          |               |           | 2471.5431       |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | 0.0000 (98b)    |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |           |          |          |          |          |          |               |           | 0.0000          |
| Space heating kWh                                                              | 536.0503  | 414.1066  | 301.5996  | 129.9584  | 32.0388  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 142.9395      | 357.2396  | 557.6105 (98c)  |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |          |          |          |          |          |               |           | 2471.5431       |
| Space heating per m2                                                           |           |           |           |           |          |          |          |          |          | (98c) / (4) = |           | 26.0656 (99)    |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                                                      |          |          |          |          |          |          |          |          |          |          |          |                 |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (201)    |
| Fraction of space heat from main system(s)                                                           |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (202)    |
| Efficiency of main space heating system 1 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 91.7000 (206)   |
| Efficiency of main space heating system 2 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)    |
| Efficiency of secondary/supplementary heating system, %                                              |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)    |
|                                                                                                      | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec             |
| Space heating requirement                                                                            | 536.0503 | 414.1066 | 301.5996 | 129.9584 | 32.0388  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 142.9395 | 357.2396 | 557.6105 (98)   |
| Space heating efficiency (main heating system 1)                                                     | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 91.7000  | 91.7000  | 91.7000 (210)   |
| Space heating fuel (main heating system)                                                             | 584.5695 | 451.5884 | 328.8981 | 141.7212 | 34.9387  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 155.8773 | 389.5742 | 608.0813 (211)  |
| Space heating efficiency (main heating system 2)                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)    |
| Space heating fuel (main heating system 2)                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)    |
| Space heating fuel (secondary)                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)    |
| Water heating requirement                                                                            | 204.9526 | 180.4725 | 190.2991 | 164.5092 | 157.4266 | 139.6815 | 136.5416 | 143.3578 | 146.4181 | 165.8134 | 179.3286 | 202.4003 (64)   |
| Efficiency of water heater (217)m                                                                    | 88.2091  | 88.1519  | 87.9756  | 87.6144  | 87.0481  | 86.7000  | 86.7000  | 86.7000  | 86.7000  | 87.6597  | 88.0869  | 86.7000 (216)   |
| Fuel for water heating, kWh/month                                                                    | 232.3487 | 204.7289 | 216.3089 | 187.7650 | 180.8502 | 161.1090 | 157.4874 | 165.3492 | 168.8790 | 189.1557 | 203.5814 | 229.3985 (219)  |
| Space cooling fuel requirement                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)    |
| Pumps and Fa                                                                                         | 11.2600  | 10.1703  | 11.2600  | 10.8967  | 11.2600  | 10.8967  | 11.2600  | 11.2600  | 10.8967  | 11.2600  | 10.8967  | 11.2600 (231)   |
| Lighting                                                                                             | 24.7371  | 19.8450  | 17.8683  | 13.0911  | 10.1119  | 8.2615   | 9.2244   | 11.9903  | 15.5742  | 20.4341  | 23.0803  | 25.4247 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | -15.6190 | -23.5119 | -39.6513 | -52.7819 | -61.3023 | -61.7585 | -60.2056 | -54.5131 | -43.7099 | -30.8996 | -18.5675 | -12.8750 (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | -4.3417  | -9.2903  | -22.2296 | -41.4662 | -58.7043 | -67.1664 | -64.5439 | -52.3765 | -33.2487 | -15.9167 | -6.3436  | -3.2295 (233b)  |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234b)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235d)   |
| Annual totals kWh/year                                                                               |          |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating fuel - main system 1                                                                   |          |          |          |          |          |          |          |          |          |          |          | 2695.2488 (211) |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)    |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)    |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          | 86.7000         |
| Water heating fuel used                                                                              |          |          |          |          |          |          |          |          |          |          |          | 2296.9618 (219) |
| Space cooling fuel                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (221)    |

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## Electricity for pumps and fans:

|                                                                                         |                |
|-----------------------------------------------------------------------------------------|----------------|
| (MEVDecentralised, Database: total watage = 6.9420, total flow = 45.0000, SFP = 0.1543) |                |
| mechanical ventilation fans (SFP = 0.1543)                                              | 46.5771 (230a) |
| central heating pump                                                                    | 41.0000 (230c) |
| main heating flue fan                                                                   | 45.0000 (230e) |
| Total electricity for the above, kWh/year                                               | 132.5771 (231) |
| Electricity for lighting (calculated in Appendix L)                                     | 199.6429 (232) |

## Energy saving/generation technologies (Appendices M ,N and Q)

|                                                |                 |
|------------------------------------------------|-----------------|
| PV generation                                  | -854.2531 (233) |
| Wind generation                                | 0.0000 (234)    |
| Hydro-electric generation (Appendix N)         | 0.0000 (235a)   |
| Electricity generated - Micro CHP (Appendix N) | 0.0000 (235)    |
| Appendix Q - special features                  |                 |
| Energy saved or generated                      | -0.0000 (236)   |
| Energy used                                    | 0.0000 (237)    |
| Total delivered energy for all uses            | 4470.1774 (238) |

## 10a. Fuel costs - using BEDF prices (596)

|                                             | Fuel<br>kWh/year | Fuel price<br>p/kWh | Fuel cost<br>£/year |
|---------------------------------------------|------------------|---------------------|---------------------|
| Space heating - main system 1               | 2695.2488        | 7.3200              | 197.2922 (240)      |
| Total CO2 associated with community systems |                  |                     | 0.0000 (473)        |
| Water heating (other fuel)                  | 2296.9618        | 7.3200              | 168.1376 (247)      |
| Energy for instantaneous electric shower(s) | 0.0000           | 27.6700             | 0.0000 (247a)       |
| Pumps, fans and electric keep-hot           | 132.5771         | 27.6700             | 36.6841 (249)       |
| Energy for lighting                         | 199.6429         | 27.6700             | 55.2412 (250)       |
| Additional standing charges                 |                  |                     | 108.0000 (251)      |
| Energy saving/generation technologies       |                  |                     |                     |
| PV Unit electricity used in dwelling        | -475.3956        | 27.6700             | -131.5419           |
| PV Unit electricity exported                | -378.8575        | 5.8100              | -22.0116            |
| Total                                       |                  |                     | -153.5536 (252)     |
| Total energy cost                           |                  |                     | 411.8015 (255)      |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|---------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1               | 2695.2488          | 0.2100                        | 566.0022 (261)           |
| Total CO2 associated with community systems |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                  | 2296.9618          | 0.2100                        | 482.3620 (264)           |
| Space and water heating                     |                    |                               | 1048.3642 (265)          |
| Pumps, fans and electric keep-hot           | 132.5771           | 0.1387                        | 18.3901 (267)            |
| Energy for lighting                         | 199.6429           | 0.1443                        | 28.8146 (268)            |
| Energy saving/generation technologies       |                    |                               |                          |
| PV Unit electricity used in dwelling        | -475.3956          | 0.1318                        | -62.6507                 |
| PV Unit electricity exported                | -378.8575          | 0.1212                        | -45.9143                 |
| Total                                       |                    |                               | -108.5651 (269)          |
| Total CO2, kg/year                          |                    |                               | 987.0038 (272)           |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1               | 2695.2488          | 1.1300                              | 3045.6311 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 2296.9618          | 1.1300                              | 2595.5668 (278)            |
| Space and water heating                     |                    |                                     | 5641.1979 (279)            |
| Pumps, fans and electric keep-hot           | 132.5771           | 1.5128                              | 200.5626 (281)             |
| Energy for lighting                         | 199.6429           | 1.5338                              | 306.2189 (282)             |
| Energy saving/generation technologies       |                    |                                     |                            |
| PV Unit electricity used in dwelling        | -475.3956          | 1.4869                              | -706.8613                  |
| PV Unit electricity exported                | -378.8575          | 0.4445                              | -168.4174                  |
| Total                                       |                    |                                     | -875.2787 (283)            |
| Total Primary energy kWh/year               |                    |                                     | 5272.7008 (286)            |

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|                                    |                                                          |               |        |                |            |
|------------------------------------|----------------------------------------------------------|---------------|--------|----------------|------------|
| Plot Reference                     | 4907-R823-9471-005                                       |               |        | Issued on Date | 21/07/2026 |
| Assessment Reference               | Plot 5                                                   | Plot Type Ref | Plot 5 |                |            |
| Plot Address                       | Plot 5, Beaconsfield-Semi, K, WC, B, ES, 1012            |               |        | SAP Version    | 10.2       |
| SAP Rating                         | 90 B                                                     | DER           | 11.13  | TER            | 11.53      |
| Environmental                      | 91 B                                                     | % DER < TER   |        |                | 3.47       |
| CO <sub>2</sub> Emissions (t/year) | 0.85                                                     | DFEE          | 34.39  | TFEE           | 36.96      |
| Compliance Check                   | See BREL                                                 | % DFEE < TFEE |        |                | 6.96       |
| % DPER < TPER                      | 0.74                                                     | DPER          | 59.80  | TPER           | 60.25      |
| Assessor Details                   | Mr. Daniel Harris                                        |               |        | Assessor ID    | R823-0001  |
| Client                             | Crest Nicholson Head Office, Crest Nicholson Head Office |               |        |                |            |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)            | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Main dwelling                                          |                           |                                 |                             |
| Ground floor                                           | 42.9900 (1b)              | x 2.4600 (2b)                   | = 105.7554 (1b) - (3b)      |
| First floor                                            | 42.9900 (1c)              | x 2.7600 (2c)                   | = 118.6524 (1c) - (3c)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 85.9800                   |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 224.4078 (5)              |

## 2. Ventilation rate

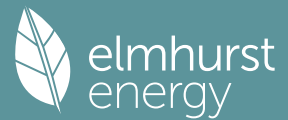
|                                                                                                    | m <sup>3</sup> per hour                 |
|----------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                    |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                    |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                    |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                    |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                    |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                    |
| Number of intermittent extract fans                                                                | 0 * 10 = 0.0000 (7a)                    |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)                    |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 0.0000 / (5) = 0.0000 (8)               |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 4.5000 (17)                             |
| Infiltration rate                                                                                  | 0.2250 (18)                             |
| Number of sides sheltered                                                                          | 2 (19)                                  |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 0.8500 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.1913 (21)        |

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor                                                                                             | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate                                                                                         | 0.2438 | 0.2391 | 0.2343 | 0.2104 | 0.2056 | 0.1817 | 0.1817 | 0.1769 | 0.1913 | 0.2056 | 0.2152 | 0.2247 (22b) |
| Mechanical extract ventilation - decentralised                                                          |        |        |        |        |        |        |        |        |        |        |        |              |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 (25)  |

## 3. Heat losses and heat loss parameter

| Element                                                      | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K   |
|--------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|-----------------|
| Main dwelling                                                |                         |                            |                           |                               |              |                                |                 |
| Front Door                                                   |                         |                            | 2.5500                    | 1.2000                        | 3.0600       |                                | (26)            |
| Windows                                                      |                         |                            | 10.2500                   | 1.2357                        | 12.6663      |                                | (27)            |
| French Doors                                                 |                         |                            | 3.3300                    | 1.2357                        | 4.1150       |                                | (27)            |
| GF SPVL 125TS P/A                                            |                         |                            | 42.9900                   | 0.1300                        | 5.5887       | 75.0000                        | 3224.2500 (28a) |
| EW Brick AAC011                                              | 97.2486                 | 16.1300                    | 81.1186                   | 0.1800                        | 14.6013      | 60.0000                        | 4867.1160 (29a) |
| PR 500mm MW044                                               | 42.9900                 |                            | 42.9900                   | 0.0900                        | 3.8691       | 9.0000                         | 386.9100 (30)   |
| Total net area of external elements Aum (A, m <sup>2</sup> ) |                         |                            | 183.2286                  |                               |              |                                | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                          |                         |                            | (26)...(30) + (32) =      |                               | 43.9005      |                                | (33)            |
| Main dwelling                                                |                         |                            |                           |                               |              |                                |                 |
| E-WM-30                                                      |                         |                            | 43.8000                   | 0.0000                        | 0.0000       | 45.0000                        | 1971.0000 (32)  |
| Timber - GF                                                  |                         |                            | 88.6100                   |                               |              | 9.0000                         | 797.4900 (32c)  |
| Timber - FF                                                  |                         |                            | 126.9000                  |                               |              | 9.0000                         | 1142.1000 (32c) |
| Internal Floor FF                                            |                         |                            | 42.9900                   |                               |              | 18.0000                        | 773.8200 (32d)  |
| Internal Ceiling GF                                          |                         |                            | 42.9900                   |                               |              | 9.0000                         | 386.9100 (32e)  |

# Full SAP Calculation Printout



Heat capacity  $C_m = \text{Sum}(A \times k)$   
Thermal mass parameter (TMP) =  $C_m / \text{TFA}$  in  $\text{kJ/m}^2\text{K}$   
List of Thermal Bridges

(28)...(30) + (32) + (32a)...(32e) = 13549.5960 (34)  
157.5901 (35)

|                                                      | Length  | Psi-value | Total  |
|------------------------------------------------------|---------|-----------|--------|
| K1 Element                                           |         |           |        |
| E2 Other lintels (including other steel lintels)     | 10.7800 | 0.0410    | 0.4420 |
| E3 Sill                                              | 9.2000  | 0.0220    | 0.2024 |
| E4 Jamb                                              | 21.1500 | 0.0190    | 0.4018 |
| E5 Ground floor (normal)                             | 10.2300 | 0.0928    | 0.9493 |
| E6 Intermediate floor within a dwelling              | 18.6300 | 0.0020    | 0.0373 |
| E10 Eaves (insulation at ceiling level)              | 10.2500 | 0.0390    | 0.3997 |
| E18 Party wall between dwellings                     | 10.4400 | 0.0330    | 0.3445 |
| E4 Jamb                                              | 4.8000  | 0.1000    | 0.4800 |
| E2 Other lintels (including other steel lintels)     | 1.0600  | 0.0410    | 0.0435 |
| P1 Party wall - Ground floor                         | 8.3900  | 0.1000    | 0.8390 |
| P2 Party wall - Intermediate floor within a dwelling | 8.3900  | 0.0000    | 0.0000 |
| P4 Party wall - Roof (insulation at ceiling level)   | 8.3900  | 0.0350    | 0.2937 |
| E5 Ground floor (normal)                             | 8.3900  | 0.0980    | 0.8222 |
| E12 Gable (insulation at ceiling level)              | 8.3900  | 0.0870    | 0.7299 |
| E16 Corner (normal)                                  | 10.4400 | 0.0420    | 0.4385 |

Thermal bridges (Sum(L x Psi) calculated using Appendix K)  
Point Thermal bridges (36a) = 6.4238 (36)  
Total fabric heat loss (33) + (36) + (36a) = 50.3244 (37)

|                                                                                        |         |         |         |         |         |         |         |         |         |         |         |         |      |
|----------------------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)\text{m} \times (5)$ | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |      |
| (38)m                                                                                  | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | (38) |
| Heat transfer coeff                                                                    | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | (39) |
| Average = Sum(39)m / 12 =                                                              |         |         |         |         |         |         |         |         |         |         |         | 87.3516 | (39) |
| HLP                                                                                    | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |      |
| HLP (average)                                                                          | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | (40) |
| Days in mont                                                                           | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31      |      |

## 4. Water heating energy requirements (kWh/year)

|                                                                 |          |          |          |          |          |          |          |          |          |                    |          |           |             |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------------------|----------|-----------|-------------|
| Assumed occupancy                                               |          |          |          |          |          |          |          |          |          |                    |          |           | 2.5666 (42) |
| Hot water usage for mixer showers                               |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| 67.2533                                                         | 66.2426  | 64.7698  | 61.9519  | 59.8724  | 57.5533  | 56.2352  | 57.6968  | 59.2990  | 61.7890  | 64.6674            | 66.9956  | (42a)     |             |
| Hot water usage for baths                                       |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| 29.0443                                                         | 28.6130  | 28.0055  | 26.8856  | 26.0469  | 25.1170  | 24.6147  | 25.2179  | 25.8746  | 26.8697  | 28.0127            | 28.9461  | (42b)     |             |
| Hot water usage for other uses                                  |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| 40.9146                                                         | 39.4268  | 37.9390  | 36.4512  | 34.9634  | 33.4756  | 33.4756  | 34.9634  | 36.4512  | 37.9390  | 39.4268            | 40.9146  | (42c)     |             |
| Average daily hot water use (litres/day)                        |          |          |          |          |          |          |          |          |          |                    |          | 126.1290  | (43)        |
| Daily hot water use                                             | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct                | Nov      | Dec       |             |
| 137.2122                                                        | 134.2823 | 130.7143 | 125.2887 | 120.8827 | 116.1459 | 114.3255 | 117.8781 | 121.6248 | 126.5977 | 132.1069           | 136.8563 | (44)      |             |
| Energy content (annual)                                         | 217.3105 | 191.2162 | 200.9030 | 171.5139 | 162.7313 | 142.8150 | 138.2667 | 145.9577 | 149.9756 | 171.7918           | 188.2105 | 214.2839  | (45)        |
| Distribution loss (46)m = 0.15 x (45)m                          |          |          |          |          |          |          |          |          |          | Total = Sum(45)m = |          | 2094.9763 |             |
| 32.5966                                                         | 28.6824  | 30.1355  | 25.7271  | 24.4097  | 21.4222  | 20.7400  | 21.8937  | 22.4963  | 25.7688  | 28.2316            | 32.1426  | (46)      |             |
| Water storage loss (or HIU loss):                               |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| Total storage loss                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | 0.0000    | (56)        |
| If cylinder contains dedicated solar storage                    |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| 0.0000                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | 0.0000    | (57)        |
| Primary loss                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | 0.0000    | (59)        |
| Combi loss                                                      | 11.9874  | 10.8167  | 11.9530  | 11.5193  | 11.8728  | 11.4590  | 11.8214  | 11.8376  | 11.4740  | 11.8918            | 11.5543  | 11.9811   | (61)        |
| Total heat required for water heating calculated for each month |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| 229.2979                                                        | 202.0330 | 212.8560 | 183.0332 | 174.6042 | 154.2740 | 150.0882 | 157.7953 | 161.4496 | 183.6836 | 199.7649           | 226.2650 | (62)      |             |
| WWHRS                                                           | -29.9438 | -26.4825 | -27.7310 | -22.9624 | -21.4001 | -18.3122 | -17.1648 | -18.2530 | -18.9465 | -22.3359           | -25.3038 | -29.3893  | (63a)       |
| PV diverter                                                     | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000            | -0.0000  | -0.0000   | (63b)       |
| Solar input                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | 0.0000    | (63c)       |
| FGHRS                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | 0.0000    | (63d)       |
| Output from w/h                                                 | 199.3541 | 175.5504 | 185.1250 | 160.0708 | 153.2041 | 135.9618 | 132.9234 | 139.5422 | 142.5031 | 161.3478           | 174.4610 | 196.8757  | (64)        |
| 12Total per year (kWh/year)                                     |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| Electric shower(s)                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | 0.0000    | (64a)       |
|                                                                 |          |          |          |          |          |          |          |          |          |                    |          | 1956.9195 | (64)        |
|                                                                 |          |          |          |          |          |          |          |          |          |                    |          | 1957      | (64)        |
|                                                                 |          |          |          |          |          |          |          |          |          |                    |          | 0.0000    | (64a)       |
|                                                                 |          |          |          |          |          |          |          |          |          |                    |          | 0.0000    | (64a)       |
| Heat gains from water heating, kWh/month                        |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| 75.2526                                                         | 66.2836  | 69.7885  | 59.9082  | 57.0764  | 50.3507  | 48.9291  | 51.4903  | 52.7354  | 60.0937  | 65.4686            | 74.2447  | (65)      |             |

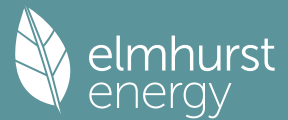
## 5. Internal gains (see Table 5 and 5a)

| Metabolic gains (Table 5), Watts                                                    |           |           |           |           |           |           |           |           |           |           |           |                |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
|                                                                                     | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec            |
| (66)m                                                                               | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     |           |           |           |           |           |           |           |           |           |           |           |                |
|                                                                                     | 122.1242  | 135.2090  | 122.1242  | 126.1950  | 122.1242  | 126.1950  | 122.1242  | 122.1242  | 126.1950  | 122.1242  | 126.1950  | 122.1242 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 |           |           |           |           |           |           |           |           |           |           |           |                |
|                                                                                     | 231.4847  | 233.8867  | 227.8336  | 214.9471  | 198.6802  | 183.3916  | 173.1779  | 170.7758  | 176.8289  | 189.7154  | 205.9823  | 221.2709 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    |           |           |           |           |           |           |           |           |           |           |           |                |
|                                                                                     | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330 (69)   |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 3.0000    | 3.0000    | 3.0000 (70)    |
| Losses e.g. evaporation (negative values) (Table 5)                                 |           |           |           |           |           |           |           |           |           |           |           |                |
|                                                                                     | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 (71) |
| Water heating gains (Table 5)                                                       |           |           |           |           |           |           |           |           |           |           |           |                |
|                                                                                     | 101.1460  | 98.6363   | 93.8018   | 83.2058   | 76.7156   | 69.9316   | 65.7649   | 69.2074   | 73.2436   | 80.7712   | 90.9286   | 99.7912 (72)   |
| Total internal gains                                                                |           |           |           |           |           |           |           |           |           |           |           |                |
|                                                                                     | 519.2539  | 532.2311  | 508.2586  | 488.8470  | 462.0190  | 441.0172  | 422.5660  | 423.6065  | 437.7667  | 457.1099  | 487.6050  | 507.6854 (73)  |

## 6. Solar gains

| [Jan] | Area<br>m <sup>2</sup> | Solar flux<br>Table 6a<br>W/m <sup>2</sup> | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W |
|-------|------------------------|--------------------------------------------|-----------------------------------|------------------------------------|------------------------------|------------|
|-------|------------------------|--------------------------------------------|-----------------------------------|------------------------------------|------------------------------|------------|

# Full SAP Calculation Printout



|       |  |  |        |  |         |  |        |  |        |  |        |  |              |
|-------|--|--|--------|--|---------|--|--------|--|--------|--|--------|--|--------------|
| North |  |  | 4.1200 |  | 10.6334 |  | 0.4500 |  | 0.0000 |  | 0.7700 |  | 15.1800 (74) |
| South |  |  | 5.6100 |  | 46.7521 |  | 0.4500 |  | 0.0000 |  | 0.7700 |  | 90.8797 (78) |
| West  |  |  | 0.5200 |  | 19.6403 |  | 0.4500 |  | 0.0000 |  | 0.7700 |  | 3.5388 (80)  |
| North |  |  | 3.3300 |  | 10.6334 |  | 0.4500 |  | 0.0000 |  | 0.7700 |  | 12.2693 (74) |

|             |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Solar gains | 121.8678 | 208.2172 | 290.1305 | 374.0852 | 436.5439 | 442.2258 | 422.5917 | 373.8995 | 318.4831 | 231.1927 | 145.9981 | 104.3216 (83) |
| Total gains | 641.1217 | 740.4482 | 798.3891 | 862.9322 | 898.5630 | 883.2430 | 845.1577 | 797.5060 | 756.2498 | 688.3026 | 633.6032 | 612.0071 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |                           |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |                           |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |                           |         |         |              |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep                       | Oct     | Nov     | Dec          |
| tau                                                                         | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876                   | 43.0876 | 43.0876 | 43.0876      |
| alpha                                                                       | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725                    | 3.8725  | 3.8725  | 3.8725       |
| util living area                                                            | 0.9763  | 0.9587  | 0.9308  | 0.8667  | 0.7529  | 0.5887  | 0.4428  | 0.4856  | 0.6965                    | 0.8884  | 0.9598  | 0.9800 (86)  |
| MIT                                                                         | 19.2875 | 19.5678 | 19.9236 | 20.3644 | 20.7207 | 20.9195 | 20.9792 | 20.9701 | 20.8438                   | 20.3893 | 19.7537 | 19.2157 (87) |
| Th 2                                                                        | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701                   | 20.0701 | 20.0701 | 20.0701 (88) |
| util rest of house                                                          | 0.9717  | 0.9508  | 0.9173  | 0.8405  | 0.7060  | 0.5168  | 0.3543  | 0.3949  | 0.6289                    | 0.8607  | 0.9507  | 0.9760 (89)  |
| MIT 2                                                                       | 18.3035 | 18.6160 | 19.0095 | 19.4838 | 19.8436 | 20.0200 | 20.0614 | 20.0567 | 19.9626                   | 19.5204 | 18.8278 | 18.2230 (90) |
| Living area fraction                                                        |         |         |         |         |         |         |         |         | FLA = Living area / (4) = |         |         | 0.1933 (91)  |
| MIT                                                                         | 18.4937 | 18.7999 | 19.1862 | 19.6540 | 20.0132 | 20.1939 | 20.2388 | 20.2333 | 20.1330                   | 19.6884 | 19.0068 | 18.4149 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |                           |         |         | 0.0000       |
| adjusted MIT                                                                | 18.4937 | 18.7999 | 19.1862 | 19.6540 | 20.0132 | 20.1939 | 20.2388 | 20.2333 | 20.1330                   | 19.6884 | 19.0068 | 18.4149 (93) |

## 8. Space heating requirement

|                                                                                |           |           |           |          |          |          |          |          |          |               |           |                |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|---------------|-----------|----------------|
|                                                                                | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov       | Dec            |
| Utilisation                                                                    | 0.9609    | 0.9369    | 0.9015    | 0.8271   | 0.7029   | 0.5268   | 0.3707   | 0.4113   | 0.6338   | 0.8473        | 0.9370    | 0.9662 (94)    |
| Useful gains                                                                   | 616.0355  | 693.6908  | 719.7806  | 713.6930 | 631.6192 | 465.2760 | 313.3241 | 328.0018 | 479.3454 | 583.1852      | 593.7109  | 591.3031 (95)  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000    | 4.2000 (96)    |
| Heat loss rate W                                                               | 1239.8438 | 1214.1832 | 1108.1605 | 939.3812 | 726.1686 | 488.6341 | 317.8571 | 334.8446 | 526.9901 | 793.8854      | 1040.0806 | 1241.6966 (97) |
| Space heating kWh                                                              | 464.1134  | 349.7709  | 288.9546  | 162.4955 | 70.3447  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 156.7609      | 321.3862  | 483.8927 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |          |          |          |          |          |          |               |           | 2297.7189      |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |          |          |          |          |          |          |               |           | 0.0000         |
| Space heating kWh                                                              | 464.1134  | 349.7709  | 288.9546  | 162.4955 | 70.3447  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 156.7609      | 321.3862  | 483.8927 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |          |          |          |          |          |          |               |           | 2297.7189      |
| Space heating per m2                                                           |           |           |           |          |          |          |          |          |          | (98c) / (4) = |           | 26.7239 (99)   |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                                                      |          |          |          |          |          |          |          |          |          |          |          |                 |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (201)    |
| Fraction of space heat from main system(s)                                                           |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (202)    |
| Efficiency of main space heating system 1 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 91.7000 (206)   |
| Efficiency of main space heating system 2 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)    |
| Efficiency of secondary/supplementary heating system, %                                              |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)    |
|                                                                                                      | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec             |
| Space heating requirement                                                                            | 464.1134 | 349.7709 | 288.9546 | 162.4955 | 70.3447  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 156.7609 | 321.3862 | 483.8927 (98)   |
| Space heating efficiency (main heating system 1)                                                     | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 91.7000  | 91.7000  | 91.7000 (210)   |
| Space heating fuel (main heating system)                                                             | 506.1215 | 381.4295 | 315.1086 | 177.2033 | 76.7118  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 170.9497 | 350.4757 | 527.6911 (211)  |
| Space heating efficiency (main heating system 2)                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)    |
| Space heating fuel (main heating system 2)                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)    |
| Space heating fuel (secondary)                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)    |
| Water heating                                                                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| Water heating requirement                                                                            | 199.3541 | 175.5504 | 185.1250 | 160.0708 | 153.2041 | 135.9618 | 132.9234 | 139.5422 | 142.5031 | 161.3478 | 174.4610 | 196.8757 (64)   |
| Efficiency of water heater (217)m                                                                    | 88.1584  | 88.0870  | 87.9680  | 87.7453  | 87.3500  | 86.7000  | 86.7000  | 86.7000  | 86.7000  | 87.7223  | 88.0496  | 88.1823 (216)   |
| Fuel for water heating, kWh/month                                                                    | 226.1318 | 199.2921 | 210.4459 | 182.4266 | 175.3910 | 156.8186 | 153.3142 | 160.9484 | 164.3635 | 183.9302 | 198.1394 | 223.2598 (219)  |
| Space cooling fuel requirement                                                                       |          |          |          |          |          |          |          |          |          |          |          |                 |
| (221)m                                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)    |
| Pumps and Fa                                                                                         | 10.9478  | 9.8883   | 10.9478  | 10.9478  | 10.9478  | 10.9478  | 10.9478  | 10.9478  | 10.9478  | 10.9478  | 10.9478  | 10.9478 (231)   |
| Lighting                                                                                             | 23.4106  | 18.7809  | 16.9101  | 12.3891  | 9.5697   | 7.8185   | 8.7298   | 11.3473  | 14.7390  | 19.3384  | 21.8427  | 24.0613 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| (233a)m                                                                                              | -14.6942 | -22.4007 | -34.8599 | -42.5373 | -48.8442 | -46.7030 | -46.0948 | -41.9719 | -35.2991 | -26.9662 | -16.7286 | -12.5110 (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |          |          |          |          |          |          |          |          |                 |
| (234a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |          |          |          |          |          |          |          |          |                 |
| (235a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |          |          |          |          |          |          |          |          |                 |
| (235c)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| (233b)m                                                                                              | -4.0882  | -8.9418  | -18.5200 | -29.0022 | -39.5369 | -40.1897 | -39.6495 | -32.9433 | -23.3746 | -13.1010 | -5.5501  | -3.2067 (233b)  |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |          |          |          |          |          |          |          |          |                 |
| (234b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234b)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |          |          |          |          |          |          |          |          |                 |
| (235b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |          |          |          |          |          |          |          |          |                 |
| (235d)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235d)   |
| Annual totals kWh/year                                                                               |          |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating fuel - main system 1                                                                   |          |          |          |          |          |          |          |          |          |          |          | 2505.6913 (211) |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)    |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)    |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          | 86.7000         |

# Full SAP Calculation Printout



|                                                                                         |                 |
|-----------------------------------------------------------------------------------------|-----------------|
| Water heating fuel used                                                                 | 2234.4615 (219) |
| Space cooling fuel                                                                      | 0.0000 (221)    |
| Electricity for pumps and fans:                                                         |                 |
| (MEVDecentralised, Database: total watage = 5.7980, total flow = 37.0000, SFP = 0.1567) |                 |
| mechanical ventilation fans (SFP = 0.1567)                                              | 42.9017 (230a)  |
| central heating pump                                                                    | 41.0000 (230c)  |
| main heating flue fan                                                                   | 45.0000 (230e)  |
| Total electricity for the above, kWh/year                                               | 128.9017 (231)  |
| Electricity for lighting (calculated in Appendix L)                                     | 188.9373 (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                           |                 |
| PV generation                                                                           | -647.7148 (233) |
| Wind generation                                                                         | 0.0000 (234)    |
| Hydro-electric generation (Appendix N)                                                  | 0.0000 (235a)   |
| Electricity generated - Micro CHP (Appendix N)                                          | 0.0000 (235)    |
| Appendix Q - special features                                                           |                 |
| Energy saved or generated                                                               | -0.0000 (236)   |
| Energy used                                                                             | 0.0000 (237)    |
| Total delivered energy for all uses                                                     | 4410.2770 (238) |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                                 | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|-------------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1                   | 2505.6913          | 0.2100                        | 526.1952 (261)           |
| Total CO2 associated with community systems     |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                      | 2234.4615          | 0.2100                        | 469.2369 (264)           |
| Space and water heating                         |                    |                               | 995.4321 (265)           |
| Pumps, fans and electric keep-hot               | 128.9017           | 0.1387                        | 17.8803 (267)            |
| Energy for lighting                             | 188.9373           | 0.1443                        | 27.2695 (268)            |
| Energy saving/generation technologies           |                    |                               |                          |
| PV Unit electricity used in dwelling            | -389.6109          | 0.1330                        | -51.8040                 |
| PV Unit electricity exported                    | -258.1039          | 0.1248                        | -32.1992                 |
| Total                                           |                    |                               | -84.0033 (269)           |
| Total CO2, kg/year                              |                    |                               | 956.5786 (272)           |
| EPC Dwelling Carbon Dioxide Emission Rate (DER) |                    |                               | 11.1300 (273)            |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1               | 2505.6913          | 1.1300                              | 2831.4312 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 2234.4615          | 1.1300                              | 2524.9415 (278)            |
| Space and water heating                     |                    |                                     | 5356.3727 (279)            |
| Pumps, fans and electric keep-hot           | 128.9017           | 1.5128                              | 195.0025 (281)             |
| Energy for lighting                         | 188.9373           | 1.5338                              | 289.7983 (282)             |
| Energy saving/generation technologies       |                    |                                     |                            |
| PV Unit electricity used in dwelling        | -389.6109          | 1.4913                              | -581.0334                  |
| PV Unit electricity exported                | -258.1039          | 0.4579                              | -118.1785                  |
| Total                                       |                    |                                     | -699.2119 (283)            |
| Total Primary energy kWh/year               |                    |                                     | 5141.9616 (286)            |
| Dwelling Primary energy Rate (DPER)         |                    |                                     | 59.8000 (287)              |

## SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF TARGET EMISSIONS

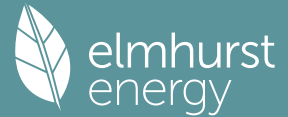
### 1. Overall dwelling characteristics

|                                                         | Area<br>(m2) | Storey height<br>(m)             | Volume<br>(m3)         |
|---------------------------------------------------------|--------------|----------------------------------|------------------------|
| Main dwelling                                           |              |                                  |                        |
| Ground floor                                            | 42.9900 (1b) | x 2.4600 (2b)                    | = 105.7554 (1b) - (3b) |
| First floor                                             | 42.9900 (1c) | x 2.7600 (2c)                    | = 118.6524 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)... (1n) | 85.9800      |                                  | (4)                    |
| Dwelling volume                                         |              | (3a)+(3b)+(3c)+(3d)+(3e)... (3n) | = 224.4078 (5)         |

### 2. Ventilation rate

|                                                                                                    | m3 per hour                |
|----------------------------------------------------------------------------------------------------|----------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)       |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)       |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)       |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)       |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)       |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)       |
| Number of intermittent extract fans                                                                | 3 * 10 = 30.0000 (7a)      |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)       |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)       |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 30.0000 / (5) = 0.1337 (8) |
| Pressure test                                                                                      | Yes                        |
| Pressure Test Method                                                                               | Blower Door                |
| Measured/design AP50                                                                               | 5.0000 (17)                |
| Infiltration rate                                                                                  | 0.3837 (18)                |
| Number of sides sheltered                                                                          | 2 (19)                     |

# Full SAP Calculation Printout



Shelter factor  
Infiltration rate adjusted to include shelter factor

$$(20) = 1 - [0.075 \times (19)] = 0.8500 \quad (20)$$

$$(21) = (18) \times (20) = 0.3261 \quad (21)$$

|                 | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |       |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|
| Wind speed      | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 | (22)  |
| Wind factor     | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 | (22a) |
| Adj infilt rate | 0.4158 | 0.4077 | 0.3995 | 0.3587 | 0.3506 | 0.3098 | 0.3098 | 0.3017 | 0.3261 | 0.3506 | 0.3669 | 0.3832 | (22b) |
| Effective ac    | 0.5865 | 0.5831 | 0.5798 | 0.5643 | 0.5615 | 0.5480 | 0.5480 | 0.5455 | 0.5532 | 0.5615 | 0.5673 | 0.5734 | (25)  |

## 3. Heat losses and heat loss parameter

| Element                                           | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K | A x U<br>W/K         | K-value<br>kJ/m2K | A x K<br>kJ/K |       |
|---------------------------------------------------|-------------|----------------|---------------|------------------|----------------------|-------------------|---------------|-------|
| Main dwelling                                     |             |                |               |                  |                      |                   |               |       |
| TER Opaque door                                   |             |                | 2.5500        | 1.0000           | 2.5500               |                   |               | (26)  |
| TER Opening Type                                  |             |                | 13.5800       | 1.1450           | 15.5496              |                   |               | (27)  |
| GF SPVL 125TS P/A                                 |             |                | 42.9900       | 0.1300           | 5.5887               |                   |               | (28a) |
| EW Brick AAC011                                   | 97.2486     | 16.1300        | 81.1186       | 0.1800           | 14.6013              |                   |               | (29a) |
| PR 500mm MW044                                    | 42.9900     |                | 42.9900       | 0.1100           | 4.7289               |                   |               | (30)  |
| Total net area of external elements Aum(A, m2)    |             |                | 183.2286      |                  |                      |                   |               | (31)  |
| Fabric heat loss, W/K = Sum (A x U)               |             |                |               |                  | (26)...(30) + (32) = | 43.0186           |               | (33)  |
| Main dwelling                                     |             |                |               |                  |                      |                   |               |       |
| E-WM-30                                           |             |                | 43.8000       | 0.0000           | 0.0000               |                   |               | (32)  |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K |             |                |               |                  |                      |                   | 157.5901      | (35)  |

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

List of Thermal Bridges

|                                                            | Length  | Psi-value | Total                 |              |
|------------------------------------------------------------|---------|-----------|-----------------------|--------------|
| K1 Element                                                 | 10.7800 | 0.0500    | 0.5390                |              |
| E2 Other lintels (including other steel lintels)           | 9.2000  | 0.0500    | 0.4600                |              |
| E3 Sill                                                    | 21.1500 | 0.0500    | 1.0575                |              |
| E4 Jamb                                                    | 10.2300 | 0.1600    | 1.6368                |              |
| E5 Ground floor (normal)                                   | 18.6300 | 0.0000    | 0.0000                |              |
| E6 Intermediate floor within a dwelling                    | 10.2500 | 0.0600    | 0.6150                |              |
| E10 Eaves (insulation at ceiling level)                    | 10.4400 | 0.0600    | 0.6264                |              |
| E18 Party wall between dwellings                           | 4.8000  | 0.0500    | 0.2400                |              |
| E4 Jamb                                                    | 1.0600  | 0.0500    | 0.0530                |              |
| E2 Other lintels (including other steel lintels)           | 8.3900  | 0.0800    | 0.6712                |              |
| P1 Party wall - Ground floor                               | 8.3900  | 0.0000    | 0.0000                |              |
| P2 Party wall - Intermediate floor within a dwelling       | 8.3900  | 0.1200    | 1.0068                |              |
| P4 Party wall - Roof (insulation at ceiling level)         | 8.3900  | 0.1600    | 1.3424                |              |
| E5 Ground floor (normal)                                   | 8.3900  | 0.0600    | 0.5034                |              |
| E12 Gable (insulation at ceiling level)                    | 10.4400 | 0.0900    | 0.9396                |              |
| E16 Corner (normal)                                        |         |           |                       |              |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |         |           |                       | 9.6911 (36)  |
| Point Thermal bridges                                      |         |           | (36a) =               | 0.0000       |
| Total fabric heat loss                                     |         |           | (33) + (36) + (36a) = | 52.7097 (37) |

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

Point Thermal bridges

Total fabric heat loss

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

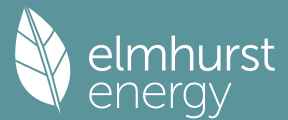
|                           | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |      |
|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| (38)m                     | 43.4295 | 43.1809 | 42.9372 | 41.7926 | 41.5785 | 40.5816 | 40.5816 | 40.3970 | 40.9656 | 41.5785 | 42.0117 | 42.4646 | (38) |
| Heat transfer coeff       | 96.1392 | 95.8906 | 95.6469 | 94.5023 | 94.2882 | 93.2913 | 93.2913 | 93.1067 | 93.6753 | 94.2882 | 94.7214 | 95.1743 | (39) |
| Average = Sum(39)m / 12 = |         |         |         |         |         |         |         |         |         |         |         | 94.5013 |      |

|               | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |      |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| HLP           | 1.1182 | 1.1153 | 1.1124 | 1.0991 | 1.0966 | 1.0850 | 1.0850 | 1.0829 | 1.0895 | 1.0966 | 1.1017 | 1.1069 | (40) |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 1.0991 |      |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31     |      |

## 4. Water heating energy requirements (kWh/year)

|                                                                                |          |          |          |          |          |          |          |          |          |          |          |               |             |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|-------------|
| Assumed occupancy                                                              |          |          |          |          |          |          |          |          |          |          |          |               | 2.5666 (42) |
| Hot water usage for mixer showers                                              |          |          |          |          |          |          |          |          |          |          |          |               |             |
| 67.2533                                                                        | 66.2426  | 64.7698  | 61.9519  | 59.8724  | 57.5533  | 56.2352  | 57.6968  | 59.2990  | 61.7890  | 64.6674  | 66.9956  | 66.9956 (42a) |             |
| Hot water usage for baths                                                      |          |          |          |          |          |          |          |          |          |          |          |               |             |
| 29.0443                                                                        | 28.6130  | 28.0055  | 26.8856  | 26.0469  | 25.1170  | 24.6147  | 25.2179  | 25.8746  | 26.8697  | 28.0127  | 28.9461  | 28.9461 (42b) |             |
| Hot water usage for other uses                                                 |          |          |          |          |          |          |          |          |          |          |          |               |             |
| 40.9146                                                                        | 39.4268  | 37.9390  | 36.4512  | 34.9634  | 33.4756  | 33.4756  | 34.9634  | 36.4512  | 37.9390  | 39.4268  | 40.9146  | 40.9146 (42c) |             |
| Average daily hot water use (litres/day)                                       |          |          |          |          |          |          |          |          |          |          |          | 126.1290      | (43)        |
| Daily hot water use                                                            |          |          |          |          |          |          |          |          |          |          |          |               |             |
| 137.2122                                                                       | 134.2823 | 130.7143 | 125.2887 | 120.8827 | 116.1459 | 114.3255 | 117.8781 | 121.6248 | 126.5977 | 132.1069 | 136.8563 | 136.8563 (44) |             |
| Energy content (annual)                                                        | 217.3105 | 191.2162 | 200.9030 | 171.5139 | 162.7313 | 142.8150 | 138.2667 | 145.9577 | 149.9756 | 171.7918 | 188.2105 | 214.2839      | (45)        |
| Distribution loss (46)m = 0.15 x (45)m                                         | 32.5966  | 28.6824  | 30.1355  | 25.7271  | 24.4097  | 21.4222  | 20.7400  | 21.8937  | 22.4963  | 25.7688  | 28.2316  | 32.1426       | (46)        |
| Water storage loss (or HIU loss):                                              |          |          |          |          |          |          |          |          |          |          |          |               |             |
| Total storage loss                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | (56)        |
| If cylinder contains dedicated solar storage                                   |          |          |          |          |          |          |          |          |          |          |          |               |             |
| 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | (57)        |
| Primary loss                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | (59)        |
| Combi loss                                                                     | 50.9589  | 46.0274  | 50.9589  | 49.3151  | 50.9589  | 49.3151  | 50.9589  | 50.9589  | 49.3151  | 50.9589  | 49.3151  | 50.9589       | (61)        |
| Total heat required for water heating calculated for each month                |          |          |          |          |          |          |          |          |          |          |          |               |             |
| 268.2694                                                                       | 237.2436 | 251.8620 | 220.8290 | 213.6902 | 192.1300 | 189.2257 | 196.9166 | 199.2907 | 222.7507 | 237.5256 | 265.2428 | 265.2428 (62) |             |
| WWHRS                                                                          | -30.7454 | -27.1915 | -28.4733 | -23.5770 | -21.9730 | -18.8024 | -17.6243 | -18.7416 | -19.4537 | -22.9338 | -25.9812 | -30.1760      | (63a)       |
| PV diverter                                                                    | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000       | (63b)       |
| Solar input                                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | (63c)       |
| FGHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | (63d)       |
| Output from w/h                                                                | 237.5241 | 210.0522 | 223.3886 | 197.2519 | 191.7173 | 173.3276 | 171.6014 | 178.1749 | 179.8370 | 199.8169 | 211.5444 | 235.0668      | (64)        |
| 12Total per year (kWh/year)                                                    |          |          |          |          |          |          |          |          |          |          |          | 2409.3031     | (64)        |
| Electric shower(s)                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | (64a)       |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |          |          |          |          |          |          |          |          | 0.0000        | (64a)       |
| Heat gains from water heating, kWh/month                                       |          |          |          |          |          |          |          |          |          |          |          |               |             |
| 84.9955                                                                        | 75.0862  | 79.5400  | 69.3571  | 66.8479  | 59.8147  | 58.7134  | 61.2707  | 62.1957  | 69.8605  | 74.9088  | 83.9891  | 83.9891 (65)  |             |

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## 5. Internal gains (see Table 5 and 5a)

| Metabolic gains (Table 5), Watts                                                    |           |           |           |           |           |           |           |           |           |           |           |                |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
|                                                                                     | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec            |
| (66)m                                                                               | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 122.1242  | 135.2090  | 122.1242  | 126.1950  | 122.1242  | 126.1950  | 122.1242  | 122.1242  | 126.1950  | 122.1242  | 126.1950  | 122.1242 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 231.4847  | 233.8867  | 227.8336  | 214.9471  | 198.6802  | 183.3916  | 173.1779  | 170.7758  | 176.8289  | 189.7154  | 205.9823  | 221.2709 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330 (69)   |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 3.0000    | 3.0000    | 3.0000 (70)    |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 (71) |
| Water heating gains (Table 5)                                                       | 114.2412  | 111.7355  | 106.9086  | 96.3294   | 89.8493   | 83.0760   | 78.9159   | 82.3530   | 86.3828   | 93.8985   | 104.0399  | 112.8886 (72)  |
| Total internal gains                                                                | 532.3492  | 545.3303  | 521.3654  | 501.9705  | 475.1528  | 454.1617  | 435.7170  | 436.7521  | 450.9059  | 470.2373  | 500.7164  | 520.7828 (73)  |

## 6. Solar gains

| [Jan]       |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W   |          |          |               |
|-------------|----------|----------|----------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|--------------|----------|----------|---------------|
| North       |          |          |          | 7.4500     | 10.6334                        | 0.6300                            | 0.7000                             | 0.7700                       | 24.2103 (74) |          |          |               |
| South       |          |          |          | 5.6100     | 46.7521                        | 0.6300                            | 0.7000                             | 0.7700                       | 80.1559 (78) |          |          |               |
| West        |          |          |          | 0.5200     | 19.6403                        | 0.6300                            | 0.7000                             | 0.7700                       | 3.1212 (80)  |          |          |               |
|             |          |          |          |            |                                |                                   |                                    |                              |              |          |          |               |
| Solar gains | 107.4874 | 183.6475 | 255.8951 | 329.9432   | 385.0318                       | 390.0431                          | 372.7259                           | 329.7794                     | 280.9021     | 203.9120 | 128.7704 | 92.0117 (83)  |
| Total gains | 639.8366 | 728.9778 | 777.2605 | 831.9137   | 860.1845                       | 844.2049                          | 808.4429                           | 766.5314                     | 731.8080     | 674.1493 | 629.4868 | 612.7945 (84) |

## 7. Mean internal temperature (heating season)

| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |         |         |         |              |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| tau                                                                         | 39.1493 | 39.2508 | 39.3508 | 39.8274 | 39.9178 | 40.3444 | 40.3444 | 40.4244 | 40.1790 | 39.9178 | 39.7352 | 39.5462      |
| alpha                                                                       | 3.6100  | 3.6167  | 3.6234  | 3.6552  | 3.6612  | 3.6896  | 3.6896  | 3.6950  | 3.6786  | 3.6612  | 3.6490  | 3.6364       |
| util living area                                                            | 0.9780  | 0.9639  | 0.9421  | 0.8897  | 0.7929  | 0.6354  | 0.4864  | 0.5280  | 0.7350  | 0.9040  | 0.9635  | 0.9809 (86)  |
| MIT                                                                         | 19.2598 | 19.5049 | 19.8356 | 20.2802 | 20.6521 | 20.8914 | 20.9690 | 20.9578 | 20.8059 | 20.3371 | 19.7334 | 19.2226 (87) |
| Th 2                                                                        | 19.9860 | 19.9884 | 19.9907 | 20.0016 | 20.0036 | 20.0131 | 20.0131 | 20.0148 | 20.0094 | 20.0036 | 19.9995 | 19.9952 (88) |
| util rest of house                                                          | 0.9734  | 0.9566  | 0.9299  | 0.8657  | 0.7471  | 0.5585  | 0.3861  | 0.4271  | 0.6659  | 0.8781  | 0.9548  | 0.9770 (89)  |
| MIT 2                                                                       | 17.9686 | 18.2790 | 18.6953 | 19.2482 | 19.6820 | 19.9361 | 19.9986 | 19.9936 | 19.8573 | 19.3283 | 18.5786 | 17.9275 (90) |
| Living area fraction                                                        | 18.2182 | 18.5159 | 18.9157 | 19.4477 | 19.8695 | 20.1208 | 20.1862 | 20.1800 | 20.0407 | 19.5233 | 18.8018 | 18.1779 (92) |
| MIT                                                                         | 18.2182 | 18.5159 | 18.9157 | 19.4477 | 19.8695 | 20.1208 | 20.1862 | 20.1800 | 20.0407 | 19.5233 | 18.8018 | 18.1779 (93) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT                                                                | 18.2182 | 18.5159 | 18.9157 | 19.4477 | 19.8695 | 20.1208 | 20.1862 | 20.1800 | 20.0407 | 19.5233 | 18.8018 | 18.1779 (93) |

## 8. Space heating requirement

|                                                                                | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov       | Dec            |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|---------------|-----------|----------------|
| Utilisation                                                                    | 0.9624    | 0.9424    | 0.9134    | 0.8499   | 0.7402   | 0.5675   | 0.4043   | 0.4448   | 0.6683   | 0.8629        | 0.9409    | 0.9669 (94)    |
| Useful gains                                                                   | 615.7576  | 687.0120  | 709.9672  | 707.0356 | 636.6783 | 479.0609 | 326.8758 | 340.9337 | 489.1003 | 581.7083      | 592.2975  | 592.5120 (95)  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000    | 4.2000 (96)    |
| Heat loss rate W                                                               | 1338.0861 | 1305.6403 | 1187.5243 | 996.7818 | 770.2901 | 515.0386 | 334.5622 | 351.9452 | 556.4967 | 841.3604      | 1108.4096 | 1330.3346 (97) |
| Space heating kWh                                                              | 537.4124  | 415.7183  | 355.3024  | 208.6173 | 99.4072  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 193.1811      | 371.6007  | 548.9400 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |          |          |          |          |          |          |               |           | 2730.1794      |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |          |          |          |          |          |          |               |           | 0.0000         |
| Space heating kWh                                                              | 537.4124  | 415.7183  | 355.3024  | 208.6173 | 99.4072  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 193.1811      | 371.6007  | 548.9400 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |          |          |          |          |          |          |               |           | 2730.1794      |
| Space heating per m <sup>2</sup>                                               |           |           |           |          |          |          |          |          |          | (98c) / (4) = |           | 31.7537 (99)   |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

| Fraction of space heat from secondary/supplementary system (Table 11) |          |          |          |          |          |          |          |          |          |          |          |                |
|-----------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| Efficiency of main space heating system 1 (in %)                      |          |          |          |          |          |          |          |          |          |          |          |                |
| Efficiency of main space heating system 2 (in %)                      |          |          |          |          |          |          |          |          |          |          |          |                |
| Efficiency of secondary/supplementary heating system, %               |          |          |          |          |          |          |          |          |          |          |          |                |
|                                                                       | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec            |
| Space heating requirement                                             | 537.4124 | 415.7183 | 355.3024 | 208.6173 | 99.4072  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 193.1811 | 371.6007 | 548.9400 (98)  |
| Space heating efficiency (main heating system 1)                      | 92.4000  | 92.4000  | 92.4000  | 92.4000  | 92.4000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 92.4000  | 92.4000  | 92.4000 (210)  |
| Space heating fuel (main heating system)                              | 581.6151 | 449.9116 | 384.5265 | 225.7763 | 107.5835 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 209.0705 | 402.1652 | 594.0909 (211) |
| Space heating efficiency (main heating system 2)                      | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)   |
| Space heating fuel (main heating system 2)                            | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)   |
| Space heating fuel (secondary)                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)   |
| Water heating                                                         |          |          |          |          |          |          |          |          |          |          |          |                |
| Water heating requirement                                             | 237.5241 | 210.0522 | 223.3886 | 197.2519 | 191.7173 | 173.3276 | 171.6014 | 178.1749 | 179.8370 | 199.8169 | 211.5444 | 235.0668 (64)  |
| Efficiency of water heater                                            |          |          |          |          |          |          |          |          |          |          |          | 80.3000 (216)  |

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|                                                                                                      |          |          |          |           |           |           |           |           |           |          |          |            |        |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|----------|------------|--------|
| (217)m                                                                                               | 86.0745  | 85.8150  | 85.3706  | 84.5017   | 83.0431   | 80.3000   | 80.3000   | 80.3000   | 80.3000   | 84.3091  | 85.5753  | 86.1341    | (217)  |
| Fuel for water heating, kWh/month                                                                    | 275.9518 | 244.7733 | 261.6694 | 233.4295  | 230.8648  | 215.8501  | 213.7004  | 221.8866  | 223.9564  | 237.0052 | 247.2027 | 272.9078   | (219)  |
| Space cooling fuel requirement                                                                       |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (221)m                                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (221)  |
| Pumps and Fa                                                                                         | 7.3041   | 6.5973   | 7.3041   | 7.0685    | 7.3041    | 7.0685    | 7.3041    | 7.0685    | 7.3041    | 7.0685   | 7.3041   | 7.0685     | (231)  |
| Lighting                                                                                             | 25.3750  | 20.3568  | 18.3290  | 13.4286   | 10.3727   | 8.4745    | 9.4623    | 12.2994   | 15.9757   | 20.9610  | 23.6755  | 26.0803    | (232)  |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (233a)m                                                                                              | -39.8696 | -56.0257 | -80.2676 | -89.9369  | -96.7057  | -90.1510  | -89.0213  | -84.1676  | -75.5697  | -63.9045 | -43.7612 | -34.4899   | (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (234a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (234a) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (235a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (235a) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (235c)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (235c) |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (233b)m                                                                                              | -23.0762 | -48.4849 | -96.2662 | -144.4459 | -190.8693 | -191.7487 | -189.5061 | -160.5221 | -117.7385 | -69.3076 | -30.7987 | -18.2537   | (233b) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (234b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (234b) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (235b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (235b) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (235d)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (235d) |
| Annual totals kWh/year                                                                               |          |          |          |           |           |           |           |           |           |          |          |            |        |
| Space heating fuel - main system 1                                                                   |          |          |          |           |           |           |           |           |           |          |          | 2954.7396  | (211)  |
| Space heating fuel - main system 2                                                                   |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (213)  |
| Space heating fuel - secondary                                                                       |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (215)  |
| Efficiency of water heater                                                                           |          |          |          |           |           |           |           |           |           |          |          | 80.3000    |        |
| Water heating fuel used                                                                              |          |          |          |           |           |           |           |           |           |          |          | 2879.1979  | (219)  |
| Space cooling fuel                                                                                   |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (221)  |
| Electricity for pumps and fans:                                                                      |          |          |          |           |           |           |           |           |           |          |          |            |        |
| Total electricity for the above, kWh/year                                                            |          |          |          |           |           |           |           |           |           |          |          | 86.0000    | (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |          |          |          |           |           |           |           |           |           |          |          | 204.7908   | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |          |          |           |           |           |           |           |           |          |          |            |        |
| PV generation                                                                                        |          |          |          |           |           |           |           |           |           |          |          | -2124.8885 | (233)  |
| Wind generation                                                                                      |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (234)  |
| Hydro-electric generation (Appendix N)                                                               |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (235a) |
| Electricity generated - Micro CHP (Appendix N)                                                       |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (235)  |
| Appendix Q - special features                                                                        |          |          |          |           |           |           |           |           |           |          |          |            |        |
| Energy saved or generated                                                                            |          |          |          |           |           |           |           |           |           |          |          | -0.0000    | (236)  |
| Energy used                                                                                          |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (237)  |
| Total delivered energy for all uses                                                                  |          |          |          |           |           |           |           |           |           |          |          | 3999.8399  | (238)  |

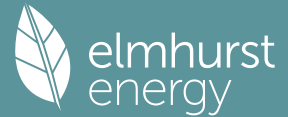
## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                               | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|-----------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1                 | 2954.7396          | 0.2100                        | 620.4953 (261)           |
| Total CO2 associated with community systems   |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                    | 2879.1979          | 0.2100                        | 604.6316 (264)           |
| Space and water heating                       |                    |                               | 1225.1269 (265)          |
| Pumps, fans and electric keep-hot             | 86.0000            | 0.1387                        | 11.9293 (267)            |
| Energy for lighting                           | 204.7908           | 0.1443                        | 29.5576 (268)            |
| Energy saving/generation technologies         |                    |                               |                          |
| PV Unit electricity used in dwelling          | -843.8706          | 0.1347                        | -113.6365                |
| PV Unit electricity exported                  | -1281.0179         | 0.1259                        | -161.3091                |
| Total                                         |                    |                               | -274.9456 (269)          |
| Total CO2, kg/year                            |                    |                               | 991.6682 (272)           |
| EPC Target Carbon Dioxide Emission Rate (TER) |                    |                               | 11.5300 (273)            |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1               | 2954.7396          | 1.1300                              | 3338.8558 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 2879.1979          | 1.1300                              | 3253.4937 (278)            |
| Space and water heating                     |                    |                                     | 6592.3495 (279)            |
| Pumps, fans and electric keep-hot           | 86.0000            | 1.5128                              | 130.1008 (281)             |
| Energy for lighting                         | 204.7908           | 1.5338                              | 314.1150 (282)             |
| Energy saving/generation technologies       |                    |                                     |                            |
| PV Unit electricity used in dwelling        | -843.8706          | 1.4977                              | -1263.8554                 |
| PV Unit electricity exported                | -1281.0179         | 0.4622                              | -592.1168                  |
| Total                                       |                    |                                     | -1855.9722 (283)           |
| Total Primary energy kWh/year               |                    |                                     | 5180.5931 (286)            |
| Target Primary Energy Rate (TPER)           |                    |                                     | 60.2500 (287)              |

# Full SAP Calculation Printout



|                                    |                                                          |               |       |        |                |            |
|------------------------------------|----------------------------------------------------------|---------------|-------|--------|----------------|------------|
| Plot Reference                     | 4907-R823-9471-005                                       |               |       |        | Issued on Date | 21/07/2026 |
| Assessment Reference               | Plot 5                                                   | Plot Type Ref |       | Plot 5 |                |            |
| Plot Address                       | Plot 5, Beaconsfield-Semi, K, WC, B, ES, 1012            |               |       |        | SAP Version    | 10.2       |
|                                    |                                                          |               |       |        |                |            |
| SAP Rating                         | 90 B                                                     | DER           | 11.13 | TER    | 11.53          |            |
| Environmental                      | 91 B                                                     | % DER < TER   |       |        |                | 3.47       |
| CO <sub>2</sub> Emissions (t/year) | 0.85                                                     | DFEE          | 34.39 | TFEE   | 36.96          |            |
| Compliance Check                   | See BREL                                                 | % DFEE < TFEE |       |        |                | 6.96       |
| % DPER < TPER                      | 0.74                                                     | DPER          | 59.80 | TPER   | 60.25          |            |
|                                    |                                                          |               |       |        |                |            |
| Assessor Details                   | Mr. Daniel Harris                                        |               |       |        | Assessor ID    | R823-0001  |
| Client                             | Crest Nicholson Head Office, Crest Nicholson Head Office |               |       |        |                |            |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF FABRIC ENERGY EFFICIENCY

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)            | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Main dwelling                                          |                           |                                 |                             |
| Ground floor                                           | 42.9900 (1b)              | x 2.4600 (2b)                   | = 105.7554 (1b) - (3b)      |
| First floor                                            | 42.9900 (1c)              | x 2.7600 (2c)                   | = 118.6524 (1c) - (3c)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 85.9800                   |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 224.4078 (5)              |

## 2. Ventilation rate

|                                                                                                    | m <sup>3</sup> per hour                            |
|----------------------------------------------------------------------------------------------------|----------------------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                               |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                               |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                               |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                               |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                               |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                               |
| Number of intermittent extract fans                                                                | 3 * 10 = 30.0000 (7a)                              |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)                               |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)                               |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | Air changes per hour<br>30.0000 / (5) = 0.1337 (8) |
| Pressure test                                                                                      | Yes                                                |
| Pressure Test Method                                                                               | Blower Door                                        |
| Measured/design AP50                                                                               | 4.5000 (17)                                        |
| Infiltration rate                                                                                  | 0.3587 (18)                                        |
| Number of sides sheltered                                                                          | 2 (19)                                             |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 0.8500 (20)            |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.3049 (21)                   |

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor                                                                                             | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate                                                                                         | 0.3887 | 0.3811 | 0.3735 | 0.3354 | 0.3277 | 0.2896 | 0.2896 | 0.2820 | 0.3049 | 0.3277 | 0.3430 | 0.3582 (22b) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.0000 (23b) |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =            |        |        |        |        |        |        |        |        |        |        |        | 0.0000 (23c) |
| Effective ac                                                                                            | 0.5756 | 0.5726 | 0.5697 | 0.5562 | 0.5537 | 0.5419 | 0.5419 | 0.5398 | 0.5465 | 0.5537 | 0.5588 | 0.5642 (25)  |

## 3. Heat losses and heat loss parameter

| Element                                                        | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K         | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K                                        |
|----------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|----------------------|--------------------------------|------------------------------------------------------|
| Main dwelling                                                  |                         |                            |                           |                               |                      |                                |                                                      |
| Front Door                                                     |                         |                            | 2.5500                    | 1.2000                        | 3.0600               |                                | (26)                                                 |
| Windows                                                        |                         |                            | 10.2500                   | 1.2357                        | 12.6663              |                                | (27)                                                 |
| French Doors                                                   |                         |                            | 3.3300                    | 1.2357                        | 4.1150               |                                | (27)                                                 |
| GF SPVL 125TS P/A                                              |                         |                            | 42.9900                   | 0.1300                        | 5.5887               | 75.0000                        | 3224.2500 (28a)                                      |
| EW Brick AAC011                                                | 97.2486                 | 16.1300                    | 81.1186                   | 0.1800                        | 14.6013              | 60.0000                        | 4867.1160 (29a)                                      |
| PR 500mm MW044                                                 | 42.9900                 |                            | 42.9900                   | 0.0900                        | 3.8691               | 9.0000                         | 386.9100 (30)                                        |
| Total net area of external elements Aum(A, m <sup>2</sup> )    |                         |                            | 183.2286                  |                               |                      |                                | (31)                                                 |
| Fabric heat loss, W/K = Sum (A x U)                            |                         |                            |                           |                               | (26)...(30) + (32) = | 43.9005                        | (33)                                                 |
| Main dwelling                                                  |                         |                            |                           |                               |                      |                                |                                                      |
| E-WM-30                                                        |                         |                            | 43.8000                   | 0.0000                        | 0.0000               | 45.0000                        | 1971.0000 (32)                                       |
| Timber - GF                                                    |                         |                            | 88.6100                   |                               |                      | 9.0000                         | 797.4900 (32c)                                       |
| Timber - FF                                                    |                         |                            | 126.9000                  |                               |                      | 9.0000                         | 1142.1000 (32c)                                      |
| Internal Floor FF                                              |                         |                            | 42.9900                   |                               |                      | 18.0000                        | 773.8200 (32d)                                       |
| Internal Ceiling GF                                            |                         |                            | 42.9900                   |                               |                      | 9.0000                         | 386.9100 (32e)                                       |
| Heat capacity Cm = Sum(A x k)                                  |                         |                            |                           |                               |                      |                                | (28)...(30) + (32) + (32a)...(32e) = 13549.5960 (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K |                         |                            |                           |                               |                      |                                | 157.5901 (35)                                        |

# Full SAP Calculation Printout



## List of Thermal Bridges

|                                                            | Length  | Psi-value | Total                              |
|------------------------------------------------------------|---------|-----------|------------------------------------|
| K1 Element                                                 |         |           |                                    |
| E2 Other lintels (including other steel lintels)           | 10.7800 | 0.0410    | 0.4420                             |
| E3 Sill                                                    | 9.2000  | 0.0220    | 0.2024                             |
| E4 Jamb                                                    | 21.1500 | 0.0190    | 0.4018                             |
| E5 Ground floor (normal)                                   | 10.2300 | 0.0928    | 0.9493                             |
| E6 Intermediate floor within a dwelling                    | 18.6300 | 0.0020    | 0.0373                             |
| E10 Eaves (insulation at ceiling level)                    | 10.2500 | 0.0390    | 0.3997                             |
| E18 Party wall between dwellings                           | 10.4400 | 0.0330    | 0.3445                             |
| E4 Jamb                                                    | 4.8000  | 0.1000    | 0.4800                             |
| E2 Other lintels (including other steel lintels)           | 1.0600  | 0.0410    | 0.0435                             |
| P1 Party wall - Ground floor                               | 8.3900  | 0.1000    | 0.8390                             |
| P2 Party wall - Intermediate floor within a dwelling       | 8.3900  | 0.0000    | 0.0000                             |
| P4 Party wall - Roof (insulation at ceiling level)         | 8.3900  | 0.0350    | 0.2937                             |
| E5 Ground floor (normal)                                   | 8.3900  | 0.0980    | 0.8222                             |
| E12 Gable (insulation at ceiling level)                    | 8.3900  | 0.0870    | 0.7299                             |
| E16 Corner (normal)                                        | 10.4400 | 0.0420    | 0.4385                             |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |         |           | 6.4238 (36)                        |
| Point Thermal bridges                                      |         |           | 0.0000 (36a) =                     |
| Total fabric heat loss                                     |         |           | 50.3244 (37) (33) + (36) + (36a) = |

## Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

|                           | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |      |
|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| (38)m                     | 42.6224 | 42.4051 | 42.1922 | 41.1919 | 41.0047 | 40.1335 | 40.1335 | 39.9722 | 40.4691 | 41.0047 | 41.3833 | 41.7791 | (38) |
| Heat transfer coeff       | 92.9467 | 92.7295 | 92.5165 | 91.5162 | 91.3291 | 90.4579 | 90.4579 | 90.2965 | 90.7935 | 91.3291 | 91.7077 | 92.1035 | (39) |
| Average = Sum(39)m / 12 = |         |         |         |         |         |         |         |         |         |         |         | 91.5153 |      |
| HLP                       | 1.0810  | 1.0785  | 1.0760  | 1.0644  | 1.0622  | 1.0521  | 1.0521  | 1.0502  | 1.0560  | 1.0622  | 1.0666  | 1.0712  | (40) |
| HLP (average)             |         |         |         |         |         |         |         |         |         |         |         | 1.0644  |      |
| Days in mont              | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31      |      |

## 4. Water heating energy requirements (kWh/year)

|                                                                                |          |         |          |         |         |         |         |         |         |                                        |         |           |             |
|--------------------------------------------------------------------------------|----------|---------|----------|---------|---------|---------|---------|---------|---------|----------------------------------------|---------|-----------|-------------|
| Assumed occupancy                                                              |          |         |          |         |         |         |         |         |         |                                        |         |           | 2.5666 (42) |
| Hot water usage for mixer showers                                              |          |         |          |         |         |         |         |         |         |                                        |         |           |             |
| 0.0000                                                                         | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000    | (42a)       |
| Hot water usage for baths                                                      | 29.0443  | 28.6130 | 28.0055  | 26.8856 | 26.0469 | 25.1170 | 24.6147 | 25.2179 | 25.8746 | 26.8697                                | 28.0127 | 28.9461   | (42b)       |
| Hot water usage for other uses                                                 | 40.9146  | 39.4268 | 37.9390  | 36.4512 | 34.9634 | 33.4756 | 33.4756 | 34.9634 | 36.4512 | 37.9390                                | 39.4268 | 40.9146   | (42c)       |
| Average daily hot water use (litres/day)                                       |          |         |          |         |         |         |         |         |         |                                        |         | 64.1237   | (43)        |
| Daily hot water use                                                            | 69.9589  | 68.0398 | 65.9445  | 63.3367 | 61.0103 | 58.5926 | 58.0903 | 60.1813 | 62.3258 | 64.8087                                | 67.4395 | 69.8607   | (44)        |
| Energy conte                                                                   | 110.7978 | 96.8877 | 101.3543 | 86.7048 | 82.1316 | 72.0464 | 70.2552 | 74.5170 | 76.8540 | 87.9448                                | 96.0800 | 109.3850  | (45)        |
| Energy content (annual)                                                        |          |         |          |         |         |         |         |         |         | Total = Sum(45)m =                     |         | 1064.9585 |             |
| Distribution loss (46)m = 0.15 x (45)m                                         | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000    | (46)        |
| Water storage loss (or HIU loss):                                              |          |         |          |         |         |         |         |         |         |                                        |         |           |             |
| Total storage loss                                                             | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000    | (56)        |
| If cylinder contains dedicated solar storage                                   |          |         |          |         |         |         |         |         |         |                                        |         |           |             |
| 0.0000                                                                         | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000    | (57)        |
| Primary loss                                                                   | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000    | (59)        |
| Combi loss                                                                     | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000    | (61)        |
| Total heat required for water heating calculated for each month                | 94.1781  | 82.3546 | 86.1511  | 73.6991 | 69.8118 | 61.2394 | 59.7169 | 63.3394 | 65.3259 | 74.7530                                | 81.6680 | 92.9773   | (62)        |
| WWHRS                                                                          | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000    | (63a)       |
| PV diverter                                                                    | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000    | (63b)       |
| Solar input                                                                    | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000    | (63c)       |
| FGHRS                                                                          | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000    | (63d)       |
| Output from w/h                                                                | 94.1781  | 82.3546 | 86.1511  | 73.6991 | 69.8118 | 61.2394 | 59.7169 | 63.3394 | 65.3259 | 74.7530                                | 81.6680 | 92.9773   | (64)        |
| 12Total per year (kWh/year)                                                    |          |         |          |         |         |         |         |         |         | Total per year (kWh/year) = Sum(64)m = |         | 905.2147  | (64)        |
| Electric shower(s)                                                             | 53.8586  | 47.9885 | 52.4016  | 50.0062 | 50.9446 | 48.5962 | 50.2160 | 50.9446 | 50.0062 | 52.4016                                | 51.4162 | 53.8586   | (64a)       |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |         |          |         |         |         |         |         |         |                                        |         | 612.6389  | (64a)       |
| Heat gains from water heating, kWh/month                                       | 37.0092  | 32.5858 | 34.6382  | 30.9263 | 30.1891 | 27.4589 | 27.4832 | 28.5710 | 28.8330 | 31.7887                                | 33.2711 | 36.7090   | (65)        |

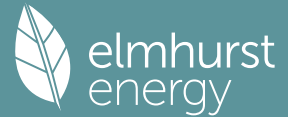
## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |           |           |           |           |           |           |           |           |           |           |           |           |      |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------|
| Metabolic gains (Table 5), Watts                                                    |           |           |           |           |           |           |           |           |           |           |           |           |      |
| (66)m                                                                               | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 122.1242  | 135.2090  | 122.1242  | 126.1950  | 122.1242  | 126.1950  | 122.1242  | 122.1242  | 126.1950  | 122.1242  | 126.1950  | 122.1242  | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 231.4847  | 233.8867  | 227.8336  | 214.9471  | 198.6802  | 183.3916  | 173.1779  | 170.7758  | 176.8289  | 189.7154  | 205.9823  | 221.2709  | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | (69) |
| Pumps, fans                                                                         | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | (71) |
| Water heating gains (Table 5)                                                       | 49.7435   | 48.4907   | 46.5567   | 42.9532   | 40.5767   | 38.1374   | 36.9398   | 38.4019   | 40.0459   | 42.7267   | 46.2098   | 49.3400   | (72) |
| Total internal gains                                                                | 464.8515  | 479.0855  | 458.0136  | 445.5944  | 422.8802  | 409.2230  | 393.7410  | 392.8009  | 404.5689  | 416.0654  | 439.8863  | 454.2343  | (73) |

## 6. Solar gains

| [Jan] | Area<br>m <sup>2</sup> | Solar flux<br>Table 6a<br>W/m <sup>2</sup> | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W   |
|-------|------------------------|--------------------------------------------|-----------------------------------|------------------------------------|------------------------------|--------------|
| North | 4.1200                 | 10.6334                                    | 0.4500                            | 0.0000                             | 0.7700                       | 15.1800 (74) |
| South | 5.6100                 | 46.7521                                    | 0.4500                            | 0.0000                             | 0.7700                       | 90.8797 (78) |

# Full SAP Calculation Printout



|       |        |         |        |        |        |              |
|-------|--------|---------|--------|--------|--------|--------------|
| West  | 0.5200 | 19.6403 | 0.4500 | 0.0000 | 0.7700 | 3.5388 (80)  |
| North | 3.3300 | 10.6334 | 0.4500 | 0.0000 | 0.7700 | 12.2693 (74) |

|             |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Solar gains | 121.8678 | 208.2172 | 290.1305 | 374.0852 | 436.5439 | 442.2258 | 422.5917 | 373.8995 | 318.4831 | 231.1927 | 145.9981 | 104.3216 (83) |
| Total gains | 586.7193 | 687.3027 | 748.1440 | 819.6796 | 859.4241 | 851.4488 | 816.3327 | 766.7004 | 723.0520 | 647.2582 | 585.8844 | 558.5559 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |                           |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |                           |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |                           |         |         |              |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep                       | Oct     | Nov     | Dec          |
| tau                                                                         | 40.4939 | 40.5888 | 40.6822 | 41.1269 | 41.2111 | 41.6081 | 41.6081 | 41.6824 | 41.4543                   | 41.2111 | 41.0410 | 40.8646      |
| alpha                                                                       | 3.6996  | 3.7059  | 3.7121  | 3.7418  | 3.7474  | 3.7739  | 3.7739  | 3.7788  | 3.7636                    | 3.7474  | 3.7361  | 3.7243       |
| util living area                                                            | 0.9828  | 0.9687  | 0.9459  | 0.8891  | 0.7847  | 0.6196  | 0.4704  | 0.5159  | 0.7301                    | 0.9097  | 0.9696  | 0.9855 (86)  |
| MIT                                                                         | 19.2505 | 19.5157 | 19.8619 | 20.3181 | 20.6846 | 20.9072 | 20.9747 | 20.9641 | 20.8221                   | 20.3494 | 19.7279 | 19.2077 (87) |
| Th 2                                                                        | 20.0164 | 20.0184 | 20.0205 | 20.0300 | 20.0318 | 20.0402 | 20.0402 | 20.0417 | 20.0369                   | 20.0318 | 20.0282 | 20.0244 (88) |
| util rest of house                                                          | 0.9792  | 0.9624  | 0.9346  | 0.8653  | 0.7389  | 0.5447  | 0.3749  | 0.4187  | 0.6621                    | 0.8853  | 0.9623  | 0.9825 (89)  |
| MIT 2                                                                       | 18.4270 | 18.6896 | 19.0298 | 19.4729 | 19.8049 | 19.9890 | 20.0309 | 20.0276 | 19.9281                   | 19.5121 | 18.9089 | 18.3906 (90) |
| Living area fraction                                                        |         |         |         |         |         |         |         |         | fLA = Living area / (4) = |         |         | 0.1933 (91)  |
| MIT                                                                         | 18.5862 | 18.8493 | 19.1907 | 19.6363 | 19.9749 | 20.1665 | 20.2134 | 20.2086 | 20.1009                   | 19.6739 | 19.0672 | 18.5485 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |                           |         |         | 0.0000       |
| adjusted MIT                                                                | 18.5862 | 18.8493 | 19.1907 | 19.6363 | 19.9749 | 20.1665 | 20.2134 | 20.2086 | 20.1009                   | 19.6739 | 19.0672 | 18.5485 (93) |

## 8. Space heating requirement

|                                                                                |           |           |           |          |          |          |          |          |          |               |           |                |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|---------------|-----------|----------------|
|                                                                                | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov       | Dec            |
| Utilisation                                                                    | 0.9722    | 0.9526    | 0.9227    | 0.8541   | 0.7359   | 0.5551   | 0.3927   | 0.4363   | 0.6670   | 0.8744        | 0.9529    | 0.9762 (94)    |
| Useful gains                                                                   | 570.4148  | 654.7182  | 690.2773  | 700.0717 | 632.4660 | 472.6801 | 320.5817 | 334.5370 | 482.3084 | 565.9753      | 558.2942  | 545.2807 (95)  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000    | 4.2000 (96)    |
| Heat loss rate W                                                               | 1327.8548 | 1293.5110 | 1174.0956 | 982.5435 | 755.7424 | 503.5343 | 326.8565 | 343.9068 | 544.8413 | 828.7128      | 1097.4839 | 1321.5493 (97) |
| Space heating kWh                                                              | 563.5354  | 429.2687  | 359.9608  | 203.3797 | 91.7177  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 195.4767      | 388.2166  | 577.5438 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |          |          |          |          |          |          |               |           | 2809.0994      |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |          |          |          |          |          |          |               |           | 0.0000         |
| Space heating kWh                                                              | 563.5354  | 429.2687  | 359.9608  | 203.3797 | 91.7177  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 195.4767      | 388.2166  | 577.5438 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |          |          |          |          |          |          |               |           | 2809.0994      |
| Space heating per m2                                                           |           |           |           |          |          |          |          |          |          | (98c) / (4) = |           | 32.6715 (99)   |

## 8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

|                                  |        |        |        |        |         |          |          |          |                          |         |        |                |
|----------------------------------|--------|--------|--------|--------|---------|----------|----------|----------|--------------------------|---------|--------|----------------|
|                                  | Jan    | Feb    | Mar    | Apr    | May     | Jun      | Jul      | Aug      | Sep                      | Oct     | Nov    | Dec            |
| Ext. temp.                       | 4.3000 | 4.9000 | 6.5000 | 8.9000 | 11.7000 | 14.6000  | 16.6000  | 16.4000  | 14.1000                  | 10.6000 | 7.1000 | 4.2000         |
| Heat loss rate W                 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 850.3041 | 669.3883 | 686.2537 | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (100)   |
| Utilisation                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 0.8296   | 0.8907   | 0.8658   | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (101)   |
| Useful loss                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 705.4261 | 596.2385 | 594.1923 | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (102)   |
| Total gains                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 943.7271 | 905.1968 | 849.6226 | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (103)   |
| Space cooling kWh                | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 171.5768 | 229.8650 | 190.0401 | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (104)   |
| Cooled fraction                  |        |        |        |        |         |          |          |          | fC = cooled area / (4) = |         |        | 1.0000 (105)   |
| Intermittency factor (Table 10b) | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500  | 0.2500   | 0.2500   | 0.2500   | 0.2500                   | 0.2500  | 0.2500 | 0.2500 (106)   |
| Space cooling kWh                | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 42.8942  | 57.4662  | 47.5100  | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (107)   |
| Space cooling requirement        |        |        |        |        |         |          |          |          |                          |         |        | 147.8705 (107) |
| Energy for space heating         |        |        |        |        |         |          |          |          |                          |         |        | 32.6715 (99)   |
| Energy for space cooling         |        |        |        |        |         |          |          |          |                          |         |        | 1.7198 (108)   |
| Total                            |        |        |        |        |         |          |          |          |                          |         |        | 34.3914 (109)  |
| Fabric Energy Efficiency (DFEE)  |        |        |        |        |         |          |          |          |                          |         |        | 34.4 (109)     |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

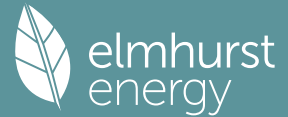
## 1. Overall dwelling characteristics

|                                                        |              |                                   |                        |
|--------------------------------------------------------|--------------|-----------------------------------|------------------------|
| Main dwelling                                          | Area (m2)    | Storey height (m)                 | Volume (m3)            |
| Ground floor                                           | 42.9900 (1b) | x 2.4600 (2b)                     | = 105.7554 (1b) - (3b) |
| First floor                                            | 42.9900 (1c) | x 2.7600 (2c)                     | = 118.6524 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 85.9800      |                                   | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 224.4078 (5)           |

## 2. Ventilation rate

|                         |          |             |
|-------------------------|----------|-------------|
| Number of open chimneys | 0 * 80 = | 0.0000 (6a) |
|-------------------------|----------|-------------|

# Full SAP Calculation Printout



Number of open flues  
Number of chimneys / flues attached to closed fire  
Number of flues attached to solid fuel boiler  
Number of flues attached to other heater  
Number of blocked chimneys  
Number of intermittent extract fans  
Number of passive vents  
Number of flueless gas fires

0 \* 20 = 0.0000 (6b)  
0 \* 10 = 0.0000 (6c)  
0 \* 20 = 0.0000 (6d)  
0 \* 35 = 0.0000 (6e)  
0 \* 20 = 0.0000 (6f)  
3 \* 10 = 30.0000 (7a)  
0 \* 10 = 0.0000 (7b)  
0 \* 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 30.0000  
Air changes per hour  
Pressure test  
Pressure Test Method  
Measured/design AP50  
Infiltration rate  
Number of sides sheltered  
Blower Door  
Shelter factor  
Infiltration rate adjusted to include shelter factor

0.1337 (8)  
Yes  
5.0000 (17)  
0.3837 (18)  
2 (19)  
(20) = 1 - [0.075 x (19)] = 0.8500 (20)  
(21) = (18) x (20) = 0.3261 (21)

|                                                                                                         |        |        |        |        |        |        |        |        |        |        |        |              |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
| Wind factor                                                                                             | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000       |
| Adj infilt rate                                                                                         | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750       |
|                                                                                                         | 0.4158 | 0.4077 | 0.3995 | 0.3587 | 0.3506 | 0.3098 | 0.3098 | 0.3017 | 0.3261 | 0.3506 | 0.3669 | 0.3832       |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.0000 (22)  |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =            |        |        |        |        |        |        |        |        |        |        |        | 0.0000 (23b) |
| Effective ac                                                                                            | 0.5865 | 0.5831 | 0.5798 | 0.5643 | 0.5615 | 0.5480 | 0.5480 | 0.5455 | 0.5532 | 0.5615 | 0.5673 | 0.5734 (25)  |

### 3. Heat losses and heat loss parameter

| Element                                           | Gross m2 | Openings m2 | NetArea m2 | U-value W/m2K        | A x U W/K | K-value kJ/m2K | A x K kJ/K    |
|---------------------------------------------------|----------|-------------|------------|----------------------|-----------|----------------|---------------|
| Main dwelling                                     |          |             |            |                      |           |                |               |
| TER Opaque door                                   |          |             | 2.5500     | 1.0000               | 2.5500    |                | (26)          |
| TER Opening Type                                  |          |             | 13.5800    | 1.1450               | 15.5496   |                | (27)          |
| GF SPVL 125TS P/A                                 |          |             | 42.9900    | 0.1300               | 5.5887    |                | (28a)         |
| EW Brick AAC011                                   | 97.2486  | 16.1300     | 81.1186    | 0.1800               | 14.6013   |                | (29a)         |
| PR 500mm MW044                                    | 42.9900  |             | 42.9900    | 0.1100               | 4.7289    |                | (30)          |
| Total net area of external elements Aum(A, m2)    |          |             | 183.2286   |                      |           |                | (31)          |
| Fabric heat loss, W/K = Sum (A x U)               |          |             |            | (26)...(30) + (32) = | 43.0186   |                | (33)          |
| Main dwelling                                     |          |             |            |                      |           |                |               |
| E-WM-30                                           |          |             | 43.8000    | 0.0000               | 0.0000    |                | (32)          |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K |          |             |            |                      |           |                | 157.5901 (35) |

List of Thermal Bridges

| K1 Element                                                 | Length  | Psi-value             | Total        |
|------------------------------------------------------------|---------|-----------------------|--------------|
| E2 Other lintels (including other steel lintels)           | 10.7800 | 0.0500                | 0.5390       |
| E3 Sill                                                    | 9.2000  | 0.0500                | 0.4600       |
| E4 Jamb                                                    | 21.1500 | 0.0500                | 1.0575       |
| E5 Ground floor (normal)                                   | 10.2300 | 0.1600                | 1.6368       |
| E6 Intermediate floor within a dwelling                    | 18.6300 | 0.0000                | 0.0000       |
| E10 Eaves (insulation at ceiling level)                    | 10.2500 | 0.0600                | 0.6150       |
| E18 Party wall between dwellings                           | 10.4400 | 0.0600                | 0.6264       |
| E4 Jamb                                                    | 4.8000  | 0.0500                | 0.2400       |
| E2 Other lintels (including other steel lintels)           | 1.0600  | 0.0500                | 0.0530       |
| P1 Party wall - Ground floor                               | 8.3900  | 0.0800                | 0.6712       |
| P2 Party wall - Intermediate floor within a dwelling       | 8.3900  | 0.0000                | 0.0000       |
| P4 Party wall - Roof (insulation at ceiling level)         | 8.3900  | 0.1200                | 1.0068       |
| E5 Ground floor (normal)                                   | 8.3900  | 0.1600                | 1.3424       |
| E12 Gable (insulation at ceiling level)                    | 8.3900  | 0.0600                | 0.5034       |
| E16 Corner (normal)                                        | 10.4400 | 0.0900                | 0.9396       |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |         |                       | 9.6911 (36)  |
| Point Thermal Bridges                                      |         |                       | 0.0000       |
| Total fabric heat loss                                     |         | (33) + (36) + (36a) = | 52.7097 (37) |

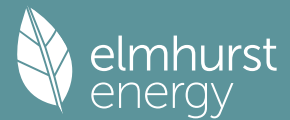
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

|                           |         |         |         |         |         |         |         |         |         |         |         |              |
|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| (38)m                     | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| Heat transfer coeff       | 43.4295 | 43.1809 | 42.9372 | 41.7926 | 41.5785 | 40.5816 | 40.5816 | 40.3970 | 40.9656 | 41.5785 | 42.0117 | 42.4646      |
| Average = Sum(39)m / 12 = | 96.1392 | 95.8906 | 95.6469 | 94.5023 | 94.2882 | 93.2913 | 93.2913 | 93.1067 | 93.6753 | 94.2882 | 94.7214 | 95.1743      |
|                           |         |         |         |         |         |         |         |         |         |         |         | 94.5013 (39) |
| HLP                       | 1.1182  | 1.1153  | 1.1124  | 1.0991  | 1.0966  | 1.0850  | 1.0850  | 1.0829  | 1.0895  | 1.0966  | 1.1017  | 1.1069       |
| HLP (average)             |         |         |         |         |         |         |         |         |         |         |         | 1.0991       |
| Days in mont              | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31           |

### 4. Water heating energy requirements (kWh/year)

|                                                                 |          |         |          |         |         |         |         |         |         |         |         |          |              |
|-----------------------------------------------------------------|----------|---------|----------|---------|---------|---------|---------|---------|---------|---------|---------|----------|--------------|
| Assumed occupancy                                               |          |         |          |         |         |         |         |         |         |         |         |          | 2.5666 (42)  |
| Hot water usage for mixer showers                               |          |         |          |         |         |         |         |         |         |         |         |          | 0.0000 (42a) |
| Hot water usage for baths                                       | 29.0443  | 28.6130 | 28.0055  | 26.8856 | 26.0469 | 25.1170 | 24.6147 | 25.2179 | 25.8746 | 26.8697 | 28.0127 | 28.9461  |              |
| Hot water usage for other uses                                  | 40.9146  | 39.4268 | 37.9390  | 36.4512 | 34.9634 | 33.4756 | 33.4756 | 34.9634 | 36.4512 | 37.9390 | 39.4268 | 40.9146  |              |
| Average daily hot water use (litres/day)                        |          |         |          |         |         |         |         |         |         |         |         |          | 64.1237 (43) |
| Daily hot water use                                             | 69.9589  | 68.0398 | 65.9445  | 63.3367 | 61.0103 | 58.5926 | 58.0903 | 60.1813 | 62.3258 | 64.8087 | 67.4395 | 69.8607  |              |
| Energy conte                                                    | 110.7978 | 96.8877 | 101.3543 | 86.7048 | 82.1316 | 72.0464 | 70.2552 | 74.5170 | 76.8540 | 87.9448 | 96.0800 | 109.3850 |              |
| Energy content (annual)                                         |          |         |          |         |         |         |         |         |         |         |         |          | 1064.9585    |
| Distribution loss (46)m = 0.15 x (45)m                          |          |         |          |         |         |         |         |         |         |         |         |          | 0.0000 (46)  |
| Water storage loss (or HIU loss):                               |          |         |          |         |         |         |         |         |         |         |         |          |              |
| Total storage loss                                              | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000   |              |
| If cylinder contains dedicated solar storage                    |          |         |          |         |         |         |         |         |         |         |         |          | 0.0000 (56)  |
| Primary loss                                                    | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000   |              |
| Combi loss                                                      | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000   |              |
| Total heat required for water heating calculated for each month |          |         |          |         |         |         |         |         |         |         |         |          | 0.0000 (59)  |

# Full SAP Calculation Printout



|                                                                                         |         |         |         |         |         |         |         |         |         |         |         |                |
|-----------------------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|----------------|
| WWHRS                                                                                   | 94.1781 | 82.3546 | 86.1511 | 73.6991 | 69.8118 | 61.2394 | 59.7169 | 63.3394 | 65.3259 | 74.7530 | 81.6680 | 92.9773 (62)   |
| PV diverter                                                                             | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (63a)   |
| Solar input                                                                             | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (63b)   |
| FGHRS                                                                                   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (63c)   |
| Output from w/h                                                                         | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (63d)   |
| 12Total per year (kWh/year)                                                             | 94.1781 | 82.3546 | 86.1511 | 73.6991 | 69.8118 | 61.2394 | 59.7169 | 63.3394 | 65.3259 | 74.7530 | 81.6680 | 92.9773 (64)   |
| Electric shower(s)                                                                      | 53.8586 | 47.9885 | 52.4016 | 50.0062 | 50.9446 | 48.5962 | 50.2160 | 50.9446 | 50.0062 | 52.4016 | 51.4162 | 905.2147 (64a) |
| Heat gains from water heating, kWh/month                                                | 37.0092 | 32.5858 | 34.6382 | 30.9263 | 30.1891 | 27.4589 | 27.4832 | 28.5710 | 28.8330 | 31.7887 | 33.2711 | 36.7090 (65)   |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 905 (64) |         |         |         |         |         |         |         |         |         |         |         |                |

## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |           |           |           |           |           |           |           |           |           |           |           |           |      |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------|
| Metabolic gains (Table 5), Watts                                                    | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec       |      |
| (66)m                                                                               | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 122.1242  | 135.2090  | 122.1242  | 126.1950  | 122.1242  | 126.1950  | 122.1242  | 122.1242  | 126.1950  | 122.1242  | 126.1950  | 122.1242  | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 231.4847  | 233.8867  | 227.8336  | 214.9471  | 198.6802  | 183.3916  | 173.1779  | 170.7758  | 176.8289  | 189.7154  | 205.9823  | 221.2709  | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | (69) |
| Pumps, fans                                                                         | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | (71) |
| Water heating gains (Table 5)                                                       | 49.7435   | 48.4907   | 46.5567   | 42.9532   | 40.5767   | 38.1374   | 36.9398   | 38.4019   | 40.0459   | 42.7267   | 46.2098   | 49.3400   | (72) |
| Total internal gains                                                                | 464.8515  | 479.0855  | 458.0136  | 445.5944  | 422.8802  | 409.2230  | 393.7410  | 392.8009  | 404.5689  | 416.0654  | 439.8863  | 454.2343  | (73) |

## 6. Solar gains

| [Jan]       |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 |          | g<br>Specific data<br>or Table 6b |          | FF<br>Specific data<br>or Table 6c |          | Access<br>factor<br>Table 6d |          | Gains<br>W   |
|-------------|----------|----------|----------|------------|--------------------------------|----------|-----------------------------------|----------|------------------------------------|----------|------------------------------|----------|--------------|
| North       |          |          |          | 7.4500     | 10.6334                        |          | 0.6300                            |          | 0.7000                             |          | 0.7700                       |          | 24.2103 (74) |
| South       |          |          |          | 5.6100     | 46.7521                        |          | 0.6300                            |          | 0.7000                             |          | 0.7700                       |          | 80.1559 (78) |
| West        |          |          |          | 0.5200     | 19.6403                        |          | 0.6300                            |          | 0.7000                             |          | 0.7700                       |          | 3.1212 (80)  |
| Solar gains | 107.4874 | 183.6475 | 255.8951 | 329.9432   | 385.0318                       | 390.0431 | 372.7259                          | 329.7794 | 280.9021                           | 203.9120 | 128.7704                     | 92.0117  | (83)         |
| Total gains | 572.3389 | 662.7330 | 713.9086 | 775.5376   | 807.9120                       | 799.2662 | 766.4669                          | 722.5803 | 685.4710                           | 619.9774 | 568.6566                     | 546.2459 | (84)         |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |         |                           |         |              |             |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|--------------|-------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |                           |         | 21.0000 (85) |             |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |         |                           |         |              |             |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct                       | Nov     | Dec          |             |
| tau                                                                         | 39.1493 | 39.2508 | 39.3508 | 39.8274 | 39.9178 | 40.3444 | 40.3444 | 40.4244 | 40.1790 | 39.9178                   | 39.7352 | 39.5462      |             |
| alpha                                                                       | 3.6100  | 3.6167  | 3.6234  | 3.6552  | 3.6612  | 3.6896  | 3.6896  | 3.6950  | 3.6786  | 3.6612                    | 3.6490  | 3.6364       |             |
| util living area                                                            | 0.9843  | 0.9726  | 0.9541  | 0.9069  | 0.8164  | 0.6606  | 0.5093  | 0.5545  | 0.7626  | 0.9222                    | 0.9729  | 0.9867 (86)  |             |
| MIT                                                                         | 19.1491 | 19.4017 | 19.7447 | 20.2144 | 20.6119 | 20.8762 | 20.9640 | 20.9505 | 20.7788 | 20.2698                   | 19.6384 | 19.1119 (87) |             |
| Th 2                                                                        | 19.9860 | 19.9884 | 19.9907 | 20.0016 | 20.0036 | 20.0131 | 20.0131 | 20.0148 | 20.0094 | 20.0036                   | 19.9995 | 19.9952 (88) |             |
| util rest of house                                                          | 0.9810  | 0.9669  | 0.9441  | 0.8855  | 0.7730  | 0.5835  | 0.4058  | 0.4506  | 0.6956  | 0.9000                    | 0.9662  | 0.9838 (89)  |             |
| MIT 2                                                                       | 18.3049 | 18.5558 | 18.8944 | 19.3548 | 19.7206 | 19.9438 | 19.9998 | 19.9951 | 19.8720 | 19.4165                   | 18.8001 | 18.2747 (90) |             |
| Living area fraction                                                        | 18.4680 | 18.7193 | 19.0587 | 19.5210 | 19.8929 | 20.1241 | 20.1862 | 20.1798 | 20.0473 | fLA = Living area / (4) = |         |              | 0.1933 (91) |
| MIT                                                                         | 18.4680 | 18.7193 | 19.0587 | 19.5210 | 19.8929 | 20.1241 | 20.1862 | 20.1798 | 20.0473 | 19.5815                   | 18.9622 | 18.4365 (92) |             |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |                           |         | 0.0000       |             |
| adjusted MIT                                                                | 18.4680 | 18.7193 | 19.0587 | 19.5210 | 19.8929 | 20.1241 | 20.1862 | 20.1798 | 20.0473 | 19.5815                   | 18.9622 | 18.4365 (93) |             |

## 8. Space heating requirement

|                                                                                | Jan       | Feb       | Mar       | Apr       | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov       | Dec            |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|---------------|-----------|----------------|
| Utilisation                                                                    | 0.9742    | 0.9575    | 0.9323    | 0.8733    | 0.7675   | 0.5928   | 0.4247   | 0.4689   | 0.6984   | 0.8884        | 0.9570    | 0.9777 (94)    |
| Useful gains                                                                   | 557.5600  | 634.5530  | 665.5934  | 677.2719  | 620.0860 | 473.7818 | 325.5228 | 338.8280 | 478.7560 | 550.7714      | 544.2245  | 534.0828 (95)  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000    | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000    | 4.2000 (96)    |
| Heat loss rate W                                                               |           |           |           |           |          |          |          |          |          |               |           |                |
| Space heating kWh                                                              | 1362.1036 | 1325.1392 | 1201.2039 | 1003.7044 | 772.4920 | 515.3466 | 334.5599 | 351.9252 | 557.1163 | 846.8451      | 1123.5993 | 1354.9513 (97) |
| Space heating requirement - total per year (kWh/year)                          | 598.5804  | 464.0740  | 398.4942  | 235.0314  | 113.3901 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 220.2789      | 417.1498  | 610.7262 (98a) |
| Solar heating kWh                                                              |           |           |           |           |          |          |          |          |          |               |           | 3057.7250      |
| Space heating contribution - total per year (kWh/year)                         | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | 0.0000 (98b)   |
| Space heating kWh                                                              | 598.5804  | 464.0740  | 398.4942  | 235.0314  | 113.3901 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 220.2789      | 417.1498  | 610.7262 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |          |          |          |          |          |               |           | 3057.7250      |
| Space heating per m2                                                           |           |           |           |           |          |          |          |          |          | (98c) / (4) = |           | 35.5632 (99)   |

## 8c. Space cooling requirement

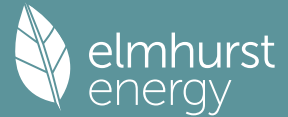
|                                                     |        |        |        |        |         |          |          |          |         |         |        |              |
|-----------------------------------------------------|--------|--------|--------|--------|---------|----------|----------|----------|---------|---------|--------|--------------|
| Calculated for June, July and August. See Table 10b |        |        |        |        |         |          |          |          |         |         |        |              |
|                                                     | Jan    | Feb    | Mar    | Apr    | May     | Jun      | Jul      | Aug      | Sep     | Oct     | Nov    | Dec          |
| Ext. temp.                                          | 4.3000 | 4.9000 | 6.5000 | 8.9000 | 11.7000 | 14.6000  | 16.6000  | 16.4000  | 14.1000 | 10.6000 | 7.1000 | 4.2000       |
| Heat loss rate W                                    | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 876.9380 | 690.3555 | 707.6107 | 0.0000  | 0.0000  | 0.0000 | 0.0000 (100) |
| Utilisation                                         | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 0.7893   | 0.8590   | 0.8316   | 0.0000  | 0.0000  | 0.0000 | 0.0000 (101) |

# Full SAP Calculation Printout



|                                  |        |        |        |        |        |          |          |          |                          |        |        |                |
|----------------------------------|--------|--------|--------|--------|--------|----------|----------|----------|--------------------------|--------|--------|----------------|
| Useful loss                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 692.2086 | 592.9833 | 588.4423 | 0.0000                   | 0.0000 | 0.0000 | 0.0000 (102)   |
| Total gains                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 882.7344 | 846.9121 | 798.0536 | 0.0000                   | 0.0000 | 0.0000 | 0.0000 (103)   |
| Space cooling kWh                |        |        |        |        |        |          |          |          |                          |        |        |                |
|                                  | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 137.1786 | 188.9230 | 155.9508 | 0.0000                   | 0.0000 | 0.0000 | 0.0000 (104)   |
| Cooled fraction                  |        |        |        |        |        |          |          |          | fC = cooled area / (4) = |        |        | 1.0000 (105)   |
| Intermittency factor (Table 10b) |        |        |        |        |        |          |          |          |                          |        |        |                |
|                                  | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500   | 0.2500   | 0.2500   | 0.2500                   | 0.2500 | 0.2500 | 0.2500 (106)   |
| Space cooling kWh                |        |        |        |        |        |          |          |          |                          |        |        |                |
|                                  | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 34.2946  | 47.2308  | 38.9877  | 0.0000                   | 0.0000 | 0.0000 | 0.0000 (107)   |
| Space cooling requirement        |        |        |        |        |        |          |          |          |                          |        |        | 120.5131 (107) |
| Energy for space heating         |        |        |        |        |        |          |          |          |                          |        |        | 35.5632 (99)   |
| Energy for space cooling         |        |        |        |        |        |          |          |          |                          |        |        | 1.4016 (108)   |
| Total                            |        |        |        |        |        |          |          |          |                          |        |        | 36.9649 (109)  |
| Fabric Energy Efficiency (TFEE)  |        |        |        |        |        |          |          |          |                          |        |        | 37.0 (109)     |

# Full SAP Calculation Printout



|                                    |                                                          |               |        |                |            |
|------------------------------------|----------------------------------------------------------|---------------|--------|----------------|------------|
| Plot Reference                     | 4907-R823-9471-005                                       |               |        | Issued on Date | 21/07/2026 |
| Assessment Reference               | Plot 5                                                   | Plot Type Ref | Plot 5 |                |            |
| Plot Address                       | Plot 5, Beaconsfield-Semi, K, WC, B, ES, 1012            |               |        | SAP Version    | 10.2       |
| SAP Rating                         | 90 B                                                     | DER           | 11.13  | TER            | 11.53      |
| Environmental                      | 91 B                                                     | % DER < TER   |        |                | 3.47       |
| CO <sub>2</sub> Emissions (t/year) | 0.85                                                     | DFEE          | 34.39  | TFEE           | 36.96      |
| Compliance Check                   | See BREL                                                 | % DFEE < TFEE |        |                | 6.96       |
| % DPER < TPER                      | 0.74                                                     | DPER          | 59.80  | TPER           | 60.25      |
| Assessor Details                   | Mr. Daniel Harris                                        |               |        | Assessor ID    | R823-0001  |
| Client                             | Crest Nicholson Head Office, Crest Nicholson Head Office |               |        |                |            |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)            | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Main dwelling                                          |                           |                                 |                             |
| Ground floor                                           | 42.9900 (1b)              | x 2.4600 (2b)                   | = 105.7554 (1b) - (3b)      |
| First floor                                            | 42.9900 (1c)              | x 2.7600 (2c)                   | = 118.6524 (1c) - (3c)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 85.9800                   |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 224.4078 (5)              |

## 2. Ventilation rate

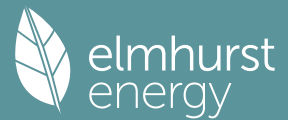
|                                                                                                    | m <sup>3</sup> per hour                 |
|----------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                    |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                    |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                    |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                    |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                    |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                    |
| Number of intermittent extract fans                                                                | 0 * 10 = 0.0000 (7a)                    |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)                    |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 0.0000 / (5) = 0.0000 (8)               |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 4.5000 (17)                             |
| Infiltration rate                                                                                  | 0.2250 (18)                             |
| Number of sides sheltered                                                                          | 2 (19)                                  |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 0.8500 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.1913 (21)        |

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor                                                                                             | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate                                                                                         | 0.2438 | 0.2391 | 0.2343 | 0.2104 | 0.2056 | 0.1817 | 0.1817 | 0.1769 | 0.1913 | 0.2056 | 0.2152 | 0.2247 (22b) |
| Mechanical extract ventilation - decentralised                                                          |        |        |        |        |        |        |        |        |        |        |        |              |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 (25)  |

## 3. Heat losses and heat loss parameter

| Element                                                     | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K   |
|-------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|-----------------|
| Main dwelling                                               |                         |                            |                           |                               |              |                                |                 |
| Front Door                                                  |                         |                            | 2.5500                    | 1.2000                        | 3.0600       |                                | (26)            |
| Windows                                                     |                         |                            | 10.2500                   | 1.2357                        | 12.6663      |                                | (27)            |
| French Doors                                                |                         |                            | 3.3300                    | 1.2357                        | 4.1150       |                                | (27)            |
| GF SPVL 125TS P/A                                           |                         |                            | 42.9900                   | 0.1300                        | 5.5887       | 75.0000                        | 3224.2500 (28a) |
| EW Brick AAC011                                             | 97.2486                 | 16.1300                    | 81.1186                   | 0.1800                        | 14.6013      | 60.0000                        | 4867.1160 (29a) |
| PR 500mm MW044                                              | 42.9900                 |                            | 42.9900                   | 0.0900                        | 3.8691       | 9.0000                         | 386.9100 (30)   |
| Total net area of external elements Aum(A, m <sup>2</sup> ) |                         |                            | 183.2286                  |                               |              |                                | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                         |                         |                            | (26)...(30) + (32) =      |                               | 43.9005      |                                | (33)            |
| Main dwelling                                               |                         |                            |                           |                               |              |                                |                 |
| E-WM-30                                                     |                         |                            | 43.8000                   | 0.0000                        | 0.0000       | 45.0000                        | 1971.0000 (32)  |
| Timber - GF                                                 |                         |                            | 88.6100                   |                               |              | 9.0000                         | 797.4900 (32c)  |
| Timber - FF                                                 |                         |                            | 126.9000                  |                               |              | 9.0000                         | 1142.1000 (32c) |
| Internal Floor FF                                           |                         |                            | 42.9900                   |                               |              | 18.0000                        | 773.8200 (32d)  |
| Internal Ceiling GF                                         |                         |                            | 42.9900                   |                               |              | 9.0000                         | 386.9100 (32e)  |

# Full SAP Calculation Printout



Heat capacity  $C_m = \text{Sum}(A \times k)$   
Thermal mass parameter (TMP) =  $C_m / \text{TFA}$  in  $\text{kJ/m}^2\text{K}$   
List of Thermal Bridges

|                                                      | Length  | Psi-value | Total  |
|------------------------------------------------------|---------|-----------|--------|
| K1 Element                                           |         |           |        |
| E2 Other lintels (including other steel lintels)     | 10.7800 | 0.0410    | 0.4420 |
| E3 Sill                                              | 9.2000  | 0.0220    | 0.2024 |
| E4 Jamb                                              | 21.1500 | 0.0190    | 0.4018 |
| E5 Ground floor (normal)                             | 10.2300 | 0.0928    | 0.9493 |
| E6 Intermediate floor within a dwelling              | 18.6300 | 0.0020    | 0.0373 |
| E10 Eaves (insulation at ceiling level)              | 10.2500 | 0.0390    | 0.3997 |
| E18 Party wall between dwellings                     | 10.4400 | 0.0330    | 0.3445 |
| E4 Jamb                                              | 4.8000  | 0.1000    | 0.4800 |
| E2 Other lintels (including other steel lintels)     | 1.0600  | 0.0410    | 0.0435 |
| P1 Party wall - Ground floor                         | 8.3900  | 0.1000    | 0.8390 |
| P2 Party wall - Intermediate floor within a dwelling | 8.3900  | 0.0000    | 0.0000 |
| P4 Party wall - Roof (insulation at ceiling level)   | 8.3900  | 0.0350    | 0.2937 |
| E5 Ground floor (normal)                             | 8.3900  | 0.0980    | 0.8222 |
| E12 Gable (insulation at ceiling level)              | 8.3900  | 0.0870    | 0.7299 |
| E16 Corner (normal)                                  | 10.4400 | 0.0420    | 0.4385 |

Thermal bridges (Sum(L x Psi) calculated using Appendix K)  
Point Thermal bridges (36a) = 6.4238 (36)  
Total fabric heat loss (33) + (36) + (36a) = 50.3244 (37)

|                                                                                        |         |         |         |         |         |         |         |         |         |         |         |         |      |
|----------------------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)\text{m} \times (5)$ | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |      |
| (38)m                                                                                  | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | (38) |
| Heat transfer coeff                                                                    | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | (39) |
| Average = Sum(39)m / 12 =                                                              |         |         |         |         |         |         |         |         |         |         |         | 87.3516 | (39) |
| HLP                                                                                    | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |      |
| HLP (average)                                                                          | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | (40) |
| Days in mont                                                                           | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31      |      |

## 4. Water heating energy requirements (kWh/year)

|                                                                                |          |          |          |          |          |          |          |          |          |                    |          |           |             |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------------------|----------|-----------|-------------|
| Assumed occupancy                                                              |          |          |          |          |          |          |          |          |          |                    |          |           | 2.5666 (42) |
| Hot water usage for mixer showers                                              |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| 67.2533                                                                        | 66.2426  | 64.7698  | 61.9519  | 59.8724  | 57.5533  | 56.2352  | 57.6968  | 59.2990  | 61.7890  | 64.6674            | 66.9956  | (42a)     |             |
| Hot water usage for baths                                                      |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| 29.0443                                                                        | 28.6130  | 28.0055  | 26.8856  | 26.0469  | 25.1170  | 24.6147  | 25.2179  | 25.8746  | 26.8697  | 28.0127            | 28.9461  | (42b)     |             |
| Hot water usage for other uses                                                 |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| 40.9146                                                                        | 39.4268  | 37.9390  | 36.4512  | 34.9634  | 33.4756  | 33.4756  | 34.9634  | 36.4512  | 37.9390  | 39.4268            | 40.9146  | (42c)     |             |
| Average daily hot water use (litres/day)                                       |          |          |          |          |          |          |          |          |          |                    |          | 126.1290  | (43)        |
| Daily hot water use                                                            | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct                | Nov      | Dec       |             |
| 137.2122                                                                       | 134.2823 | 130.7143 | 125.2887 | 120.8827 | 116.1459 | 114.3255 | 117.8781 | 121.6248 | 126.5977 | 132.1069           | 136.8563 | (44)      |             |
| Energy content (annual)                                                        | 217.3105 | 191.2162 | 200.9030 | 171.5139 | 162.7313 | 142.8150 | 138.2667 | 145.9577 | 149.9756 | 171.7918           | 188.2105 | 214.2839  | (45)        |
| Distribution loss (46)m = 0.15 x (45)m                                         |          |          |          |          |          |          |          |          |          | Total = Sum(45)m = |          | 2094.9763 |             |
| 32.5966                                                                        | 28.6824  | 30.1355  | 25.7271  | 24.4097  | 21.4222  | 20.7400  | 21.8937  | 22.4963  | 25.7688  | 28.2316            | 32.1426  | (46)      |             |
| Water storage loss (or HIU loss):                                              |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| Total storage loss                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | 0.0000    | (56)        |
| If cylinder contains dedicated solar storage                                   |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | 0.0000    | (57)        |
| Primary loss                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | 0.0000    | (59)        |
| Combi loss                                                                     | 11.9874  | 10.8167  | 11.9530  | 11.5193  | 11.8728  | 11.4590  | 11.8214  | 11.8376  | 11.4740  | 11.8918            | 11.5543  | 11.9811   | (61)        |
| Total heat required for water heating calculated for each month                |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| 229.2979                                                                       | 202.0330 | 212.8560 | 183.0332 | 174.6042 | 154.2740 | 150.0882 | 157.7953 | 161.4496 | 183.6836 | 199.7649           | 226.2650 | (62)      |             |
| WWHRS                                                                          | -29.9438 | -26.4825 | -27.7310 | -22.9624 | -21.4001 | -18.3122 | -17.1648 | -18.2530 | -18.9465 | -22.3359           | -25.3038 | -29.3893  | (63a)       |
| PV diverter                                                                    | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000            | -0.0000  | -0.0000   | (63b)       |
| Solar input                                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | 0.0000    | (63c)       |
| FGHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | 0.0000    | (63d)       |
| Output from w/h                                                                | 199.3541 | 175.5504 | 185.1250 | 160.0708 | 153.2041 | 135.9618 | 132.9234 | 139.5422 | 142.5031 | 161.3478           | 174.4610 | 196.8757  | (64)        |
| 12Total per year (kWh/year)                                                    |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| Electric shower(s)                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | 0.0000    | (64a)       |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |          |          |          |          |          |          |                    |          | 0.0000    | (64a)       |
| Heat gains from water heating, kWh/month                                       | 75.2526  | 66.2836  | 69.7885  | 59.9082  | 57.0764  | 50.3507  | 48.9291  | 51.4903  | 52.7354  | 60.0937            | 65.4686  | 74.2447   | (65)        |

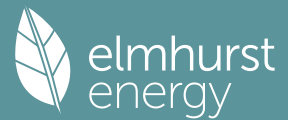
## 5. Internal gains (see Table 5 and 5a)

| Metabolic gains (Table 5), Watts                                                    |           |           |           |           |           |           |           |           |           |           |           |                |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
|                                                                                     | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec            |
| (66)m                                                                               | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 122.1242  | 135.2090  | 122.1242  | 126.1950  | 122.1242  | 126.1950  | 122.1242  | 122.1242  | 126.1950  | 122.1242  | 126.1950  | 122.1242 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 231.4847  | 233.8867  | 227.8336  | 214.9471  | 198.6802  | 183.3916  | 173.1779  | 170.7758  | 176.8289  | 189.7154  | 205.9823  | 221.2709 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330 (69)   |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 3.0000    | 3.0000    | 3.0000 (70)    |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 (71) |
| Water heating gains (Table 5)                                                       | 101.1460  | 98.6363   | 93.8018   | 83.2058   | 76.7156   | 69.9316   | 65.7649   | 69.2074   | 73.2436   | 80.7712   | 90.9286   | 99.7912 (72)   |
| Total internal gains                                                                | 519.2539  | 532.2311  | 508.2586  | 488.8470  | 462.0190  | 441.0172  | 422.5660  | 423.6065  | 437.7667  | 457.1099  | 487.6050  | 507.6854 (73)  |

## 6. Solar gains

| [Jan] | Area<br>m <sup>2</sup> | Solar flux<br>Table 6a<br>W/m <sup>2</sup> | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W |
|-------|------------------------|--------------------------------------------|-----------------------------------|------------------------------------|------------------------------|------------|
|-------|------------------------|--------------------------------------------|-----------------------------------|------------------------------------|------------------------------|------------|

# Full SAP Calculation Printout



|       |  |  |        |  |         |  |        |  |        |  |        |  |              |
|-------|--|--|--------|--|---------|--|--------|--|--------|--|--------|--|--------------|
| North |  |  | 4.1200 |  | 10.6334 |  | 0.4500 |  | 0.0000 |  | 0.7700 |  | 15.1800 (74) |
| South |  |  | 5.6100 |  | 46.7521 |  | 0.4500 |  | 0.0000 |  | 0.7700 |  | 90.8797 (78) |
| West  |  |  | 0.5200 |  | 19.6403 |  | 0.4500 |  | 0.0000 |  | 0.7700 |  | 3.5388 (80)  |
| North |  |  | 3.3300 |  | 10.6334 |  | 0.4500 |  | 0.0000 |  | 0.7700 |  | 12.2693 (74) |

|             |          |          |          |          |          |          |          |          |          |          |          |          |      |
|-------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| Solar gains | 121.8678 | 208.2172 | 290.1305 | 374.0852 | 436.5439 | 442.2258 | 422.5917 | 373.8995 | 318.4831 | 231.1927 | 145.9981 | 104.3216 | (83) |
| Total gains | 641.1217 | 740.4482 | 798.3891 | 862.9322 | 898.5630 | 883.2430 | 845.1577 | 797.5060 | 756.2498 | 688.3026 | 633.6032 | 612.0071 | (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |         |         |         |         |              |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |              |
| tau                                                                         | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 |              |
| alpha                                                                       | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  |              |
| util living area                                                            | 0.9763  | 0.9587  | 0.9308  | 0.8667  | 0.7529  | 0.5887  | 0.4428  | 0.4856  | 0.6965  | 0.8884  | 0.9598  | 0.9800  | (86)         |
| MIT                                                                         | 19.2875 | 19.5678 | 19.9236 | 20.3644 | 20.7207 | 20.9195 | 20.9792 | 20.9701 | 20.8438 | 20.3893 | 19.7537 | 19.2157 | (87)         |
| Th 2                                                                        | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | (88)         |
| util rest of house                                                          | 0.9717  | 0.9508  | 0.9173  | 0.8405  | 0.7060  | 0.5168  | 0.3543  | 0.3949  | 0.6289  | 0.8607  | 0.9507  | 0.9760  | (89)         |
| MIT 2                                                                       | 18.3035 | 18.6160 | 19.0095 | 19.4838 | 19.8436 | 20.0200 | 20.0614 | 20.0567 | 19.9626 | 19.5204 | 18.8278 | 18.2230 | (90)         |
| Living area fraction                                                        |         |         |         |         |         |         |         |         |         |         |         |         | 0.1933 (91)  |
| MIT                                                                         | 18.4937 | 18.7999 | 19.1862 | 19.6540 | 20.0132 | 20.1939 | 20.2388 | 20.2333 | 20.1330 | 19.6884 | 19.0068 | 18.4149 | (92)         |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT                                                                | 18.4937 | 18.7999 | 19.1862 | 19.6540 | 20.0132 | 20.1939 | 20.2388 | 20.2333 | 20.1330 | 19.6884 | 19.0068 | 18.4149 | (93)         |

## 8. Space heating requirement

|                                                                                |           |           |           |          |          |          |          |          |          |               |           |           |       |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|---------------|-----------|-----------|-------|
|                                                                                | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov       | Dec       |       |
| Utilisation                                                                    | 0.9609    | 0.9369    | 0.9015    | 0.8271   | 0.7029   | 0.5268   | 0.3707   | 0.4113   | 0.6338   | 0.8473        | 0.9370    | 0.9662    | (94)  |
| Useful gains                                                                   | 616.0355  | 693.6908  | 719.7806  | 713.6930 | 631.6192 | 465.2760 | 313.3241 | 328.0018 | 479.3454 | 583.1852      | 593.7109  | 591.3031  | (95)  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000    | 4.2000    | (96)  |
| Heat loss rate W                                                               | 1239.8438 | 1214.1832 | 1108.1605 | 939.3812 | 726.1686 | 488.6341 | 317.8571 | 334.8446 | 526.9901 | 793.8854      | 1040.0806 | 1241.6966 | (97)  |
| Space heating kWh                                                              | 464.1134  | 349.7709  | 288.9546  | 162.4955 | 70.3447  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 156.7609      | 321.3862  | 483.8927  | (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |          |          |          |          |          |          |               |           | 2297.7189 |       |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | 0.0000    | (98b) |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |          |          |          |          |          |          |               |           | 0.0000    |       |
| Space heating kWh                                                              | 464.1134  | 349.7709  | 288.9546  | 162.4955 | 70.3447  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 156.7609      | 321.3862  | 483.8927  | (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |          |          |          |          |          |          |               |           | 2297.7189 |       |
| Space heating per m2                                                           |           |           |           |          |          |          |          |          |          | (98c) / (4) = |           | 26.7239   | (99)  |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                                                      |          |          |          |          |          |          |          |          |          |          |          |           |               |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|---------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                |          |          |          |          |          |          |          |          |          |          |          |           | 0.0000 (201)  |
| Fraction of space heat from main system(s)                                                           |          |          |          |          |          |          |          |          |          |          |          |           | 1.0000 (202)  |
| Efficiency of main space heating system 1 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          |           | 91.7000 (206) |
| Efficiency of main space heating system 2 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          |           | 0.0000 (207)  |
| Efficiency of secondary/supplementary heating system, %                                              |          |          |          |          |          |          |          |          |          |          |          |           | 0.0000 (208)  |
|                                                                                                      | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec       |               |
| Space heating requirement                                                                            | 464.1134 | 349.7709 | 288.9546 | 162.4955 | 70.3447  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 156.7609 | 321.3862 | 483.8927  | (98)          |
| Space heating efficiency (main heating system 1)                                                     | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 91.7000  | 91.7000  | 91.7000   | (210)         |
| Space heating fuel (main heating system)                                                             | 506.1215 | 381.4295 | 315.1086 | 177.2033 | 76.7118  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 170.9497 | 350.4757 | 527.6911  | (211)         |
| Space heating efficiency (main heating system 2)                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (212)         |
| Space heating fuel (main heating system 2)                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (213)         |
| Space heating fuel (secondary)                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (215)         |
| Water heating                                                                                        |          |          |          |          |          |          |          |          |          |          |          |           |               |
| Water heating requirement                                                                            | 199.3541 | 175.5504 | 185.1250 | 160.0708 | 153.2041 | 135.9618 | 132.9234 | 139.5422 | 142.5031 | 161.3478 | 174.4610 | 196.8757  | (64)          |
| Efficiency of water heater (217)m                                                                    | 88.1584  | 88.0870  | 87.9680  | 87.7453  | 87.3500  | 86.7000  | 86.7000  | 86.7000  | 86.7000  | 87.7223  | 88.0496  | 88.1823   | (216)         |
| Fuel for water heating, kWh/month                                                                    | 226.1318 | 199.2921 | 210.4459 | 182.4266 | 175.3910 | 156.8186 | 153.3142 | 160.9484 | 164.3635 | 183.9302 | 198.1394 | 223.2598  | (219)         |
| Space cooling fuel requirement                                                                       |          |          |          |          |          |          |          |          |          |          |          |           |               |
| (221)m                                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (221)         |
| Pumps and Fa                                                                                         | 10.9478  | 9.8883   | 10.9478  | 10.9478  | 10.9478  | 10.9478  | 10.9478  | 10.9478  | 10.9478  | 10.9478  | 10.9478  | 10.9478   | (231)         |
| Lighting                                                                                             | 23.4106  | 18.7809  | 16.9101  | 12.3891  | 9.5697   | 7.8185   | 8.7298   | 11.3473  | 14.7390  | 19.3384  | 21.8427  | 24.0613   | (232)         |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |          |          |          |          |          |          |           |               |
| (233a)m                                                                                              | -14.6942 | -22.4007 | -34.8599 | -42.5373 | -48.8442 | -46.7030 | -46.0948 | -41.9719 | -35.2991 | -26.9662 | -16.7286 | -12.5110  | (233a)        |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |          |          |          |          |          |          |          |          |           |               |
| (234a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (234a)        |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |          |          |          |          |          |          |          |          |           |               |
| (235a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235a)        |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |          |          |          |          |          |          |          |          |           |               |
| (235c)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235c)        |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |          |          |          |          |          |          |           |               |
| (233b)m                                                                                              | -4.0882  | -8.9418  | -18.5200 | -29.0022 | -39.5369 | -40.1897 | -39.6495 | -32.9433 | -23.3746 | -13.1010 | -5.5501  | -3.2067   | (233b)        |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |          |          |          |          |          |          |          |          |           |               |
| (234b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (234b)        |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |          |          |          |          |          |          |          |          |           |               |
| (235b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235b)        |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |          |          |          |          |          |          |          |          |           |               |
| (235d)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235d)        |
| Annual totals kWh/year                                                                               |          |          |          |          |          |          |          |          |          |          |          |           |               |
| Space heating fuel - main system 1                                                                   |          |          |          |          |          |          |          |          |          |          |          | 2505.6913 | (211)         |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (213)         |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (215)         |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          | 86.7000   |               |

# Full SAP Calculation Printout



|                                                                                         |                 |
|-----------------------------------------------------------------------------------------|-----------------|
| Water heating fuel used                                                                 | 2234.4615 (219) |
| Space cooling fuel                                                                      | 0.0000 (221)    |
| Electricity for pumps and fans:                                                         |                 |
| (MEVDecentralised, Database: total watage = 5.7980, total flow = 37.0000, SFP = 0.1567) |                 |
| mechanical ventilation fans (SFP = 0.1567)                                              | 42.9017 (230a)  |
| central heating pump                                                                    | 41.0000 (230c)  |
| main heating flue fan                                                                   | 45.0000 (230e)  |
| Total electricity for the above, kWh/year                                               | 128.9017 (231)  |
| Electricity for lighting (calculated in Appendix L)                                     | 188.9373 (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                           |                 |
| PV generation                                                                           | -647.7148 (233) |
| Wind generation                                                                         | 0.0000 (234)    |
| Hydro-electric generation (Appendix N)                                                  | 0.0000 (235a)   |
| Electricity generated - Micro CHP (Appendix N)                                          | 0.0000 (235)    |
| Appendix Q - special features                                                           |                 |
| Energy saved or generated                                                               | -0.0000 (236)   |
| Energy used                                                                             | 0.0000 (237)    |
| Total delivered energy for all uses                                                     | 4410.2770 (238) |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                                 | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|-------------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1                   | 2505.6913          | 0.2100                        | 526.1952 (261)           |
| Total CO2 associated with community systems     |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                      | 2234.4615          | 0.2100                        | 469.2369 (264)           |
| Space and water heating                         |                    |                               | 995.4321 (265)           |
| Pumps, fans and electric keep-hot               | 128.9017           | 0.1387                        | 17.8803 (267)            |
| Energy for lighting                             | 188.9373           | 0.1443                        | 27.2695 (268)            |
| Energy saving/generation technologies           |                    |                               |                          |
| PV Unit electricity used in dwelling            | -389.6109          | 0.1330                        | -51.8040                 |
| PV Unit electricity exported                    | -258.1039          | 0.1248                        | -32.1992                 |
| Total                                           |                    |                               | -84.0033 (269)           |
| Total CO2, kg/year                              |                    |                               | 956.5786 (272)           |
| EPC Dwelling Carbon Dioxide Emission Rate (DER) |                    |                               | 11.1300 (273)            |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1               | 2505.6913          | 1.1300                              | 2831.4312 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 2234.4615          | 1.1300                              | 2524.9415 (278)            |
| Space and water heating                     |                    |                                     | 5356.3727 (279)            |
| Pumps, fans and electric keep-hot           | 128.9017           | 1.5128                              | 195.0025 (281)             |
| Energy for lighting                         | 188.9373           | 1.5338                              | 289.7983 (282)             |
| Energy saving/generation technologies       |                    |                                     |                            |
| PV Unit electricity used in dwelling        | -389.6109          | 1.4913                              | -581.0334                  |
| PV Unit electricity exported                | -258.1039          | 0.4579                              | -118.1785                  |
| Total                                       |                    |                                     | -699.2119 (283)            |
| Total Primary energy kWh/year               |                    |                                     | 5141.9616 (286)            |
| Dwelling Primary energy Rate (DPER)         |                    |                                     | 59.8000 (287)              |

## SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF TARGET EMISSIONS

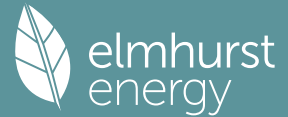
### 1. Overall dwelling characteristics

|                                                         | Area<br>(m2) | Storey height<br>(m)             | Volume<br>(m3)         |
|---------------------------------------------------------|--------------|----------------------------------|------------------------|
| Main dwelling                                           |              |                                  |                        |
| Ground floor                                            | 42.9900 (1b) | x 2.4600 (2b)                    | = 105.7554 (1b) - (3b) |
| First floor                                             | 42.9900 (1c) | x 2.7600 (2c)                    | = 118.6524 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)... (1n) | 85.9800      |                                  | (4)                    |
| Dwelling volume                                         |              | (3a)+(3b)+(3c)+(3d)+(3e)... (3n) | = 224.4078 (5)         |

### 2. Ventilation rate

|                                                                                                    | m3 per hour                |
|----------------------------------------------------------------------------------------------------|----------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)       |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)       |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)       |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)       |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)       |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)       |
| Number of intermittent extract fans                                                                | 3 * 10 = 30.0000 (7a)      |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)       |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)       |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 30.0000 / (5) = 0.1337 (8) |
| Pressure test                                                                                      | Yes                        |
| Pressure Test Method                                                                               | Blower Door                |
| Measured/design AP50                                                                               | 5.0000 (17)                |
| Infiltration rate                                                                                  | 0.3837 (18)                |
| Number of sides sheltered                                                                          | 2 (19)                     |

# Full SAP Calculation Printout



Shelter factor  
Infiltration rate adjusted to include shelter factor

$$(20) = 1 - [0.075 \times (19)] = 0.8500 \quad (20)$$

$$(21) = (18) \times (20) = 0.3261 \quad (21)$$

|                 | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |       |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|
| Wind speed      | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 | (22)  |
| Wind factor     | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 | (22a) |
| Adj infilt rate | 0.4158 | 0.4077 | 0.3995 | 0.3587 | 0.3506 | 0.3098 | 0.3098 | 0.3017 | 0.3261 | 0.3506 | 0.3669 | 0.3832 | (22b) |
| Effective ac    | 0.5865 | 0.5831 | 0.5798 | 0.5643 | 0.5615 | 0.5480 | 0.5480 | 0.5455 | 0.5532 | 0.5615 | 0.5673 | 0.5734 | (25)  |

## 3. Heat losses and heat loss parameter

| Element                                           | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K | A x U<br>W/K         | K-value<br>kJ/m2K | A x K<br>kJ/K |       |
|---------------------------------------------------|-------------|----------------|---------------|------------------|----------------------|-------------------|---------------|-------|
| Main dwelling                                     |             |                |               |                  |                      |                   |               |       |
| TER Opaque door                                   |             |                | 2.5500        | 1.0000           | 2.5500               |                   |               | (26)  |
| TER Opening Type                                  |             |                | 13.5800       | 1.1450           | 15.5496              |                   |               | (27)  |
| GF SPVL 125TS P/A                                 |             |                | 42.9900       | 0.1300           | 5.5887               |                   |               | (28a) |
| EW Brick AAC011                                   | 97.2486     | 16.1300        | 81.1186       | 0.1800           | 14.6013              |                   |               | (29a) |
| PR 500mm MW044                                    | 42.9900     |                | 42.9900       | 0.1100           | 4.7289               |                   |               | (30)  |
| Total net area of external elements Aum(A, m2)    |             |                | 183.2286      |                  |                      |                   |               | (31)  |
| Fabric heat loss, W/K = Sum (A x U)               |             |                |               |                  | (26)...(30) + (32) = | 43.0186           |               | (33)  |
| Main dwelling                                     |             |                |               |                  |                      |                   |               |       |
| E-WM-30                                           |             |                | 43.8000       | 0.0000           | 0.0000               |                   |               | (32)  |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K |             |                |               |                  |                      |                   | 157.5901      | (35)  |

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

List of Thermal Bridges

|                                                            | Length  | Psi-value | Total                 |              |
|------------------------------------------------------------|---------|-----------|-----------------------|--------------|
| K1 Element                                                 | 10.7800 | 0.0500    | 0.5390                |              |
| E2 Other lintels (including other steel lintels)           | 9.2000  | 0.0500    | 0.4600                |              |
| E3 Sill                                                    | 21.1500 | 0.0500    | 1.0575                |              |
| E4 Jamb                                                    | 10.2300 | 0.1600    | 1.6368                |              |
| E5 Ground floor (normal)                                   | 18.6300 | 0.0000    | 0.0000                |              |
| E6 Intermediate floor within a dwelling                    | 10.2500 | 0.0600    | 0.6150                |              |
| E10 Eaves (insulation at ceiling level)                    | 10.4400 | 0.0600    | 0.6264                |              |
| E18 Party wall between dwellings                           | 4.8000  | 0.0500    | 0.2400                |              |
| E4 Jamb                                                    | 1.0600  | 0.0500    | 0.0530                |              |
| E2 Other lintels (including other steel lintels)           | 8.3900  | 0.0800    | 0.6712                |              |
| P1 Party wall - Ground floor                               | 8.3900  | 0.0000    | 0.0000                |              |
| P2 Party wall - Intermediate floor within a dwelling       | 8.3900  | 0.1200    | 1.0068                |              |
| P4 Party wall - Roof (insulation at ceiling level)         | 8.3900  | 0.1600    | 1.3424                |              |
| E5 Ground floor (normal)                                   | 8.3900  | 0.0600    | 0.5034                |              |
| E12 Gable (insulation at ceiling level)                    | 10.4400 | 0.0900    | 0.9396                |              |
| E16 Corner (normal)                                        |         |           |                       |              |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |         |           |                       | 9.6911 (36)  |
| Point Thermal bridges                                      |         |           | (36a) =               | 0.0000       |
| Total fabric heat loss                                     |         |           | (33) + (36) + (36a) = | 52.7097 (37) |

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

Point Thermal bridges

Total fabric heat loss

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

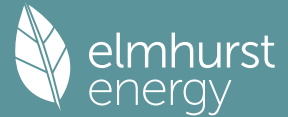
|                           | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |      |
|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| (38)m                     | 43.4295 | 43.1809 | 42.9372 | 41.7926 | 41.5785 | 40.5816 | 40.5816 | 40.3970 | 40.9656 | 41.5785 | 42.0117 | 42.4646 | (38) |
| Heat transfer coeff       | 96.1392 | 95.8906 | 95.6469 | 94.5023 | 94.2882 | 93.2913 | 93.2913 | 93.1067 | 93.6753 | 94.2882 | 94.7214 | 95.1743 | (39) |
| Average = Sum(39)m / 12 = |         |         |         |         |         |         |         |         |         |         |         | 94.5013 |      |

|               | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |      |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| HLP           | 1.1182 | 1.1153 | 1.1124 | 1.0991 | 1.0966 | 1.0850 | 1.0850 | 1.0829 | 1.0895 | 1.0966 | 1.1017 | 1.1069 | (40) |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 1.0991 |      |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31     |      |

## 4. Water heating energy requirements (kWh/year)

|                                                                                |          |          |          |          |          |          |          |          |          |          |          |           |             |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-------------|
| Assumed occupancy                                                              |          |          |          |          |          |          |          |          |          |          |          |           | 2.5666 (42) |
| Hot water usage for mixer showers                                              |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 67.2533                                                                        | 66.2426  | 64.7698  | 61.9519  | 59.8724  | 57.5533  | 56.2352  | 57.6968  | 59.2990  | 61.7890  | 64.6674  | 66.9956  | 66.9956   | (42a)       |
| Hot water usage for baths                                                      |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 29.0443                                                                        | 28.6130  | 28.0055  | 26.8856  | 26.0469  | 25.1170  | 24.6147  | 25.2179  | 25.8746  | 26.8697  | 28.0127  | 28.9461  | 28.9461   | (42b)       |
| Hot water usage for other uses                                                 |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 40.9146                                                                        | 39.4268  | 37.9390  | 36.4512  | 34.9634  | 33.4756  | 33.4756  | 34.9634  | 36.4512  | 37.9390  | 39.4268  | 40.9146  | 40.9146   | (42c)       |
| Average daily hot water use (litres/day)                                       |          |          |          |          |          |          |          |          |          |          |          | 126.1290  | (43)        |
| Daily hot water use                                                            |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 137.2122                                                                       | 134.2823 | 130.7143 | 125.2887 | 120.8827 | 116.1459 | 114.3255 | 117.8781 | 121.6248 | 126.5977 | 132.1069 | 136.8563 | 136.8563  | (44)        |
| Energy conte                                                                   | 217.3105 | 191.2162 | 200.9030 | 171.5139 | 162.7313 | 142.8150 | 138.2667 | 145.9577 | 149.9756 | 171.7918 | 188.2105 | 214.2839  | (45)        |
| Energy content (annual)                                                        |          |          |          |          |          |          |          |          |          |          |          | 2094.9763 |             |
| Distribution loss (46)m = 0.15 x (45)m                                         |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 32.5966                                                                        | 28.6824  | 30.1355  | 25.7271  | 24.4097  | 21.4222  | 20.7400  | 21.8937  | 22.4963  | 25.7688  | 28.2316  | 32.1426  | 32.1426   | (46)        |
| Water storage loss (or HIU loss):                                              |          |          |          |          |          |          |          |          |          |          |          |           |             |
| Total storage loss                                                             |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (56)        |
| If cylinder contains dedicated solar storage                                   |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (57)        |
| Primary loss                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (59)        |
| Combi loss                                                                     | 50.9589  | 46.0274  | 50.9589  | 49.3151  | 50.9589  | 49.3151  | 50.9589  | 50.9589  | 49.3151  | 50.9589  | 49.3151  | 50.9589   | (61)        |
| Total heat required for water heating calculated for each month                |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 268.2694                                                                       | 237.2436 | 251.8620 | 220.8290 | 213.6902 | 192.1300 | 189.2257 | 196.9166 | 199.2907 | 222.7507 | 237.5256 | 265.2428 | 265.2428  | (62)        |
| WWHRS                                                                          | -30.7454 | -27.1915 | -28.4733 | -23.5770 | -21.9730 | -18.8024 | -17.6243 | -18.7416 | -19.4537 | -22.9338 | -25.9812 | -30.1760  | (63a)       |
| PV diverter                                                                    | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000   | (63b)       |
| Solar input                                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (63c)       |
| FGHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (63d)       |
| Output from w/h                                                                | 237.5241 | 210.0522 | 223.3886 | 197.2519 | 191.7173 | 173.3276 | 171.6014 | 178.1749 | 179.8370 | 199.8169 | 211.5444 | 235.0668  | (64)        |
| 12Total per year (kWh/year)                                                    |          |          |          |          |          |          |          |          |          |          |          | 2409.3031 | (64)        |
| Electric shower(s)                                                             |          |          |          |          |          |          |          |          |          |          |          | 2409      | (64)        |
| 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (64a)       |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (64a)       |
| Heat gains from water heating, kWh/month                                       |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 84.9955                                                                        | 75.0862  | 79.5400  | 69.3571  | 66.8479  | 59.8147  | 58.7134  | 61.2707  | 62.1957  | 69.8605  | 74.9088  | 83.9891  | 83.9891   | (65)        |

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## 5. Internal gains (see Table 5 and 5a)

| Metabolic gains (Table 5), Watts                                                    |           |           |           |           |           |           |           |           |           |           |           |                |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
|                                                                                     | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec            |
| (66)m                                                                               | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 122.1242  | 135.2090  | 122.1242  | 126.1950  | 122.1242  | 126.1950  | 122.1242  | 122.1242  | 126.1950  | 122.1242  | 126.1950  | 122.1242 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 231.4847  | 233.8867  | 227.8336  | 214.9471  | 198.6802  | 183.3916  | 173.1779  | 170.7758  | 176.8289  | 189.7154  | 205.9823  | 221.2709 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330 (69)   |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 3.0000    | 3.0000    | 3.0000 (70)    |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 (71) |
| Water heating gains (Table 5)                                                       | 114.2412  | 111.7355  | 106.9086  | 96.3294   | 89.8493   | 83.0760   | 78.9159   | 82.3530   | 86.3828   | 93.8985   | 104.0399  | 112.8886 (72)  |
| Total internal gains                                                                | 532.3492  | 545.3303  | 521.3654  | 501.9705  | 475.1528  | 454.1617  | 435.7170  | 436.7521  | 450.9059  | 470.2373  | 500.7164  | 520.7828 (73)  |

## 6. Solar gains

| [Jan]       |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W   |          |          |               |
|-------------|----------|----------|----------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|--------------|----------|----------|---------------|
| North       |          |          |          | 7.4500     | 10.6334                        | 0.6300                            | 0.7000                             | 0.7700                       | 24.2103 (74) |          |          |               |
| South       |          |          |          | 5.6100     | 46.7521                        | 0.6300                            | 0.7000                             | 0.7700                       | 80.1559 (78) |          |          |               |
| West        |          |          |          | 0.5200     | 19.6403                        | 0.6300                            | 0.7000                             | 0.7700                       | 3.1212 (80)  |          |          |               |
|             |          |          |          |            |                                |                                   |                                    |                              |              |          |          |               |
| Solar gains | 107.4874 | 183.6475 | 255.8951 | 329.9432   | 385.0318                       | 390.0431                          | 372.7259                           | 329.7794                     | 280.9021     | 203.9120 | 128.7704 | 92.0117 (83)  |
| Total gains | 639.8366 | 728.9778 | 777.2605 | 831.9137   | 860.1845                       | 844.2049                          | 808.4429                           | 766.5314                     | 731.8080     | 674.1493 | 629.4868 | 612.7945 (84) |

## 7. Mean internal temperature (heating season)

| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |         |         |         |              |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| tau                                                                         | 39.1493 | 39.2508 | 39.3508 | 39.8274 | 39.9178 | 40.3444 | 40.3444 | 40.4244 | 40.1790 | 39.9178 | 39.7352 | 39.5462      |
| alpha                                                                       | 3.6100  | 3.6167  | 3.6234  | 3.6552  | 3.6612  | 3.6896  | 3.6896  | 3.6950  | 3.6786  | 3.6612  | 3.6490  | 3.6364       |
| util living area                                                            | 0.9780  | 0.9639  | 0.9421  | 0.8897  | 0.7929  | 0.6354  | 0.4864  | 0.5280  | 0.7350  | 0.9040  | 0.9635  | 0.9809 (86)  |
| MIT                                                                         | 19.2598 | 19.5049 | 19.8356 | 20.2802 | 20.6521 | 20.8914 | 20.9690 | 20.9578 | 20.8059 | 20.3371 | 19.7334 | 19.2226 (87) |
| Th 2                                                                        | 19.9860 | 19.9884 | 19.9907 | 20.0016 | 20.0036 | 20.0131 | 20.0131 | 20.0148 | 20.0094 | 20.0036 | 19.9995 | 19.9952 (88) |
| util rest of house                                                          | 0.9734  | 0.9566  | 0.9299  | 0.8657  | 0.7471  | 0.5585  | 0.3861  | 0.4271  | 0.6659  | 0.8781  | 0.9548  | 0.9770 (89)  |
| MIT 2                                                                       | 17.9686 | 18.2790 | 18.6953 | 19.2482 | 19.6820 | 19.9361 | 19.9986 | 19.9936 | 19.8573 | 19.3283 | 18.5786 | 17.9275 (90) |
| Living area fraction                                                        | 18.2182 | 18.5159 | 18.9157 | 19.4477 | 19.8695 | 20.1208 | 20.1862 | 20.1800 | 20.0407 | 19.5233 | 18.8018 | 18.1779 (92) |
| MIT                                                                         | 18.2182 | 18.5159 | 18.9157 | 19.4477 | 19.8695 | 20.1208 | 20.1862 | 20.1800 | 20.0407 | 19.5233 | 18.8018 | 18.1779 (93) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT                                                                | 18.2182 | 18.5159 | 18.9157 | 19.4477 | 19.8695 | 20.1208 | 20.1862 | 20.1800 | 20.0407 | 19.5233 | 18.8018 | 18.1779 (93) |

## 8. Space heating requirement

|                                                                                | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov       | Dec            |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|---------------|-----------|----------------|
| Utilisation                                                                    | 0.9624    | 0.9424    | 0.9134    | 0.8499   | 0.7402   | 0.5675   | 0.4043   | 0.4448   | 0.6683   | 0.8629        | 0.9409    | 0.9669 (94)    |
| Useful gains                                                                   | 615.7576  | 687.0120  | 709.9672  | 707.0356 | 636.6783 | 479.0609 | 326.8758 | 340.9337 | 489.1003 | 581.7083      | 592.2975  | 592.5120 (95)  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000    | 4.2000 (96)    |
| Heat loss rate W                                                               | 1338.0861 | 1305.6403 | 1187.5243 | 996.7818 | 770.2901 | 515.0386 | 334.5622 | 351.9452 | 556.4967 | 841.3604      | 1108.4096 | 1330.3346 (97) |
| Space heating kWh                                                              | 537.4124  | 415.7183  | 355.3024  | 208.6173 | 99.4072  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 193.1811      | 371.6007  | 548.9400 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |          |          |          |          |          |          |               |           | 2730.1794      |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |          |          |          |          |          |          |               |           | 0.0000         |
| Space heating kWh                                                              | 537.4124  | 415.7183  | 355.3024  | 208.6173 | 99.4072  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 193.1811      | 371.6007  | 548.9400 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |          |          |          |          |          |          |               |           | 2730.1794      |
| Space heating per m <sup>2</sup>                                               |           |           |           |          |          |          |          |          |          | (98c) / (4) = |           | 31.7537 (99)   |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

| Fraction of space heat from secondary/supplementary system (Table 11) |          |          |          |          |          |          |          |          |          |          |          |                |
|-----------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| Fraction of space heat from main system(s)                            |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (201)   |
| Efficiency of main space heating system 1 (in %)                      |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (202)   |
| Efficiency of main space heating system 2 (in %)                      |          |          |          |          |          |          |          |          |          |          |          | 92.4000 (206)  |
| Efficiency of secondary/supplementary heating system, %               |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)   |
|                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)   |
|                                                                       | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec            |
| Space heating requirement                                             | 537.4124 | 415.7183 | 355.3024 | 208.6173 | 99.4072  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 193.1811 | 371.6007 | 548.9400 (98)  |
| Space heating efficiency (main heating system 1)                      | 92.4000  | 92.4000  | 92.4000  | 92.4000  | 92.4000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 92.4000  | 92.4000  | 92.4000 (210)  |
| Space heating fuel (main heating system)                              | 581.6151 | 449.9116 | 384.5265 | 225.7763 | 107.5835 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 209.0705 | 402.1652 | 594.0909 (211) |
| Space heating efficiency (main heating system 2)                      | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)   |
| Space heating fuel (main heating system 2)                            | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)   |
| Space heating fuel (secondary)                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)   |
| Water heating                                                         |          |          |          |          |          |          |          |          |          |          |          |                |
| Water heating requirement                                             | 237.5241 | 210.0522 | 223.3886 | 197.2519 | 191.7173 | 173.3276 | 171.6014 | 178.1749 | 179.8370 | 199.8169 | 211.5444 | 235.0668 (64)  |
| Efficiency of water heater                                            |          |          |          |          |          |          |          |          |          |          |          | 80.3000 (216)  |

# Full SAP Calculation Printout



|                                                                                                      |          |          |          |           |           |           |           |           |           |          |          |            |        |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|----------|------------|--------|
| (217)m                                                                                               | 86.0745  | 85.8150  | 85.3706  | 84.5017   | 83.0431   | 80.3000   | 80.3000   | 80.3000   | 80.3000   | 84.3091  | 85.5753  | 86.1341    | (217)  |
| Fuel for water heating, kWh/month                                                                    | 275.9518 | 244.7733 | 261.6694 | 233.4295  | 230.8648  | 215.8501  | 213.7004  | 221.8866  | 223.9564  | 237.0052 | 247.2027 | 272.9078   | (219)  |
| Space cooling fuel requirement                                                                       |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (221)m                                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (221)  |
| Pumps and Fa                                                                                         | 7.3041   | 6.5973   | 7.3041   | 7.0685    | 7.3041    | 7.0685    | 7.3041    | 7.0685    | 7.3041    | 7.0685   | 7.3041   | 7.0685     | (231)  |
| Lighting                                                                                             | 25.3750  | 20.3568  | 18.3290  | 13.4286   | 10.3727   | 8.4745    | 9.4623    | 12.2994   | 15.9757   | 20.9610  | 23.6755  | 26.0803    | (232)  |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (233a)m                                                                                              | -39.8696 | -56.0257 | -80.2676 | -89.9369  | -96.7057  | -90.1510  | -89.0213  | -84.1676  | -75.5697  | -63.9045 | -43.7612 | -34.4899   | (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (234a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (234a) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (235a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (235a) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (235c)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (235c) |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (233b)m                                                                                              | -23.0762 | -48.4849 | -96.2662 | -144.4459 | -190.8693 | -191.7487 | -189.5061 | -160.5221 | -117.7385 | -69.3076 | -30.7987 | -18.2537   | (233b) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (234b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (234b) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (235b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (235b) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (235d)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (235d) |
| Annual totals kWh/year                                                                               |          |          |          |           |           |           |           |           |           |          |          |            |        |
| Space heating fuel - main system 1                                                                   |          |          |          |           |           |           |           |           |           |          |          | 2954.7396  | (211)  |
| Space heating fuel - main system 2                                                                   |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (213)  |
| Space heating fuel - secondary                                                                       |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (215)  |
| Efficiency of water heater                                                                           |          |          |          |           |           |           |           |           |           |          |          | 80.3000    |        |
| Water heating fuel used                                                                              |          |          |          |           |           |           |           |           |           |          |          | 2879.1979  | (219)  |
| Space cooling fuel                                                                                   |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (221)  |
| Electricity for pumps and fans:                                                                      |          |          |          |           |           |           |           |           |           |          |          |            |        |
| Total electricity for the above, kWh/year                                                            |          |          |          |           |           |           |           |           |           |          |          | 86.0000    | (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |          |          |          |           |           |           |           |           |           |          |          | 204.7908   | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |          |          |           |           |           |           |           |           |          |          |            |        |
| PV generation                                                                                        |          |          |          |           |           |           |           |           |           |          |          | -2124.8885 | (233)  |
| Wind generation                                                                                      |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (234)  |
| Hydro-electric generation (Appendix N)                                                               |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (235a) |
| Electricity generated - Micro CHP (Appendix N)                                                       |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (235)  |
| Appendix Q - special features                                                                        |          |          |          |           |           |           |           |           |           |          |          |            |        |
| Energy saved or generated                                                                            |          |          |          |           |           |           |           |           |           |          |          | -0.0000    | (236)  |
| Energy used                                                                                          |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (237)  |
| Total delivered energy for all uses                                                                  |          |          |          |           |           |           |           |           |           |          |          | 3999.8399  | (238)  |

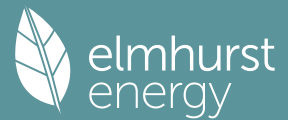
## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                               | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |       |
|-----------------------------------------------|--------------------|-------------------------------|--------------------------|-------|
| Space heating - main system 1                 | 2954.7396          | 0.2100                        | 620.4953                 | (261) |
| Total CO2 associated with community systems   |                    |                               | 0.0000                   | (373) |
| Water heating (other fuel)                    | 2879.1979          | 0.2100                        | 604.6316                 | (264) |
| Space and water heating                       |                    |                               | 1225.1269                | (265) |
| Pumps, fans and electric keep-hot             | 86.0000            | 0.1387                        | 11.9293                  | (267) |
| Energy for lighting                           | 204.7908           | 0.1443                        | 29.5576                  | (268) |
| Energy saving/generation technologies         |                    |                               |                          |       |
| PV Unit electricity used in dwelling          | -843.8706          | 0.1347                        | -113.6365                |       |
| PV Unit electricity exported                  | -1281.0179         | 0.1259                        | -161.3091                |       |
| Total                                         |                    |                               | -274.9456                | (269) |
| Total CO2, kg/year                            |                    |                               | 991.6682                 | (272) |
| EPC Target Carbon Dioxide Emission Rate (TER) |                    |                               | 11.5300                  | (273) |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |       |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|-------|
| Space heating - main system 1               | 2954.7396          | 1.1300                              | 3338.8558                  | (275) |
| Total CO2 associated with community systems |                    |                                     | 0.0000                     | (473) |
| Water heating (other fuel)                  | 2879.1979          | 1.1300                              | 3253.4937                  | (278) |
| Space and water heating                     |                    |                                     | 6592.3495                  | (279) |
| Pumps, fans and electric keep-hot           | 86.0000            | 1.5128                              | 130.1008                   | (281) |
| Energy for lighting                         | 204.7908           | 1.5338                              | 314.1150                   | (282) |
| Energy saving/generation technologies       |                    |                                     |                            |       |
| PV Unit electricity used in dwelling        | -843.8706          | 1.4977                              | -1263.8554                 |       |
| PV Unit electricity exported                | -1281.0179         | 0.4622                              | -592.1168                  |       |
| Total                                       |                    |                                     | -1855.9722                 | (283) |
| Total Primary energy kWh/year               |                    |                                     | 5180.5931                  | (286) |
| Target Primary Energy Rate (TPER)           |                    |                                     | 60.2500                    | (287) |

# Full SAP Calculation Printout



|                                    |                                                          |               |        |                |            |
|------------------------------------|----------------------------------------------------------|---------------|--------|----------------|------------|
| Plot Reference                     | 4907-R823-9471-005                                       |               |        | Issued on Date | 21/07/2026 |
| Assessment Reference               | Plot 5                                                   | Plot Type Ref | Plot 5 |                |            |
| Plot Address                       | Plot 5, Beaconsfield-Semi, K, WC, B, ES, 1012            |               |        | SAP Version    | 10.2       |
| SAP Rating                         | 90 B                                                     | DER           | 11.13  | TER            | 11.53      |
| Environmental                      | 91 B                                                     | % DER < TER   |        |                | 3.47       |
| CO <sub>2</sub> Emissions (t/year) | 0.85                                                     | DFEE          | 34.39  | TFEE           | 36.96      |
| Compliance Check                   | See BREL                                                 | % DFEE < TFEE |        |                | 6.96       |
| % DPER < TPER                      | 0.74                                                     | DPER          | 59.80  | TPER           | 60.25      |
| Assessor Details                   | Mr. Daniel Harris                                        |               |        | Assessor ID    | R823-0001  |
| Client                             | Crest Nicholson Head Office, Crest Nicholson Head Office |               |        |                |            |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF ENERGY RATING

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)              | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|-----------------------------------|-----------------------------|
| Main dwelling                                          |                           |                                   |                             |
| Ground floor                                           | 42.9900 (1b)              | x 2.4600 (2b)                     | = 105.7554 (1b) - (3b)      |
| First floor                                            | 42.9900 (1c)              | x 2.7600 (2c)                     | = 118.6524 (1c) - (3c)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 85.9800                   |                                   | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 224.4078 (5)                |

## 2. Ventilation rate

|                                                                                                    | m <sup>3</sup> per hour                 |
|----------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                    |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                    |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                    |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                    |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                    |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                    |
| Number of intermittent extract fans                                                                | 0 * 10 = 0.0000 (7a)                    |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)                    |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 0.0000 / (5) = 0.0000 (8)               |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 4.5000 (17)                             |
| Infiltration rate                                                                                  | 0.2250 (18)                             |
| Number of sides sheltered                                                                          | 2 (19)                                  |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 0.8500 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.1913 (21)        |

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor                                                                                             | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate                                                                                         | 0.2438 | 0.2391 | 0.2343 | 0.2104 | 0.2056 | 0.1817 | 0.1817 | 0.1769 | 0.1913 | 0.2056 | 0.2152 | 0.2247 (22b) |
| Mechanical extract ventilation - decentralised                                                          |        |        |        |        |        |        |        |        |        |        |        |              |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 (25)  |

## 3. Heat losses and heat loss parameter

| Element                                                     | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K   |
|-------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|-----------------|
| Main dwelling                                               |                         |                            |                           |                               |              |                                |                 |
| Front Door                                                  |                         |                            | 2.5500                    | 1.2000                        | 3.0600       |                                | (26)            |
| Windows                                                     |                         |                            | 10.2500                   | 1.2357                        | 12.6663      |                                | (27)            |
| French Doors                                                |                         |                            | 3.3300                    | 1.2357                        | 4.1150       |                                | (27)            |
| GF SPVL 125TS P/A                                           |                         |                            | 42.9900                   | 0.1300                        | 5.5887       | 75.0000                        | 3224.2500 (28a) |
| EW Brick AAC011                                             | 97.2486                 | 16.1300                    | 81.1186                   | 0.1800                        | 14.6013      | 60.0000                        | 4867.1160 (29a) |
| PR 500mm MW044                                              | 42.9900                 |                            | 42.9900                   | 0.0900                        | 3.8691       | 9.0000                         | 386.9100 (30)   |
| Total net area of external elements Aum(A, m <sup>2</sup> ) |                         |                            | 183.2286                  |                               |              |                                | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                         |                         |                            |                           | (26)...(30) + (32) =          | 43.9005      |                                | (33)            |
| Main dwelling                                               |                         |                            |                           |                               |              |                                |                 |
| E-WM-30                                                     |                         |                            | 43.8000                   | 0.0000                        | 0.0000       | 45.0000                        | 1971.0000 (32)  |
| Timber - GF                                                 |                         |                            | 88.6100                   |                               |              | 9.0000                         | 797.4900 (32c)  |
| Timber - FF                                                 |                         |                            | 126.9000                  |                               |              | 9.0000                         | 1142.1000 (32c) |
| Internal Floor FF                                           |                         |                            | 42.9900                   |                               |              | 18.0000                        | 773.8200 (32d)  |
| Internal Ceiling GF                                         |                         |                            | 42.9900                   |                               |              | 9.0000                         | 386.9100 (32e)  |

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Heat capacity  $C_m = \text{Sum}(A \times k)$   
Thermal mass parameter (TMP) =  $C_m / \text{TFA}$  in  $\text{kJ/m}^2\text{K}$   
List of Thermal Bridges

(28)...(30) + (32) + (32a)...(32e) = 13549.5960 (34)  
157.5901 (35)

|                                                      | Length  | Psi-value | Total  |
|------------------------------------------------------|---------|-----------|--------|
| K1 Element                                           |         |           |        |
| E2 Other lintels (including other steel lintels)     | 10.7800 | 0.0410    | 0.4420 |
| E3 Sill                                              | 9.2000  | 0.0220    | 0.2024 |
| E4 Jamb                                              | 21.1500 | 0.0190    | 0.4018 |
| E5 Ground floor (normal)                             | 10.2300 | 0.0928    | 0.9493 |
| E6 Intermediate floor within a dwelling              | 18.6300 | 0.0020    | 0.0373 |
| E10 Eaves (insulation at ceiling level)              | 10.2500 | 0.0390    | 0.3997 |
| E18 Party wall between dwellings                     | 10.4400 | 0.0330    | 0.3445 |
| E4 Jamb                                              | 4.8000  | 0.1000    | 0.4800 |
| E2 Other lintels (including other steel lintels)     | 1.0600  | 0.0410    | 0.0435 |
| P1 Party wall - Ground floor                         | 8.3900  | 0.1000    | 0.8390 |
| P2 Party wall - Intermediate floor within a dwelling | 8.3900  | 0.0000    | 0.0000 |
| P4 Party wall - Roof (insulation at ceiling level)   | 8.3900  | 0.0350    | 0.2937 |
| E5 Ground floor (normal)                             | 8.3900  | 0.0980    | 0.8222 |
| E12 Gable (insulation at ceiling level)              | 8.3900  | 0.0870    | 0.7299 |
| E16 Corner (normal)                                  | 10.4400 | 0.0420    | 0.4385 |

Thermal bridges (Sum(L x Psi) calculated using Appendix K)  
Point Thermal bridges (36a) = 0.0000  
Total fabric heat loss (33) + (36) + (36a) = 50.3244 (37)

| Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)\text{m} \times (5)$ | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |      |
|----------------------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| (38)m                                                                                  | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | (38) |
| Heat transfer coeff                                                                    | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | (39) |
| Average = Sum(39)m / 12 =                                                              |         |         |         |         |         |         |         |         |         |         |         | 87.3516 |      |
| HLP                                                                                    | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | (40) |
| HLP (average)                                                                          |         |         |         |         |         |         |         |         |         |         |         | 1.0160  |      |
| Days in mont                                                                           | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31      |      |

## 4. Water heating energy requirements (kWh/year)

|                                                                                |          |          |          |          |          |          |          |          |          |                    |          |           |             |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------------------|----------|-----------|-------------|
| Assumed occupancy                                                              |          |          |          |          |          |          |          |          |          |                    |          |           | 2.5666 (42) |
| Hot water usage for mixer showers                                              |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| 67.2533                                                                        | 66.2426  | 64.7698  | 61.9519  | 59.8724  | 57.5533  | 56.2352  | 57.6968  | 59.2990  | 61.7890  | 64.6674            | 66.9956  | (42a)     |             |
| Hot water usage for baths                                                      |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| 29.0443                                                                        | 28.6130  | 28.0055  | 26.8856  | 26.0469  | 25.1170  | 24.6147  | 25.2179  | 25.8746  | 26.8697  | 28.0127            | 28.9461  | (42b)     |             |
| Hot water usage for other uses                                                 |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| 40.9146                                                                        | 39.4268  | 37.9390  | 36.4512  | 34.9634  | 33.4756  | 33.4756  | 34.9634  | 36.4512  | 37.9390  | 39.4268            | 40.9146  | (42c)     |             |
| Average daily hot water use (litres/day)                                       |          |          |          |          |          |          |          |          |          |                    |          | 126.1290  | (43)        |
| Daily hot water use                                                            |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| 137.2122                                                                       | 134.2823 | 130.7143 | 125.2887 | 120.8827 | 116.1459 | 114.3255 | 117.8781 | 121.6248 | 126.5977 | 132.1069           | 136.8563 | (44)      |             |
| Energy conte                                                                   | 217.3105 | 191.2162 | 200.9030 | 171.5139 | 162.7313 | 142.8150 | 138.2667 | 145.9577 | 149.9756 | 171.7918           | 188.2105 | 214.2839  | (45)        |
| Energy content (annual)                                                        |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| Distribution loss (46)m = 0.15 x (45)m                                         |          |          |          |          |          |          |          |          |          | Total = Sum(45)m = |          | 2094.9763 |             |
| 32.5966                                                                        | 28.6824  | 30.1355  | 25.7271  | 24.4097  | 21.4222  | 20.7400  | 21.8937  | 22.4963  | 25.7688  | 28.2316            | 32.1426  | (46)      |             |
| Water storage loss (or HIU loss):                                              |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| Total storage loss                                                             |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | (56)      |             |
| If cylinder contains dedicated solar storage                                   |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | (57)      |             |
| Primary loss                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | 0.0000    | (59)        |
| Combi loss                                                                     | 11.9874  | 10.8167  | 11.9530  | 11.5193  | 11.8728  | 11.4590  | 11.8214  | 11.8376  | 11.4740  | 11.8918            | 11.5543  | 11.9811   | (61)        |
| Total heat required for water heating calculated for each month                |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| 229.2979                                                                       | 202.0330 | 212.8560 | 183.0332 | 174.6042 | 154.2740 | 150.0882 | 157.7953 | 161.4496 | 183.6836 | 199.7649           | 226.2650 | (62)      |             |
| WWHRS                                                                          | -29.9438 | -26.4825 | -27.7310 | -22.9624 | -21.4001 | -18.3122 | -17.1648 | -18.2530 | -18.9465 | -22.3359           | -25.3038 | -29.3893  | (63a)       |
| PV diverter                                                                    | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000            | -0.0000  | -0.0000   | (63b)       |
| Solar input                                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | 0.0000    | (63c)       |
| FGHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | 0.0000    | (63d)       |
| Output from w/h                                                                |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| 199.3541                                                                       | 175.5504 | 185.1250 | 160.0708 | 153.2041 | 135.9618 | 132.9234 | 139.5422 | 142.5031 | 161.3478 | 174.4610           | 196.8757 | (64)      |             |
| Electric shower(s)                                                             |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | (64a)     |             |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |          |          |          |          |          |          |                    |          | 0.0000    | (64a)       |
| Heat gains from water heating, kWh/month                                       |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| 75.2526                                                                        | 66.2836  | 69.7885  | 59.9082  | 57.0764  | 50.3507  | 48.9291  | 51.4903  | 52.7354  | 60.0937  | 65.4686            | 74.2447  | (65)      |             |

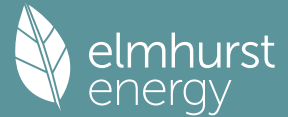
## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |           |           |           |           |           |           |           |           |           |           |           |           |      |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------|
| Metabolic gains (Table 5), Watts                                                    |           |           |           |           |           |           |           |           |           |           |           |           |      |
|                                                                                     | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec       |      |
| (66)m                                                                               | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     |           |           |           |           |           |           |           |           |           |           |           |           |      |
|                                                                                     | 26.7460   | 23.7556   | 19.3193   | 14.6260   | 10.9331   | 9.2302    | 9.9735    | 12.9640   | 17.4002   | 22.0936   | 25.7865   | 27.4894   | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 |           |           |           |           |           |           |           |           |           |           |           |           |      |
|                                                                                     | 345.4995  | 349.0847  | 340.0501  | 320.8165  | 296.5375  | 273.7188  | 258.4744  | 254.8892  | 263.9238  | 283.1574  | 307.4363  | 330.2551  | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    |           |           |           |           |           |           |           |           |           |           |           |           |      |
|                                                                                     | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | (69) |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 3.0000    | 3.0000    | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 |           |           |           |           |           |           |           |           |           |           |           |           |      |
|                                                                                     | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | (71) |
| Water heating gains (Table 5)                                                       |           |           |           |           |           |           |           |           |           |           |           |           |      |
|                                                                                     | 101.1460  | 98.6363   | 93.8018   | 83.2058   | 76.7156   | 69.9316   | 65.7649   | 69.2074   | 73.2436   | 80.7712   | 90.9286   | 99.7912   | (72) |
| Total internal gains                                                                |           |           |           |           |           |           |           |           |           |           |           |           |      |
|                                                                                     | 580.6898  | 578.7749  | 560.4695  | 525.9466  | 491.4845  | 457.1788  | 438.5111  | 441.3589  | 458.8659  | 493.3204  | 531.4497  | 564.8340  | (73) |

## 6. Solar gains

| [Jan] | Area<br>m <sup>2</sup> | Solar flux<br>Table 6a<br>W/m <sup>2</sup> | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W   |
|-------|------------------------|--------------------------------------------|-----------------------------------|------------------------------------|------------------------------|--------------|
| North | 4.1200                 | 10.6334                                    | 0.4500                            | 0.0000                             | 0.7700                       | 15.1800 (74) |

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|       |        |         |        |        |        |              |
|-------|--------|---------|--------|--------|--------|--------------|
| South | 5.6100 | 46.7521 | 0.4500 | 0.0000 | 0.7700 | 90.8797 (78) |
| West  | 0.5200 | 19.6403 | 0.4500 | 0.0000 | 0.7700 | 3.5388 (80)  |
| North | 3.3300 | 10.6334 | 0.4500 | 0.0000 | 0.7700 | 12.2693 (74) |

|             |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Solar gains | 121.8678 | 208.2172 | 290.1305 | 374.0852 | 436.5439 | 442.2258 | 422.5917 | 373.8995 | 318.4831 | 231.1927 | 145.9981 | 104.3216 (83) |
| Total gains | 702.5576 | 786.9920 | 850.6000 | 900.0318 | 928.0284 | 899.4046 | 861.1028 | 815.2584 | 777.3491 | 724.5132 | 677.4478 | 669.1557 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |                           |         |         |         |         |         |         |         |         |         |         |              |             |
|-----------------------------------------------------------------------------|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|-------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |                           |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |             |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |                           |         |         |         |         |         |         |         |         |         |         |              |             |
|                                                                             | Jan                       | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |             |
| tau                                                                         | 43.0876                   | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876      |             |
| alpha                                                                       | 3.8725                    | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725       |             |
| util living area                                                            | 0.9685                    | 0.9506  | 0.9179  | 0.8533  | 0.7388  | 0.5802  | 0.4353  | 0.4762  | 0.6838  | 0.8738  | 0.9510  | 0.9734 (86)  |             |
| MIT                                                                         | 19.3995                   | 19.6464 | 20.0010 | 20.4058 | 20.7394 | 20.9235 | 20.9804 | 20.9720 | 20.8537 | 20.4337 | 19.8280 | 19.3218 (87) |             |
| Th 2                                                                        | 20.0701                   | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 (88) |             |
| util rest of house                                                          | 0.9625                    | 0.9414  | 0.9025  | 0.8256  | 0.6912  | 0.5087  | 0.3480  | 0.3867  | 0.6160  | 0.8438  | 0.9402  | 0.9683 (89)  |             |
| MIT 2                                                                       | 18.4281                   | 18.7022 | 19.0923 | 19.5253 | 19.8602 | 20.0226 | 20.0619 | 20.0577 | 19.9701 | 19.5647 | 18.9089 | 18.3415 (90) |             |
| Living area fraction                                                        | fLA = Living area / (4) = |         |         |         |         |         |         |         |         |         |         |              | 0.1933 (91) |
| MIT                                                                         | 18.6159                   | 18.8847 | 19.2679 | 19.6955 | 20.0301 | 20.1967 | 20.2395 | 20.2344 | 20.1409 | 19.7327 | 19.0866 | 18.5310 (92) |             |
| Temperature adjustment                                                      |                           |         |         |         |         |         |         |         |         |         |         |              | 0.0000      |
| adjusted MIT                                                                | 18.6159                   | 18.8847 | 19.2679 | 19.6955 | 20.0301 | 20.1967 | 20.2395 | 20.2344 | 20.1409 | 19.7327 | 19.0866 | 18.5310 (93) |             |

## 8. Space heating requirement

|                                                                                |                            |           |           |          |          |          |          |          |          |          |           |                |
|--------------------------------------------------------------------------------|----------------------------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|-----------|----------------|
|                                                                                | Jan                        | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov       | Dec            |
| Utilisation                                                                    | 0.9500                     | 0.9266    | 0.8866    | 0.8129   | 0.6890   | 0.5189   | 0.3642   | 0.4030   | 0.6215   | 0.8312   | 0.9257    | 0.9568 (94)    |
| Useful gains                                                                   | 667.4324                   | 729.1983  | 754.1330  | 731.6128 | 639.4299 | 466.6920 | 313.6505 | 328.5616 | 483.1279 | 602.1921 | 627.1172  | 640.2463 (95)  |
| Ext temp.                                                                      | 4.3000                     | 4.9000    | 6.5000    | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000  | 7.1000    | 4.2000 (96)    |
| Heat loss rate W                                                               | 1250.5164                  | 1221.5895 | 1115.2987 | 943.0032 | 727.6503 | 488.8847 | 317.9143 | 334.9425 | 527.6850 | 797.7572 | 1047.0466 | 1251.8360 (97) |
| Space heating kWh                                                              | 433.8145                   | 330.8869  | 268.7073  | 152.2010 | 65.6360  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 145.5005 | 302.3492  | 455.0227 (98a) |
| Space heating requirement - total per year (kWh/year)                          | 2154.1181                  |           |           |          |          |          |          |          |          |          |           |                |
| Solar heating kWh                                                              | 0.0000                     | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         | 0.0000                     |           |           |          |          |          |          |          |          |          |           |                |
| Space heating kWh                                                              | 433.8145                   | 330.8869  | 268.7073  | 152.2010 | 65.6360  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 145.5005 | 302.3492  | 455.0227 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) | 2154.1181                  |           |           |          |          |          |          |          |          |          |           |                |
| Space heating per m2                                                           | (98c) / (4) = 25.0537 (99) |           |           |          |          |          |          |          |          |          |           |                |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                                                              |                 |          |          |          |          |          |          |          |          |          |          |                 |
|--------------------------------------------------------------------------------------------------------------|-----------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                        |                 |          |          |          |          |          |          |          |          |          |          | 0.0000 (201)    |
| Fraction of space heat from main system(s)                                                                   |                 |          |          |          |          |          |          |          |          |          |          | 1.0000 (202)    |
| Efficiency of main space heating system 1 (in %)                                                             |                 |          |          |          |          |          |          |          |          |          |          | 91.7000 (206)   |
| Efficiency of main space heating system 2 (in %)                                                             |                 |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)    |
| Efficiency of secondary/supplementary heating system, %                                                      |                 |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)    |
|                                                                                                              | Jan             | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec             |
| Space heating requirement                                                                                    | 433.8145        | 330.8869 | 268.7073 | 152.2010 | 65.6360  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 145.5005 | 302.3492 | 455.0227 (98)   |
| Space heating efficiency (main heating system 1)                                                             | 91.7000         | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 91.7000  | 91.7000  | 91.7000 (210)   |
| Space heating fuel (main heating system)                                                                     | 473.0801        | 360.8363 | 293.0287 | 165.9771 | 71.5769  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 158.6701 | 329.7156 | 496.2080 (211)  |
| Space heating efficiency (main heating system 2)                                                             | 0.0000          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)    |
| Space heating fuel (main heating system 2)                                                                   | 0.0000          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)    |
| Space heating fuel (secondary)                                                                               | 0.0000          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)    |
| Water heating                                                                                                |                 |          |          |          |          |          |          |          |          |          |          |                 |
| Water heating requirement                                                                                    | 199.3541        | 175.5504 | 185.1250 | 160.0708 | 153.2041 | 135.9618 | 132.9234 | 139.5422 | 142.5031 | 161.3478 | 174.4610 | 196.8757 (64)   |
| Efficiency of water heater (217)m                                                                            | 88.1279         | 88.0606  | 87.9312  | 87.7110  | 87.3193  | 86.7000  | 86.7000  | 86.7000  | 86.7000  | 87.6832  | 88.0199  | 86.7000 (216)   |
| Fuel for water heating, kWh/month                                                                            | 226.2100        | 199.3517 | 210.5339 | 182.4980 | 175.4526 | 156.8186 | 153.3142 | 160.9484 | 164.3635 | 184.0121 | 198.2063 | 223.3286 (219)  |
| Space cooling fuel requirement (221)m                                                                        | 0.0000          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)    |
| Pumps and Fa                                                                                                 | 10.9478         | 9.8883   | 10.9478  | 10.5947  | 10.9478  | 10.5947  | 10.9478  | 10.9478  | 10.5947  | 10.9478  | 10.5947  | 10.9478 (231)   |
| Lighting                                                                                                     | 23.4106         | 18.7809  | 16.9101  | 12.3891  | 9.5697   | 7.8185   | 8.7298   | 11.3473  | 14.7390  | 19.3384  | 21.8427  | 24.0613 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity) (233a)m                                        | -14.6942        | -22.4007 | -34.8599 | -42.5373 | -48.8442 | -46.7030 | -46.0948 | -41.9719 | -35.2991 | -26.9662 | -16.7286 | -12.5110 (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m                              | 0.0000          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m                  | 0.0000          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m | 0.0000          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)   |
| Electricity generated by PVs (Appendix M) (negative quantity) (233b)m                                        | -4.0882         | -8.9418  | -18.5200 | -29.0022 | -39.5369 | -40.1897 | -39.6495 | -32.9433 | -23.3746 | -13.1010 | -5.5501  | -3.2067 (233b)  |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m                              | 0.0000          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234b)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m                  | 0.0000          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m | 0.0000          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235d)   |
| Annual totals kWh/year                                                                                       |                 |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating fuel - main system 1                                                                           | 2349.0928 (211) |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating fuel - main system 2                                                                           | 0.0000 (213)    |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating fuel - secondary                                                                               | 0.0000 (215)    |          |          |          |          |          |          |          |          |          |          |                 |
| Efficiency of water heater                                                                                   | 86.7000         |          |          |          |          |          |          |          |          |          |          |                 |
| Water heating fuel used                                                                                      | 2235.0379 (219) |          |          |          |          |          |          |          |          |          |          |                 |

# Full SAP Calculation Printout



|                                                                                                                            |                 |
|----------------------------------------------------------------------------------------------------------------------------|-----------------|
| Space cooling fuel                                                                                                         | 0.0000 (221)    |
| Electricity for pumps and fans:<br>(MEVDecentralised, Database: total watage = 5.7980, total flow = 37.0000, SFP = 0.1567) |                 |
| mechanical ventilation fans (SFP = 0.1567)                                                                                 | 42.9017 (230a)  |
| central heating pump                                                                                                       | 41.0000 (230c)  |
| main heating flue fan                                                                                                      | 45.0000 (230e)  |
| Total electricity for the above, kWh/year                                                                                  | 128.9017 (231)  |
| Electricity for lighting (calculated in Appendix L)                                                                        | 188.9373 (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                                              |                 |
| PV generation                                                                                                              | -647.7148 (233) |
| Wind generation                                                                                                            | 0.0000 (234)    |
| Hydro-electric generation (Appendix N)                                                                                     | 0.0000 (235a)   |
| Electricity generated - Micro CHP (Appendix N)                                                                             | 0.0000 (235)    |
| Appendix Q - special features                                                                                              |                 |
| Energy saved or generated                                                                                                  | -0.0000 (236)   |
| Energy used                                                                                                                | 0.0000 (237)    |
| Total delivered energy for all uses                                                                                        | 4254.2549 (238) |

## 10a. Fuel costs - using Table 12 prices

|                                             | Fuel<br>kWh/year | Fuel price<br>p/kWh | Fuel cost<br>£/year |
|---------------------------------------------|------------------|---------------------|---------------------|
| Space heating - main system 1               | 2349.0928        | 3.6400              | 85.5070 (240)       |
| Total CO2 associated with community systems |                  |                     | 0.0000 (473)        |
| Water heating (other fuel)                  | 2235.0379        | 3.6400              | 81.3554 (247)       |
| Energy for instantaneous electric shower(s) | 0.0000           | 16.4900             | 0.0000 (247a)       |
| Pumps, fans and electric keep-hot           | 128.9017         | 16.4900             | 21.2559 (249)       |
| Energy for lighting                         | 188.9373         | 16.4900             | 31.1558 (250)       |
| Additional standing charges                 |                  |                     | 92.0000 (251)       |
| Energy saving/generation technologies       |                  |                     |                     |
| PV Unit electricity used in dwelling        | -389.6109        | 16.4900             | -64.2468            |
| PV Unit electricity exported                | -258.1039        | 5.5900              | -14.4280            |
| Total                                       |                  |                     | -78.6748 (252)      |
| Total energy cost                           |                  |                     | 232.5992 (255)      |

## 11a. SAP rating - Individual heating systems

|                                  |                                               |
|----------------------------------|-----------------------------------------------|
| Energy cost deflator (Table 12): | 0.3600 (256)                                  |
| Energy cost factor (ECF)         | [(255) x (256)] / [(4) + 45.0] = 0.6393 (257) |
| SAP value                        | 89.6369                                       |
| SAP rating (Section 12)          | 90 (258)                                      |
| SAP band                         | B                                             |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|---------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1               | 2349.0928          | 0.2100                        | 493.3095 (261)           |
| Total CO2 associated with community systems |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                  | 2235.0379          | 0.2100                        | 469.3580 (264)           |
| Space and water heating                     |                    |                               | 962.6674 (265)           |
| Pumps, fans and electric keep-hot           | 128.9017           | 0.1387                        | 17.8803 (267)            |
| Energy for lighting                         | 188.9373           | 0.1443                        | 27.2695 (268)            |
| Energy saving/generation technologies       |                    |                               |                          |
| PV Unit electricity used in dwelling        | -389.6109          | 0.1330                        | -51.8040                 |
| PV Unit electricity exported                | -258.1039          | 0.1248                        | -32.1992                 |
| Total                                       |                    |                               | -84.0033 (269)           |
| Total CO2, kg/year                          |                    |                               | 923.8139 (272)           |
| CO2 emissions per m2                        |                    |                               | 10.7400 (273)            |
| EI value                                    |                    |                               | 90.5489                  |
| EI rating                                   |                    |                               | 91 (274)                 |
| EI band                                     |                    |                               | B                        |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m2) | Storey height<br>(m)              | Volume<br>(m3)         |
|--------------------------------------------------------|--------------|-----------------------------------|------------------------|
| Main dwelling                                          |              |                                   |                        |
| Ground floor                                           | 42.9900 (1b) | x 2.4600 (2b)                     | = 105.7554 (1b) - (3b) |
| First floor                                            | 42.9900 (1c) | x 2.7600 (2c)                     | = 118.6524 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 85.9800      |                                   | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 224.4078 (5)           |

## 2. Ventilation rate

|                                                    | m3 per hour          |
|----------------------------------------------------|----------------------|
| Number of open chimneys                            | 0 * 80 = 0.0000 (6a) |
| Number of open flues                               | 0 * 20 = 0.0000 (6b) |
| Number of chimneys / flues attached to closed fire | 0 * 10 = 0.0000 (6c) |

# Full SAP Calculation Printout



Number of flues attached to solid fuel boiler 0 \* 20 = 0.0000 (6d)  
Number of flues attached to other heater 0 \* 35 = 0.0000 (6e)  
Number of blocked chimneys 0 \* 20 = 0.0000 (6f)  
Number of intermittent extract fans 0 \* 10 = 0.0000 (7a)  
Number of passive vents 0 \* 10 = 0.0000 (7b)  
Number of flueless gas fires 0 \* 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 0.0000 / (5) = 0.0000 (8)  
Pressure test Yes  
Pressure Test Method Blower Door  
Measured/design AP50 4.5000 (17)  
Infiltration rate 0.2250 (18)  
Number of sides sheltered 2 (19)  
Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)  
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1913 (21)

|                                                                                                         |        |        |        |        |        |        |        |        |        |        |        |              |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|                                                                                                         | 4.2000 | 4.0000 | 4.0000 | 3.7000 | 3.7000 | 3.3000 | 3.4000 | 3.2000 | 3.3000 | 3.5000 | 3.5000 | 3.8000       |
| Wind factor                                                                                             | 1.0500 | 1.0000 | 1.0000 | 0.9250 | 0.9250 | 0.8250 | 0.8500 | 0.8000 | 0.8250 | 0.8750 | 0.8750 | 0.9500       |
| Adj infilt rate                                                                                         | 0.2008 | 0.1913 | 0.1913 | 0.1769 | 0.1769 | 0.1578 | 0.1626 | 0.1530 | 0.1578 | 0.1673 | 0.1673 | 0.1817       |
| Mechanical extract ventilation - decentralised                                                          |        |        |        |        |        |        |        |        |        |        |        |              |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 (25)  |

## 3. Heat losses and heat loss parameter

| Element                                        | Gross m2 | Openings m2 | NetArea m2 | U-value W/m2K        | A x U W/K | K-value kJ/m2K | A x K kJ/K      |
|------------------------------------------------|----------|-------------|------------|----------------------|-----------|----------------|-----------------|
| Main dwelling                                  |          |             |            |                      |           |                |                 |
| Front Door                                     |          |             | 2.5500     | 1.2000               | 3.0600    |                | (26)            |
| Windows                                        |          |             | 10.2500    | 1.2357               | 12.6663   |                | (27)            |
| French Doors                                   |          |             | 3.3300     | 1.2357               | 4.1150    |                | (27)            |
| GF SPVL 125TS P/A                              |          |             | 42.9900    | 0.1300               | 5.5887    | 75.0000        | 3224.2500 (28a) |
| EW Brick AAC011                                | 97.2486  | 16.1300     | 81.1186    | 0.1800               | 14.6013   | 60.0000        | 4867.1160 (29a) |
| PR 500mm MW044                                 | 42.9900  |             | 42.9900    | 0.0900               | 3.8691    | 9.0000         | 386.9100 (30)   |
| Total net area of external elements Aum(A, m2) |          |             | 183.2286   |                      |           |                | (31)            |
| Fabric heat loss, W/K = Sum (A x U)            |          |             |            | (26)...(30) + (32) = | 43.9005   |                | (33)            |
| Main dwelling                                  |          |             |            |                      |           |                |                 |
| E-WM-30                                        |          |             | 43.8000    | 0.0000               | 0.0000    | 45.0000        | 1971.0000 (32)  |
| Timber - GF                                    |          |             | 88.6100    |                      |           | 9.0000         | 797.4900 (32c)  |
| Timber - FF                                    |          |             | 126.9000   |                      |           | 9.0000         | 1142.1000 (32c) |
| Internal Floor FF                              |          |             | 42.9900    |                      |           | 18.0000        | 773.8200 (32d)  |
| Internal Ceiling GF                            |          |             | 42.9900    |                      |           | 9.0000         | 386.9100 (32e)  |

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13549.5960 (34)  
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 157.5901 (35)

List of Thermal Bridges

| K1 Element                                           | Length  | Psi-value | Total  |
|------------------------------------------------------|---------|-----------|--------|
| E2 Other lintels (including other steel lintels)     | 10.7800 | 0.0410    | 0.4420 |
| E3 Sill                                              | 9.2000  | 0.0220    | 0.2024 |
| E4 Jamb                                              | 21.1500 | 0.0190    | 0.4018 |
| E5 Ground floor (normal)                             | 10.2300 | 0.0928    | 0.9493 |
| E6 Intermediate floor within a dwelling              | 18.6300 | 0.0020    | 0.0373 |
| E10 Eaves (insulation at ceiling level)              | 10.2500 | 0.0390    | 0.3997 |
| E18 Party wall between dwellings                     | 10.4400 | 0.0330    | 0.3445 |
| E4 Jamb                                              | 4.8000  | 0.1000    | 0.4800 |
| E2 Other lintels (including other steel lintels)     | 1.0600  | 0.0410    | 0.0435 |
| P1 Party wall - Ground floor                         | 8.3900  | 0.1000    | 0.8390 |
| P2 Party wall - Intermediate floor within a dwelling | 8.3900  | 0.0000    | 0.0000 |
| P4 Party wall - Roof (insulation at ceiling level)   | 8.3900  | 0.0350    | 0.2937 |
| E5 Ground floor (normal)                             | 8.3900  | 0.0980    | 0.8222 |
| E12 Gable (insulation at ceiling level)              | 8.3900  | 0.0870    | 0.7299 |
| E16 Corner (normal)                                  | 10.4400 | 0.0420    | 0.4385 |

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.4238 (36)  
Point Thermal bridges (36a) = 0.0000  
Total fabric heat loss (33) + (36) + (36a) = 50.3244 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

|                           |         |         |         |         |         |         |         |         |         |         |         |              |
|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| (38)m                     | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
|                           | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 (38) |
| Heat transfer coeff       | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 (39) |
| Average = Sum(39)m / 12 = |         |         |         |         |         |         |         |         |         |         |         | 87.3516      |

|               |        |        |        |        |        |        |        |        |        |        |        |             |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------------|
| HLP           | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec         |
|               | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 (40) |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 1.0160      |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31          |

## 4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5666 (42)

Hot water usage for mixer showers 67.2533 66.2426 64.7698 61.9519 59.8724 57.5533 56.2352 57.6968 59.2990 61.7890 64.6674 66.9956 (42a)

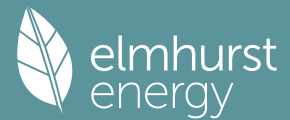
Hot water usage for baths 29.0443 28.6130 28.0055 26.8856 26.0469 25.1170 24.6147 25.2179 25.8746 26.8697 28.0127 28.9461 (42b)

Hot water usage for other uses 40.9146 39.4268 37.9390 36.4512 34.9634 33.4756 33.4756 34.9634 36.4512 37.9390 39.4268 40.9146 (42c)

Average daily hot water use (litres/day) 126.1290 (43)

|                                        |          |          |          |          |          |          |          |          |          |          |          |                              |
|----------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------------------------------|
| Daily hot water use                    | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec                          |
|                                        | 137.2122 | 134.2823 | 130.7143 | 125.2887 | 120.8827 | 116.1459 | 114.3255 | 117.8781 | 121.6248 | 126.5977 | 132.1069 | 136.8563 (44)                |
| Energy conte                           | 217.3105 | 191.2162 | 200.9030 | 171.5139 | 162.7313 | 142.8150 | 138.2667 | 145.9577 | 149.9756 | 171.7918 | 188.2105 | 214.2839 (45)                |
| Energy content (annual)                |          |          |          |          |          |          |          |          |          |          |          | Total = Sum(45)m = 2094.9763 |
| Distribution loss (46)m = 0.15 x (45)m |          |          |          |          |          |          |          |          |          |          |          |                              |
|                                        | 32.5966  | 28.6824  | 30.1355  | 25.7271  | 24.4097  | 21.4222  | 20.7400  | 21.8937  | 22.4963  | 25.7688  | 28.2316  | 32.1426 (46)                 |
| Water storage loss (or HIU loss):      |          |          |          |          |          |          |          |          |          |          |          |                              |
| Total storage loss                     |          |          |          |          |          |          |          |          |          |          |          |                              |

# Full SAP Calculation Printout



|                                                                                             |          |          |          |          |          |          |          |          |          |          |          |                |
|---------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| If cylinder contains dedicated solar storage                                                | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (56)    |
| Primary loss                                                                                | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (57)    |
| Combi loss                                                                                  | 11.9874  | 10.8167  | 11.9530  | 11.5193  | 11.8728  | 11.4590  | 11.8214  | 11.8376  | 11.4740  | 11.8918  | 11.5543  | 11.9811 (61)   |
| Total heat required for water heating calculated for each month                             | 229.2979 | 202.0330 | 212.8560 | 183.0332 | 174.6042 | 154.2740 | 150.0882 | 157.7953 | 161.4496 | 183.6836 | 199.7649 | 226.2650 (62)  |
| WWHRS                                                                                       | -29.9438 | -26.4825 | -27.7310 | -22.9624 | -21.4001 | -18.3122 | -17.1648 | -18.2530 | -18.9465 | -22.3359 | -25.3038 | -29.3893 (63a) |
| PV diverter                                                                                 | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000 (63b)  |
| Solar input                                                                                 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63c)   |
| FGHRS                                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63d)   |
| Output from w/h                                                                             | 199.3541 | 175.5504 | 185.1250 | 160.0708 | 153.2041 | 135.9618 | 132.9234 | 139.5422 | 142.5031 | 161.3478 | 174.4610 | 196.8757 (64)  |
| Electric shower(s)                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (64a)   |
| Heat gains from water heating, kWh/month                                                    | 75.2526  | 66.2836  | 69.7885  | 59.9082  | 57.0764  | 50.3507  | 48.9291  | 51.4903  | 52.7354  | 60.0937  | 65.4686  | 74.2447 (65)   |
| Total per year (kWh/year) = Sum(64)m = 1956.9195 (64)                                       |          |          |          |          |          |          |          |          |          |          |          |                |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a) |          |          |          |          |          |          |          |          |          |          |          |                |

## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |           |           |           |           |           |           |           |           |           |           |           |                |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
| Metabolic gains (Table 5), Watts                                                    | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec            |
| (66)m                                                                               | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 26.7460   | 23.7556   | 19.3193   | 14.6260   | 10.9331   | 9.2302    | 9.9735    | 12.9640   | 17.4002   | 22.0936   | 25.7865   | 27.4894 (67)   |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 345.4995  | 349.0847  | 340.0501  | 320.8165  | 296.5375  | 273.7188  | 258.4744  | 254.8892  | 263.9238  | 283.1574  | 307.4363  | 330.2551 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662 (69)   |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 3.0000    | 3.0000    | 3.0000 (70)    |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 (71) |
| Water heating gains (Table 5)                                                       | 101.1460  | 98.6363   | 93.8018   | 83.2058   | 76.7156   | 69.9316   | 65.7649   | 69.2074   | 73.2436   | 80.7712   | 90.9286   | 99.7912 (72)   |
| Total internal gains                                                                | 580.6898  | 578.7749  | 560.4695  | 525.9466  | 491.4845  | 457.1788  | 438.5111  | 441.3589  | 458.8659  | 493.3204  | 531.4497  | 564.8340 (73)  |

## 6. Solar gains

| [Jan]       |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W   |          |          |               |
|-------------|----------|----------|----------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|--------------|----------|----------|---------------|
| <hr/>       |          |          |          |            |                                |                                   |                                    |                              |              |          |          |               |
| North       |          |          |          | 4.1200     | 11.9814                        | 0.4500                            | 0.0000                             | 0.7700                       | 17.1045 (74) |          |          |               |
| South       |          |          |          | 5.6100     | 50.9848                        | 0.4500                            | 0.0000                             | 0.7700                       | 99.1076 (78) |          |          |               |
| West        |          |          |          | 0.5200     | 22.3313                        | 0.4500                            | 0.0000                             | 0.7700                       | 4.0237 (80)  |          |          |               |
| North       |          |          |          | 3.3300     | 11.9814                        | 0.4500                            | 0.0000                             | 0.7700                       | 13.8247 (74) |          |          |               |
| <hr/>       |          |          |          |            |                                |                                   |                                    |                              |              |          |          |               |
| Solar gains | 134.0605 | 206.4061 | 285.4873 | 382.3913   | 437.4205                       | 475.2993                          | 448.8592                           | 404.2252                     | 340.7223     | 245.0438 | 164.5793 | 113.6339 (83) |
| Total gains | 714.7502 | 785.1810 | 845.9568 | 908.3379   | 928.9050                       | 932.4781                          | 887.3703                           | 845.5841                     | 799.5882     | 738.3643 | 696.0290 | 678.4680 (84) |

## 7. Mean internal temperature (heating season)

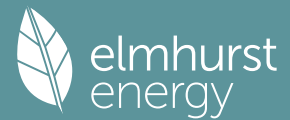
|                                                                             |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 (85) |
| tau                                                                         | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725       |
| alpha                                                                       | 0.9614  | 0.9442  | 0.9044  | 0.8199  | 0.6698  | 0.4548  | 0.3030  | 0.3275  | 0.5892  | 0.8347  | 0.9360  | 0.9671 (86)  |
| util living area                                                            | 19.5571 | 19.7583 | 20.1304 | 20.5375 | 20.8424 | 20.9740 | 20.9961 | 20.9947 | 20.9269 | 20.5789 | 20.0045 | 19.4932 (87) |
| MIT                                                                         | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 (88) |
| util rest of house                                                          | 0.9539  | 0.9335  | 0.8860  | 0.7858  | 0.6117  | 0.3756  | 0.2132  | 0.2339  | 0.5094  | 0.7956  | 0.9216  | 0.9605 (89)  |
| MIT 2                                                                       | 18.6048 | 18.8270 | 19.2337 | 19.6614 | 19.9545 | 20.0576 | 20.0692 | 20.0688 | 20.0276 | 19.7132 | 19.1034 | 18.5343 (90) |
| Living area fraction                                                        | 18.7889 | 19.0070 | 19.4070 | 19.8308 | 20.1261 | 20.2348 | 20.2483 | 20.2477 | 20.2015 | 19.8805 | 19.2776 | 18.7196 (92) |
| MIT                                                                         | 18.7889 | 19.0070 | 19.4070 | 19.8308 | 20.1261 | 20.2348 | 20.2483 | 20.2477 | 20.2015 | 19.8805 | 19.2776 | 18.7196 (93) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT                                                                | 18.7889 | 19.0070 | 19.4070 | 19.8308 | 20.1261 | 20.2348 | 20.2483 | 20.2477 | 20.2015 | 19.8805 | 19.2776 | 18.7196 (93) |

## 8. Space heating requirement

|                                                                                |           |           |           |          |          |          |          |          |          |          |          |                |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| Utilisation                                                                    | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec            |
| Useful gains                                                                   | 0.9403    | 0.9183    | 0.8704    | 0.7761   | 0.6154   | 0.3900   | 0.2306   | 0.2519   | 0.5212   | 0.7865   | 0.9063   | 0.9478 (94)    |
| Ext temp.                                                                      | 672.0801  | 721.0175  | 736.3113  | 704.9447 | 571.6785 | 363.6273 | 204.5887 | 213.0356 | 416.7486 | 580.7270 | 630.8218 | 643.0463 (95)  |
| Heat loss rate W                                                               | 5.1000    | 5.6000    | 7.4000    | 9.9000   | 13.0000  | 16.0000  | 17.9000  | 17.8000  | 15.2000  | 11.6000  | 8.0000   | 5.1000 (96)    |
| Space heating kWh                                                              | 1195.7455 | 1171.1221 | 1048.8342 | 867.4680 | 622.4803 | 369.9152 | 205.1320 | 213.8147 | 436.8853 | 723.3159 | 985.1178 | 1189.6985 (97) |
| Space heating requirement - total per year (kWh/year)                          | 389.6070  | 302.4703  | 232.5170  | 117.0167 | 37.7965  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 106.0861 | 255.0931 | 406.7093 (98a) |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (98b)   |
| Space heating kWh                                                              | 389.6070  | 302.4703  | 232.5170  | 117.0167 | 37.7965  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 106.0861 | 255.0931 | 406.7093 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |          |          |          |          |          |          |          |          | 1847.2961      |
| Space heating per m2                                                           |           |           |           |          |          |          |          |          |          |          |          | 21.4852 (99)   |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

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|                                                                                                      |          |          |          |          |          |          |          |          |          |          |          |                 |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (201)    |
| Fraction of space heat from main system(s)                                                           |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (202)    |
| Efficiency of main space heating system 1 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 91.7000 (206)   |
| Efficiency of main space heating system 2 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)    |
| Efficiency of secondary/supplementary heating system, %                                              |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)    |
|                                                                                                      | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec             |
| Space heating requirement                                                                            | 389.6070 | 302.4703 | 232.5170 | 117.0167 | 37.7965  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 106.0861 | 255.0931 | 406.7093 (98)   |
| Space heating efficiency (main heating system 1)                                                     | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 91.7000  | 91.7000  | 91.7000 (210)   |
| Space heating fuel (main heating system)                                                             | 424.8713 | 329.8477 | 253.5628 | 127.6082 | 41.2176  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 115.6882 | 278.1823 | 443.5216 (211)  |
| Space heating efficiency (main heating system 2)                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)    |
| Space heating fuel (main heating system 2)                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)    |
| Space heating fuel (secondary)                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)    |
| Water heating                                                                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| Water heating requirement                                                                            | 199.3541 | 175.5504 | 185.1250 | 160.0708 | 153.2041 | 135.9618 | 132.9234 | 139.5422 | 142.5031 | 161.3478 | 174.4610 | 196.8757 (64)   |
| Efficiency of water heater                                                                           | 88.0779  | 88.0171  | 87.8567  | 87.5746  | 87.1076  | 86.7000  | 86.7000  | 86.7000  | 86.7000  | 87.5210  | 87.9349  | 86.7000 (216)   |
| Fuel for water heating, kWh/month                                                                    | 226.3385 | 199.4504 | 210.7124 | 182.7822 | 175.8790 | 156.8186 | 153.3142 | 160.9484 | 164.3635 | 184.3532 | 198.3978 | 88.1039 (217)   |
| Space cooling fuel requirement                                                                       |          |          |          |          |          |          |          |          |          |          |          |                 |
| (221)m                                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)    |
| Pumps and Fa                                                                                         | 10.9478  | 9.8883   | 10.9478  | 10.5947  | 10.9478  | 10.5947  | 10.9478  | 10.9478  | 10.5947  | 10.9478  | 10.5947  | 10.9478 (231)   |
| Lighting                                                                                             | 23.4106  | 18.7809  | 16.9101  | 12.3891  | 9.5697   | 7.8185   | 8.7298   | 11.3473  | 14.7390  | 19.3384  | 21.8427  | 24.0613 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | -16.2309 | -22.5799 | -34.8167 | -43.4616 | -48.9761 | -49.0347 | -48.0402 | -44.4687 | -37.4200 | -28.6331 | -18.8171 | -13.7131 (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | -4.8241  | -9.0657  | -18.4786 | -30.2089 | -39.7478 | -44.3434 | -43.0957 | -36.9163 | -26.1012 | -14.5792 | -6.7758  | -3.7312 (233b)  |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234b)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235d)   |
| Annual totals kWh/year                                                                               |          |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating fuel - main system 1                                                                   |          |          |          |          |          |          |          |          |          |          |          | 2014.4996 (211) |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)    |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)    |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          | 86.7000         |
| Water heating fuel used                                                                              |          |          |          |          |          |          |          |          |          |          |          | 2236.8166 (219) |
| Space cooling fuel                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (221)    |
| Electricity for pumps and fans:                                                                      |          |          |          |          |          |          |          |          |          |          |          |                 |
| (MEV)Decentralised, Database: total watage = 5.7980, total flow = 37.0000, SFP = 0.1567)             |          |          |          |          |          |          |          |          |          |          |          |                 |
| mechanical ventilation fans (SFP = 0.1567)                                                           |          |          |          |          |          |          |          |          |          |          |          | 42.9017 (230a)  |
| central heating pump                                                                                 |          |          |          |          |          |          |          |          |          |          |          | 41.0000 (230c)  |
| main heating flue fan                                                                                |          |          |          |          |          |          |          |          |          |          |          | 45.0000 (230e)  |
| Total electricity for the above, kWh/year                                                            |          |          |          |          |          |          |          |          |          |          |          | 128.9017 (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |          |          |          |          |          |          |          |          |          |          |          | 188.9373 (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| PV generation                                                                                        |          |          |          |          |          |          |          |          |          |          |          | -684.0599 (233) |
| Wind generation                                                                                      |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (234)    |
| Hydro-electric generation (Appendix N)                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (235a)   |
| Electricity generated - Micro CHP (Appendix N)                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (235)    |
| Appendix Q - special features                                                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| Energy saved or generated                                                                            |          |          |          |          |          |          |          |          |          |          |          | -0.0000 (236)   |
| Energy used                                                                                          |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (237)    |
| Total delivered energy for all uses                                                                  |          |          |          |          |          |          |          |          |          |          |          | 3885.0953 (238) |

## 10a. Fuel costs - using BEDF prices (596)

|                                             | Fuel<br>kWh/year | Fuel price<br>p/kWh | Fuel cost<br>£/year |
|---------------------------------------------|------------------|---------------------|---------------------|
| Space heating - main system 1               | 2014.4996        | 7.3200              | 147.4614 (240)      |
| Total CO2 associated with community systems |                  |                     | 0.0000 (473)        |
| Water heating (other fuel)                  | 2236.8166        | 7.3200              | 163.7350 (247)      |
| Energy for instantaneous electric shower(s) | 0.0000           | 27.6700             | 0.0000 (247a)       |
| Pumps, fans and electric keep-hot           | 128.9017         | 27.6700             | 35.6671 (249)       |
| Energy for lighting                         | 188.9373         | 27.6700             | 52.2789 (250)       |
| Additional standing charges                 |                  |                     | 108.0000 (251)      |
| Energy saving/generation technologies       |                  |                     |                     |
| PV Unit electricity used in dwelling        | -406.1918        | 27.6700             | -112.3933           |
| PV Unit electricity exported                | -277.8681        | 5.8100              | -16.1441            |
| Total                                       |                  |                     | -128.5374 (252)     |
| Total energy cost                           |                  |                     | 378.6050 (255)      |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|---------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1               | 2014.4996          | 0.2100                        | 423.0449 (261)           |
| Total CO2 associated with community systems |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                  | 2236.8166          | 0.2100                        | 469.7315 (264)           |
| Space and water heating                     |                    |                               | 892.7764 (265)           |
| Pumps, fans and electric keep-hot           | 128.9017           | 0.1387                        | 17.8803 (267)            |
| Energy for lighting                         | 188.9373           | 0.1443                        | 27.2695 (268)            |
| Energy saving/generation technologies       |                    |                               |                          |
| PV Unit electricity used in dwelling        | -406.1918          | 0.1329                        | -53.9983                 |
| PV Unit electricity exported                | -277.8681          | 0.1242                        | -34.5129                 |

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Total  
Total CO2, kg/year

-88.5111 (269)  
849.4150 (272)

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy kWh/year | Primary energy factor kg CO2/kWh | Primary energy kWh/year |
|---------------------------------------------|-----------------|----------------------------------|-------------------------|
| Space heating - main system 1               | 2014.4996       | 1.1300                           | 2276.3846 (275)         |
| Total CO2 associated with community systems |                 |                                  | 0.0000 (473)            |
| Water heating (other fuel)                  | 2236.8166       | 1.1300                           | 2527.6028 (278)         |
| Space and water heating                     |                 |                                  | 4803.9873 (279)         |
| Pumps, fans and electric keep-hot           | 128.9017        | 1.5128                           | 195.0025 (281)          |
| Energy for lighting                         | 188.9373        | 1.5338                           | 289.7983 (282)          |
| Energy saving/generation technologies       |                 |                                  |                         |
| PV Unit electricity used in dwelling        | -406.1918       | 1.4912                           | -605.7161               |
| PV Unit electricity exported                | -277.8681       | 0.4558                           | -126.6402               |
| Total                                       |                 |                                  | -732.3563 (283)         |
| Total Primary energy kWh/year               |                 |                                  | 4556.4318 (286)         |

## SAP 10 EPC IMPROVEMENTS

Plot 5

Current energy efficiency rating: B 90  
Current environmental impact rating: B 91

|                                                         |            |             |                        |
|---------------------------------------------------------|------------|-------------|------------------------|
| N Solar water heating                                   |            |             | SAP increase too small |
| U Solar photovoltaic panels                             |            |             | Already installed      |
| V2 Wind turbine                                         |            |             | Not applicable         |
| Recommended measures:<br>(none)                         | SAP change | Cost change | CO2 change             |
| Measures omitted - SAP change or cost saving too small: |            |             |                        |
| N Solar water heating                                   | + 0.5      | -£ 31       | -140 kg (16.5%)        |

| Recommended measures<br>(none)         | Typical annual savings | Energy efficiency | Environmental impact |
|----------------------------------------|------------------------|-------------------|----------------------|
| Total Savings                          | £0                     | 0.00 kg/m²        |                      |
| Potential energy efficiency rating:    |                        | B 90              |                      |
| Potential environmental impact rating: |                        |                   | B 91                 |

Fuel prices for cost data on this page from database revision number 596 TEST (30 Jun 2026)  
Recommendation texts revision number 6.1 (11 Jun 2019)

## Typical heating and lighting costs of this home (per year, Thames Valley):

|                          | Current    | Potential  | Saving     |
|--------------------------|------------|------------|------------|
| Electricity              | £88        | £88        | £0         |
| Mains gas                | £419       | £419       | £0         |
| Space heating            | £291       | £291       | £0         |
| Water heating            | £164       | £164       | £0         |
| Lighting                 | £52        | £52        | £0         |
| Generated (PV)           | -£129      | -£129      | £0         |
| Total cost of fuels      | £378       | £378       | £0         |
| Total cost of uses       | £378       | £378       | £0         |
| Delivered energy         | 45 kWh/m²  | 45 kWh/m²  | 0 kWh/m²   |
| Carbon dioxide emissions | 0.8 tonnes | 0.8 tonnes | 0.0 tonnes |
| CO2 emissions per m²     | 10 kg/m²   | 10 kg/m²   | 0 kg/m²    |
| Primary energy           | 53 kWh/m²  | 53 kWh/m²  | 0 kWh/m²   |

## SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

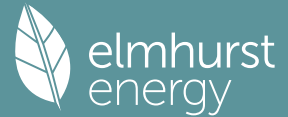
### 1. Overall dwelling characteristics

|                                                        | Area (m²)    | Storey height (m)               | Volume (m³)            |
|--------------------------------------------------------|--------------|---------------------------------|------------------------|
| Main dwelling                                          |              |                                 |                        |
| Ground floor                                           | 42.9900 (1b) | x 2.4600 (2b)                   | = 105.7554 (1b) - (3b) |
| First floor                                            | 42.9900 (1c) | x 2.7600 (2c)                   | = 118.6524 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 85.9800      |                                 | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 224.4078 (5)         |

### 2. Ventilation rate

|                         | m³ per hour          |
|-------------------------|----------------------|
| Number of open chimneys | 0 * 80 = 0.0000 (6a) |
| Number of open flues    | 0 * 20 = 0.0000 (6b) |

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Number of chimneys / flues attached to closed fire 0 \* 10 = 0.0000 (6c)  
Number of flues attached to solid fuel boiler 0 \* 20 = 0.0000 (6d)  
Number of flues attached to other heater 0 \* 35 = 0.0000 (6e)  
Number of blocked chimneys 0 \* 20 = 0.0000 (6f)  
Number of intermittent extract fans 0 \* 10 = 0.0000 (7a)  
Number of passive vents 0 \* 10 = 0.0000 (7b)  
Number of flueless gas fires 0 \* 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 0.0000 / (5) = 0.0000 (8)  
Pressure test Yes  
Pressure Test Method Blower Door  
Measured/design AP50 4.5000 (17)  
Infiltration rate 0.2250 (18)  
Number of sides sheltered 2 (19)  
Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)  
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1913 (21)

|                                                                                                         |        |        |        |        |        |        |        |        |        |        |        |        |              |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |              |
|                                                                                                         | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 | (22)         |
| Wind factor                                                                                             | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 | (22a)        |
| Adj infilt rate                                                                                         |        |        |        |        |        |        |        |        |        |        |        |        |              |
|                                                                                                         | 0.2438 | 0.2391 | 0.2343 | 0.2104 | 0.2056 | 0.1817 | 0.1817 | 0.1769 | 0.1913 | 0.2056 | 0.2152 | 0.2247 | (22b)        |
| Mechanical extract ventilation - decentralised                                                          |        |        |        |        |        |        |        |        |        |        |        |        |              |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | (25)         |

### 3. Heat losses and heat loss parameter

| Element                                                    | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K     | A x U<br>W/K | K-value<br>kJ/m2K                    | A x K<br>kJ/K         |              |
|------------------------------------------------------------|-------------|----------------|---------------|----------------------|--------------|--------------------------------------|-----------------------|--------------|
| Main dwelling                                              |             |                |               |                      |              |                                      |                       |              |
| Front Door                                                 |             |                | 2.5500        | 1.2000               | 3.0600       |                                      |                       | (26)         |
| Windows                                                    |             |                | 10.2500       | 1.2357               | 12.6663      |                                      |                       | (27)         |
| French Doors                                               |             |                | 3.3300        | 1.2357               | 4.1150       |                                      |                       | (27)         |
| GF SPVL 125TS P/A                                          |             |                | 42.9900       | 0.1300               | 5.5887       | 75.0000                              | 3224.2500             | (28a)        |
| EW Brick AAC011                                            | 97.2486     | 16.1300        | 81.1186       | 0.1800               | 14.6013      | 60.0000                              | 4867.1160             | (29a)        |
| PR 500mm MW044                                             | 42.9900     |                | 42.9900       | 0.0900               | 3.8691       | 9.0000                               | 386.9100              | (30)         |
| Total net area of external elements Aum(A, m2)             |             |                | 183.2286      |                      |              |                                      |                       | (31)         |
| Fabric heat loss, W/K = Sum (A x U)                        |             |                |               | (26)...(30) + (32) = | 43.9005      |                                      |                       | (33)         |
| Main dwelling                                              |             |                |               |                      |              |                                      |                       |              |
| E-WM-30                                                    |             |                | 43.8000       | 0.0000               | 0.0000       | 45.0000                              | 1971.0000             | (32)         |
| Timber - GF                                                |             |                | 88.6100       |                      |              | 9.0000                               | 797.4900              | (32c)        |
| Timber - FF                                                |             |                | 126.9000      |                      |              | 9.0000                               | 1142.1000             | (32c)        |
| Internal Floor FF                                          |             |                | 42.9900       |                      |              | 18.0000                              | 773.8200              | (32d)        |
| Internal Ceiling GF                                        |             |                | 42.9900       |                      |              | 9.0000                               | 386.9100              | (32e)        |
| Heat capacity Cm = Sum(A x k)                              |             |                |               |                      |              | (28)...(30) + (32) + (32a)...(32e) = | 13549.5960            | (34)         |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K          |             |                |               |                      |              |                                      | 157.5901              | (35)         |
| List of Thermal Bridges                                    |             |                |               |                      |              |                                      |                       |              |
| K1 Element                                                 |             |                |               | Length               | Psi-value    | Total                                |                       |              |
| E2 Other lintels (including other steel lintels)           |             |                |               | 10.7800              | 0.0410       | 0.4420                               |                       |              |
| E3 Sill                                                    |             |                |               | 9.2000               | 0.0220       | 0.2024                               |                       |              |
| E4 Jamb                                                    |             |                |               | 21.1500              | 0.0190       | 0.4018                               |                       |              |
| E5 Ground floor (normal)                                   |             |                |               | 10.2300              | 0.0928       | 0.9493                               |                       |              |
| E6 Intermediate floor within a dwelling                    |             |                |               | 18.6300              | 0.0020       | 0.0373                               |                       |              |
| E10 Eaves (insulation at ceiling level)                    |             |                |               | 10.2500              | 0.0390       | 0.3997                               |                       |              |
| E18 Party wall between dwellings                           |             |                |               | 10.4400              | 0.0330       | 0.3445                               |                       |              |
| E4 Jamb                                                    |             |                |               | 4.8000               | 0.1000       | 0.4800                               |                       |              |
| E2 Other lintels (including other steel lintels)           |             |                |               | 1.0600               | 0.0410       | 0.0435                               |                       |              |
| P1 Party wall - Ground floor                               |             |                |               | 8.3900               | 0.1000       | 0.8390                               |                       |              |
| P2 Party wall - Intermediate floor within a dwelling       |             |                |               | 8.3900               | 0.0000       | 0.0000                               |                       |              |
| P4 Party wall - Roof (insulation at ceiling level)         |             |                |               | 8.3900               | 0.0350       | 0.2937                               |                       |              |
| E5 Ground floor (normal)                                   |             |                |               | 8.3900               | 0.0980       | 0.8222                               |                       |              |
| E12 Gable (insulation at ceiling level)                    |             |                |               | 8.3900               | 0.0870       | 0.7299                               |                       |              |
| E16 Corner (normal)                                        |             |                |               | 10.4400              | 0.0420       | 0.4385                               |                       |              |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |             |                |               |                      |              |                                      | 6.4238                | (36)         |
| Point Thermal bridges                                      |             |                |               |                      |              |                                      | (36a) =               | 0.0000       |
| Total fabric heat loss                                     |             |                |               |                      |              |                                      | (33) + (36) + (36a) = | 50.3244 (37) |

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

|                           |         |         |         |         |         |         |         |         |         |         |         |         |         |
|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| (38)m                     | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |         |
|                           | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | (38)    |
| Heat transfer coeff       |         |         |         |         |         |         |         |         |         |         |         |         |         |
|                           | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | (39)    |
| Average = Sum(39)m / 12 = |         |         |         |         |         |         |         |         |         |         |         |         | 87.3516 |

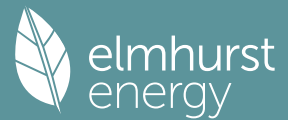
|               |        |        |        |        |        |        |        |        |        |        |        |        |        |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| HLP           | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |        |
|               | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | (40)   |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        |        | 1.0160 |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31     |        |

### 4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5666 (42)  
Hot water usage for mixer showers 67.2533 66.2426 64.7698 61.9519 59.8724 57.5533 56.2352 57.6968 59.2990 61.7890 64.6674 66.9956 (42a)  
Hot water usage for baths 29.0443 28.6130 28.0055 26.8856 26.0469 25.1170 24.6147 25.2179 25.8746 26.8697 28.0127 28.9461 (42b)  
Hot water usage for other uses 40.9146 39.4268 37.9390 36.4512 34.9634 33.4756 33.4756 34.9634 36.4512 37.9390 39.4268 40.9146 (42c)  
Average daily hot water use (litres/day) 126.1290 (43)

|                                        |          |          |          |          |          |          |          |          |          |                    |           |          |      |
|----------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------------------|-----------|----------|------|
| Daily hot water use                    | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct                | Nov       | Dec      |      |
|                                        | 137.2122 | 134.2823 | 130.7143 | 125.2887 | 120.8827 | 116.1459 | 114.3255 | 117.8781 | 121.6248 | 126.5977           | 132.1069  | 136.8563 | (44) |
| Energy conte                           | 217.3105 | 191.2162 | 200.9030 | 171.5139 | 162.7313 | 142.8150 | 138.2667 | 145.9577 | 149.9756 | 171.7918           | 188.2105  | 214.2839 | (45) |
| Energy content (annual)                |          |          |          |          |          |          |          |          |          | Total = Sum(45)m = | 2094.9763 |          |      |
| Distribution loss (46)m = 0.15 x (45)m |          |          |          |          |          |          |          |          |          |                    |           |          |      |
|                                        | 32.5966  | 28.6824  | 30.1355  | 25.7271  | 24.4097  | 21.4222  | 20.7400  | 21.8937  | 22.4963  | 25.7688            | 28.2316   | 32.1426  | (46) |
| Water storage loss (or HIU loss):      |          |          |          |          |          |          |          |          |          |                    |           |          |      |

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|                                                                                |          |          |          |          |          |          |          |          |          |          |          |                |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| Total storage loss                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (56)    |
| If cylinder contains dedicated solar storage                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (57)    |
| Primary loss                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (59)    |
| Combi loss                                                                     | 11.9874  | 10.8167  | 11.9530  | 11.5193  | 11.8728  | 11.4590  | 11.8214  | 11.8376  | 11.4740  | 11.8918  | 11.5543  | 11.9811 (61)   |
| Total heat required for water heating calculated for each month                |          |          |          |          |          |          |          |          |          |          |          |                |
| WWHRS                                                                          | 229.2979 | 202.0330 | 212.8560 | 183.0332 | 174.6042 | 154.2740 | 150.0882 | 157.7953 | 161.4496 | 183.6836 | 199.7649 | 226.2650 (62)  |
| PV diverter                                                                    | -29.9438 | -26.4825 | -27.7310 | -22.9624 | -21.4001 | -18.3122 | -17.1648 | -18.2530 | -18.9465 | -22.3359 | -25.3038 | -29.3893 (63a) |
| Solar input                                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63b)   |
| FGHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63c)   |
| Output from w/h                                                                | 199.3541 | 175.5504 | 185.1250 | 160.0708 | 153.2041 | 135.9618 | 132.9234 | 139.5422 | 142.5031 | 161.3478 | 174.4610 | 196.8757 (64)  |
| Total per year (kWh/year) = Sum(64)m =                                         |          |          |          |          |          |          |          |          |          |          |          | 1956.9195 (64) |
| Electric shower(s)                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (64a)   |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (64a)   |
| Heat gains from water heating, kWh/month                                       | 75.2526  | 66.2836  | 69.7885  | 59.9082  | 57.0764  | 50.3507  | 48.9291  | 51.4903  | 52.7354  | 60.0937  | 65.4686  | 74.2447 (65)   |

## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |           |           |           |           |           |           |           |           |           |           |           |                |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
| Metabolic gains (Table 5), Watts                                                    | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec            |
| (66)m                                                                               | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 26.7460   | 23.7556   | 19.3193   | 14.6260   | 10.9331   | 9.2302    | 9.9735    | 12.9640   | 17.4002   | 22.0936   | 25.7865   | 27.4894 (67)   |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 345.4995  | 349.0847  | 340.0501  | 320.8165  | 296.5375  | 273.7188  | 258.4744  | 254.8892  | 263.9238  | 283.1574  | 307.4363  | 330.2551 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662 (69)   |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000 (70)    |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 (71) |
| Water heating gains (Table 5)                                                       | 101.1460  | 98.6363   | 93.8018   | 83.2058   | 76.7156   | 69.9316   | 65.7649   | 69.2074   | 73.2436   | 80.7712   | 90.9286   | 99.7912 (72)   |
| Total internal gains                                                                | 580.6898  | 578.7749  | 560.4695  | 525.9466  | 491.4845  | 457.1788  | 438.5111  | 441.3589  | 458.8659  | 493.3204  | 531.4497  | 564.8340 (73)  |

## 6. Solar gains

| [Jan]       |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W   |          |          |               |
|-------------|----------|----------|----------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|--------------|----------|----------|---------------|
| -----       |          |          |          |            |                                |                                   |                                    |                              |              |          |          |               |
| North       |          |          |          | 4.1200     | 10.6334                        | 0.4500                            | 0.0000                             | 0.7700                       | 15.1800 (74) |          |          |               |
| South       |          |          |          | 5.6100     | 46.7521                        | 0.4500                            | 0.0000                             | 0.7700                       | 90.8797 (78) |          |          |               |
| West        |          |          |          | 0.5200     | 19.6403                        | 0.4500                            | 0.0000                             | 0.7700                       | 3.5388 (80)  |          |          |               |
| North       |          |          |          | 3.3300     | 10.6334                        | 0.4500                            | 0.0000                             | 0.7700                       | 12.2693 (74) |          |          |               |
| -----       |          |          |          |            |                                |                                   |                                    |                              |              |          |          |               |
| Solar gains | 121.8678 | 208.2172 | 290.1305 | 374.0852   | 436.5439                       | 442.2258                          | 422.5917                           | 373.8995                     | 318.4831     | 231.1927 | 145.9981 | 104.3216 (83) |
| Total gains | 702.5576 | 786.9920 | 850.6000 | 900.0318   | 928.0284                       | 899.4046                          | 861.1028                           | 815.2584                     | 777.3491     | 724.5132 | 677.4478 | 669.1557 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |              |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|--------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) | 21.0000 (85) |         |         |         |         |         |         |         |         |         |         |              |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          | Jan          | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| tau                                                                         | 43.0876      | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876      |
| alpha                                                                       | 3.8725       | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725       |
| util living area                                                            | 0.9685       | 0.9506  | 0.9179  | 0.8533  | 0.7388  | 0.5802  | 0.4353  | 0.4762  | 0.6838  | 0.8738  | 0.9510  | 0.9734 (86)  |
| MIT                                                                         | 19.3995      | 19.6464 | 20.0010 | 20.4058 | 20.7394 | 20.9235 | 20.9804 | 20.9720 | 20.8537 | 20.4337 | 19.8280 | 19.3218 (87) |
| Th 2                                                                        | 20.0701      | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 (88) |
| util rest of house                                                          | 0.9625       | 0.9414  | 0.9025  | 0.8256  | 0.6912  | 0.5087  | 0.3480  | 0.3867  | 0.6160  | 0.8438  | 0.9402  | 0.9683 (89)  |
| MIT 2                                                                       | 18.4281      | 18.7022 | 19.0923 | 19.5253 | 19.8602 | 20.0226 | 20.0619 | 20.0577 | 19.9701 | 19.5647 | 18.9089 | 18.3415 (90) |
| Living area fraction                                                        | 18.6159      | 18.8847 | 19.2679 | 19.6955 | 20.0301 | 20.1967 | 20.2395 | 20.2344 | 20.1409 | 19.7327 | 19.0866 | 18.5310 (91) |
| MIT                                                                         | 18.6159      | 18.8847 | 19.2679 | 19.6955 | 20.0301 | 20.1967 | 20.2395 | 20.2344 | 20.1409 | 19.7327 | 19.0866 | 18.5310 (92) |
| Temperature adjustment                                                      | 18.6159      | 18.8847 | 19.2679 | 19.6955 | 20.0301 | 20.1967 | 20.2395 | 20.2344 | 20.1409 | 19.7327 | 19.0866 | 18.5310 (93) |

## 8. Space heating requirement

|                                                                                |                            |           |           |          |          |          |          |          |          |          |           |                |
|--------------------------------------------------------------------------------|----------------------------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|-----------|----------------|
| Utilisation                                                                    | Jan                        | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov       | Dec            |
| Useful gains                                                                   | 667.4324                   | 729.1983  | 754.1330  | 731.6128 | 639.4299 | 466.6920 | 313.6505 | 328.5616 | 483.1279 | 602.1921 | 627.1172  | 640.2463 (94)  |
| Ext temp.                                                                      | 4.3000                     | 4.9000    | 6.5000    | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000  | 7.1000    | 4.2000 (95)    |
| Heat loss rate W                                                               | 1250.5164                  | 1221.5895 | 1115.2987 | 943.0032 | 727.6503 | 488.8847 | 317.9143 | 334.9425 | 527.6850 | 797.7572 | 1047.0466 | 1251.8360 (97) |
| Space heating kWh                                                              | 433.8145                   | 330.8869  | 268.7073  | 152.2010 | 65.6360  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 145.5005 | 302.3492  | 455.0227 (98a) |
| Space heating requirement - total per year (kWh/year)                          | 2154.1181                  |           |           |          |          |          |          |          |          |          |           |                |
| Solar heating kWh                                                              | 0.0000                     | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         | 0.0000                     |           |           |          |          |          |          |          |          |          |           |                |
| Space heating kWh                                                              | 433.8145                   | 330.8869  | 268.7073  | 152.2010 | 65.6360  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 145.5005 | 302.3492  | 455.0227 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) | 2154.1181                  |           |           |          |          |          |          |          |          |          |           |                |
| Space heating per m <sup>2</sup>                                               | (98c) / (4) = 25.0537 (99) |           |           |          |          |          |          |          |          |          |           |                |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

# Full SAP Calculation Printout



|                                                                                                      |          |          |          |          |          |          |          |          |          |          |          |           |        |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|--------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (201)  |
| Fraction of space heat from main system(s)                                                           |          |          |          |          |          |          |          |          |          |          |          | 1.0000    | (202)  |
| Efficiency of main space heating system 1 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 91.7000   | (206)  |
| Efficiency of main space heating system 2 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (207)  |
| Efficiency of secondary/supplementary heating system, %                                              |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (208)  |
|                                                                                                      | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec       |        |
| Space heating requirement                                                                            | 433.8145 | 330.8869 | 268.7073 | 152.2010 | 65.6360  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 145.5005 | 302.3492 | 455.0227  | (98)   |
| Space heating efficiency (main heating system 1)                                                     | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 91.7000  | 91.7000  | 91.7000   | (210)  |
| Space heating fuel (main heating system)                                                             | 473.0801 | 360.8363 | 293.0287 | 165.9771 | 71.5769  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 158.6701 | 329.7156 | 496.2080  | (211)  |
| Space heating efficiency (main heating system 2)                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (212)  |
| Space heating fuel (main heating system 2)                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (213)  |
| Space heating fuel (secondary)                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (215)  |
| Water heating                                                                                        |          |          |          |          |          |          |          |          |          |          |          |           |        |
| Water heating requirement                                                                            | 199.3541 | 175.5504 | 185.1250 | 160.0708 | 153.2041 | 135.9618 | 132.9234 | 139.5422 | 142.5031 | 161.3478 | 174.4610 | 196.8757  | (64)   |
| Efficiency of water heater                                                                           | 88.1279  | 88.0606  | 87.9312  | 87.7110  | 87.3193  | 86.7000  | 86.7000  | 86.7000  | 86.7000  | 87.6832  | 88.0199  | 88.1551   | (216)  |
| Fuel for water heating, kWh/month                                                                    | 226.2100 | 199.3517 | 210.5339 | 182.4980 | 175.4526 | 156.8186 | 153.3142 | 160.9484 | 164.3635 | 184.0121 | 198.2063 | 223.3286  | (219)  |
| Space cooling fuel requirement                                                                       |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (221)m                                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (221)  |
| Pumps and Fa                                                                                         | 10.9478  | 9.8883   | 10.9478  | 10.5947  | 10.9478  | 10.5947  | 10.9478  | 10.9478  | 10.5947  | 10.9478  | 10.5947  | 10.9478   | (231)  |
| Lighting                                                                                             | 23.4106  | 18.7809  | 16.9101  | 12.3891  | 9.5697   | 7.8185   | 8.7298   | 11.3473  | 14.7390  | 19.3384  | 21.8427  | 24.0613   | (232)  |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (233a)m                                                                                              | -14.6942 | -22.4007 | -34.8599 | -42.5373 | -48.8442 | -46.7030 | -46.0948 | -41.9719 | -35.2991 | -26.9662 | -16.7286 | -12.5110  | (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (234a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (234a) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (235a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235a) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (235c)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235c) |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (233b)m                                                                                              | -4.0882  | -8.9418  | -18.5200 | -29.0022 | -39.5369 | -40.1897 | -39.6495 | -32.9433 | -23.3746 | -13.1010 | -5.5501  | -3.2067   | (233b) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (234b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (234b) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (235b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235b) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (235d)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235d) |
| Annual totals kWh/year                                                                               |          |          |          |          |          |          |          |          |          |          |          |           |        |
| Space heating fuel - main system 1                                                                   |          |          |          |          |          |          |          |          |          |          |          | 2349.0928 | (211)  |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (213)  |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (215)  |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          | 86.7000   |        |
| Water heating fuel used                                                                              |          |          |          |          |          |          |          |          |          |          |          | 2235.0379 | (219)  |
| Space cooling fuel                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (221)  |
| Electricity for pumps and fans:                                                                      |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (MEV)Decentralised, Database: total watage = 5.7980, total flow = 37.0000, SFP = 0.1567)             |          |          |          |          |          |          |          |          |          |          |          |           |        |
| mechanical ventilation fans (SFP = 0.1567)                                                           |          |          |          |          |          |          |          |          |          |          |          | 42.9017   | (230a) |
| central heating pump                                                                                 |          |          |          |          |          |          |          |          |          |          |          | 41.0000   | (230c) |
| main heating flue fan                                                                                |          |          |          |          |          |          |          |          |          |          |          | 45.0000   | (230e) |
| Total electricity for the above, kWh/year                                                            |          |          |          |          |          |          |          |          |          |          |          | 128.9017  | (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |          |          |          |          |          |          |          |          |          |          |          | 188.9373  | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |          |          |          |          |          |          |          |          |          |          |           |        |
| PV generation                                                                                        |          |          |          |          |          |          |          |          |          |          |          | -647.7148 | (233)  |
| Wind generation                                                                                      |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (234)  |
| Hydro-electric generation (Appendix N)                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (235a) |
| Electricity generated - Micro CHP (Appendix N)                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (235)  |
| Appendix Q - special features                                                                        |          |          |          |          |          |          |          |          |          |          |          |           |        |
| Energy saved or generated                                                                            |          |          |          |          |          |          |          |          |          |          |          | -0.0000   | (236)  |
| Energy used                                                                                          |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (237)  |
| Total delivered energy for all uses                                                                  |          |          |          |          |          |          |          |          |          |          |          | 4254.2549 | (238)  |

## 10a. Fuel costs - using Table 12 prices

|                                             | Fuel<br>kWh/year | Fuel price<br>p/kWh | Fuel cost<br>£/year |        |
|---------------------------------------------|------------------|---------------------|---------------------|--------|
| Space heating - main system 1               | 2349.0928        | 3.6400              | 85.5070             | (240)  |
| Total CO2 associated with community systems |                  |                     | 0.0000              | (473)  |
| Water heating (other fuel)                  | 2235.0379        | 3.6400              | 81.3554             | (247)  |
| Energy for instantaneous electric shower(s) | 0.0000           | 16.4900             | 0.0000              | (247a) |
| Pumps, fans and electric keep-hot           | 128.9017         | 16.4900             | 21.2559             | (249)  |
| Energy for lighting                         | 188.9373         | 16.4900             | 31.1558             | (250)  |
| Additional standing charges                 |                  |                     | 92.0000             | (251)  |
| Energy saving/generation technologies       |                  |                     |                     |        |
| PV Unit electricity used in dwelling        | -389.6109        | 16.4900             | -64.2468            |        |
| PV Unit electricity exported                | -258.1039        | 5.5900              | -14.4280            |        |
| Total                                       |                  |                     | -78.6748            | (252)  |
| Total energy cost                           |                  |                     | 232.5992            | (255)  |

## 11a. SAP rating - Individual heating systems

|                                  |                                         |         |       |
|----------------------------------|-----------------------------------------|---------|-------|
| Energy cost deflator (Table 12): |                                         | 0.3600  | (256) |
| Energy cost factor (ECF)         |                                         | 0.6393  | (257) |
| SAP value                        | $[(255) \times (256)] / [(4) + 45.0] =$ | 89.6369 |       |
| SAP rating (Section 12)          |                                         | 90      | (258) |
| SAP band                         |                                         | B       |       |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

# Full SAP Calculation Printout



|                                             | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|---------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1               | 2349.0928          | 0.2100                        | 493.3095 (261)           |
| Total CO2 associated with community systems |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                  | 2235.0379          | 0.2100                        | 469.3580 (264)           |
| Space and water heating                     |                    |                               | 962.6674 (265)           |
| Pumps, fans and electric keep-hot           | 128.9017           | 0.1387                        | 17.8803 (267)            |
| Energy for lighting                         | 188.9373           | 0.1443                        | 27.2695 (268)            |
| Energy saving/generation technologies       |                    |                               |                          |
| PV Unit electricity used in dwelling        | -389.6109          | 0.1330                        | -51.8040                 |
| PV Unit electricity exported                | -258.1039          | 0.1248                        | -32.1992                 |
| Total                                       |                    |                               | -84.0033 (269)           |
| Total CO2, kg/year                          |                    |                               | 923.8139 (272)           |
| CO2 emissions per m2                        |                    |                               | 10.7400 (273)            |
| EI value                                    |                    |                               | 90.5489                  |
| EI rating                                   |                    |                               | 91 (274)                 |
| EI band                                     |                    |                               | B                        |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m2) | Storey height<br>(m)            | Volume<br>(m3)         |
|--------------------------------------------------------|--------------|---------------------------------|------------------------|
| Main dwelling                                          |              |                                 |                        |
| Ground floor                                           | 42.9900 (1b) | x 2.4600 (2b)                   | = 105.7554 (1b) - (3b) |
| First floor                                            | 42.9900 (1c) | x 2.7600 (2c)                   | = 118.6524 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 85.9800      |                                 | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 224.4078 (5)         |

## 2. Ventilation rate

|                                                                                                    | m3 per hour                             |
|----------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                    |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                    |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                    |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                    |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                    |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                    |
| Number of intermittent extract fans                                                                | 0 * 10 = 0.0000 (7a)                    |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)                    |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 0.0000 / (5) = 0.0000 (8)               |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 4.5000 (17)                             |
| Infiltration rate                                                                                  | 0.2250 (18)                             |
| Number of sides sheltered                                                                          | 2 (19)                                  |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 0.8500 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.1913 (21)        |

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | 4.2000 | 4.0000 | 4.0000 | 3.7000 | 3.7000 | 3.3000 | 3.4000 | 3.2000 | 3.3000 | 3.5000 | 3.5000 | 3.8000 (22)  |
| Wind factor                                                                                             | 1.0500 | 1.0000 | 1.0000 | 0.9250 | 0.9250 | 0.8250 | 0.8500 | 0.8000 | 0.8250 | 0.8750 | 0.8750 | 0.9500 (22a) |
| Adj infilt rate                                                                                         | 0.2008 | 0.1913 | 0.1913 | 0.1769 | 0.1769 | 0.1578 | 0.1626 | 0.1530 | 0.1578 | 0.1673 | 0.1673 | 0.1817 (22b) |
| Mechanical extract ventilation - decentralised                                                          |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        |              |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 (25)  |

## 3. Heat losses and heat loss parameter

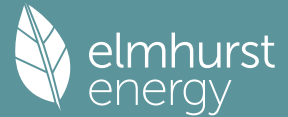
| Element                                           | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2        | U-value<br>W/m2K | A x U<br>W/K                         | K-value<br>kJ/m2K | A x K<br>kJ/K   |
|---------------------------------------------------|-------------|----------------|----------------------|------------------|--------------------------------------|-------------------|-----------------|
| Main dwelling                                     |             |                |                      |                  |                                      |                   |                 |
| Front Door                                        |             |                | 2.5500               | 1.2000           | 3.0600                               |                   | (26)            |
| Windows                                           |             |                | 10.2500              | 1.2357           | 12.6663                              |                   | (27)            |
| French Doors                                      |             |                | 3.3300               | 1.2357           | 4.1150                               |                   | (27)            |
| GF SPVL 125TS P/A                                 |             |                | 42.9900              | 0.1300           | 5.5887                               | 75.0000           | 3224.2500 (28a) |
| EW Brick AAC011                                   | 97.2486     | 16.1300        | 81.1186              | 0.1800           | 14.6013                              | 60.0000           | 4867.1160 (29a) |
| PR 500mm MW044                                    | 42.9900     |                | 42.9900              | 0.0900           | 3.8691                               | 9.0000            | 386.9100 (30)   |
| Total net area of external elements Aum(A, m2)    |             |                | 183.2286             |                  |                                      |                   | (31)            |
| Fabric heat loss, W/K = Sum (A x U)               |             |                | (26)...(30) + (32) = |                  | 43.9005                              |                   | (33)            |
| Main dwelling                                     |             |                |                      |                  |                                      |                   |                 |
| E-WM-30                                           |             |                | 43.8000              | 0.0000           | 0.0000                               | 45.0000           | 1971.0000 (32)  |
| Timber - GF                                       |             |                | 88.6100              |                  |                                      | 9.0000            | 797.4900 (32c)  |
| Timber - FF                                       |             |                | 126.9000             |                  |                                      | 9.0000            | 1142.1000 (32c) |
| Internal Floor FF                                 |             |                | 42.9900              |                  |                                      | 18.0000           | 773.8200 (32d)  |
| Internal Ceiling GF                               |             |                | 42.9900              |                  |                                      | 9.0000            | 386.9100 (32e)  |
| Heat capacity Cm = Sum(A x k)                     |             |                |                      |                  | (28)...(30) + (32) + (32a)...(32e) = |                   | 13549.5960 (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K |             |                |                      |                  |                                      |                   | 157.5901 (35)   |
| List of Thermal Bridges                           |             |                |                      |                  |                                      |                   |                 |
| K1 Element                                        |             |                |                      | Length           | Psi-value                            | Total             |                 |
| E2 Other lintels (including other steel lintels)  |             |                |                      | 10.7800          | 0.0410                               | 0.4420            |                 |

# Full SAP Calculation Printout



|                                                                                     |           |           |           |            |               |               |           |              |           |                       |           |                                                                                             |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|------------|---------------|---------------|-----------|--------------|-----------|-----------------------|-----------|---------------------------------------------------------------------------------------------|
| E3 Sill                                                                             |           |           |           |            |               |               |           |              | 9.2000    | 0.0220                | 0.2024    |                                                                                             |
| E4 Jamb                                                                             |           |           |           |            |               |               |           |              | 21.1500   | 0.0190                | 0.4018    |                                                                                             |
| E5 Ground floor (normal)                                                            |           |           |           |            |               |               |           |              | 10.2300   | 0.0928                | 0.9493    |                                                                                             |
| E6 Intermediate floor within a dwelling                                             |           |           |           |            |               |               |           |              | 18.6300   | 0.0020                | 0.0373    |                                                                                             |
| E10 Eaves (insulation at ceiling level)                                             |           |           |           |            |               |               |           |              | 10.2500   | 0.0390                | 0.3997    |                                                                                             |
| E18 Party wall between dwellings                                                    |           |           |           |            |               |               |           |              | 10.4400   | 0.0330                | 0.3445    |                                                                                             |
| E4 Jamb                                                                             |           |           |           |            |               |               |           |              | 4.8000    | 0.1000                | 0.4800    |                                                                                             |
| E2 Other lintels (including other steel lintels)                                    |           |           |           |            |               |               |           |              | 1.0600    | 0.0410                | 0.0435    |                                                                                             |
| P1 Party wall - Ground floor                                                        |           |           |           |            |               |               |           |              | 8.3900    | 0.1000                | 0.8390    |                                                                                             |
| P2 Party wall - Intermediate floor within a dwelling                                |           |           |           |            |               |               |           |              | 8.3900    | 0.0000                | 0.0000    |                                                                                             |
| P4 Party wall - Roof (insulation at ceiling level)                                  |           |           |           |            |               |               |           |              | 8.3900    | 0.0350                | 0.2937    |                                                                                             |
| E5 Ground floor (normal)                                                            |           |           |           |            |               |               |           |              | 8.3900    | 0.0980                | 0.8222    |                                                                                             |
| E12 Gable (insulation at ceiling level)                                             |           |           |           |            |               |               |           |              | 8.3900    | 0.0870                | 0.7299    |                                                                                             |
| E16 Corner (normal)                                                                 |           |           |           |            |               |               |           |              | 10.4400   | 0.0420                | 0.4385    |                                                                                             |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)                          |           |           |           |            |               |               |           |              |           |                       |           | 6.4238 (36)                                                                                 |
| Point Thermal bridges                                                               |           |           |           |            |               |               |           |              |           |                       | (36a) =   | 0.0000                                                                                      |
| Total fabric heat loss                                                              |           |           |           |            |               |               |           |              |           | (33) + (36) + (36a) = |           | 50.3244 (37)                                                                                |
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)                 |           |           |           |            |               |               |           |              |           |                       |           |                                                                                             |
| (38)m                                                                               | Jan       | Feb       | Mar       | Apr        | May           | Jun           | Jul       | Aug          | Sep       | Oct                   | Nov       | Dec                                                                                         |
| Heat transfer coeff                                                                 | 37.0273   | 37.0273   | 37.0273   | 37.0273    | 37.0273       | 37.0273       | 37.0273   | 37.0273      | 37.0273   | 37.0273               | 37.0273   | 37.0273 (38)                                                                                |
| Average = Sum(39)m / 12 =                                                           | 87.3516   | 87.3516   | 87.3516   | 87.3516    | 87.3516       | 87.3516       | 87.3516   | 87.3516      | 87.3516   | 87.3516               | 87.3516   | 87.3516 (39)                                                                                |
| HLP                                                                                 | Jan       | Feb       | Mar       | Apr        | May           | Jun           | Jul       | Aug          | Sep       | Oct                   | Nov       | Dec                                                                                         |
| HLP (average)                                                                       | 1.0160    | 1.0160    | 1.0160    | 1.0160     | 1.0160        | 1.0160        | 1.0160    | 1.0160       | 1.0160    | 1.0160                | 1.0160    | 1.0160 (40)                                                                                 |
| Days in mont                                                                        | 31        | 28        | 31        | 30         | 31            | 30            | 31        | 31           | 30        | 31                    | 30        | 31                                                                                          |
| -----                                                                               |           |           |           |            |               |               |           |              |           |                       |           |                                                                                             |
| 4. Water heating energy requirements (kWh/year)                                     |           |           |           |            |               |               |           |              |           |                       |           |                                                                                             |
| -----                                                                               |           |           |           |            |               |               |           |              |           |                       |           |                                                                                             |
| Assumed occupancy                                                                   |           |           |           |            |               |               |           |              |           |                       |           | 2.5666 (42)                                                                                 |
| Hot water usage for mixer showers                                                   |           |           |           |            |               |               |           |              |           |                       |           |                                                                                             |
| Hot water usage for baths                                                           | 67.2533   | 66.2426   | 64.7698   | 61.9519    | 59.8724       | 57.5533       | 56.2352   | 57.6968      | 59.2990   | 61.7890               | 64.6674   | 66.9956 (42a)                                                                               |
| Hot water usage for other uses                                                      | 29.0443   | 28.6130   | 28.0055   | 26.8856    | 26.0469       | 25.1170       | 24.6147   | 25.2179      | 25.8746   | 26.8697               | 28.0127   | 28.9461 (42b)                                                                               |
| Average daily hot water use (litres/day)                                            | 40.9146   | 39.4268   | 37.9390   | 36.4512    | 34.9634       | 33.4756       | 33.4756   | 34.9634      | 36.4512   | 37.9390               | 39.4268   | 40.9146 (42c)                                                                               |
|                                                                                     |           |           |           |            |               |               |           |              |           |                       |           | 126.1290 (43)                                                                               |
| Daily hot water use                                                                 | Jan       | Feb       | Mar       | Apr        | May           | Jun           | Jul       | Aug          | Sep       | Oct                   | Nov       | Dec                                                                                         |
| Energy conte                                                                        | 137.2122  | 134.2823  | 130.7143  | 125.2887   | 120.8827      | 116.1459      | 114.3255  | 117.8781     | 121.6248  | 126.5977              | 132.1069  | 136.8563 (44)                                                                               |
| Energy content (annual)                                                             | 217.3105  | 191.2162  | 200.9030  | 171.5139   | 162.7313      | 142.8150      | 138.2667  | 145.9577     | 149.9756  | 171.7918              | 188.2105  | 214.2839 (45)                                                                               |
| Distribution loss (46)m = 0.15 x (45)m                                              |           |           |           |            |               |               |           |              |           |                       |           | Total = Sum(45)m = 2094.9763                                                                |
| Water storage loss (or HIU loss):                                                   | 32.5966   | 28.6824   | 30.1355   | 25.7271    | 24.4097       | 21.4222       | 20.7400   | 21.8937      | 22.4963   | 25.7688               | 28.2316   | 32.1426 (46)                                                                                |
| Total storage loss                                                                  | 0.0000    | 0.0000    | 0.0000    | 0.0000     | 0.0000        | 0.0000        | 0.0000    | 0.0000       | 0.0000    | 0.0000                | 0.0000    | 0.0000 (56)                                                                                 |
| If cylinder contains dedicated solar storage                                        | 0.0000    | 0.0000    | 0.0000    | 0.0000     | 0.0000        | 0.0000        | 0.0000    | 0.0000       | 0.0000    | 0.0000                | 0.0000    | 0.0000 (57)                                                                                 |
| Primary loss                                                                        | 0.0000    | 0.0000    | 0.0000    | 0.0000     | 0.0000        | 0.0000        | 0.0000    | 0.0000       | 0.0000    | 0.0000                | 0.0000    | 0.0000 (59)                                                                                 |
| Combi loss                                                                          | 11.9874   | 10.8167   | 11.9530   | 11.5193    | 11.8728       | 11.4590       | 11.8214   | 11.8376      | 11.4740   | 11.8918               | 11.5543   | 11.9811 (61)                                                                                |
| Total heat required for water heating calculated for each month                     | 229.2979  | 202.0330  | 212.8560  | 183.0332   | 174.6042      | 154.2740      | 150.0882  | 157.7953     | 161.4496  | 183.6836              | 199.7649  | 226.2650 (62)                                                                               |
| WWHRS                                                                               | -29.9438  | -26.4825  | -27.7310  | -22.9624   | -21.4001      | -18.3122      | -17.1648  | -18.2530     | -18.9465  | -22.3359              | -25.3038  | -29.3893 (63a)                                                                              |
| FV diverter                                                                         | -0.0000   | -0.0000   | -0.0000   | -0.0000    | -0.0000       | -0.0000       | -0.0000   | -0.0000      | -0.0000   | -0.0000               | -0.0000   | -0.0000 (63b)                                                                               |
| Solar input                                                                         | 0.0000    | 0.0000    | 0.0000    | 0.0000     | 0.0000        | 0.0000        | 0.0000    | 0.0000       | 0.0000    | 0.0000                | 0.0000    | 0.0000 (63c)                                                                                |
| FGHRS                                                                               | 0.0000    | 0.0000    | 0.0000    | 0.0000     | 0.0000        | 0.0000        | 0.0000    | 0.0000       | 0.0000    | 0.0000                | 0.0000    | 0.0000 (63d)                                                                                |
| Output from w/h                                                                     | 199.3541  | 175.5504  | 185.1250  | 160.0708   | 153.2041      | 135.9618      | 132.9234  | 139.5422     | 142.5031  | 161.3478              | 174.4610  | 196.8757 (64)                                                                               |
|                                                                                     |           |           |           |            |               |               |           |              |           |                       |           | Total per year (kWh/year) = Sum(64)m = 1956.9195 (64)                                       |
| Electric shower(s)                                                                  | 0.0000    | 0.0000    | 0.0000    | 0.0000     | 0.0000        | 0.0000        | 0.0000    | 0.0000       | 0.0000    | 0.0000                | 0.0000    | 0.0000 (64a)                                                                                |
|                                                                                     |           |           |           |            |               |               |           |              |           |                       |           | Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a) |
| Heat gains from water heating, kWh/month                                            | 75.2526   | 66.2836   | 69.7885   | 59.9082    | 57.0764       | 50.3507       | 48.9291   | 51.4903      | 52.7354   | 60.0937               | 65.4686   | 74.2447 (65)                                                                                |
| -----                                                                               |           |           |           |            |               |               |           |              |           |                       |           |                                                                                             |
| 5. Internal gains (see Table 5 and 5a)                                              |           |           |           |            |               |               |           |              |           |                       |           |                                                                                             |
| -----                                                                               |           |           |           |            |               |               |           |              |           |                       |           |                                                                                             |
| Metabolic gains (Table 5), Watts                                                    | Jan       | Feb       | Mar       | Apr        | May           | Jun           | Jul       | Aug          | Sep       | Oct                   | Nov       | Dec                                                                                         |
| (66)m                                                                               | 153.9962  | 153.9962  | 153.9962  | 153.9962   | 153.9962      | 153.9962      | 153.9962  | 153.9962     | 153.9962  | 153.9962              | 153.9962  | 153.9962 (66)                                                                               |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 26.7460   | 23.7556   | 19.3193   | 14.6260    | 10.9331       | 9.2302        | 9.9735    | 12.9640      | 17.4002   | 22.0936               | 25.7865   | 27.4894 (67)                                                                                |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 345.4995  | 349.0847  | 340.0501  | 320.8165   | 296.5375      | 273.7188      | 258.4744  | 254.8892     | 263.9238  | 283.1574              | 307.4363  | 330.2551 (68)                                                                               |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 52.9662   | 52.9662   | 52.9662   | 52.9662    | 52.9662       | 52.9662       | 52.9662   | 52.9662      | 52.9662   | 52.9662               | 52.9662   | 52.9662 (69)                                                                                |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000     | 3.0000        | 3.0000        | 3.0000    | 3.0000       | 3.0000    | 3.0000                | 3.0000    | 3.0000 (70)                                                                                 |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -102.6642 | -102.6642 | -102.6642 | -102.6642  | -102.6642     | -102.6642     | -102.6642 | -102.6642    | -102.6642 | -102.6642             | -102.6642 | -102.6642 (71)                                                                              |
| Water heating gains (Table 5)                                                       | 101.1460  | 98.6363   | 93.8018   | 83.2058    | 76.7156       | 69.9316       | 65.7649   | 69.2074      | 73.2436   | 80.7712               | 90.9286   | 99.7912 (72)                                                                                |
| Total internal gains                                                                | 580.6898  | 578.7749  | 560.4695  | 525.9466   | 491.4845      | 457.1788      | 438.5111  | 441.3589     | 458.8659  | 493.3204              | 531.4497  | 564.8340 (73)                                                                               |
| -----                                                                               |           |           |           |            |               |               |           |              |           |                       |           |                                                                                             |
| 6. Solar gains                                                                      |           |           |           |            |               |               |           |              |           |                       |           |                                                                                             |
| -----                                                                               |           |           |           |            |               |               |           |              |           |                       |           |                                                                                             |
| [Jan]                                                                               |           |           | Area      | Solar flux | g             | FF            | Access    | Gains        |           |                       |           |                                                                                             |
|                                                                                     |           |           | m2        | Table 6a   | Specific data | Specific data | factor    | W            |           |                       |           |                                                                                             |
|                                                                                     |           |           |           | W/m2       | or Table 6b   | or Table 6c   | Table 6d  |              |           |                       |           |                                                                                             |
| North                                                                               |           |           | 4.1200    | 11.9814    | 0.4500        | 0.0000        | 0.7700    | 17.1045 (74) |           |                       |           |                                                                                             |
| South                                                                               |           |           | 5.6100    | 50.9848    | 0.4500        | 0.0000        | 0.7700    | 99.1076 (78) |           |                       |           |                                                                                             |
| West                                                                                |           |           | 0.5200    | 22.3313    | 0.4500        | 0.0000        | 0.7700    | 4.0237 (80)  |           |                       |           |                                                                                             |
| North                                                                               |           |           | 3.3300    | 11.9814    | 0.4500        | 0.0000        | 0.7700    | 13.8247 (74) |           |                       |           |                                                                                             |

# Full SAP Calculation Printout



|             |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Solar gains | 134.0605 | 206.4061 | 285.4873 | 382.3913 | 437.4205 | 475.2993 | 448.8592 | 404.2252 | 340.7223 | 245.0438 | 164.5793 | 113.6339 (83) |
| Total gains | 714.7502 | 785.1810 | 845.9568 | 908.3379 | 928.9050 | 932.4781 | 887.3703 | 845.5841 | 799.5882 | 738.3643 | 696.0290 | 678.4680 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |                           |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |                           |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |                           |         |         |              |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep                       | Oct     | Nov     | Dec          |
| tau                                                                         | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876                   | 43.0876 | 43.0876 | 43.0876      |
| alpha                                                                       | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725                    | 3.8725  | 3.8725  | 3.8725       |
| util living area                                                            | 0.9614  | 0.9442  | 0.9044  | 0.8199  | 0.6698  | 0.4548  | 0.3030  | 0.3275  | 0.5892                    | 0.8347  | 0.9360  | 0.9671 (86)  |
| MIT                                                                         | 19.5571 | 19.7583 | 20.1304 | 20.5375 | 20.8424 | 20.9740 | 20.9961 | 20.9947 | 20.9269                   | 20.5789 | 20.0045 | 19.4932 (87) |
| Th 2                                                                        | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701                   | 20.0701 | 20.0701 | 20.0701 (88) |
| util rest of house                                                          | 0.9539  | 0.9335  | 0.8860  | 0.7858  | 0.6117  | 0.3756  | 0.2132  | 0.2339  | 0.5094                    | 0.7956  | 0.9216  | 0.9605 (89)  |
| MIT 2                                                                       | 18.6048 | 18.8270 | 19.2337 | 19.6614 | 19.9545 | 20.0576 | 20.0692 | 20.0688 | 20.0276                   | 19.7132 | 19.1034 | 18.5343 (90) |
| Living area fraction                                                        |         |         |         |         |         |         |         |         | FLA = Living area / (4) = |         |         | 0.1933 (91)  |
| MIT                                                                         | 18.7889 | 19.0070 | 19.4070 | 19.8308 | 20.1261 | 20.2348 | 20.2483 | 20.2477 | 20.2015                   | 19.8805 | 19.2776 | 18.7196 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |                           |         |         | 0.0000       |
| adjusted MIT                                                                | 18.7889 | 19.0070 | 19.4070 | 19.8308 | 20.1261 | 20.2348 | 20.2483 | 20.2477 | 20.2015                   | 19.8805 | 19.2776 | 18.7196 (93) |

## 8. Space heating requirement

|                                                                                |           |           |           |          |          |          |          |          |          |               |          |                |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|---------------|----------|----------------|
|                                                                                | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov      | Dec            |
| Utilisation                                                                    | 0.9403    | 0.9183    | 0.8704    | 0.7761   | 0.6154   | 0.3900   | 0.2306   | 0.2519   | 0.5212   | 0.7865        | 0.9063   | 0.9478 (94)    |
| Useful gains                                                                   | 672.0801  | 721.0175  | 736.3113  | 704.9447 | 571.6785 | 363.6273 | 204.5887 | 213.0356 | 416.7486 | 580.7270      | 630.8218 | 643.0463 (95)  |
| Ext temp.                                                                      | 5.1000    | 5.6000    | 7.4000    | 9.9000   | 13.0000  | 16.0000  | 17.9000  | 17.8000  | 15.2000  | 11.6000       | 8.0000   | 5.1000 (96)    |
| Heat loss rate W                                                               | 1195.7455 | 1171.1221 | 1048.8342 | 867.4680 | 622.4803 | 369.9152 | 205.1320 | 213.8147 | 436.8853 | 723.3159      | 985.1178 | 1189.6985 (97) |
| Space heating kWh                                                              | 389.6070  | 302.4703  | 232.5170  | 117.0167 | 37.7965  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 106.0861      | 255.0931 | 406.7093 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |          |          |          |          |          |          |               |          | 1847.2961      |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000   | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |          |          |          |          |          |          |               |          | 0.0000         |
| Space heating kWh                                                              | 389.6070  | 302.4703  | 232.5170  | 117.0167 | 37.7965  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 106.0861      | 255.0931 | 406.7093 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |          |          |          |          |          |          |               |          | 1847.2961      |
| Space heating per m2                                                           |           |           |           |          |          |          |          |          |          | (98c) / (4) = |          | 21.4852 (99)   |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                                                      |          |          |          |          |          |          |          |          |          |          |          |                 |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (201)    |
| Fraction of space heat from main system(s)                                                           |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (202)    |
| Efficiency of main space heating system 1 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 91.7000 (206)   |
| Efficiency of main space heating system 2 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)    |
| Efficiency of secondary/supplementary heating system, %                                              |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)    |
|                                                                                                      | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec             |
| Space heating requirement                                                                            | 389.6070 | 302.4703 | 232.5170 | 117.0167 | 37.7965  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 106.0861 | 255.0931 | 406.7093 (98)   |
| Space heating efficiency (main heating system 1)                                                     | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 91.7000  | 91.7000  | 91.7000 (210)   |
| Space heating fuel (main heating system)                                                             | 424.8713 | 329.8477 | 253.5628 | 127.6082 | 41.2176  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 115.6882 | 278.1823 | 443.5216 (211)  |
| Space heating efficiency (main heating system 2)                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)    |
| Space heating fuel (main heating system 2)                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)    |
| Space heating fuel (secondary)                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)    |
| Water heating                                                                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| Water heating requirement                                                                            | 199.3541 | 175.5504 | 185.1250 | 160.0708 | 153.2041 | 135.9618 | 132.9234 | 139.5422 | 142.5031 | 161.3478 | 174.4610 | 196.8757 (64)   |
| Efficiency of water heater                                                                           | 88.0779  | 88.0171  | 87.8567  | 87.5746  | 87.1076  | 86.7000  | 86.7000  | 86.7000  | 86.7000  | 87.5210  | 87.9349  | 86.7000 (216)   |
| Fuel for water heating, kWh/month                                                                    | 226.3385 | 199.4504 | 210.7124 | 182.7822 | 175.8790 | 156.8186 | 153.3142 | 160.9484 | 164.3635 | 184.3532 | 198.3978 | 223.4584 (219)  |
| Space cooling fuel requirement                                                                       |          |          |          |          |          |          |          |          |          |          |          |                 |
| (221)m                                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)    |
| Pumps and Fa                                                                                         | 10.9478  | 9.8883   | 10.9478  | 10.5947  | 10.9478  | 10.5947  | 10.9478  | 10.9478  | 10.5947  | 10.9478  | 10.5947  | 10.9478 (231)   |
| Lighting                                                                                             | 23.4106  | 18.7809  | 16.9101  | 12.3891  | 9.5697   | 7.8185   | 8.7298   | 11.3473  | 14.7390  | 19.3384  | 21.8427  | 24.0613 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | -16.2309 | -22.5799 | -34.8167 | -43.4616 | -48.9761 | -49.0347 | -48.0402 | -44.4687 | -37.4200 | -28.6331 | -18.8171 | -13.7131 (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | -4.8241  | -9.0657  | -18.4786 | -30.2089 | -39.7478 | -44.3434 | -43.0957 | -36.9163 | -26.1012 | -14.5792 | -6.7758  | -3.7312 (233b)  |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234b)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235d)   |
| Annual totals kWh/year                                                                               |          |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating fuel - main system 1                                                                   |          |          |          |          |          |          |          |          |          |          |          | 2014.4996 (211) |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)    |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)    |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          | 86.7000         |
| Water heating fuel used                                                                              |          |          |          |          |          |          |          |          |          |          |          | 2236.8166 (219) |
| Space cooling fuel                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (221)    |

|                                                                                            |  |  |  |  |  |  |  |  |  |  |  |                |
|--------------------------------------------------------------------------------------------|--|--|--|--|--|--|--|--|--|--|--|----------------|
| Electricity for pumps and fans:                                                            |  |  |  |  |  |  |  |  |  |  |  |                |
| (MEVDe decentralised, Database: total watage = 5.7980, total flow = 37.0000, SFP = 0.1567) |  |  |  |  |  |  |  |  |  |  |  |                |
| mechanical ventilation fans (SFP = 0.1567)                                                 |  |  |  |  |  |  |  |  |  |  |  | 42.9017 (230a) |

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|                                                     |                |
|-----------------------------------------------------|----------------|
| central heating pump                                | 41.0000 (230c) |
| main heating flue fan                               | 45.0000 (230e) |
| Total electricity for the above, kWh/year           | 128.9017 (231) |
| Electricity for lighting (calculated in Appendix L) | 188.9373 (232) |

|                                                               |                 |
|---------------------------------------------------------------|-----------------|
| Energy saving/generation technologies (Appendices M ,N and Q) |                 |
| PV generation                                                 | -684.0599 (233) |
| Wind generation                                               | 0.0000 (234)    |
| Hydro-electric generation (Appendix N)                        | 0.0000 (235a)   |
| Electricity generated - Micro CHP (Appendix N)                | 0.0000 (235)    |
| Appendix Q - special features                                 |                 |
| Energy saved or generated                                     | -0.0000 (236)   |
| Energy used                                                   | 0.0000 (237)    |
| Total delivered energy for all uses                           | 3885.0953 (238) |

## 10a. Fuel costs - using BEDF prices (596)

|                                             | Fuel<br>kWh/year | Fuel price<br>p/kWh | Fuel cost<br>£/year |
|---------------------------------------------|------------------|---------------------|---------------------|
| Space heating - main system 1               | 2014.4996        | 7.3200              | 147.4614 (240)      |
| Total CO2 associated with community systems |                  |                     | 0.0000 (473)        |
| Water heating (other fuel)                  | 2236.8166        | 7.3200              | 163.7350 (247)      |
| Energy for instantaneous electric shower(s) | 0.0000           | 27.6700             | 0.0000 (247a)       |
| Pumps, fans and electric keep-hot           | 128.9017         | 27.6700             | 35.6671 (249)       |
| Energy for lighting                         | 188.9373         | 27.6700             | 52.2789 (250)       |
| Additional standing charges                 |                  |                     | 108.0000 (251)      |
| Energy saving/generation technologies       |                  |                     |                     |
| PV Unit electricity used in dwelling        | -406.1918        | 27.6700             | -112.3933           |
| PV Unit electricity exported                | -277.8681        | 5.8100              | -16.1441            |
| Total                                       |                  |                     | -128.5374 (252)     |
| Total energy cost                           |                  |                     | 378.6050 (255)      |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|---------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1               | 2014.4996          | 0.2100                        | 423.0449 (261)           |
| Total CO2 associated with community systems |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                  | 2236.8166          | 0.2100                        | 469.7315 (264)           |
| Space and water heating                     |                    |                               | 892.7764 (265)           |
| Pumps, fans and electric keep-hot           | 128.9017           | 0.1387                        | 17.8803 (267)            |
| Energy for lighting                         | 188.9373           | 0.1443                        | 27.2695 (268)            |
| Energy saving/generation technologies       |                    |                               |                          |
| PV Unit electricity used in dwelling        | -406.1918          | 0.1329                        | -53.9983                 |
| PV Unit electricity exported                | -277.8681          | 0.1242                        | -34.5129                 |
| Total                                       |                    |                               | -88.5111 (269)           |
| Total CO2, kg/year                          |                    |                               | 849.4150 (272)           |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1               | 2014.4996          | 1.1300                              | 2276.3846 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 2236.8166          | 1.1300                              | 2527.6028 (278)            |
| Space and water heating                     |                    |                                     | 4803.9873 (279)            |
| Pumps, fans and electric keep-hot           | 128.9017           | 1.5128                              | 195.0025 (281)             |
| Energy for lighting                         | 188.9373           | 1.5338                              | 289.7983 (282)             |
| Energy saving/generation technologies       |                    |                                     |                            |
| PV Unit electricity used in dwelling        | -406.1918          | 1.4912                              | -605.7161                  |
| PV Unit electricity exported                | -277.8681          | 0.4558                              | -126.6402                  |
| Total                                       |                    |                                     | -732.3563 (283)            |
| Total Primary energy kWh/year               |                    |                                     | 4556.4318 (286)            |

# Full SAP Calculation Printout



|                                    |                                                          |               |        |                |            |
|------------------------------------|----------------------------------------------------------|---------------|--------|----------------|------------|
| Plot Reference                     | 4907-R823-9471-006                                       |               |        | Issued on Date | 21/07/2026 |
| Assessment Reference               | Plot 6                                                   | Plot Type Ref | Plot 6 |                |            |
| Plot Address                       | Plot 6, Beaconsfield-Semi, K, WC, B, ES, 1012            |               |        | SAP Version    | 10.2       |
| SAP Rating                         | 90 B                                                     | DER           | 11.17  | TER            | 11.66      |
| Environmental                      | 91 B                                                     | % DER < TER   |        | 4.20           |            |
| CO <sub>2</sub> Emissions (t/year) | 0.85                                                     | DFEE          | 34.92  | TFEE           | 37.57      |
| Compliance Check                   | See BREL                                                 | % DFEE < TFEE |        | 7.06           |            |
| % DPER < TPER                      | 1.47                                                     | DPER          | 60.05  | TPER           | 60.94      |
| Assessor Details                   | Mr. Daniel Harris                                        |               |        | Assessor ID    | R823-0001  |
| Client                             | Crest Nicholson Head Office, Crest Nicholson Head Office |               |        |                |            |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)              | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|-----------------------------------|-----------------------------|
| Main dwelling                                          |                           |                                   |                             |
| Ground floor                                           | 42.9900 (1b)              | x 2.4600 (2b)                     | = 105.7554 (1b) - (3b)      |
| First floor                                            | 42.9900 (1c)              | x 2.7600 (2c)                     | = 118.6524 (1c) - (3c)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 85.9800                   |                                   | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 224.4078 (5)                |

## 2. Ventilation rate

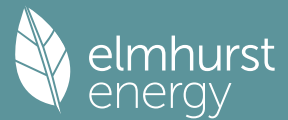
|                                                                                                         | m <sup>3</sup> per hour                                                                                                                  |
|---------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| Number of open chimneys                                                                                 | 0 * 80 = 0.0000 (6a)                                                                                                                     |
| Number of open flues                                                                                    | 0 * 20 = 0.0000 (6b)                                                                                                                     |
| Number of chimneys / flues attached to closed fire                                                      | 0 * 10 = 0.0000 (6c)                                                                                                                     |
| Number of flues attached to solid fuel boiler                                                           | 0 * 20 = 0.0000 (6d)                                                                                                                     |
| Number of flues attached to other heater                                                                | 0 * 35 = 0.0000 (6e)                                                                                                                     |
| Number of blocked chimneys                                                                              | 0 * 20 = 0.0000 (6f)                                                                                                                     |
| Number of intermittent extract fans                                                                     | 0 * 10 = 0.0000 (7a)                                                                                                                     |
| Number of passive vents                                                                                 | 0 * 10 = 0.0000 (7b)                                                                                                                     |
| Number of flueless gas fires                                                                            | 0 * 40 = 0.0000 (7c)                                                                                                                     |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =      | 0.0000 / (5) = 0.0000 (8)                                                                                                                |
| Pressure test                                                                                           | Yes                                                                                                                                      |
| Pressure Test Method                                                                                    | Blower Door                                                                                                                              |
| Measured/design AP50                                                                                    | 4.5000 (17)                                                                                                                              |
| Infiltration rate                                                                                       | 0.2250 (18)                                                                                                                              |
| Number of sides sheltered                                                                               | 1 (19)                                                                                                                                   |
| Shelter factor                                                                                          | (20) = 1 - [0.075 x (19)] = 0.9250 (20)                                                                                                  |
| Infiltration rate adjusted to include shelter factor                                                    | (21) = (18) x (20) = 0.2081 (21)                                                                                                         |
| Wind speed                                                                                              | Jan 5.1000 Feb 5.0000 Mar 4.9000 Apr 4.4000 May 4.3000 Jun 3.8000 Jul 3.8000 Aug 3.7000 Sep 4.0000 Oct 4.3000 Nov 4.5000 Dec 4.7000 (22) |
| Wind factor                                                                                             | 1.2750 1.2500 1.2250 1.1000 1.0750 0.9500 0.9500 0.9250 1.0000 1.0750 1.1250 1.1750 (22a)                                                |
| Adj infilt rate                                                                                         | 0.2654 0.2602 0.2550 0.2289 0.2237 0.1977 0.1977 0.1925 0.2081 0.2237 0.2341 0.2445 (22b)                                                |
| Mechanical extract ventilation - decentralised                                                          |                                                                                                                                          |
| If mechanical ventilation                                                                               | 0.5000 (23a)                                                                                                                             |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) | 0.5000 (23b)                                                                                                                             |
| Effective ac                                                                                            | 0.5154 0.5102 0.5050 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 (25)                                                 |

## 3. Heat losses and heat loss parameter

| Element                                                      | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K   |
|--------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|-----------------|
| Main dwelling                                                |                         |                            |                           |                               |              |                                |                 |
| Front Door                                                   |                         |                            | 2.5500                    | 1.2000                        | 3.0600       |                                | (26)            |
| Windows                                                      |                         |                            | 10.2500                   | 1.2357                        | 12.6663      |                                | (27)            |
| French Doors                                                 |                         |                            | 3.3300                    | 1.2357                        | 4.1150       |                                | (27)            |
| GF SPVL 125TS P/A                                            |                         |                            | 42.9900                   | 0.1300                        | 5.5887       | 75.0000                        | 3224.2500 (28a) |
| EW Brick AAC011                                              | 97.2486                 | 16.1300                    | 81.1186                   | 0.1800                        | 14.6013      | 60.0000                        | 4867.1160 (29a) |
| PR 500mm MW044                                               | 42.9900                 |                            | 42.9900                   | 0.0900                        | 3.8691       | 9.0000                         | 386.9100 (30)   |
| Total net area of external elements Aum (A, m <sup>2</sup> ) |                         |                            | 183.2286                  |                               |              |                                | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                          |                         |                            | (26)...(30) + (32) =      |                               | 43.9005      |                                | (33)            |
| Main dwelling                                                |                         |                            |                           |                               |              |                                |                 |
| E-WM-30                                                      |                         |                            | 43.8000                   | 0.0000                        | 0.0000       | 45.0000                        | 1971.0000 (32)  |
| Timber - GF                                                  |                         |                            | 88.6100                   |                               |              | 9.0000                         | 797.4900 (32c)  |
| Timber - FF                                                  |                         |                            | 126.9000                  |                               |              | 9.0000                         | 1142.1000 (32c) |
| Internal Floor FF                                            |                         |                            | 42.9900                   |                               |              | 18.0000                        | 773.8200 (32d)  |
| Internal Ceiling GF                                          |                         |                            | 42.9900                   |                               |              | 9.0000                         | 386.9100 (32e)  |



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|       |  |  |        |  |         |  |        |  |        |  |        |  |              |
|-------|--|--|--------|--|---------|--|--------|--|--------|--|--------|--|--------------|
| North |  |  | 4.1200 |  | 10.6334 |  | 0.4500 |  | 0.0000 |  | 0.7700 |  | 15.1800 (74) |
| South |  |  | 5.6100 |  | 46.7521 |  | 0.4500 |  | 0.0000 |  | 0.7700 |  | 90.8797 (78) |
| West  |  |  | 0.5200 |  | 19.6403 |  | 0.4500 |  | 0.0000 |  | 0.7700 |  | 3.5388 (80)  |
| North |  |  | 3.3300 |  | 10.6334 |  | 0.4500 |  | 0.0000 |  | 0.7700 |  | 12.2693 (74) |

|             |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Solar gains | 121.8678 | 208.2172 | 290.1305 | 374.0852 | 436.5439 | 442.2258 | 422.5917 | 373.8995 | 318.4831 | 231.1927 | 145.9981 | 104.3216 (83) |
| Total gains | 641.1217 | 740.4482 | 798.3891 | 862.9322 | 898.5630 | 883.2430 | 845.1577 | 797.5060 | 756.2498 | 688.3026 | 633.6032 | 612.0071 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |         |                     |         |              |             |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------|---------|--------------|-------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |                     |         | 21.0000 (85) |             |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |         |                     |         |              |             |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct                 | Nov     | Dec          |             |
| tau                                                                         | 42.5338 | 42.7198 | 42.9075 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876             | 43.0876 | 43.0876      |             |
| alpha                                                                       | 3.8356  | 3.8480  | 3.8605  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725              | 3.8725  | 3.8725       |             |
| util living area                                                            | 0.9766  | 0.9591  | 0.9312  | 0.8667  | 0.7529  | 0.5887  | 0.4428  | 0.4856  | 0.6965  | 0.8884              | 0.9598  | 0.9800 (86)  |             |
| MIT                                                                         | 19.2549 | 19.5468 | 19.9145 | 20.3644 | 20.7207 | 20.9195 | 20.9792 | 20.9701 | 20.8438 | 20.3893             | 19.7537 | 19.2157 (87) |             |
| Th 2                                                                        | 20.0591 | 20.0628 | 20.0665 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701             | 20.0701 | 20.0701 (88) |             |
| util rest of house                                                          | 0.9719  | 0.9512  | 0.9177  | 0.8405  | 0.7060  | 0.5168  | 0.3543  | 0.3949  | 0.6289  | 0.8607              | 0.9507  | 0.9760 (89)  |             |
| MIT 2                                                                       | 18.2595 | 18.5876 | 18.9970 | 19.4838 | 19.8436 | 20.0200 | 20.0614 | 20.0567 | 19.9626 | 19.5204             | 18.8278 | 18.2230 (90) |             |
| Living area fraction                                                        |         |         |         |         |         |         |         |         | fLA =   | Living area / (4) = |         |              | 0.1933 (91) |
| MIT                                                                         | 18.4519 | 18.7730 | 19.1743 | 19.6540 | 20.0132 | 20.1939 | 20.2388 | 20.2333 | 20.1330 | 19.6884             | 19.0068 | 18.4149 (92) |             |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |                     |         | 0.0000       |             |
| adjusted MIT                                                                | 18.4519 | 18.7730 | 19.1743 | 19.6540 | 20.0132 | 20.1939 | 20.2388 | 20.2333 | 20.1330 | 19.6884             | 19.0068 | 18.4149 (93) |             |

## 8. Space heating requirement

|                                                                                |           |           |           |          |          |          |          |          |          |               |           |                |  |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|---------------|-----------|----------------|--|
|                                                                                | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov       | Dec            |  |
| Utilisation                                                                    | 0.9610    | 0.9372    | 0.9019    | 0.8271   | 0.7029   | 0.5268   | 0.3707   | 0.4113   | 0.6338   | 0.8473        | 0.9370    | 0.9662 (94)    |  |
| Useful gains                                                                   | 616.1448  | 693.9277  | 720.0381  | 713.6930 | 631.6192 | 465.2760 | 313.3241 | 328.0018 | 479.3454 | 583.1852      | 593.7109  | 591.3031 (95)  |  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000    | 4.2000 (96)    |  |
| Heat loss rate W                                                               | 1252.2917 | 1222.2671 | 1111.7740 | 939.3812 | 726.1686 | 488.6341 | 317.8571 | 334.8446 | 526.9901 | 793.8854      | 1040.0806 | 1241.6966 (97) |  |
| Space heating kWh                                                              | 473.2933  | 355.0441  | 291.4515  | 162.4955 | 70.3447  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 156.7609      | 321.3862  | 483.8927 (98a) |  |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |          |          |          |          |          |          |               |           | 2314.6688      |  |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | 0.0000 (98b)   |  |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |          |          |          |          |          |          |               |           | 0.0000         |  |
| Space heating kWh                                                              | 473.2933  | 355.0441  | 291.4515  | 162.4955 | 70.3447  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 156.7609      | 321.3862  | 483.8927 (98c) |  |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |          |          |          |          |          |          |               |           | 2314.6688      |  |
| Space heating per m2                                                           |           |           |           |          |          |          |          |          |          | (98c) / (4) = |           | 26.9210 (99)   |  |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                                                      |          |          |          |          |          |          |          |          |          |          |          |          |                 |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (201)    |
| Fraction of space heat from main system(s)                                                           |          |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (202)    |
| Efficiency of main space heating system 1 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          |          | 91.7000 (206)   |
| Efficiency of main space heating system 2 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)    |
| Efficiency of secondary/supplementary heating system, %                                              |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)    |
|                                                                                                      | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |                 |
| Space heating requirement                                                                            | 473.2933 | 355.0441 | 291.4515 | 162.4955 | 70.3447  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 156.7609 | 321.3862 | 483.8927 | (98)            |
| Space heating efficiency (main heating system 1)                                                     | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 91.7000  | 91.7000  | 91.7000  | (210)           |
| Space heating fuel (main heating system)                                                             | 516.1322 | 387.1800 | 317.8315 | 177.2033 | 76.7118  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 170.9497 | 350.4757 | 527.6911 | (211)           |
| Space heating efficiency (main heating system 2)                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (212)           |
| Space heating fuel (main heating system 2)                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (213)           |
| Space heating fuel (secondary)                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (215)           |
| Water heating                                                                                        |          |          |          |          |          |          |          |          |          |          |          |          |                 |
| Water heating requirement                                                                            | 199.3541 | 175.5504 | 185.1250 | 160.0708 | 153.2041 | 135.9618 | 132.9234 | 139.5422 | 142.5031 | 161.3478 | 174.4610 | 196.8757 | (64)            |
| Efficiency of water heater                                                                           | 88.1671  | 88.0940  | 87.9723  | 87.7453  | 87.3500  | 86.7000  | 86.7000  | 86.7000  | 86.7000  | 87.7223  | 88.0496  | 86.7000  | (216)           |
| Fuel for water heating, kWh/month                                                                    | 226.1095 | 199.2762 | 210.4356 | 182.4266 | 175.3910 | 156.8186 | 153.3142 | 160.9484 | 164.3635 | 183.9302 | 198.1394 | 223.2598 | (217)           |
| Space cooling fuel requirement                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (221)           |
| Pumps and Fa                                                                                         | 10.9478  | 9.8883   | 10.9478  | 10.5947  | 10.9478  | 10.5947  | 10.9478  | 10.9478  | 10.5947  | 10.9478  | 10.5947  | 10.9478  | (231)           |
| Lighting                                                                                             | 23.4106  | 18.7809  | 16.9101  | 12.3891  | 9.5697   | 7.8185   | 8.7298   | 11.3473  | 14.7390  | 19.3384  | 21.8427  | 24.0613  | (232)           |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | -14.6942 | -22.4007 | -34.8599 | -42.5373 | -48.8442 | -46.7030 | -46.0948 | -41.9719 | -35.2991 | -26.9662 | -16.7286 | -12.5110 | (233a)          |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (234a)          |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (235a)          |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (235c)          |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | -4.0882  | -8.9418  | -18.5200 | -29.0022 | -39.5369 | -40.1897 | -39.6495 | -32.9433 | -23.3746 | -13.1010 | -5.5501  | -3.2067  | (233b)          |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (234b)          |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (235b)          |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (235d)          |
| Annual totals kWh/year                                                                               |          |          |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating fuel - main system 1                                                                   |          |          |          |          |          |          |          |          |          |          |          |          | 2524.1754 (211) |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)    |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)    |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          |          | 86.7000         |

# Full SAP Calculation Printout



|                                                                                                                            |                 |
|----------------------------------------------------------------------------------------------------------------------------|-----------------|
| Water heating fuel used                                                                                                    | 2234.4130 (219) |
| Space cooling fuel                                                                                                         | 0.0000 (221)    |
| Electricity for pumps and fans:<br>(MEVDecentralised, Database: total watage = 5.7980, total flow = 37.0000, SFP = 0.1567) |                 |
| mechanical ventilation fans (SFP = 0.1567)                                                                                 | 42.9017 (230a)  |
| central heating pump                                                                                                       | 41.0000 (230c)  |
| main heating flue fan                                                                                                      | 45.0000 (230e)  |
| Total electricity for the above, kWh/year                                                                                  | 128.9017 (231)  |
| Electricity for lighting (calculated in Appendix L)                                                                        | 188.9373 (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                                              |                 |
| PV generation                                                                                                              | -647.7148 (233) |
| Wind generation                                                                                                            | 0.0000 (234)    |
| Hydro-electric generation (Appendix N)                                                                                     | 0.0000 (235a)   |
| Electricity generated - Micro CHP (Appendix N)                                                                             | 0.0000 (235)    |
| Appendix Q - special features                                                                                              |                 |
| Energy saved or generated                                                                                                  | -0.0000 (236)   |
| Energy used                                                                                                                | 0.0000 (237)    |
| Total delivered energy for all uses                                                                                        | 4428.7126 (238) |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                                 | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |       |
|-------------------------------------------------|--------------------|-------------------------------|--------------------------|-------|
| Space heating - main system 1                   | 2524.1754          | 0.2100                        | 530.0768                 | (261) |
| Total CO2 associated with community systems     |                    |                               | 0.0000                   | (373) |
| Water heating (other fuel)                      | 2234.4130          | 0.2100                        | 469.2267                 | (264) |
| Space and water heating                         |                    |                               | 999.3036                 | (265) |
| Pumps, fans and electric keep-hot               | 128.9017           | 0.1387                        | 17.8803                  | (267) |
| Energy for lighting                             | 188.9373           | 0.1443                        | 27.2695                  | (268) |
| Energy saving/generation technologies           |                    |                               |                          |       |
| PV Unit electricity used in dwelling            | -389.6109          | 0.1330                        | -51.8040                 |       |
| PV Unit electricity exported                    | -258.1039          | 0.1248                        | -32.1992                 |       |
| Total                                           |                    |                               | -84.0033                 | (269) |
| Total CO2, kg/year                              |                    |                               | 960.4500                 | (272) |
| EPC Dwelling Carbon Dioxide Emission Rate (DER) |                    |                               | 11.1700                  | (273) |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |       |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|-------|
| Space heating - main system 1               | 2524.1754          | 1.1300                              | 2852.3182                  | (275) |
| Total CO2 associated with community systems |                    |                                     | 0.0000                     | (473) |
| Water heating (other fuel)                  | 2234.4130          | 1.1300                              | 2524.8867                  | (278) |
| Space and water heating                     |                    |                                     | 5377.2049                  | (279) |
| Pumps, fans and electric keep-hot           | 128.9017           | 1.5128                              | 195.0025                   | (281) |
| Energy for lighting                         | 188.9373           | 1.5338                              | 289.7983                   | (282) |
| Energy saving/generation technologies       |                    |                                     |                            |       |
| PV Unit electricity used in dwelling        | -389.6109          | 1.4913                              | -581.0334                  |       |
| PV Unit electricity exported                | -258.1039          | 0.4579                              | -118.1785                  |       |
| Total                                       |                    |                                     | -699.2119                  | (283) |
| Total Primary energy kWh/year               |                    |                                     | 5162.7938                  | (286) |
| Dwelling Primary energy Rate (DPER)         |                    |                                     | 60.0500                    | (287) |

## SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF TARGET EMISSIONS

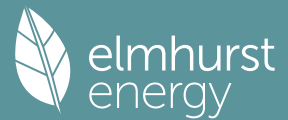
### 1. Overall dwelling characteristics

|                                                        | Area<br>(m2) | Storey height<br>(m)            | Volume<br>(m3)         |  |
|--------------------------------------------------------|--------------|---------------------------------|------------------------|--|
| Main dwelling                                          |              |                                 |                        |  |
| Ground floor                                           | 42.9900 (1b) | x 2.4600 (2b)                   | = 105.7554 (1b) - (3b) |  |
| First floor                                            | 42.9900 (1c) | x 2.7600 (2c)                   | = 118.6524 (1c) - (3c) |  |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 85.9800      |                                 | (4)                    |  |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 224.4078 (5)         |  |

### 2. Ventilation rate

|                                                                                                    | m3 per hour     |              |
|----------------------------------------------------------------------------------------------------|-----------------|--------------|
| Number of open chimneys                                                                            | 0 * 80 =        | 0.0000 (6a)  |
| Number of open flues                                                                               | 0 * 20 =        | 0.0000 (6b)  |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 =        | 0.0000 (6c)  |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 =        | 0.0000 (6d)  |
| Number of flues attached to other heater                                                           | 0 * 35 =        | 0.0000 (6e)  |
| Number of blocked chimneys                                                                         | 0 * 20 =        | 0.0000 (6f)  |
| Number of intermittent extract fans                                                                | 3 * 10 =        | 30.0000 (7a) |
| Number of passive vents                                                                            | 0 * 10 =        | 0.0000 (7b)  |
| Number of flueless gas fires                                                                       | 0 * 40 =        | 0.0000 (7c)  |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 30.0000 / (5) = | 0.1337 (8)   |
| Pressure test                                                                                      | Yes             |              |
| Pressure Test Method                                                                               | Blower Door     |              |
| Measured/design AP50                                                                               | 5.0000          | (17)         |
| Infiltration rate                                                                                  | 0.3837          | (18)         |
| Number of sides sheltered                                                                          | 1               | (19)         |

# Full SAP Calculation Printout



Shelter factor  
Infiltration rate adjusted to include shelter factor

$$(20) = 1 - [0.075 \times (19)] = 0.9250 \quad (20)$$

$$(21) = (18) \times (20) = 0.3549 \quad (21)$$

|                 |               |               |               |               |               |               |               |               |               |               |               |               |       |
|-----------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|-------|
| Wind speed      | Jan<br>5.1000 | Feb<br>5.0000 | Mar<br>4.9000 | Apr<br>4.4000 | May<br>4.3000 | Jun<br>3.8000 | Jul<br>3.8000 | Aug<br>3.7000 | Sep<br>4.0000 | Oct<br>4.3000 | Nov<br>4.5000 | Dec<br>4.7000 | (22)  |
| Wind factor     | 1.2750        | 1.2500        | 1.2250        | 1.1000        | 1.0750        | 0.9500        | 0.9500        | 0.9250        | 1.0000        | 1.0750        | 1.1250        | 1.1750        | (22a) |
| Adj infilt rate | 0.4525        | 0.4436        | 0.4348        | 0.3904        | 0.3815        | 0.3372        | 0.3372        | 0.3283        | 0.3549        | 0.3815        | 0.3993        | 0.4170        | (22b) |
| Effective ac    | 0.6024        | 0.5984        | 0.5945        | 0.5762        | 0.5728        | 0.5568        | 0.5568        | 0.5539        | 0.5630        | 0.5728        | 0.5797        | 0.5870        | (25)  |

## 3. Heat losses and heat loss parameter

| Element                                           | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K | A x U<br>W/K | K-value<br>kJ/m2K | A x K<br>kJ/K |
|---------------------------------------------------|-------------|----------------|---------------|------------------|--------------|-------------------|---------------|
| Main dwelling                                     |             |                |               |                  |              |                   |               |
| TER Opaque door                                   |             |                | 2.5500        | 1.0000           | 2.5500       |                   | (26)          |
| TER Opening Type                                  |             |                | 13.5800       | 1.1450           | 15.5496      |                   | (27)          |
| GF SPVL 125TS P/A                                 |             |                | 42.9900       | 0.1300           | 5.5887       |                   | (28a)         |
| EW Brick AAC011                                   | 97.2486     | 16.1300        | 81.1186       | 0.1800           | 14.6013      |                   | (29a)         |
| PR 500mm MW044                                    | 42.9900     |                | 42.9900       | 0.1100           | 4.7289       |                   | (30)          |
| Total net area of external elements Aum(A, m2)    |             |                | 183.2286      |                  |              |                   | (31)          |
| Fabric heat loss, W/K = Sum (A x U)               |             |                |               |                  |              |                   | (32)          |
| Main dwelling                                     |             |                |               |                  |              |                   |               |
| E-WM-30                                           |             |                | 43.8000       | 0.0000           | 0.0000       |                   | (32)          |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K |             |                |               |                  |              |                   | 157.5901 (35) |

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

List of Thermal Bridges

|                                                      | Length  | Psi-value | Total  |
|------------------------------------------------------|---------|-----------|--------|
| K1 Element                                           | 10.7800 | 0.0500    | 0.5390 |
| E2 Other lintels (including other steel lintels)     | 9.2000  | 0.0500    | 0.4600 |
| E3 Sill                                              | 21.1500 | 0.0500    | 1.0575 |
| E4 Jamb                                              | 10.2300 | 0.1600    | 1.6368 |
| E5 Ground floor (normal)                             | 18.6300 | 0.0000    | 0.0000 |
| E6 Intermediate floor within a dwelling              | 10.2500 | 0.0600    | 0.6150 |
| E10 Eaves (insulation at ceiling level)              | 10.4400 | 0.0600    | 0.6264 |
| E18 Party wall between dwellings                     | 4.8000  | 0.0500    | 0.2400 |
| E4 Jamb                                              | 1.0600  | 0.0500    | 0.0530 |
| E2 Other lintels (including other steel lintels)     | 8.3900  | 0.0800    | 0.6712 |
| P1 Party wall - Ground floor                         | 8.3900  | 0.0000    | 0.0000 |
| P2 Party wall - Intermediate floor within a dwelling | 8.3900  | 0.1200    | 1.0068 |
| P4 Party wall - Roof (insulation at ceiling level)   | 8.3900  | 0.1600    | 1.3424 |
| E5 Ground floor (normal)                             | 8.3900  | 0.0600    | 0.5034 |
| E12 Gable (insulation at ceiling level)              | 10.4400 | 0.0900    | 0.9396 |
| E16 Corner (normal)                                  |         |           |        |

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

Point Thermal bridges

Total fabric heat loss (33) + (36) + (36a) = 52.7097 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

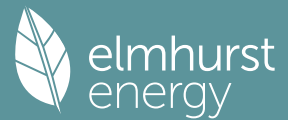
|                           |                |                |                |                |                |                |                |                |                |                |                |                |      |
|---------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|------|
| (38)m                     | Jan<br>44.6091 | Feb<br>44.3147 | Mar<br>44.0262 | Apr<br>42.6707 | May<br>42.4171 | Jun<br>41.2365 | Jul<br>41.2365 | Aug<br>41.0179 | Sep<br>41.6913 | Oct<br>42.4171 | Nov<br>42.9301 | Dec<br>43.4665 | (38) |
| Heat transfer coeff       | 97.3188        | 97.0244        | 96.7358        | 95.3804        | 95.1268        | 93.9462        | 93.9462        | 93.7276        | 94.4009        | 95.1268        | 95.6398        | 96.1761        | (39) |
| Average = Sum(39)m / 12 = |                |                |                |                |                |                |                |                |                |                |                | 95.3791        |      |

|               |               |               |               |               |               |               |               |               |               |               |               |               |      |
|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|------|
| HLP           | Jan<br>1.1319 | Feb<br>1.1285 | Mar<br>1.1251 | Apr<br>1.1093 | May<br>1.1064 | Jun<br>1.0927 | Jul<br>1.0927 | Aug<br>1.0901 | Sep<br>1.0979 | Oct<br>1.1064 | Nov<br>1.1123 | Dec<br>1.1186 | (40) |
| HLP (average) |               |               |               |               |               |               |               |               |               |               |               | 1.1093        |      |
| Days in mont  | 31            | 28            | 31            | 30            | 31            | 30            | 31            | 31            | 30            | 31            | 30            | 31            |      |

## 4. Water heating energy requirements (kWh/year)

|                                                                 |                                        |          |          |          |          |          |          |          |          |          |          |               |                |
|-----------------------------------------------------------------|----------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|----------------|
| Assumed occupancy                                               |                                        |          |          |          |          |          |          |          |          |          |          |               | 2.5666 (42)    |
| Hot water usage for mixer showers                               |                                        |          |          |          |          |          |          |          |          |          |          |               |                |
| 67.2533                                                         | 66.2426                                | 64.7698  | 61.9519  | 59.8724  | 57.5533  | 56.2352  | 57.6968  | 59.2990  | 61.7890  | 64.6674  | 66.9956  | 66.9956 (42a) |                |
| Hot water usage for baths                                       |                                        |          |          |          |          |          |          |          |          |          |          |               |                |
| 29.0443                                                         | 28.6130                                | 28.0055  | 26.8856  | 26.0469  | 25.1170  | 24.6147  | 25.2179  | 25.8746  | 26.8697  | 28.0127  | 28.9461  | 28.9461 (42b) |                |
| Hot water usage for other uses                                  |                                        |          |          |          |          |          |          |          |          |          |          |               |                |
| 40.9146                                                         | 39.4268                                | 37.9390  | 36.4512  | 34.9634  | 33.4756  | 33.4756  | 34.9634  | 36.4512  | 37.9390  | 39.4268  | 40.9146  | 40.9146 (42c) |                |
| Average daily hot water use (litres/day)                        |                                        |          |          |          |          |          |          |          |          |          |          |               | 126.1290 (43)  |
| Daily hot water use                                             | Jan                                    | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |                |
| 137.2122                                                        | 134.2823                               | 130.7143 | 125.2887 | 120.8827 | 116.1459 | 114.3255 | 117.8781 | 121.6248 | 126.5977 | 132.1069 | 136.8563 | 136.8563 (44) |                |
| Energy content (annual)                                         | 217.3105                               | 191.2162 | 200.9030 | 171.5139 | 162.7313 | 142.8150 | 138.2667 | 145.9577 | 149.9756 | 171.7918 | 188.2105 | 214.2839      | (45)           |
| Distribution loss (46)m = 0.15 x (45)m                          | 32.5966                                | 28.6824  | 30.1355  | 25.7271  | 24.4097  | 21.4222  | 20.7400  | 21.8937  | 22.4963  | 25.7688  | 28.2316  | 32.1426       | (46)           |
| Water storage loss (or HIU loss):                               |                                        |          |          |          |          |          |          |          |          |          |          |               |                |
| Total storage loss                                              | 0.0000                                 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | (56)           |
| If cylinder contains dedicated solar storage                    |                                        |          |          |          |          |          |          |          |          |          |          |               |                |
| 0.0000                                                          | 0.0000                                 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | (57)           |
| Primary loss                                                    | 0.0000                                 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | (59)           |
| Combi loss                                                      | 50.9589                                | 46.0274  | 50.9589  | 49.3151  | 50.9589  | 49.3151  | 50.9589  | 50.9589  | 49.3151  | 50.9589  | 49.3151  | 50.9589       | (61)           |
| Total heat required for water heating calculated for each month |                                        |          |          |          |          |          |          |          |          |          |          |               |                |
| 268.2694                                                        | 237.2436                               | 251.8620 | 220.8290 | 213.6902 | 192.1300 | 189.2257 | 196.9166 | 199.2907 | 222.7507 | 237.5256 | 265.2428 | 265.2428 (62) |                |
| WWHRS                                                           | -30.7454                               | -27.1915 | -28.4733 | -23.5770 | -21.9730 | -18.8024 | -17.6243 | -18.7416 | -19.4537 | -22.9338 | -25.9812 | -30.1760      | (63a)          |
| PV diverter                                                     | -0.0000                                | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000       | (63b)          |
| Solar input                                                     | 0.0000                                 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | (63c)          |
| FGHRS                                                           | 0.0000                                 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | (63d)          |
| Output from w/h                                                 | 237.5241                               | 210.0522 | 223.3886 | 197.2519 | 191.7173 | 173.3276 | 171.6014 | 178.1749 | 179.8370 | 199.8169 | 211.5444 | 235.0668      | (64)           |
| 12Total per year (kWh/year)                                     |                                        |          |          |          |          |          |          |          |          |          |          |               |                |
|                                                                 | Total per year (kWh/year) = Sum(64)m = |          |          |          |          |          |          |          |          |          |          |               | 2409.3031 (64) |
|                                                                 |                                        |          |          |          |          |          |          |          |          |          |          |               | 2409 (64)      |

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## 5. Internal gains (see Table 5 and 5a)

| Metabolic gains (Table 5), Watts                                                    |           |           |           |           |           |           |           |           |           |           |           |                |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
|                                                                                     | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec            |
| (66)m                                                                               | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 122.1242  | 135.2090  | 122.1242  | 126.1950  | 122.1242  | 126.1950  | 122.1242  | 122.1242  | 126.1950  | 122.1242  | 126.1950  | 122.1242 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 231.4847  | 233.8867  | 227.8336  | 214.9471  | 198.6802  | 183.3916  | 173.1779  | 170.7758  | 176.8289  | 189.7154  | 205.9823  | 221.2709 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330 (69)   |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 3.0000    | 3.0000    | 3.0000 (70)    |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 (71) |
| Water heating gains (Table 5)                                                       | 114.2412  | 111.7355  | 106.9086  | 96.3294   | 89.8493   | 83.0760   | 78.9159   | 82.3530   | 86.3828   | 93.8985   | 104.0399  | 112.8886 (72)  |
| Total internal gains                                                                | 532.3492  | 545.3303  | 521.3654  | 501.9705  | 475.1528  | 454.1617  | 435.7170  | 436.7521  | 450.9059  | 470.2373  | 500.7164  | 520.7828 (73)  |

## 6. Solar gains

| [Jan]       |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W   |          |          |               |
|-------------|----------|----------|----------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|--------------|----------|----------|---------------|
| North       |          |          |          | 7.4500     | 10.6334                        | 0.6300                            | 0.7000                             | 0.7700                       | 24.2103 (74) |          |          |               |
| South       |          |          |          | 5.6100     | 46.7521                        | 0.6300                            | 0.7000                             | 0.7700                       | 80.1559 (78) |          |          |               |
| West        |          |          |          | 0.5200     | 19.6403                        | 0.6300                            | 0.7000                             | 0.7700                       | 3.1212 (80)  |          |          |               |
|             |          |          |          |            |                                |                                   |                                    |                              |              |          |          |               |
| Solar gains | 107.4874 | 183.6475 | 255.8951 | 329.9432   | 385.0318                       | 390.0431                          | 372.7259                           | 329.7794                     | 280.9021     | 203.9120 | 128.7704 | 92.0117 (83)  |
| Total gains | 639.8366 | 728.9778 | 777.2605 | 831.9137   | 860.1845                       | 844.2049                          | 808.4429                           | 766.5314                     | 731.8080     | 674.1493 | 629.4868 | 612.7945 (84) |

## 7. Mean internal temperature (heating season)

| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |         |         |         |              |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| tau                                                                         | 38.6747 | 38.7921 | 38.9078 | 39.4607 | 39.5659 | 40.0631 | 40.0631 | 40.1566 | 39.8701 | 39.5659 | 39.3537 | 39.1342      |
| alpha                                                                       | 3.5783  | 3.5861  | 3.5939  | 3.6307  | 3.6377  | 3.6709  | 3.6709  | 3.6771  | 3.6580  | 3.6377  | 3.6236  | 3.6089       |
| util living area                                                            | 0.9781  | 0.9642  | 0.9428  | 0.8910  | 0.7953  | 0.6380  | 0.4890  | 0.5306  | 0.7374  | 0.9050  | 0.9638  | 0.9810 (86)  |
| MIT                                                                         | 19.2313 | 19.4781 | 19.8124 | 20.2651 | 20.6426 | 20.8881 | 20.9678 | 20.9564 | 20.8006 | 20.3245 | 19.7145 | 19.1982 (87) |
| Th 2                                                                        | 19.9749 | 19.9777 | 19.9804 | 19.9932 | 19.9956 | 20.0068 | 20.0068 | 20.0089 | 20.0025 | 19.9956 | 19.9908 | 19.9857 (88) |
| util rest of house                                                          | 0.9736  | 0.9570  | 0.9307  | 0.8671  | 0.7494  | 0.5607  | 0.3878  | 0.4288  | 0.6682  | 0.8793  | 0.9552  | 0.9771 (89)  |
| MIT 2                                                                       | 17.9253 | 18.2382 | 18.6594 | 19.2240 | 19.6652 | 19.9275 | 19.9919 | 19.9870 | 19.8462 | 19.3075 | 18.5491 | 17.8905 (90) |
| Living area fraction                                                        | 18.1778 | 18.4779 | 18.8823 | 19.4253 | 19.8541 | 20.1132 | 20.1805 | 20.1744 | 20.0307 | 19.5041 | 18.7744 | 18.1433 (91) |
| MIT                                                                         | 18.1778 | 18.4779 | 18.8823 | 19.4253 | 19.8541 | 20.1132 | 20.1805 | 20.1744 | 20.0307 | 19.5041 | 18.7744 | 18.1433 (92) |
| Temperature adjustment                                                      | 18.1778 | 18.4779 | 18.8823 | 19.4253 | 19.8541 | 20.1132 | 20.1805 | 20.1744 | 20.0307 | 19.5041 | 18.7744 | 18.1433 (93) |
| adjusted MIT                                                                | 18.1778 | 18.4779 | 18.8823 | 19.4253 | 19.8541 | 20.1132 | 20.1805 | 20.1744 | 20.0307 | 19.5041 | 18.7744 | 18.1433 (93) |

## 8. Space heating requirement

|                                                                                | Jan       | Feb       | Mar       | Apr       | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov       | Dec            |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|-----------|----------------|
| Utilisation                                                                    | 0.9624    | 0.9427    | 0.9140    | 0.8510    | 0.7421   | 0.5696   | 0.4062   | 0.4466   | 0.6704   | 0.8638   | 0.9412    | 0.9669 (94)    |
| Useful gains                                                                   | 615.8082  | 687.2111  | 710.4175  | 707.9501  | 638.3583 | 480.8476 | 328.3862 | 342.3649 | 490.5806 | 582.3190 | 592.4478  | 592.5365 (95)  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000    | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000  | 7.1000    | 4.2000 (96)    |
| Heat loss rate W                                                               | 1350.5677 | 1317.3849 | 1197.8091 | 1003.9025 | 775.6763 | 517.9447 | 336.3754 | 353.7646 | 559.8651 | 847.0155 | 1116.5375 | 1341.0082 (97) |
| Space heating kWh                                                              | 546.6610  | 423.4768  | 362.6193  | 213.0858  | 102.1645 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 196.9342 | 377.3446  | 556.8629 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |          |          |          |          |          |          |           | 2779.1492      |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |           |          |          |          |          |          |          |           | 0.0000         |
| Space heating kWh                                                              | 546.6610  | 423.4768  | 362.6193  | 213.0858  | 102.1645 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 196.9342 | 377.3446  | 556.8629 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |          |          |          |          |          |          |           | 2779.1492      |
| Space heating per m <sup>2</sup>                                               |           |           |           |           |          |          |          |          |          |          |           | 32.3232 (99)   |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

| Fraction of space heat from secondary/supplementary system (Table 11) |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (201)   |
|-----------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| Fraction of space heat from main system(s)                            |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (202)   |
| Efficiency of main space heating system 1 (in %)                      |          |          |          |          |          |          |          |          |          |          |          | 92.4000 (206)  |
| Efficiency of main space heating system 2 (in %)                      |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)   |
| Efficiency of secondary/supplementary heating system, %               |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)   |
|                                                                       | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec            |
| Space heating requirement                                             | 546.6610 | 423.4768 | 362.6193 | 213.0858 | 102.1645 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 196.9342 | 377.3446 | 556.8629 (98)  |
| Space heating efficiency (main heating system 1)                      | 92.4000  | 92.4000  | 92.4000  | 92.4000  | 92.4000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 92.4000  | 92.4000  | 92.4000 (210)  |
| Space heating fuel (main heating system)                              | 591.6245 | 458.3082 | 392.4452 | 230.6123 | 110.5677 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 213.1322 | 408.3816 | 602.6655 (211) |
| Space heating efficiency (main heating system 2)                      | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)   |
| Space heating fuel (main heating system 2)                            | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)   |
| Space heating fuel (secondary)                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)   |
| Water heating                                                         |          |          |          |          |          |          |          |          |          |          |          |                |
| Water heating requirement                                             | 237.5241 | 210.0522 | 223.3886 | 197.2519 | 191.7173 | 173.3276 | 171.6014 | 178.1749 | 179.8370 | 199.8169 | 211.5444 | 235.0668 (64)  |
| Efficiency of water heater                                            |          |          |          |          |          |          |          |          |          |          |          | 80.3000 (216)  |

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|                                                                                                      |          |          |          |           |           |           |           |           |           |          |          |            |        |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|----------|------------|--------|
| (217)m                                                                                               | 86.1068  | 85.8515  | 85.4129  | 84.5473   | 83.0944   | 80.3000   | 80.3000   | 80.3000   | 80.3000   | 84.3503  | 85.6065  | 86.1610    | (217)  |
| Fuel for water heating, kWh/month                                                                    | 275.8483 | 244.6693 | 261.5397 | 233.3037  | 230.7221  | 215.8501  | 213.7004  | 221.8866  | 223.9564  | 236.8895 | 247.1125 | 272.8228   | (219)  |
| Space cooling fuel requirement                                                                       |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (221)m                                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (221)  |
| Pumps and Fa                                                                                         | 7.3041   | 6.5973   | 7.3041   | 7.0685    | 7.3041    | 7.0685    | 7.3041    | 7.0685    | 7.3041    | 7.0685   | 7.3041   | 7.0685     | (231)  |
| Lighting                                                                                             | 25.3750  | 20.3568  | 18.3290  | 13.4286   | 10.3727   | 8.4745    | 9.4623    | 12.2994   | 15.9757   | 20.9610  | 23.6755  | 26.0803    | (232)  |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (233a)m                                                                                              | -39.8696 | -56.0257 | -80.2676 | -89.9369  | -96.7057  | -90.1510  | -89.0213  | -84.1676  | -75.5697  | -63.9045 | -43.7612 | -34.4899   | (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (234a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (234a) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (235a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (235a) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (235c)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (235c) |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (233b)m                                                                                              | -23.0762 | -48.4849 | -96.2662 | -144.4459 | -190.8693 | -191.7487 | -189.5061 | -160.5221 | -117.7385 | -69.3076 | -30.7987 | -18.2537   | (233b) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (234b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (234b) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (235b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (235b) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (235d)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (235d) |
| Annual totals kWh/year                                                                               |          |          |          |           |           |           |           |           |           |          |          |            |        |
| Space heating fuel - main system 1                                                                   |          |          |          |           |           |           |           |           |           |          |          | 3007.7372  | (211)  |
| Space heating fuel - main system 2                                                                   |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (213)  |
| Space heating fuel - secondary                                                                       |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (215)  |
| Efficiency of water heater                                                                           |          |          |          |           |           |           |           |           |           |          |          | 80.3000    |        |
| Water heating fuel used                                                                              |          |          |          |           |           |           |           |           |           |          |          | 2878.3014  | (219)  |
| Space cooling fuel                                                                                   |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (221)  |
| Electricity for pumps and fans:                                                                      |          |          |          |           |           |           |           |           |           |          |          |            |        |
| Total electricity for the above, kWh/year                                                            |          |          |          |           |           |           |           |           |           |          |          | 86.0000    | (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |          |          |          |           |           |           |           |           |           |          |          | 204.7908   | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |          |          |           |           |           |           |           |           |          |          |            |        |
| PV generation                                                                                        |          |          |          |           |           |           |           |           |           |          |          | -2124.8885 | (233)  |
| Wind generation                                                                                      |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (234)  |
| Hydro-electric generation (Appendix N)                                                               |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (235a) |
| Electricity generated - Micro CHP (Appendix N)                                                       |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (235)  |
| Appendix Q - special features                                                                        |          |          |          |           |           |           |           |           |           |          |          |            |        |
| Energy saved or generated                                                                            |          |          |          |           |           |           |           |           |           |          |          | -0.0000    | (236)  |
| Energy used                                                                                          |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (237)  |
| Total delivered energy for all uses                                                                  |          |          |          |           |           |           |           |           |           |          |          | 4051.9410  | (238)  |

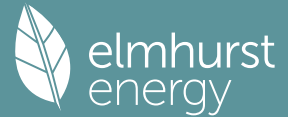
## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                               | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |       |
|-----------------------------------------------|--------------------|-------------------------------|--------------------------|-------|
| Space heating - main system 1                 | 3007.7372          | 0.2100                        | 631.6248                 | (261) |
| Total CO2 associated with community systems   |                    |                               | 0.0000                   | (373) |
| Water heating (other fuel)                    | 2878.3014          | 0.2100                        | 604.4433                 | (264) |
| Space and water heating                       |                    |                               | 1236.0681                | (265) |
| Pumps, fans and electric keep-hot             | 86.0000            | 0.1387                        | 11.9293                  | (267) |
| Energy for lighting                           | 204.7908           | 0.1443                        | 29.5576                  | (268) |
| Energy saving/generation technologies         |                    |                               |                          |       |
| PV Unit electricity used in dwelling          | -843.8706          | 0.1347                        | -113.6365                |       |
| PV Unit electricity exported                  | -1281.0179         | 0.1259                        | -161.3091                |       |
| Total                                         |                    |                               | -274.9456                | (269) |
| Total CO2, kg/year                            |                    |                               | 1002.6094                | (272) |
| EPC Target Carbon Dioxide Emission Rate (TER) |                    |                               | 11.6600                  | (273) |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |       |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|-------|
| Space heating - main system 1               | 3007.7372          | 1.1300                              | 3398.7431                  | (275) |
| Total CO2 associated with community systems |                    |                                     | 0.0000                     | (473) |
| Water heating (other fuel)                  | 2878.3014          | 1.1300                              | 3252.4806                  | (278) |
| Space and water heating                     |                    |                                     | 6651.2236                  | (279) |
| Pumps, fans and electric keep-hot           | 86.0000            | 1.5128                              | 130.1008                   | (281) |
| Energy for lighting                         | 204.7908           | 1.5338                              | 314.1150                   | (282) |
| Energy saving/generation technologies       |                    |                                     |                            |       |
| PV Unit electricity used in dwelling        | -843.8706          | 1.4977                              | -1263.8554                 |       |
| PV Unit electricity exported                | -1281.0179         | 0.4622                              | -592.1168                  |       |
| Total                                       |                    |                                     | -1855.9722                 | (283) |
| Total Primary energy kWh/year               |                    |                                     | 5239.4672                  | (286) |
| Target Primary Energy Rate (TPER)           |                    |                                     | 60.9400                    | (287) |

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|                                    |                                                          |               |       |               |                |            |  |
|------------------------------------|----------------------------------------------------------|---------------|-------|---------------|----------------|------------|--|
| Plot Reference                     | 4907-R823-9471-006                                       |               |       |               | Issued on Date | 21/07/2026 |  |
| Assessment Reference               | Plot 6                                                   |               |       | Plot Type Ref | Plot 6         |            |  |
| Plot Address                       | Plot 6, Beaconsfield-Semi, K, WC, B, ES, 1012            |               |       |               | SAP Version    | 10.2       |  |
|                                    |                                                          |               |       |               |                |            |  |
| SAP Rating                         | 90 B                                                     | DER           | 11.17 | TER           | 11.66          |            |  |
| Environmental                      | 91 B                                                     | % DER < TER   |       |               |                | 4.20       |  |
| CO <sub>2</sub> Emissions (t/year) | 0.85                                                     | DFEE          | 34.92 | TFEE          | 37.57          |            |  |
| Compliance Check                   | See BREL                                                 | % DFEE < TFEE |       |               |                | 7.06       |  |
| % DPER < TPER                      | 1.47                                                     | DPER          | 60.05 | TPER          | 60.94          |            |  |
|                                    |                                                          |               |       |               |                |            |  |
| Assessor Details                   | Mr. Daniel Harris                                        |               |       |               | Assessor ID    | R823-0001  |  |
| Client                             | Crest Nicholson Head Office, Crest Nicholson Head Office |               |       |               |                |            |  |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF FABRIC ENERGY EFFICIENCY

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)            | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Main dwelling                                          |                           |                                 |                             |
| Ground floor                                           | 42.9900 (1b)              | x 2.4600 (2b)                   | = 105.7554 (1b) - (3b)      |
| First floor                                            | 42.9900 (1c)              | x 2.7600 (2c)                   | = 118.6524 (1c) - (3c)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 85.9800                   |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 224.4078 (5)              |

## 2. Ventilation rate

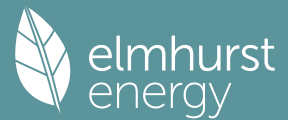
|                                                                                                    | m <sup>3</sup> per hour                            |
|----------------------------------------------------------------------------------------------------|----------------------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                               |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                               |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                               |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                               |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                               |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                               |
| Number of intermittent extract fans                                                                | 3 * 10 = 30.0000 (7a)                              |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)                               |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)                               |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | Air changes per hour<br>30.0000 / (5) = 0.1337 (8) |
| Pressure test                                                                                      | Yes                                                |
| Pressure Test Method                                                                               | Blower Door                                        |
| Measured/design AP50                                                                               | 4.5000 (17)                                        |
| Infiltration rate                                                                                  | 0.3587 (18)                                        |
| Number of sides sheltered                                                                          | 1 (19)                                             |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 0.9250 (20)            |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.3318 (21)                   |

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor                                                                                             | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate                                                                                         | 0.4230 | 0.4147 | 0.4064 | 0.3650 | 0.3567 | 0.3152 | 0.3152 | 0.3069 | 0.3318 | 0.3567 | 0.3733 | 0.3898 (22b) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.0000 (23b) |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =            |        |        |        |        |        |        |        |        |        |        |        | 0.0000 (23c) |
| Effective ac                                                                                            | 0.5895 | 0.5860 | 0.5826 | 0.5666 | 0.5636 | 0.5497 | 0.5497 | 0.5471 | 0.5550 | 0.5636 | 0.5697 | 0.5760 (25)  |

## 3. Heat losses and heat loss parameter

| Element                                                        | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K       | A x K<br>kJ/K   |
|----------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------------|-----------------|
| Main dwelling                                                  |                         |                            |                           |                               |              |                                      |                 |
| Front Door                                                     |                         |                            | 2.5500                    | 1.2000                        | 3.0600       |                                      | (26)            |
| Windows                                                        |                         |                            | 10.2500                   | 1.2357                        | 12.6663      |                                      | (27)            |
| French Doors                                                   |                         |                            | 3.3300                    | 1.2357                        | 4.1150       |                                      | (27)            |
| GF SPVL 125TS P/A                                              |                         |                            | 42.9900                   | 0.1300                        | 5.5887       | 75.0000                              | 3224.2500 (28a) |
| EW Brick AAC011                                                | 97.2486                 | 16.1300                    | 81.1186                   | 0.1800                        | 14.6013      | 60.0000                              | 4867.1160 (29a) |
| PR 500mm MW044                                                 | 42.9900                 |                            | 42.9900                   | 0.0900                        | 3.8691       | 9.0000                               | 386.9100 (30)   |
| Total net area of external elements Aum(A, m <sup>2</sup> )    |                         |                            | 183.2286                  |                               |              |                                      | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                            |                         |                            |                           | (26)...(30) + (32) =          | 43.9005      |                                      | (33)            |
| Main dwelling                                                  |                         |                            |                           |                               |              |                                      |                 |
| E-WM-30                                                        |                         |                            | 43.8000                   | 0.0000                        | 0.0000       | 45.0000                              | 1971.0000 (32)  |
| Timber - GF                                                    |                         |                            | 88.6100                   |                               |              | 9.0000                               | 797.4900 (32c)  |
| Timber - FF                                                    |                         |                            | 126.9000                  |                               |              | 9.0000                               | 1142.1000 (32c) |
| Internal Floor FF                                              |                         |                            | 42.9900                   |                               |              | 18.0000                              | 773.8200 (32d)  |
| Internal Ceiling GF                                            |                         |                            | 42.9900                   |                               |              | 9.0000                               | 386.9100 (32e)  |
| Heat capacity Cm = Sum(A x k)                                  |                         |                            |                           |                               |              | (28)...(30) + (32) + (32a)...(32e) = | 13549.5960 (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K |                         |                            |                           |                               |              |                                      | 157.5901 (35)   |

# Full SAP Calculation Printout



## List of Thermal Bridges

|                                                            | Length  | Psi-value             | Total        |
|------------------------------------------------------------|---------|-----------------------|--------------|
| K1 Element                                                 |         |                       |              |
| E2 Other lintels (including other steel lintels)           | 10.7800 | 0.0410                | 0.4420       |
| E3 Sill                                                    | 9.2000  | 0.0220                | 0.2024       |
| E4 Jamb                                                    | 21.1500 | 0.0190                | 0.4018       |
| E5 Ground floor (normal)                                   | 10.2300 | 0.0928                | 0.9493       |
| E6 Intermediate floor within a dwelling                    | 18.6300 | 0.0020                | 0.0373       |
| E10 Eaves (insulation at ceiling level)                    | 10.2500 | 0.0390                | 0.3997       |
| E18 Party wall between dwellings                           | 10.4400 | 0.0330                | 0.3445       |
| E4 Jamb                                                    | 4.8000  | 0.1000                | 0.4800       |
| E2 Other lintels (including other steel lintels)           | 1.0600  | 0.0410                | 0.0435       |
| P1 Party wall - Ground floor                               | 8.3900  | 0.1000                | 0.8390       |
| P2 Party wall - Intermediate floor within a dwelling       | 8.3900  | 0.0000                | 0.0000       |
| P4 Party wall - Roof (insulation at ceiling level)         | 8.3900  | 0.0350                | 0.2937       |
| E5 Ground floor (normal)                                   | 8.3900  | 0.0980                | 0.8222       |
| E12 Gable (insulation at ceiling level)                    | 8.3900  | 0.0870                | 0.7299       |
| E16 Corner (normal)                                        | 10.4400 | 0.0420                | 0.4385       |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |         |                       | 6.4238 (36)  |
| Point Thermal bridges                                      |         |                       | 0.0000       |
| Total fabric heat loss                                     |         | (33) + (36) + (36a) = | 50.3244 (37) |

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

|                           | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |      |
|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| (38)m                     | 43.6533 | 43.3960 | 43.1438 | 41.9592 | 41.7376 | 40.7059 | 40.7059 | 40.5148 | 41.1033 | 41.7376 | 42.1860 | 42.6547 | (38) |
| Heat transfer coeff       | 93.9777 | 93.7204 | 93.4682 | 92.2836 | 92.0620 | 91.0302 | 91.0302 | 90.8392 | 91.4276 | 92.0620 | 92.5103 | 92.9791 | (39) |
| Average = Sum(39)m / 12 = |         |         |         |         |         |         |         |         |         |         |         | 92.2825 |      |
| HLP                       | 1.0930  | 1.0900  | 1.0871  | 1.0733  | 1.0707  | 1.0587  | 1.0587  | 1.0565  | 1.0634  | 1.0707  | 1.0760  | 1.0814  | (40) |
| HLP (average)             |         |         |         |         |         |         |         |         |         |         |         | 1.0733  |      |
| Days in mont              | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31      |      |

## 4. Water heating energy requirements (kWh/year)

|                                                                                |          |         |          |         |         |         |         |         |         |                                        |         |           |             |
|--------------------------------------------------------------------------------|----------|---------|----------|---------|---------|---------|---------|---------|---------|----------------------------------------|---------|-----------|-------------|
| Assumed occupancy                                                              |          |         |          |         |         |         |         |         |         |                                        |         |           | 2.5666 (42) |
| Hot water usage for mixer showers                                              |          |         |          |         |         |         |         |         |         |                                        |         |           |             |
| 0.0000                                                                         | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000    | (42a)       |
| Hot water usage for baths                                                      | 29.0443  | 28.6130 | 28.0055  | 26.8856 | 26.0469 | 25.1170 | 24.6147 | 25.2179 | 25.8746 | 26.8697                                | 28.0127 | 28.9461   | (42b)       |
| Hot water usage for other uses                                                 | 40.9146  | 39.4268 | 37.9390  | 36.4512 | 34.9634 | 33.4756 | 33.4756 | 34.9634 | 36.4512 | 37.9390                                | 39.4268 | 40.9146   | (42c)       |
| Average daily hot water use (litres/day)                                       |          |         |          |         |         |         |         |         |         |                                        |         | 64.1237   | (43)        |
| Daily hot water use                                                            | 69.9589  | 68.0398 | 65.9445  | 63.3367 | 61.0103 | 58.5926 | 58.0903 | 60.1813 | 62.3258 | 64.8087                                | 67.4395 | 69.8607   | (44)        |
| Energy conte                                                                   | 110.7978 | 96.8877 | 101.3543 | 86.7048 | 82.1316 | 72.0464 | 70.2552 | 74.5170 | 76.8540 | 87.9448                                | 96.0800 | 109.3850  | (45)        |
| Energy content (annual)                                                        |          |         |          |         |         |         |         |         |         | Total = Sum(45)m =                     |         | 1064.9585 |             |
| Distribution loss (46)m = 0.15 x (45)m                                         | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000    | (46)        |
| Water storage loss (or HIU loss):                                              |          |         |          |         |         |         |         |         |         |                                        |         |           |             |
| Total storage loss                                                             | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000    | (56)        |
| If cylinder contains dedicated solar storage                                   |          |         |          |         |         |         |         |         |         |                                        |         |           |             |
| 0.0000                                                                         | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000    | (57)        |
| Primary loss                                                                   | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000    | (59)        |
| Combi loss                                                                     | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000    | (61)        |
| Total heat required for water heating calculated for each month                | 94.1781  | 82.3546 | 86.1511  | 73.6991 | 69.8118 | 61.2394 | 59.7169 | 63.3394 | 65.3259 | 74.7530                                | 81.6680 | 92.9773   | (62)        |
| WWHRS                                                                          | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000    | (63a)       |
| PV diverter                                                                    | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000    | (63b)       |
| Solar input                                                                    | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000    | (63c)       |
| FGHRS                                                                          | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000                                 | 0.0000  | 0.0000    | (63d)       |
| Output from w/h                                                                | 94.1781  | 82.3546 | 86.1511  | 73.6991 | 69.8118 | 61.2394 | 59.7169 | 63.3394 | 65.3259 | 74.7530                                | 81.6680 | 92.9773   | (64)        |
| 12Total per year (kWh/year)                                                    |          |         |          |         |         |         |         |         |         | Total per year (kWh/year) = Sum(64)m = |         | 905.2147  | (64)        |
| Electric shower(s)                                                             | 53.8586  | 47.9885 | 52.4016  | 50.0062 | 50.9446 | 48.5962 | 50.2160 | 50.9446 | 50.0062 | 52.4016                                | 51.4162 | 53.8586   | (64a)       |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |         |          |         |         |         |         |         |         |                                        |         | 612.6389  | (64a)       |
| Heat gains from water heating, kWh/month                                       | 37.0092  | 32.5858 | 34.6382  | 30.9263 | 30.1891 | 27.4589 | 27.4832 | 28.5710 | 28.8330 | 31.7887                                | 33.2711 | 36.7090   | (65)        |

## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |           |           |           |           |           |           |           |           |           |           |           |           |      |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------|
| Metabolic gains (Table 5), Watts                                                    |           |           |           |           |           |           |           |           |           |           |           |           |      |
| (66)m                                                                               | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 122.1242  | 135.2090  | 122.1242  | 126.1950  | 122.1242  | 126.1950  | 122.1242  | 122.1242  | 126.1950  | 122.1242  | 126.1950  | 122.1242  | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 231.4847  | 233.8867  | 227.8336  | 214.9471  | 198.6802  | 183.3916  | 173.1779  | 170.7758  | 176.8289  | 189.7154  | 205.9823  | 221.2709  | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | (69) |
| Pumps, fans                                                                         | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | (71) |
| Water heating gains (Table 5)                                                       | 49.7435   | 48.4907   | 46.5567   | 42.9532   | 40.5767   | 38.1374   | 36.9398   | 38.4019   | 40.0459   | 42.7267   | 46.2098   | 49.3400   | (72) |
| Total internal gains                                                                | 464.8515  | 479.0855  | 458.0136  | 445.5944  | 422.8802  | 409.2230  | 393.7410  | 392.8009  | 404.5689  | 416.0654  | 439.8863  | 454.2343  | (73) |

## 6. Solar gains

| [Jan] | Area<br>m <sup>2</sup> | Solar flux<br>Table 6a<br>W/m <sup>2</sup> | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W   |
|-------|------------------------|--------------------------------------------|-----------------------------------|------------------------------------|------------------------------|--------------|
| North | 4.1200                 | 10.6334                                    | 0.4500                            | 0.0000                             | 0.7700                       | 15.1800 (74) |
| South | 5.6100                 | 46.7521                                    | 0.4500                            | 0.0000                             | 0.7700                       | 90.8797 (78) |

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|       |        |         |        |        |        |              |
|-------|--------|---------|--------|--------|--------|--------------|
| West  | 0.5200 | 19.6403 | 0.4500 | 0.0000 | 0.7700 | 3.5388 (80)  |
| North | 3.3300 | 10.6334 | 0.4500 | 0.0000 | 0.7700 | 12.2693 (74) |

|             |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Solar gains | 121.8678 | 208.2172 | 290.1305 | 374.0852 | 436.5439 | 442.2258 | 422.5917 | 373.8995 | 318.4831 | 231.1927 | 145.9981 | 104.3216 (83) |
| Total gains | 586.7193 | 687.3027 | 748.1440 | 819.6796 | 859.4241 | 851.4488 | 816.3327 | 766.7004 | 723.0520 | 647.2582 | 585.8844 | 558.5559 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |                           |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |                           |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |                           |         |         |              |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep                       | Oct     | Nov     | Dec          |
| tau                                                                         | 40.0497 | 40.1596 | 40.2680 | 40.7849 | 40.8831 | 41.3465 | 41.3465 | 41.4334 | 41.1667                   | 40.8831 | 40.6849 | 40.4798      |
| alpha                                                                       | 3.6700  | 3.6773  | 3.6845  | 3.7190  | 3.7255  | 3.7564  | 3.7564  | 3.7622  | 3.7444                    | 3.7255  | 3.7123  | 3.6987       |
| util living area                                                            | 0.9829  | 0.9690  | 0.9465  | 0.8903  | 0.7869  | 0.6221  | 0.4728  | 0.5182  | 0.7324                    | 0.9106  | 0.9698  | 0.9856 (86)  |
| MIT                                                                         | 19.2253 | 19.4920 | 19.8413 | 20.3048 | 20.6765 | 20.9045 | 20.9737 | 20.9630 | 20.8175                   | 20.3382 | 19.7113 | 19.1861 (87) |
| Th 2                                                                        | 20.0065 | 20.0090 | 20.0114 | 20.0227 | 20.0248 | 20.0347 | 20.0347 | 20.0365 | 20.0309                   | 20.0248 | 20.0205 | 20.0160 (88) |
| util rest of house                                                          | 0.9793  | 0.9627  | 0.9352  | 0.8666  | 0.7411  | 0.5468  | 0.3765  | 0.4203  | 0.6642                    | 0.8863  | 0.9626  | 0.9825 (89)  |
| MIT 2                                                                       | 18.3950 | 18.6593 | 19.0030 | 19.4546 | 19.7919 | 19.9821 | 20.0251 | 20.0220 | 19.9192                   | 19.4961 | 18.8868 | 18.3632 (90) |
| Living area fraction                                                        |         |         |         |         |         |         |         |         | fLA = Living area / (4) = |         |         | 0.1933 (91)  |
| MIT                                                                         | 18.5555 | 18.8203 | 19.1650 | 19.6190 | 19.9629 | 20.1604 | 20.2085 | 20.2039 | 20.0928                   | 19.6589 | 19.0462 | 18.5223 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |                           |         |         | 0.0000       |
| adjusted MIT                                                                | 18.5555 | 18.8203 | 19.1650 | 19.6190 | 19.9629 | 20.1604 | 20.2085 | 20.2039 | 20.0928                   | 19.6589 | 19.0462 | 18.5223 (93) |

## 8. Space heating requirement

|                                                                                |           |           |           |          |          |          |          |          |          |               |           |                |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|---------------|-----------|----------------|
|                                                                                | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov       | Dec            |
| Utilisation                                                                    | 0.9723    | 0.9528    | 0.9232    | 0.8552   | 0.7379   | 0.5572   | 0.3944   | 0.4381   | 0.6690   | 0.8753        | 0.9531    | 0.9763 (94)    |
| Useful gains                                                                   | 570.4440  | 654.8773  | 690.6827  | 700.9682 | 634.1349 | 474.3869 | 321.9715 | 335.8565 | 483.7170 | 566.5192      | 558.4037  | 545.2915 (95)  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000    | 4.2000 (96)    |
| Heat loss rate W                                                               | 1339.6946 | 1304.6125 | 1183.7748 | 989.1838 | 760.7009 | 506.1616 | 328.4812 | 345.5387 | 547.9102 | 833.9783      | 1105.1461 | 1331.6703 (97) |
| Space heating kWh                                                              | 572.3224  | 436.6220  | 366.8606  | 207.5153 | 94.1651  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 198.9896      | 393.6545  | 585.0658 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |          |          |          |          |          |          |               |           | 2855.1953      |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |          |          |          |          |          |          |               |           | 0.0000         |
| Space heating kWh                                                              | 572.3224  | 436.6220  | 366.8606  | 207.5153 | 94.1651  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 198.9896      | 393.6545  | 585.0658 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |          |          |          |          |          |          |               |           | 2855.1953      |
| Space heating per m2                                                           |           |           |           |          |          |          |          |          |          | (98c) / (4) = |           | 33.2077 (99)   |

## 8c. Space cooling requirement

|                                                     |        |        |        |        |         |          |          |          |                          |         |        |                |
|-----------------------------------------------------|--------|--------|--------|--------|---------|----------|----------|----------|--------------------------|---------|--------|----------------|
| Calculated for June, July and August. See Table 10b |        |        |        |        |         |          |          |          |                          |         |        |                |
|                                                     | Jan    | Feb    | Mar    | Apr    | May     | Jun      | Jul      | Aug      | Sep                      | Oct     | Nov    | Dec            |
| Ext. temp.                                          | 4.3000 | 4.9000 | 6.5000 | 8.9000 | 11.7000 | 14.6000  | 16.6000  | 16.4000  | 14.1000                  | 10.6000 | 7.1000 | 4.2000         |
| Heat loss rate W                                    | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 855.6841 | 673.6236 | 690.3776 | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (100)   |
| Utilisation                                         | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 0.8266   | 0.8883   | 0.8633   | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (101)   |
| Useful loss                                         | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 707.2956 | 598.3715 | 595.9810 | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (102)   |
| Total gains                                         | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 943.7271 | 905.1968 | 849.6226 | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (103)   |
| Space cooling kWh                                   | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 170.2307 | 228.2781 | 188.7093 | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (104)   |
| Cooled fraction                                     |        |        |        |        |         |          |          |          | fC = cooled area / (4) = |         |        | 1.0000 (105)   |
| Intermittency factor (Table 10b)                    | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500  | 0.2500   | 0.2500   | 0.2500   | 0.2500                   | 0.2500  | 0.2500 | 0.2500 (106)   |
| Space cooling kWh                                   | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 42.5577  | 57.0695  | 47.1773  | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (107)   |
| Space cooling requirement                           |        |        |        |        |         |          |          |          |                          |         |        | 146.8045 (107) |
| Energy for space heating                            |        |        |        |        |         |          |          |          |                          |         |        | 33.2077 (99)   |
| Energy for space cooling                            |        |        |        |        |         |          |          |          |                          |         |        | 1.7074 (108)   |
| Total                                               |        |        |        |        |         |          |          |          |                          |         |        | 34.9151 (109)  |
| Fabric Energy Efficiency (DFEE)                     |        |        |        |        |         |          |          |          |                          |         |        | 34.9 (109)     |

## SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

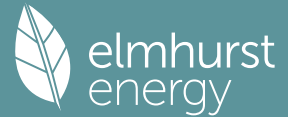
### 1. Overall dwelling characteristics

|                                                        |              |                                   |                        |
|--------------------------------------------------------|--------------|-----------------------------------|------------------------|
| Main dwelling                                          | Area (m2)    | Storey height (m)                 | Volume (m3)            |
| Ground floor                                           | 42.9900 (1b) | x 2.4600 (2b)                     | = 105.7554 (1b) - (3b) |
| First floor                                            | 42.9900 (1c) | x 2.7600 (2c)                     | = 118.6524 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 85.9800      |                                   | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 224.4078 (5)           |

### 2. Ventilation rate

|                         |             |
|-------------------------|-------------|
| Number of open chimneys | m3 per hour |
| 0 * 80 =                | 0.0000 (6a) |

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Number of open flues  
Number of chimneys / flues attached to closed fire  
Number of flues attached to solid fuel boiler  
Number of flues attached to other heater  
Number of blocked chimneys  
Number of intermittent extract fans  
Number of passive vents  
Number of flueless gas fires

0 \* 20 = 0.0000 (6b)  
0 \* 10 = 0.0000 (6c)  
0 \* 20 = 0.0000 (6d)  
0 \* 35 = 0.0000 (6e)  
0 \* 20 = 0.0000 (6f)  
3 \* 10 = 30.0000 (7a)  
0 \* 10 = 0.0000 (7b)  
0 \* 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 30.0000  
Air changes per hour  
Pressure test  
Pressure Test Method  
Measured/design AP50  
Infiltration rate  
Number of sides sheltered  
Shelter factor  
Infiltration rate adjusted to include shelter factor

30.0000 / (5) = 0.1337 (8)  
Yes  
Blower Door  
5.0000 (17)  
0.3837 (18)  
1 (19)  
(20) = 1 - [0.075 x (19)] = 0.9250 (20)  
(21) = (18) x (20) = 0.3549 (21)

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor                                                                                             | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate                                                                                         | 0.4525 | 0.4436 | 0.4348 | 0.3904 | 0.3815 | 0.3372 | 0.3372 | 0.3283 | 0.3549 | 0.3815 | 0.3993 | 0.4170 (22b) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.0000 (23b) |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =            |        |        |        |        |        |        |        |        |        |        |        | 0.0000 (23c) |
| Effective ac                                                                                            | 0.6024 | 0.5984 | 0.5945 | 0.5762 | 0.5728 | 0.5568 | 0.5568 | 0.5539 | 0.5630 | 0.5728 | 0.5797 | 0.5870 (25)  |

### 3. Heat losses and heat loss parameter

| Element                                        | Gross m2 | Openings m2 | NetArea m2 | U-value W/m2K | A x U W/K                    | K-value kJ/m2K | A x K kJ/K |
|------------------------------------------------|----------|-------------|------------|---------------|------------------------------|----------------|------------|
| Main dwelling                                  |          |             |            |               |                              |                |            |
| TER Opaque door                                |          |             | 2.5500     | 1.0000        | 2.5500                       |                | (26)       |
| TER Opening Type                               |          |             | 13.5800    | 1.1450        | 15.5496                      |                | (27)       |
| GF SPVL 125TS P/A                              |          |             | 42.9900    | 0.1300        | 5.5887                       |                | (28a)      |
| EW Brick AAC011                                | 97.2486  | 16.1300     | 81.1186    | 0.1800        | 14.6013                      |                | (29a)      |
| PR 500mm MW044                                 | 42.9900  |             | 42.9900    | 0.1100        | 4.7289                       |                | (30)       |
| Total net area of external elements Aum(A, m2) |          |             | 183.2286   |               |                              |                | (31)       |
| Fabric heat loss, W/K = Sum (A x U)            |          |             |            |               | (26)...(30) + (32) = 43.0186 |                | (33)       |
| Main dwelling                                  |          |             |            |               |                              |                |            |
| E-WM-30                                        |          |             | 43.8000    | 0.0000        | 0.0000                       |                | (32)       |

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 157.5901 (35)

List of Thermal Bridges

| K1 Element                                           | Length  | Psi-value | Total  |
|------------------------------------------------------|---------|-----------|--------|
| E2 Other lintels (including other steel lintels)     | 10.7800 | 0.0500    | 0.5390 |
| E3 Sill                                              | 9.2000  | 0.0500    | 0.4600 |
| E4 Jamb                                              | 21.1500 | 0.0500    | 1.0575 |
| E5 Ground floor (normal)                             | 10.2300 | 0.1600    | 1.6368 |
| E6 Intermediate floor within a dwelling              | 18.6300 | 0.0000    | 0.0000 |
| E10 Eaves (insulation at ceiling level)              | 10.2500 | 0.0600    | 0.6150 |
| E18 Party wall between dwellings                     | 10.4400 | 0.0600    | 0.6264 |
| E4 Jamb                                              | 4.8000  | 0.0500    | 0.2400 |
| E2 Other lintels (including other steel lintels)     | 1.0600  | 0.0500    | 0.0530 |
| P1 Party wall - Ground floor                         | 8.3900  | 0.0800    | 0.6712 |
| P2 Party wall - Intermediate floor within a dwelling | 8.3900  | 0.0000    | 0.0000 |
| P4 Party wall - Roof (insulation at ceiling level)   | 8.3900  | 0.1200    | 1.0068 |
| E5 Ground floor (normal)                             | 8.3900  | 0.1600    | 1.3424 |
| E12 Gable (insulation at ceiling level)              | 8.3900  | 0.0600    | 0.5034 |
| E16 Corner (normal)                                  | 10.4400 | 0.0900    | 0.9396 |

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.6911 (36)

Point Thermal Bridges 0.0000

Total fabric heat loss (33) + (36) + (36a) = 52.7097 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

|                           | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| (38)m                     | 44.6091 | 44.3147 | 44.0262 | 42.6707 | 42.4171 | 41.2365 | 41.2365 | 41.0179 | 41.6913 | 42.4171 | 42.9301 | 43.4665 (38) |
| Heat transfer coeff       | 97.3188 | 97.0244 | 96.7358 | 95.3804 | 95.1268 | 93.9462 | 93.9462 | 93.7276 | 94.4009 | 95.1268 | 95.6398 | 96.1761 (39) |
| Average = Sum(39)m / 12 = |         |         |         |         |         |         |         |         |         |         |         | 95.3791      |

|               | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec         |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------------|
| HLP           | 1.1319 | 1.1285 | 1.1251 | 1.1093 | 1.1064 | 1.0927 | 1.0927 | 1.0901 | 1.0979 | 1.1064 | 1.1123 | 1.1186 (40) |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 1.1093      |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31          |

### 4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5666 (42)

Hot water usage for mixer showers 0.0000 (42a)

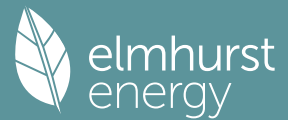
Hot water usage for baths 29.0443 28.6130 28.0055 26.8856 26.0469 25.1170 24.6147 25.2179 25.8746 26.8697 28.0127 28.9461 (42b)

Hot water usage for other uses 40.9146 39.4268 37.9390 36.4512 34.9634 33.4756 33.4756 34.9634 36.4512 37.9390 39.4268 40.9146 (42c)

Average daily hot water use (litres/day) 64.1237 (43)

|                                                                 | Jan      | Feb     | Mar      | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct                | Nov     | Dec           |
|-----------------------------------------------------------------|----------|---------|----------|---------|---------|---------|---------|---------|---------|--------------------|---------|---------------|
| Daily hot water use                                             | 69.9589  | 68.0398 | 65.9445  | 63.3367 | 61.0103 | 58.5926 | 58.0903 | 60.1813 | 62.3258 | 64.8087            | 67.4395 | 69.8607 (44)  |
| Energy conte                                                    | 110.7978 | 96.8877 | 101.3543 | 86.7048 | 82.1316 | 72.0464 | 70.2552 | 74.5170 | 76.8540 | 87.9448            | 96.0800 | 109.3850 (45) |
| Energy content (annual)                                         |          |         |          |         |         |         |         |         |         | Total = Sum(45)m = |         | 1064.9585     |
| Distribution loss (46)m = 0.15 x (45)m                          | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000             | 0.0000  | 0.0000 (46)   |
| Water storage loss (or HIU loss):                               |          |         |          |         |         |         |         |         |         |                    |         |               |
| Total storage loss                                              | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000             | 0.0000  | 0.0000 (56)   |
| If cylinder contains dedicated solar storage                    |          |         |          |         |         |         |         |         |         |                    |         |               |
| 0.0000                                                          | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000             | 0.0000  | 0.0000 (57)   |
| Primary loss                                                    | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000             | 0.0000  | 0.0000 (59)   |
| Combi loss                                                      | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000             | 0.0000  | 0.0000 (61)   |
| Total heat required for water heating calculated for each month |          |         |          |         |         |         |         |         |         |                    |         |               |

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|                                                                                         |         |         |         |         |         |         |         |         |         |         |         |                |
|-----------------------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|----------------|
| WWHRS                                                                                   | 94.1781 | 82.3546 | 86.1511 | 73.6991 | 69.8118 | 61.2394 | 59.7169 | 63.3394 | 65.3259 | 74.7530 | 81.6680 | 92.9773 (62)   |
| PV diverter                                                                             | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (63a)   |
| Solar input                                                                             | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (63b)   |
| FGHRS                                                                                   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (63c)   |
| Output from w/h                                                                         | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (63d)   |
| 12Total per year (kWh/year)                                                             | 94.1781 | 82.3546 | 86.1511 | 73.6991 | 69.8118 | 61.2394 | 59.7169 | 63.3394 | 65.3259 | 74.7530 | 81.6680 | 92.9773 (64)   |
| Electric shower(s)                                                                      | 53.8586 | 47.9885 | 52.4016 | 50.0062 | 50.9446 | 48.5962 | 50.2160 | 50.9446 | 50.0062 | 52.4016 | 51.4162 | 905.2147 (64a) |
| Heat gains from water heating, kWh/month                                                | 37.0092 | 32.5858 | 34.6382 | 30.9263 | 30.1891 | 27.4589 | 27.4832 | 28.5710 | 28.8330 | 31.7887 | 33.2711 | 36.7090 (65)   |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 905 (64) |         |         |         |         |         |         |         |         |         |         |         |                |

## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |           |           |           |           |           |           |           |           |           |           |           |           |      |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------|
| Metabolic gains (Table 5), Watts                                                    | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec       |      |
| (66)m                                                                               | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 122.1242  | 135.2090  | 122.1242  | 126.1950  | 122.1242  | 126.1950  | 122.1242  | 122.1242  | 126.1950  | 122.1242  | 126.1950  | 122.1242  | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 231.4847  | 233.8867  | 227.8336  | 214.9471  | 198.6802  | 183.3916  | 173.1779  | 170.7758  | 176.8289  | 189.7154  | 205.9823  | 221.2709  | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | (69) |
| Pumps, fans                                                                         | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | (71) |
| Water heating gains (Table 5)                                                       | 49.7435   | 48.4907   | 46.5567   | 42.9532   | 40.5767   | 38.1374   | 36.9398   | 38.4019   | 40.0459   | 42.7267   | 46.2098   | 49.3400   | (72) |
| Total internal gains                                                                | 464.8515  | 479.0855  | 458.0136  | 445.5944  | 422.8802  | 409.2230  | 393.7410  | 392.8009  | 404.5689  | 416.0654  | 439.8863  | 454.2343  | (73) |

## 6. Solar gains

| [Jan]       |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 |          | g<br>Specific data<br>or Table 6b |          | FF<br>Specific data<br>or Table 6c |          | Access<br>factor<br>Table 6d |  | Gains<br>W    |
|-------------|----------|----------|----------|------------|--------------------------------|----------|-----------------------------------|----------|------------------------------------|----------|------------------------------|--|---------------|
|             |          |          |          |            |                                |          |                                   |          |                                    |          |                              |  |               |
| North       |          |          |          | 7.4500     | 10.6334                        |          | 0.6300                            |          | 0.7000                             |          | 0.7700                       |  | 24.2103 (74)  |
| South       |          |          |          | 5.6100     | 46.7521                        |          | 0.6300                            |          | 0.7000                             |          | 0.7700                       |  | 80.1559 (78)  |
| West        |          |          |          | 0.5200     | 19.6403                        |          | 0.6300                            |          | 0.7000                             |          | 0.7700                       |  | 3.1212 (80)   |
|             |          |          |          |            |                                |          |                                   |          |                                    |          |                              |  |               |
| Solar gains | 107.4874 | 183.6475 | 255.8951 | 329.9432   | 385.0318                       | 390.0431 | 372.7259                          | 329.7794 | 280.9021                           | 203.9120 | 128.7704                     |  | 92.0117 (83)  |
| Total gains | 572.3389 | 662.7330 | 713.9086 | 775.5376   | 807.9120                       | 799.2662 | 766.4669                          | 722.5803 | 685.4710                           | 619.9774 | 568.6566                     |  | 546.2459 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |                           |         |         |              |             |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|--------------|-------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |                           |         |         | 21.0000 (85) |             |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |                           |         |         |              |             |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep                       | Oct     | Nov     | Dec          |             |
| tau                                                                         | 38.6747 | 38.7921 | 38.9078 | 39.4607 | 39.5659 | 40.0631 | 40.0631 | 40.1566 | 39.8701                   | 39.5659 | 39.3537 | 39.1342      |             |
| alpha                                                                       | 3.5783  | 3.5861  | 3.5939  | 3.6307  | 3.6377  | 3.6709  | 3.6709  | 3.6771  | 3.6580                    | 3.6377  | 3.6236  | 3.6089       |             |
| util living area                                                            | 0.9844  | 0.9729  | 0.9546  | 0.9079  | 0.8185  | 0.6631  | 0.5120  | 0.5571  | 0.7648                    | 0.9230  | 0.9731  | 0.9867 (86)  |             |
| MIT                                                                         | 19.1208 | 19.3751 | 19.7215 | 20.1990 | 20.6020 | 20.8726 | 20.9626 | 20.9488 | 20.7731                   | 20.2570 | 19.6196 | 19.0878 (87) |             |
| Th 2                                                                        | 19.9749 | 19.9777 | 19.9804 | 19.9932 | 19.9956 | 20.0068 | 20.0068 | 20.0089 | 20.0025                   | 19.9956 | 19.9908 | 19.9857 (88) |             |
| util rest of house                                                          | 0.9811  | 0.9672  | 0.9446  | 0.8867  | 0.7751  | 0.5857  | 0.4076  | 0.4524  | 0.6977                    | 0.9008  | 0.9664  | 0.9839 (89)  |             |
| MIT 2                                                                       | 18.2689 | 18.5218 | 18.8641 | 19.3338 | 19.7053 | 19.9356 | 19.9931 | 19.9886 | 19.8616                   | 19.3983 | 18.7753 | 18.2440 (90) |             |
| Living area fraction                                                        | 18.4336 | 18.6867 | 19.0298 | 19.5010 | 19.8786 | 20.1167 | 20.1805 | 20.1742 | fLA = Living area / (4) = |         |         |              | 0.1933 (91) |
| MIT                                                                         | 18.4336 | 18.6867 | 19.0298 | 19.5010 | 19.8786 | 20.1167 | 20.1805 | 20.1742 | 20.0378                   | 19.5643 | 18.9385 | 18.4071 (92) |             |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |                           |         |         | 0.0000       |             |
| adjusted MIT                                                                | 18.4336 | 18.6867 | 19.0298 | 19.5010 | 19.8786 | 20.1167 | 20.1805 | 20.1742 | 20.0378                   | 19.5643 | 18.9385 | 18.4071 (93) |             |

## 8. Space heating requirement

|                                                                                | Jan       | Feb       | Mar       | Apr       | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov       | Dec            |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|---------------|-----------|----------------|
| Utilisation                                                                    | 0.9742    | 0.9577    | 0.9328    | 0.8742    | 0.7693   | 0.5949   | 0.4266   | 0.4708   | 0.7004   | 0.8891        | 0.9572    | 0.9777 (94)    |
| Useful gains                                                                   | 557.5719  | 634.6685  | 665.9070  | 678.0116  | 621.5642 | 475.4650 | 326.9928 | 340.2049 | 480.0833 | 551.2322      | 544.3081  | 534.0821 (95)  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000    | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000    | 4.2000 (96)    |
| Heat loss rate W                                                               | 1375.4643 | 1337.6465 | 1212.0799 | 1011.1312 | 778.0078 | 518.2743 | 336.3750 | 353.7469 | 560.5310 | 852.7458      | 1132.2361 | 1366.3810 (97) |
| Space heating kWh                                                              | 608.5120  | 472.4012  | 406.3526  | 239.8461  | 116.3940 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 224.3261      | 423.3082  | 619.2304 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |          |          |          |          |          |               |           | 3110.3707      |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |           |          |          |          |          |          |               |           | 0.0000         |
| Space heating kWh                                                              | 608.5120  | 472.4012  | 406.3526  | 239.8461  | 116.3940 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 224.3261      | 423.3082  | 619.2304 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |          |          |          |          |          |               |           | 3110.3707      |
| Space heating per m2                                                           |           |           |           |           |          |          |          |          |          | (98c) / (4) = |           | 36.1755 (99)   |

## 8c. Space cooling requirement

|                                                     |        |        |        |        |         |          |          |          |         |         |        |              |
|-----------------------------------------------------|--------|--------|--------|--------|---------|----------|----------|----------|---------|---------|--------|--------------|
| Calculated for June, July and August. See Table 10b |        |        |        |        |         |          |          |          |         |         |        |              |
|                                                     | Jan    | Feb    | Mar    | Apr    | May     | Jun      | Jul      | Aug      | Sep     | Oct     | Nov    | Dec          |
| Ext. temp.                                          | 4.3000 | 4.9000 | 6.5000 | 8.9000 | 11.7000 | 14.6000  | 16.6000  | 16.4000  | 14.1000 | 10.6000 | 7.1000 | 4.2000       |
| Heat loss rate W                                    |        |        |        |        |         |          |          |          |         |         |        |              |
|                                                     | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 883.0941 | 695.2018 | 712.3295 | 0.0000  | 0.0000  | 0.0000 | 0.0000 (100) |
| Utilisation                                         | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 0.7857   | 0.8559   | 0.8284   | 0.0000  | 0.0000  | 0.0000 | 0.0000 (101) |

# Full SAP Calculation Printout



|                                  |        |        |        |        |        |          |          |          |                          |        |        |                |
|----------------------------------|--------|--------|--------|--------|--------|----------|----------|----------|--------------------------|--------|--------|----------------|
| Useful loss                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 693.8887 | 595.0186 | 590.1204 | 0.0000                   | 0.0000 | 0.0000 | 0.0000 (102)   |
| Total gains                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 882.7344 | 846.9121 | 798.0536 | 0.0000                   | 0.0000 | 0.0000 | 0.0000 (103)   |
| Space cooling kWh                |        |        |        |        |        |          |          |          |                          |        |        |                |
|                                  | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 135.9689 | 187.4088 | 154.7023 | 0.0000                   | 0.0000 | 0.0000 | 0.0000 (104)   |
| Cooled fraction                  |        |        |        |        |        |          |          |          | fC = cooled area / (4) = |        |        | 1.0000 (105)   |
| Intermittency factor (Table 10b) |        |        |        |        |        |          |          |          |                          |        |        |                |
|                                  | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500   | 0.2500   | 0.2500   | 0.2500                   | 0.2500 | 0.2500 | 0.2500 (106)   |
| Space cooling kWh                |        |        |        |        |        |          |          |          |                          |        |        |                |
|                                  | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 33.9922  | 46.8522  | 38.6756  | 0.0000                   | 0.0000 | 0.0000 | 0.0000 (107)   |
| Space cooling requirement        |        |        |        |        |        |          |          |          |                          |        |        | 119.5200 (107) |
| Energy for space heating         |        |        |        |        |        |          |          |          |                          |        |        | 36.1755 (99)   |
| Energy for space cooling         |        |        |        |        |        |          |          |          |                          |        |        | 1.3901 (108)   |
| Total                            |        |        |        |        |        |          |          |          |                          |        |        | 37.5656 (109)  |
| Fabric Energy Efficiency (TFEE)  |        |        |        |        |        |          |          |          |                          |        |        | 37.6 (109)     |

# Full SAP Calculation Printout



|                                    |                                                          |               |        |                |            |
|------------------------------------|----------------------------------------------------------|---------------|--------|----------------|------------|
| Plot Reference                     | 4907-R823-9471-006                                       |               |        | Issued on Date | 21/07/2026 |
| Assessment Reference               | Plot 6                                                   | Plot Type Ref | Plot 6 |                |            |
| Plot Address                       | Plot 6, Beaconsfield-Semi, K, WC, B, ES, 1012            |               |        | SAP Version    | 10.2       |
| SAP Rating                         | 90 B                                                     | DER           | 11.17  | TER            | 11.66      |
| Environmental                      | 91 B                                                     | % DER < TER   |        | 4.20           |            |
| CO <sub>2</sub> Emissions (t/year) | 0.85                                                     | DFEE          | 34.92  | TFEE           | 37.57      |
| Compliance Check                   | See BREL                                                 | % DFEE < TFEE |        | 7.06           |            |
| % DPER < TPER                      | 1.47                                                     | DPER          | 60.05  | TPER           | 60.94      |
| Assessor Details                   | Mr. Daniel Harris                                        |               |        | Assessor ID    | R823-0001  |
| Client                             | Crest Nicholson Head Office, Crest Nicholson Head Office |               |        |                |            |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)            | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Main dwelling                                          |                           |                                 |                             |
| Ground floor                                           | 42.9900 (1b)              | x 2.4600 (2b)                   | = 105.7554 (1b) - (3b)      |
| First floor                                            | 42.9900 (1c)              | x 2.7600 (2c)                   | = 118.6524 (1c) - (3c)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 85.9800                   |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 224.4078 (5)              |

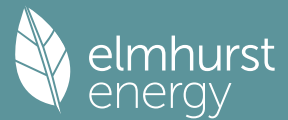
## 2. Ventilation rate

|                                                                                                         | m <sup>3</sup> per hour                                                                                                                  |
|---------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| Number of open chimneys                                                                                 | 0 * 80 = 0.0000 (6a)                                                                                                                     |
| Number of open flues                                                                                    | 0 * 20 = 0.0000 (6b)                                                                                                                     |
| Number of chimneys / flues attached to closed fire                                                      | 0 * 10 = 0.0000 (6c)                                                                                                                     |
| Number of flues attached to solid fuel boiler                                                           | 0 * 20 = 0.0000 (6d)                                                                                                                     |
| Number of flues attached to other heater                                                                | 0 * 35 = 0.0000 (6e)                                                                                                                     |
| Number of blocked chimneys                                                                              | 0 * 20 = 0.0000 (6f)                                                                                                                     |
| Number of intermittent extract fans                                                                     | 0 * 10 = 0.0000 (7a)                                                                                                                     |
| Number of passive vents                                                                                 | 0 * 10 = 0.0000 (7b)                                                                                                                     |
| Number of flueless gas fires                                                                            | 0 * 40 = 0.0000 (7c)                                                                                                                     |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =      | 0.0000 / (5) = 0.0000 (8)                                                                                                                |
| Pressure test                                                                                           | Yes                                                                                                                                      |
| Pressure Test Method                                                                                    | Blower Door                                                                                                                              |
| Measured/design AP50                                                                                    | 4.5000 (17)                                                                                                                              |
| Infiltration rate                                                                                       | 0.2250 (18)                                                                                                                              |
| Number of sides sheltered                                                                               | 1 (19)                                                                                                                                   |
| Shelter factor                                                                                          | (20) = 1 - [0.075 x (19)] = 0.9250 (20)                                                                                                  |
| Infiltration rate adjusted to include shelter factor                                                    | (21) = (18) x (20) = 0.2081 (21)                                                                                                         |
| Wind speed                                                                                              | Jan 5.1000 Feb 5.0000 Mar 4.9000 Apr 4.4000 May 4.3000 Jun 3.8000 Jul 3.8000 Aug 3.7000 Sep 4.0000 Oct 4.3000 Nov 4.5000 Dec 4.7000 (22) |
| Wind factor                                                                                             | 1.2750 1.2500 1.2250 1.1000 1.0750 0.9500 0.9500 0.9250 1.0000 1.0750 1.1250 1.1750 (22a)                                                |
| Adj infilt rate                                                                                         | 0.2654 0.2602 0.2550 0.2289 0.2237 0.1977 0.1977 0.1925 0.2081 0.2237 0.2341 0.2445 (22b)                                                |
| Mechanical extract ventilation - decentralised                                                          |                                                                                                                                          |
| If mechanical ventilation                                                                               | 0.5000 (23a)                                                                                                                             |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) | 0.5000 (23b)                                                                                                                             |
| Effective ac                                                                                            | 0.5154 0.5102 0.5050 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 0.5000 (25)                                                 |

## 3. Heat losses and heat loss parameter

| Element                                                      | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K   |
|--------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|-----------------|
| Main dwelling                                                |                         |                            |                           |                               |              |                                |                 |
| Front Door                                                   |                         |                            | 2.5500                    | 1.2000                        | 3.0600       |                                | (26)            |
| Windows                                                      |                         |                            | 10.2500                   | 1.2357                        | 12.6663      |                                | (27)            |
| French Doors                                                 |                         |                            | 3.3300                    | 1.2357                        | 4.1150       |                                | (27)            |
| GF SPVL 125TS P/A                                            |                         |                            | 42.9900                   | 0.1300                        | 5.5887       | 75.0000                        | 3224.2500 (28a) |
| EW Brick AAC011                                              | 97.2486                 | 16.1300                    | 81.1186                   | 0.1800                        | 14.6013      | 60.0000                        | 4867.1160 (29a) |
| PR 500mm MW044                                               | 42.9900                 |                            | 42.9900                   | 0.0900                        | 3.8691       | 9.0000                         | 386.9100 (30)   |
| Total net area of external elements Aum (A, m <sup>2</sup> ) |                         |                            | 183.2286                  |                               |              |                                | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                          |                         |                            | (26)...(30) + (32) =      |                               | 43.9005      |                                | (33)            |
| Main dwelling                                                |                         |                            |                           |                               |              |                                |                 |
| E-WM-30                                                      |                         |                            | 43.8000                   | 0.0000                        | 0.0000       | 45.0000                        | 1971.0000 (32)  |
| Timber - GF                                                  |                         |                            | 88.6100                   |                               |              | 9.0000                         | 797.4900 (32c)  |
| Timber - FF                                                  |                         |                            | 126.9000                  |                               |              | 9.0000                         | 1142.1000 (32c) |
| Internal Floor FF                                            |                         |                            | 42.9900                   |                               |              | 18.0000                        | 773.8200 (32d)  |
| Internal Ceiling GF                                          |                         |                            | 42.9900                   |                               |              | 9.0000                         | 386.9100 (32e)  |

# Full SAP Calculation Printout



Heat capacity  $C_m = \text{Sum}(A \times k)$   
Thermal mass parameter (TMP) =  $C_m / \text{TFA}$  in  $\text{kJ/m}^2\text{K}$   
List of Thermal Bridges

|                                                      | Length  | Psi-value | Total  |
|------------------------------------------------------|---------|-----------|--------|
| K1 Element                                           |         |           |        |
| E2 Other lintels (including other steel lintels)     | 10.7800 | 0.0410    | 0.4420 |
| E3 Sill                                              | 9.2000  | 0.0220    | 0.2024 |
| E4 Jamb                                              | 21.1500 | 0.0190    | 0.4018 |
| E5 Ground floor (normal)                             | 10.2300 | 0.0928    | 0.9493 |
| E6 Intermediate floor within a dwelling              | 18.6300 | 0.0020    | 0.0373 |
| E10 Eaves (insulation at ceiling level)              | 10.2500 | 0.0390    | 0.3997 |
| E18 Party wall between dwellings                     | 10.4400 | 0.0330    | 0.3445 |
| E4 Jamb                                              | 4.8000  | 0.1000    | 0.4800 |
| E2 Other lintels (including other steel lintels)     | 1.0600  | 0.0410    | 0.0435 |
| P1 Party wall - Ground floor                         | 8.3900  | 0.1000    | 0.8390 |
| P2 Party wall - Intermediate floor within a dwelling | 8.3900  | 0.0000    | 0.0000 |
| P4 Party wall - Roof (insulation at ceiling level)   | 8.3900  | 0.0350    | 0.2937 |
| E5 Ground floor (normal)                             | 8.3900  | 0.0980    | 0.8222 |
| E12 Gable (insulation at ceiling level)              | 8.3900  | 0.0870    | 0.7299 |
| E16 Corner (normal)                                  | 10.4400 | 0.0420    | 0.4385 |

Thermal bridges (Sum(L x Psi) calculated using Appendix K)  
Point Thermal bridges (36a) = 6.4238 (36)  
Total fabric heat loss (33) + (36) + (36a) = 50.3244 (37)

|                                                                                        |         |         |         |         |         |         |         |         |         |         |         |         |      |
|----------------------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)\text{m} \times (5)$ | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |      |
| (38)m                                                                                  | 38.1647 | 37.7794 | 37.3941 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | (38) |
| Heat transfer coeff                                                                    | 88.4891 | 88.1038 | 87.7184 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | (39) |
| Average = Sum(39)m / 12 =                                                              |         |         |         |         |         |         |         |         |         |         |         | 87.5397 |      |
| HLP                                                                                    | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |      |
| HLP (average)                                                                          | 1.0292  | 1.0247  | 1.0202  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | (40) |
| Days in mont                                                                           | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31      |      |

## 4. Water heating energy requirements (kWh/year)

|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------------|-----------|-------------|
| Assumed occupancy                                               |          |          |          |          |          |          |          |          |          |          |            |           | 2.5666 (42) |
| Hot water usage for mixer showers                               |          |          |          |          |          |          |          |          |          |          |            |           |             |
| 67.2533                                                         | 66.2426  | 64.7698  | 61.9519  | 59.8724  | 57.5533  | 56.2352  | 57.6968  | 59.2990  | 61.7890  | 64.6674  | 66.9956    | (42a)     |             |
| Hot water usage for baths                                       |          |          |          |          |          |          |          |          |          |          |            |           |             |
| 29.0443                                                         | 28.6130  | 28.0055  | 26.8856  | 26.0469  | 25.1170  | 24.6147  | 25.2179  | 25.8746  | 26.8697  | 28.0127  | 28.9461    | (42b)     |             |
| Hot water usage for other uses                                  |          |          |          |          |          |          |          |          |          |          |            |           |             |
| 40.9146                                                         | 39.4268  | 37.9390  | 36.4512  | 34.9634  | 33.4756  | 33.4756  | 34.9634  | 36.4512  | 37.9390  | 39.4268  | 40.9146    | (42c)     |             |
| Average daily hot water use (litres/day)                        |          |          |          |          |          |          |          |          |          |          |            | 126.1290  | (43)        |
| Daily hot water use                                             | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov        | Dec       |             |
| 137.2122                                                        | 134.2823 | 130.7143 | 125.2887 | 120.8827 | 116.1459 | 114.3255 | 117.8781 | 121.6248 | 126.5977 | 132.1069 | 136.8563   | (44)      |             |
| Energy conte                                                    | 217.3105 | 191.2162 | 200.9030 | 171.5139 | 162.7313 | 142.8150 | 138.2667 | 145.9577 | 149.9756 | 171.7918 | 188.2105   | 214.2839  | (45)        |
| Energy content (annual)                                         |          |          |          |          |          |          |          |          |          | Total =  | Sum(45)m = | 2094.9763 | (45)        |
| Distribution loss (46)m = 0.15 x (45)m                          |          |          |          |          |          |          |          |          |          |          |            |           |             |
| 32.5966                                                         | 28.6824  | 30.1355  | 25.7271  | 24.4097  | 21.4222  | 20.7400  | 21.8937  | 22.4963  | 25.7688  | 28.2316  | 32.1426    | (46)      |             |
| Water storage loss (or HIU loss):                               |          |          |          |          |          |          |          |          |          |          |            |           |             |
| Total storage loss                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | 0.0000    | (56)        |
| If cylinder contains dedicated solar storage                    |          |          |          |          |          |          |          |          |          |          |            |           |             |
| 0.0000                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | 0.0000    | (57)        |
| Primary loss                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | 0.0000    | (59)        |
| Combi loss                                                      | 11.9874  | 10.8167  | 11.9530  | 11.5193  | 11.8728  | 11.4590  | 11.8214  | 11.8376  | 11.4740  | 11.8918  | 11.5543    | 11.9811   | (61)        |
| Total heat required for water heating calculated for each month |          |          |          |          |          |          |          |          |          |          |            |           |             |
| 229.2979                                                        | 202.0330 | 212.8560 | 183.0332 | 174.6042 | 154.2740 | 150.0882 | 157.7953 | 161.4496 | 183.6836 | 199.7649 | 226.2650   | (62)      |             |
| WWHRS                                                           | -29.9438 | -26.4825 | -27.7310 | -22.9624 | -21.4001 | -18.3122 | -17.1648 | -18.2530 | -18.9465 | -22.3359 | -25.3038   | -29.3893  | (63a)       |
| PV diverter                                                     | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000    | -0.0000   | (63b)       |
| Solar input                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | 0.0000    | (63c)       |
| FGHRS                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | 0.0000    | (63d)       |
| Output from w/h                                                 | 199.3541 | 175.5504 | 185.1250 | 160.0708 | 153.2041 | 135.9618 | 132.9234 | 139.5422 | 142.5031 | 161.3478 | 174.4610   | 196.8757  | (64)        |
| 12Total per year (kWh/year)                                     |          |          |          |          |          |          |          |          |          |          |            |           |             |
| Electric shower(s)                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000     | 0.0000    | (64a)       |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |
|                                                                 |          |          |          |          |          |          |          |          |          |          |            |           |             |

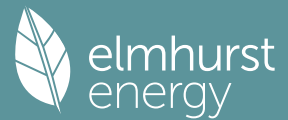
## 5. Internal gains (see Table 5 and 5a)

| Metabolic gains (Table 5), Watts                                                    |           |           |           |           |           |           |           |           |           |           |           |                |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
|                                                                                     | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec            |
| (66)m                                                                               | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 122.1242  | 135.2090  | 122.1242  | 126.1950  | 122.1242  | 126.1950  | 122.1242  | 122.1242  | 126.1950  | 122.1242  | 126.1950  | 122.1242 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 231.4847  | 233.8867  | 227.8336  | 214.9471  | 198.6802  | 183.3916  | 173.1779  | 170.7758  | 176.8289  | 189.7154  | 205.9823  | 221.2709 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330 (69)   |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 3.0000    | 3.0000    | 3.0000 (70)    |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 (71) |
| Water heating gains (Table 5)                                                       | 101.1460  | 98.6363   | 93.8018   | 83.2058   | 76.7156   | 69.9316   | 65.7649   | 69.2074   | 73.2436   | 80.7712   | 90.9286   | 99.7912 (72)   |
| Total internal gains                                                                | 519.2539  | 532.2311  | 508.2586  | 488.8470  | 462.0190  | 441.0172  | 422.5660  | 423.6065  | 437.7667  | 457.1099  | 487.6050  | 507.6854 (73)  |

## 6. Solar gains

| [Jan] | Area<br>m <sup>2</sup> | Solar flux<br>Table 6a<br>W/m <sup>2</sup> | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W |
|-------|------------------------|--------------------------------------------|-----------------------------------|------------------------------------|------------------------------|------------|
|-------|------------------------|--------------------------------------------|-----------------------------------|------------------------------------|------------------------------|------------|

# Full SAP Calculation Printout



|       |  |  |        |  |         |  |        |  |        |  |        |  |              |
|-------|--|--|--------|--|---------|--|--------|--|--------|--|--------|--|--------------|
| North |  |  | 4.1200 |  | 10.6334 |  | 0.4500 |  | 0.0000 |  | 0.7700 |  | 15.1800 (74) |
| South |  |  | 5.6100 |  | 46.7521 |  | 0.4500 |  | 0.0000 |  | 0.7700 |  | 90.8797 (78) |
| West  |  |  | 0.5200 |  | 19.6403 |  | 0.4500 |  | 0.0000 |  | 0.7700 |  | 3.5388 (80)  |
| North |  |  | 3.3300 |  | 10.6334 |  | 0.4500 |  | 0.0000 |  | 0.7700 |  | 12.2693 (74) |

|             |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Solar gains | 121.8678 | 208.2172 | 290.1305 | 374.0852 | 436.5439 | 442.2258 | 422.5917 | 373.8995 | 318.4831 | 231.1927 | 145.9981 | 104.3216 (83) |
| Total gains | 641.1217 | 740.4482 | 798.3891 | 862.9322 | 898.5630 | 883.2430 | 845.1577 | 797.5060 | 756.2498 | 688.3026 | 633.6032 | 612.0071 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |                           |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |                           |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |                           |         |         |              |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep                       | Oct     | Nov     | Dec          |
| tau                                                                         | 42.5338 | 42.7198 | 42.9075 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876                   | 43.0876 | 43.0876 | 43.0876      |
| alpha                                                                       | 3.8356  | 3.8480  | 3.8605  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725                    | 3.8725  | 3.8725  | 3.8725       |
| util living area                                                            | 0.9766  | 0.9591  | 0.9312  | 0.8667  | 0.7529  | 0.5887  | 0.4428  | 0.4856  | 0.6965                    | 0.8884  | 0.9598  | 0.9800 (86)  |
| MIT                                                                         | 19.2549 | 19.5468 | 19.9145 | 20.3644 | 20.7207 | 20.9195 | 20.9792 | 20.9701 | 20.8438                   | 20.3893 | 19.7537 | 19.2157 (87) |
| Th 2                                                                        | 20.0591 | 20.0628 | 20.0665 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701                   | 20.0701 | 20.0701 | 20.0701 (88) |
| util rest of house                                                          | 0.9719  | 0.9512  | 0.9177  | 0.8405  | 0.7060  | 0.5168  | 0.3543  | 0.3949  | 0.6289                    | 0.8607  | 0.9507  | 0.9760 (89)  |
| MIT 2                                                                       | 18.2595 | 18.5876 | 18.9970 | 19.4838 | 19.8436 | 20.0200 | 20.0614 | 20.0567 | 19.9626                   | 19.5204 | 18.8278 | 18.2230 (90) |
| Living area fraction                                                        |         |         |         |         |         |         |         |         | fLA = Living area / (4) = |         |         | 0.1933 (91)  |
| MIT                                                                         | 18.4519 | 18.7730 | 19.1743 | 19.6540 | 20.0132 | 20.1939 | 20.2388 | 20.2333 | 20.1330                   | 19.6884 | 19.0068 | 18.4149 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |                           |         |         | 0.0000       |
| adjusted MIT                                                                | 18.4519 | 18.7730 | 19.1743 | 19.6540 | 20.0132 | 20.1939 | 20.2388 | 20.2333 | 20.1330                   | 19.6884 | 19.0068 | 18.4149 (93) |

## 8. Space heating requirement

|                                                                                |           |           |           |          |          |          |          |          |          |               |           |                |  |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|---------------|-----------|----------------|--|
|                                                                                | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov       | Dec            |  |
| Utilisation                                                                    | 0.9610    | 0.9372    | 0.9019    | 0.8271   | 0.7029   | 0.5268   | 0.3707   | 0.4113   | 0.6338   | 0.8473        | 0.9370    | 0.9662 (94)    |  |
| Useful gains                                                                   | 616.1448  | 693.9277  | 720.0381  | 713.6930 | 631.6192 | 465.2760 | 313.3241 | 328.0018 | 479.3454 | 583.1852      | 593.7109  | 591.3031 (95)  |  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000    | 4.2000 (96)    |  |
| Heat loss rate W                                                               | 1252.2917 | 1222.2671 | 1111.7740 | 939.3812 | 726.1686 | 488.6341 | 317.8571 | 334.8446 | 526.9901 | 793.8854      | 1040.0806 | 1241.6966 (97) |  |
| Space heating kWh                                                              | 473.2933  | 355.0441  | 291.4515  | 162.4955 | 70.3447  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 156.7609      | 321.3862  | 483.8927 (98a) |  |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |          |          |          |          |          |          |               |           | 2314.6688      |  |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | 0.0000 (98b)   |  |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |          |          |          |          |          |          |               |           | 0.0000         |  |
| Space heating kWh                                                              | 473.2933  | 355.0441  | 291.4515  | 162.4955 | 70.3447  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 156.7609      | 321.3862  | 483.8927 (98c) |  |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |          |          |          |          |          |          |               |           | 2314.6688      |  |
| Space heating per m2                                                           |           |           |           |          |          |          |          |          |          | (98c) / (4) = |           | 26.9210 (99)   |  |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                                                              |          |          |          |          |          |          |          |          |          |          |          |                 |               |
|--------------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|---------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                        |          |          |          |          |          |          |          |          |          |          |          |                 | 0.0000 (201)  |
| Fraction of space heat from main system(s)                                                                   |          |          |          |          |          |          |          |          |          |          |          |                 | 1.0000 (202)  |
| Efficiency of main space heating system 1 (in %)                                                             |          |          |          |          |          |          |          |          |          |          |          |                 | 91.7000 (206) |
| Efficiency of main space heating system 2 (in %)                                                             |          |          |          |          |          |          |          |          |          |          |          |                 | 0.0000 (207)  |
| Efficiency of secondary/supplementary heating system, %                                                      |          |          |          |          |          |          |          |          |          |          |          |                 | 0.0000 (208)  |
|                                                                                                              | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec             |               |
| Space heating requirement                                                                                    | 473.2933 | 355.0441 | 291.4515 | 162.4955 | 70.3447  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 156.7609 | 321.3862 | 483.8927 (98)   |               |
| Space heating efficiency (main heating system 1)                                                             | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 91.7000  | 91.7000  | 91.7000 (210)   |               |
| Space heating fuel (main heating system)                                                                     | 516.1322 | 387.1800 | 317.8315 | 177.2033 | 76.7118  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 170.9497 | 350.4757 | 527.6911 (211)  |               |
| Space heating efficiency (main heating system 2)                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)    |               |
| Space heating fuel (main heating system 2)                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)    |               |
| Space heating fuel (secondary)                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)    |               |
| Water heating                                                                                                |          |          |          |          |          |          |          |          |          |          |          |                 |               |
| Water heating requirement                                                                                    | 199.3541 | 175.5504 | 185.1250 | 160.0708 | 153.2041 | 135.9618 | 132.9234 | 139.5422 | 142.5031 | 161.3478 | 174.4610 | 196.8757 (64)   |               |
| Efficiency of water heater (217)m                                                                            | 88.1671  | 88.0940  | 87.9723  | 87.7453  | 87.3500  | 86.7000  | 86.7000  | 86.7000  | 86.7000  | 87.7223  | 88.0496  | 88.1823 (216)   |               |
| Fuel for water heating, kWh/month                                                                            | 226.1095 | 199.2762 | 210.4356 | 182.4266 | 175.3910 | 156.8186 | 153.3142 | 160.9484 | 164.3635 | 183.9302 | 198.1394 | 223.2598 (219)  |               |
| Space cooling fuel requirement (221)m                                                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)    |               |
| Pumps and Fa                                                                                                 | 10.9478  | 9.8883   | 10.9478  | 10.9478  | 10.9478  | 10.9478  | 10.9478  | 10.9478  | 10.9478  | 10.9478  | 10.9478  | 10.9478 (231)   |               |
| Lighting                                                                                                     | 23.4106  | 18.7809  | 16.9101  | 12.3891  | 9.5697   | 7.8185   | 8.7298   | 11.3473  | 14.7390  | 19.3384  | 21.8427  | 24.0613 (232)   |               |
| Electricity generated by PVs (Appendix M) (negative quantity) (233a)m                                        | -14.6942 | -22.4007 | -34.8599 | -42.5373 | -48.8442 | -46.7030 | -46.0948 | -41.9719 | -35.2991 | -26.9662 | -16.7286 | -12.5110 (233a) |               |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)   |               |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)   |               |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)   |               |
| Electricity generated by PVs (Appendix M) (negative quantity) (233b)m                                        | -4.0882  | -8.9418  | -18.5200 | -29.0022 | -39.5369 | -40.1897 | -39.6495 | -32.9433 | -23.3746 | -13.1010 | -5.5501  | -3.2067 (233b)  |               |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234b)   |               |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)   |               |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235d)   |               |
| Annual totals kWh/year                                                                                       |          |          |          |          |          |          |          |          |          |          |          |                 |               |
| Space heating fuel - main system 1                                                                           |          |          |          |          |          |          |          |          |          |          |          | 2524.1754 (211) |               |
| Space heating fuel - main system 2                                                                           |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)    |               |
| Space heating fuel - secondary                                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)    |               |
| Efficiency of water heater                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 86.7000         |               |

# Full SAP Calculation Printout



|                                                                                                                            |                 |
|----------------------------------------------------------------------------------------------------------------------------|-----------------|
| Water heating fuel used                                                                                                    | 2234.4130 (219) |
| Space cooling fuel                                                                                                         | 0.0000 (221)    |
| Electricity for pumps and fans:<br>(MEVDecentralised, Database: total watage = 5.7980, total flow = 37.0000, SFP = 0.1567) |                 |
| mechanical ventilation fans (SFP = 0.1567)                                                                                 | 42.9017 (230a)  |
| central heating pump                                                                                                       | 41.0000 (230c)  |
| main heating flue fan                                                                                                      | 45.0000 (230e)  |
| Total electricity for the above, kWh/year                                                                                  | 128.9017 (231)  |
| Electricity for lighting (calculated in Appendix L)                                                                        | 188.9373 (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                                              |                 |
| PV generation                                                                                                              | -647.7148 (233) |
| Wind generation                                                                                                            | 0.0000 (234)    |
| Hydro-electric generation (Appendix N)                                                                                     | 0.0000 (235a)   |
| Electricity generated - Micro CHP (Appendix N)                                                                             | 0.0000 (235)    |
| Appendix Q - special features                                                                                              |                 |
| Energy saved or generated                                                                                                  | -0.0000 (236)   |
| Energy used                                                                                                                | 0.0000 (237)    |
| Total delivered energy for all uses                                                                                        | 4428.7126 (238) |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                                 | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |       |
|-------------------------------------------------|--------------------|-------------------------------|--------------------------|-------|
| Space heating - main system 1                   | 2524.1754          | 0.2100                        | 530.0768                 | (261) |
| Total CO2 associated with community systems     |                    |                               | 0.0000                   | (373) |
| Water heating (other fuel)                      | 2234.4130          | 0.2100                        | 469.2267                 | (264) |
| Space and water heating                         |                    |                               | 999.3036                 | (265) |
| Pumps, fans and electric keep-hot               | 128.9017           | 0.1387                        | 17.8803                  | (267) |
| Energy for lighting                             | 188.9373           | 0.1443                        | 27.2695                  | (268) |
| Energy saving/generation technologies           |                    |                               |                          |       |
| PV Unit electricity used in dwelling            | -389.6109          | 0.1330                        | -51.8040                 |       |
| PV Unit electricity exported                    | -258.1039          | 0.1248                        | -32.1992                 |       |
| Total                                           |                    |                               | -84.0033                 | (269) |
| Total CO2, kg/year                              |                    |                               | 960.4500                 | (272) |
| EPC Dwelling Carbon Dioxide Emission Rate (DER) |                    |                               | 11.1700                  | (273) |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |       |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|-------|
| Space heating - main system 1               | 2524.1754          | 1.1300                              | 2852.3182                  | (275) |
| Total CO2 associated with community systems |                    |                                     | 0.0000                     | (473) |
| Water heating (other fuel)                  | 2234.4130          | 1.1300                              | 2524.8867                  | (278) |
| Space and water heating                     |                    |                                     | 5377.2049                  | (279) |
| Pumps, fans and electric keep-hot           | 128.9017           | 1.5128                              | 195.0025                   | (281) |
| Energy for lighting                         | 188.9373           | 1.5338                              | 289.7983                   | (282) |
| Energy saving/generation technologies       |                    |                                     |                            |       |
| PV Unit electricity used in dwelling        | -389.6109          | 1.4913                              | -581.0334                  |       |
| PV Unit electricity exported                | -258.1039          | 0.4579                              | -118.1785                  |       |
| Total                                       |                    |                                     | -699.2119                  | (283) |
| Total Primary energy kWh/year               |                    |                                     | 5162.7938                  | (286) |
| Dwelling Primary energy Rate (DPER)         |                    |                                     | 60.0500                    | (287) |

## SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF TARGET EMISSIONS

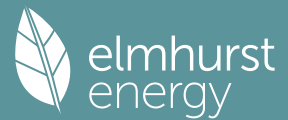
### 1. Overall dwelling characteristics

|                                                        | Area<br>(m2) | Storey height<br>(m)            | Volume<br>(m3)         |  |
|--------------------------------------------------------|--------------|---------------------------------|------------------------|--|
| Main dwelling                                          |              |                                 |                        |  |
| Ground floor                                           | 42.9900 (1b) | x 2.4600 (2b)                   | = 105.7554 (1b) - (3b) |  |
| First floor                                            | 42.9900 (1c) | x 2.7600 (2c)                   | = 118.6524 (1c) - (3c) |  |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 85.9800      |                                 | (4)                    |  |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 224.4078 (5)         |  |

### 2. Ventilation rate

|                                                                                                    | m3 per hour     |              |
|----------------------------------------------------------------------------------------------------|-----------------|--------------|
| Number of open chimneys                                                                            | 0 * 80 =        | 0.0000 (6a)  |
| Number of open flues                                                                               | 0 * 20 =        | 0.0000 (6b)  |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 =        | 0.0000 (6c)  |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 =        | 0.0000 (6d)  |
| Number of flues attached to other heater                                                           | 0 * 35 =        | 0.0000 (6e)  |
| Number of blocked chimneys                                                                         | 0 * 20 =        | 0.0000 (6f)  |
| Number of intermittent extract fans                                                                | 3 * 10 =        | 30.0000 (7a) |
| Number of passive vents                                                                            | 0 * 10 =        | 0.0000 (7b)  |
| Number of flueless gas fires                                                                       | 0 * 40 =        | 0.0000 (7c)  |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 30.0000 / (5) = | 0.1337 (8)   |
| Pressure test                                                                                      | Yes             |              |
| Pressure Test Method                                                                               | Blower Door     |              |
| Measured/design AP50                                                                               |                 | 5.0000 (17)  |
| Infiltration rate                                                                                  |                 | 0.3837 (18)  |
| Number of sides sheltered                                                                          |                 | 1 (19)       |

# Full SAP Calculation Printout



Shelter factor  
Infiltration rate adjusted to include shelter factor

$$(20) = 1 - [0.075 \times (19)] = 0.9250 \quad (20)$$

$$(21) = (18) \times (20) = 0.3549 \quad (21)$$

|                 |               |               |               |               |               |               |               |               |               |               |               |               |       |
|-----------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|-------|
| Wind speed      | Jan<br>5.1000 | Feb<br>5.0000 | Mar<br>4.9000 | Apr<br>4.4000 | May<br>4.3000 | Jun<br>3.8000 | Jul<br>3.8000 | Aug<br>3.7000 | Sep<br>4.0000 | Oct<br>4.3000 | Nov<br>4.5000 | Dec<br>4.7000 | (22)  |
| Wind factor     | 1.2750        | 1.2500        | 1.2250        | 1.1000        | 1.0750        | 0.9500        | 0.9500        | 0.9250        | 1.0000        | 1.0750        | 1.1250        | 1.1750        | (22a) |
| Adj infilt rate | 0.4525        | 0.4436        | 0.4348        | 0.3904        | 0.3815        | 0.3372        | 0.3372        | 0.3283        | 0.3549        | 0.3815        | 0.3993        | 0.4170        | (22b) |
| Effective ac    | 0.6024        | 0.5984        | 0.5945        | 0.5762        | 0.5728        | 0.5568        | 0.5568        | 0.5539        | 0.5630        | 0.5728        | 0.5797        | 0.5870        | (25)  |

## 3. Heat losses and heat loss parameter

| Element                                           | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K | A x U<br>W/K | K-value<br>kJ/m2K | A x K<br>kJ/K |
|---------------------------------------------------|-------------|----------------|---------------|------------------|--------------|-------------------|---------------|
| Main dwelling                                     |             |                |               |                  |              |                   |               |
| TER Opaque door                                   |             |                | 2.5500        | 1.0000           | 2.5500       |                   | (26)          |
| TER Opening Type                                  |             |                | 13.5800       | 1.1450           | 15.5496      |                   | (27)          |
| GF SPVL 125TS P/A                                 |             |                | 42.9900       | 0.1300           | 5.5887       |                   | (28a)         |
| EW Brick AAC011                                   | 97.2486     | 16.1300        | 81.1186       | 0.1800           | 14.6013      |                   | (29a)         |
| PR 500mm MW044                                    | 42.9900     |                | 42.9900       | 0.1100           | 4.7289       |                   | (30)          |
| Total net area of external elements Aum(A, m2)    |             |                | 183.2286      |                  |              |                   | (31)          |
| Fabric heat loss, W/K = Sum (A x U)               |             |                |               |                  |              |                   | (32)          |
| Main dwelling                                     |             |                |               |                  |              |                   |               |
| E-WM-30                                           |             |                | 43.8000       | 0.0000           | 0.0000       |                   | (32)          |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K |             |                |               |                  |              |                   | 157.5901 (35) |

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

List of Thermal Bridges

|                                                      | Length  | Psi-value | Total  |
|------------------------------------------------------|---------|-----------|--------|
| K1 Element                                           | 10.7800 | 0.0500    | 0.5390 |
| E2 Other lintels (including other steel lintels)     | 9.2000  | 0.0500    | 0.4600 |
| E3 Sill                                              | 21.1500 | 0.0500    | 1.0575 |
| E4 Jamb                                              | 10.2300 | 0.1600    | 1.6368 |
| E5 Ground floor (normal)                             | 18.6300 | 0.0000    | 0.0000 |
| E6 Intermediate floor within a dwelling              | 10.2500 | 0.0600    | 0.6150 |
| E10 Eaves (insulation at ceiling level)              | 10.4400 | 0.0600    | 0.6264 |
| E18 Party wall between dwellings                     | 4.8000  | 0.0500    | 0.2400 |
| E4 Jamb                                              | 1.0600  | 0.0500    | 0.0530 |
| E2 Other lintels (including other steel lintels)     | 8.3900  | 0.0800    | 0.6712 |
| P1 Party wall - Ground floor                         | 8.3900  | 0.0000    | 0.0000 |
| P2 Party wall - Intermediate floor within a dwelling | 8.3900  | 0.1200    | 1.0068 |
| P4 Party wall - Roof (insulation at ceiling level)   | 8.3900  | 0.1600    | 1.3424 |
| E5 Ground floor (normal)                             | 8.3900  | 0.0600    | 0.5034 |
| E12 Gable (insulation at ceiling level)              | 10.4400 | 0.0900    | 0.9396 |
| E16 Corner (normal)                                  |         |           |        |

Thermal bridges (Sum(L x Psi) calculated using Appendix K)

Point Thermal bridges

Total fabric heat loss (33) + (36) + (36a) = 52.7097 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

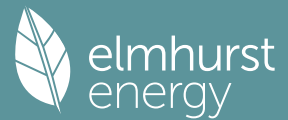
|                           |                |                |                |                |                |                |                |                |                |                |                |                |      |
|---------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|------|
| (38)m                     | Jan<br>44.6091 | Feb<br>44.3147 | Mar<br>44.0262 | Apr<br>42.6707 | May<br>42.4171 | Jun<br>41.2365 | Jul<br>41.2365 | Aug<br>41.0179 | Sep<br>41.6913 | Oct<br>42.4171 | Nov<br>42.9301 | Dec<br>43.4665 | (38) |
| Heat transfer coeff       | 97.3188        | 97.0244        | 96.7358        | 95.3804        | 95.1268        | 93.9462        | 93.9462        | 93.7276        | 94.4009        | 95.1268        | 95.6398        | 96.1761        | (39) |
| Average = Sum(39)m / 12 = |                |                |                |                |                |                |                |                |                |                |                | 95.3791        |      |

|               |               |               |               |               |               |               |               |               |               |               |               |               |      |
|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|------|
| HLP           | Jan<br>1.1319 | Feb<br>1.1285 | Mar<br>1.1251 | Apr<br>1.1093 | May<br>1.1064 | Jun<br>1.0927 | Jul<br>1.0927 | Aug<br>1.0901 | Sep<br>1.0979 | Oct<br>1.1064 | Nov<br>1.1123 | Dec<br>1.1186 | (40) |
| HLP (average) |               |               |               |               |               |               |               |               |               |               |               | 1.1093        |      |
| Days in mont  | 31            | 28            | 31            | 30            | 31            | 30            | 31            | 31            | 30            | 31            | 30            | 31            |      |

## 4. Water heating energy requirements (kWh/year)

|                                                                                |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |             |
|--------------------------------------------------------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-------------|
| Assumed occupancy                                                              |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 | 2.5666 (42) |
| Hot water usage for mixer showers                                              |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |             |
| 67.2533                                                                        | 66.2426         | 64.7698         | 61.9519         | 59.8724         | 57.5533         | 56.2352         | 57.6968         | 59.2990         | 61.7890         | 64.6674         | 66.9956         | 66.9956         | (42a)       |
| Hot water usage for baths                                                      |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |             |
| 29.0443                                                                        | 28.6130         | 28.0055         | 26.8856         | 26.0469         | 25.1170         | 24.6147         | 25.2179         | 25.8746         | 26.8697         | 28.0127         | 28.9461         | 28.9461         | (42b)       |
| Hot water usage for other uses                                                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |             |
| 40.9146                                                                        | 39.4268         | 37.9390         | 36.4512         | 34.9634         | 33.4756         | 33.4756         | 34.9634         | 36.4512         | 37.9390         | 39.4268         | 40.9146         | 40.9146         | (42c)       |
| Average daily hot water use (litres/day)                                       |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 | 126.1290        | (43)        |
| Daily hot water use                                                            | Jan<br>137.2122 | Feb<br>134.2823 | Mar<br>130.7143 | Apr<br>125.2887 | May<br>120.8827 | Jun<br>116.1459 | Jul<br>114.3255 | Aug<br>117.8781 | Sep<br>121.6248 | Oct<br>126.5977 | Nov<br>132.1069 | Dec<br>136.8563 | (44)        |
| Energy conte                                                                   | 217.3105        | 191.2162        | 200.9030        | 171.5139        | 162.7313        | 142.8150        | 138.2667        | 145.9577        | 149.9756        | 171.7918        | 188.2105        | 214.2839        | (45)        |
| Energy content (annual)                                                        |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |             |
| Distribution loss (46)m = 0.15 x (45)m                                         | 32.5966         | 28.6824         | 30.1355         | 25.7271         | 24.4097         | 21.4222         | 20.7400         | 21.8937         | 22.4963         | 25.7688         | 28.2316         | 32.1426         | (46)        |
| Water storage loss (or HIU loss):                                              |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |             |
| Total storage loss                                                             | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | (56)        |
| If cylinder contains dedicated solar storage                                   |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |             |
| 0.0000                                                                         | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | (57)        |
| Primary loss                                                                   | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | (59)        |
| Combi loss                                                                     | 50.9589         | 46.0274         | 50.9589         | 49.3151         | 50.9589         | 49.3151         | 50.9589         | 50.9589         | 49.3151         | 50.9589         | 49.3151         | 50.9589         | (61)        |
| Total heat required for water heating calculated for each month                |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |             |
| 268.2694                                                                       | 237.2436        | 251.8620        | 220.8290        | 213.6902        | 192.1300        | 189.2257        | 196.9166        | 199.2907        | 222.7507        | 237.5256        | 265.2428        | 265.2428        | (62)        |
| WWHRS                                                                          | -30.7454        | -27.1915        | -28.4733        | -23.5770        | -21.9730        | -18.8024        | -17.6243        | -18.7416        | -19.4537        | -22.9338        | -25.9812        | -30.1760        | (63a)       |
| PV diverter                                                                    | -0.0000         | -0.0000         | -0.0000         | -0.0000         | -0.0000         | -0.0000         | -0.0000         | -0.0000         | -0.0000         | -0.0000         | -0.0000         | -0.0000         | (63b)       |
| Solar input                                                                    | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | (63c)       |
| FGHRS                                                                          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | (63d)       |
| Output from w/h                                                                | 237.5241        | 210.0522        | 223.3886        | 197.2519        | 191.7173        | 173.3276        | 171.6014        | 178.1749        | 179.8370        | 199.8169        | 211.5444        | 235.0668        | (64)        |
| 12Total per year (kWh/year)                                                    |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 | 2409.3031       | (64)        |
| Electric shower(s)                                                             | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | 0.0000          | (64a)       |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 | 0.0000          | (64a)       |
| Heat gains from water heating, kWh/month                                       | 84.9955         | 75.0862         | 79.5400         | 69.3571         | 66.8479         | 59.8147         | 58.7134         | 61.2707         | 62.1957         | 69.8605         | 74.9088         | 83.9891         | (65)        |

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## 5. Internal gains (see Table 5 and 5a)

| Metabolic gains (Table 5), Watts                                                    |           |           |           |           |           |           |           |           |           |           |           |                |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
|                                                                                     | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec            |
| (66)m                                                                               | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302  | 128.3302 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 122.1242  | 135.2090  | 122.1242  | 126.1950  | 122.1242  | 126.1950  | 122.1242  | 122.1242  | 126.1950  | 122.1242  | 126.1950  | 122.1242 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 231.4847  | 233.8867  | 227.8336  | 214.9471  | 198.6802  | 183.3916  | 173.1779  | 170.7758  | 176.8289  | 189.7154  | 205.9823  | 221.2709 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330   | 35.8330 (69)   |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 3.0000    | 3.0000    | 3.0000 (70)    |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 (71) |
| Water heating gains (Table 5)                                                       | 114.2412  | 111.7355  | 106.9086  | 96.3294   | 89.8493   | 83.0760   | 78.9159   | 82.3530   | 86.3828   | 93.8985   | 104.0399  | 112.8886 (72)  |
| Total internal gains                                                                | 532.3492  | 545.3303  | 521.3654  | 501.9705  | 475.1528  | 454.1617  | 435.7170  | 436.7521  | 450.9059  | 470.2373  | 500.7164  | 520.7828 (73)  |

## 6. Solar gains

| [Jan]       |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W   |          |          |               |
|-------------|----------|----------|----------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|--------------|----------|----------|---------------|
| North       |          |          |          | 7.4500     | 10.6334                        | 0.6300                            | 0.7000                             | 0.7700                       | 24.2103 (74) |          |          |               |
| South       |          |          |          | 5.6100     | 46.7521                        | 0.6300                            | 0.7000                             | 0.7700                       | 80.1559 (78) |          |          |               |
| West        |          |          |          | 0.5200     | 19.6403                        | 0.6300                            | 0.7000                             | 0.7700                       | 3.1212 (80)  |          |          |               |
|             |          |          |          |            |                                |                                   |                                    |                              |              |          |          |               |
| Solar gains | 107.4874 | 183.6475 | 255.8951 | 329.9432   | 385.0318                       | 390.0431                          | 372.7259                           | 329.7794                     | 280.9021     | 203.9120 | 128.7704 | 92.0117 (83)  |
| Total gains | 639.8366 | 728.9778 | 777.2605 | 831.9137   | 860.1845                       | 844.2049                          | 808.4429                           | 766.5314                     | 731.8080     | 674.1493 | 629.4868 | 612.7945 (84) |

## 7. Mean internal temperature (heating season)

| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |         |         |         |              |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| tau                                                                         | 38.6747 | 38.7921 | 38.9078 | 39.4607 | 39.5659 | 40.0631 | 40.0631 | 40.1566 | 39.8701 | 39.5659 | 39.3537 | 39.1342      |
| alpha                                                                       | 3.5783  | 3.5861  | 3.5939  | 3.6307  | 3.6377  | 3.6709  | 3.6709  | 3.6771  | 3.6580  | 3.6377  | 3.6236  | 3.6089       |
| util living area                                                            | 0.9781  | 0.9642  | 0.9428  | 0.8910  | 0.7953  | 0.6380  | 0.4890  | 0.5306  | 0.7374  | 0.9050  | 0.9638  | 0.9810 (86)  |
| MIT                                                                         | 19.2313 | 19.4781 | 19.8124 | 20.2651 | 20.6426 | 20.8881 | 20.9678 | 20.9564 | 20.8006 | 20.3245 | 19.7145 | 19.1982 (87) |
| Th 2                                                                        | 19.9749 | 19.9777 | 19.9804 | 19.9932 | 19.9956 | 20.0068 | 20.0068 | 20.0089 | 20.0025 | 19.9956 | 19.9908 | 19.9857 (88) |
| util rest of house                                                          | 0.9736  | 0.9570  | 0.9307  | 0.8671  | 0.7494  | 0.5607  | 0.3878  | 0.4288  | 0.6682  | 0.8793  | 0.9552  | 0.9771 (89)  |
| MIT 2                                                                       | 17.9253 | 18.2382 | 18.6594 | 19.2240 | 19.6652 | 19.9275 | 19.9919 | 19.9870 | 19.8462 | 19.3075 | 18.5491 | 17.8905 (90) |
| Living area fraction                                                        | 18.1778 | 18.4779 | 18.8823 | 19.4253 | 19.8541 | 20.1132 | 20.1805 | 20.1744 | 20.0307 | 19.5041 | 18.7744 | 18.1433 (91) |
| MIT                                                                         | 18.1778 | 18.4779 | 18.8823 | 19.4253 | 19.8541 | 20.1132 | 20.1805 | 20.1744 | 20.0307 | 19.5041 | 18.7744 | 18.1433 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT                                                                | 18.1778 | 18.4779 | 18.8823 | 19.4253 | 19.8541 | 20.1132 | 20.1805 | 20.1744 | 20.0307 | 19.5041 | 18.7744 | 18.1433 (93) |

## 8. Space heating requirement

|                                                                                | Jan       | Feb       | Mar       | Apr       | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov       | Dec            |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|-----------|----------------|
| Utilisation                                                                    | 0.9624    | 0.9427    | 0.9140    | 0.8510    | 0.7421   | 0.5696   | 0.4062   | 0.4466   | 0.6704   | 0.8638   | 0.9412    | 0.9669 (94)    |
| Useful gains                                                                   | 615.8082  | 687.2111  | 710.4175  | 707.9501  | 638.3583 | 480.8476 | 328.3862 | 342.3649 | 490.5806 | 582.3190 | 592.4478  | 592.5365 (95)  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000    | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000  | 7.1000    | 4.2000 (96)    |
| Heat loss rate W                                                               | 1350.5677 | 1317.3849 | 1197.8091 | 1003.9025 | 775.6763 | 517.9447 | 336.3754 | 353.7646 | 559.8651 | 847.0155 | 1116.5375 | 1341.0082 (97) |
| Space heating kWh                                                              | 546.6610  | 423.4768  | 362.6193  | 213.0858  | 102.1645 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 196.9342 | 377.3446  | 556.8629 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |          |          |          |          |          |          |           | 2779.1492      |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |           |          |          |          |          |          |          |           | 0.0000         |
| Space heating kWh                                                              | 546.6610  | 423.4768  | 362.6193  | 213.0858  | 102.1645 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 196.9342 | 377.3446  | 556.8629 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |          |          |          |          |          |          |           | 2779.1492      |
| Space heating per m <sup>2</sup>                                               |           |           |           |           |          |          |          |          |          |          |           | 32.3232 (99)   |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

| Fraction of space heat from secondary/supplementary system (Table 11) |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (201)   |
|-----------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| Fraction of space heat from main system(s)                            |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (202)   |
| Efficiency of main space heating system 1 (in %)                      |          |          |          |          |          |          |          |          |          |          |          | 92.4000 (206)  |
| Efficiency of main space heating system 2 (in %)                      |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)   |
| Efficiency of secondary/supplementary heating system, %               |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)   |
|                                                                       | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec            |
| Space heating requirement                                             | 546.6610 | 423.4768 | 362.6193 | 213.0858 | 102.1645 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 196.9342 | 377.3446 | 556.8629 (98)  |
| Space heating efficiency (main heating system 1)                      | 92.4000  | 92.4000  | 92.4000  | 92.4000  | 92.4000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 92.4000  | 92.4000  | 92.4000 (210)  |
| Space heating fuel (main heating system)                              | 591.6245 | 458.3082 | 392.4452 | 230.6123 | 110.5677 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 213.1322 | 408.3816 | 602.6655 (211) |
| Space heating efficiency (main heating system 2)                      | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)   |
| Space heating fuel (main heating system 2)                            | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)   |
| Space heating fuel (secondary)                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)   |
| Water heating                                                         |          |          |          |          |          |          |          |          |          |          |          |                |
| Water heating requirement                                             | 237.5241 | 210.0522 | 223.3886 | 197.2519 | 191.7173 | 173.3276 | 171.6014 | 178.1749 | 179.8370 | 199.8169 | 211.5444 | 235.0668 (64)  |
| Efficiency of water heater                                            |          |          |          |          |          |          |          |          |          |          |          | 80.3000 (216)  |

# Full SAP Calculation Printout



|                                                                                                      |          |          |          |           |           |           |           |           |           |          |          |            |        |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|----------|------------|--------|
| (217)m                                                                                               | 86.1068  | 85.8515  | 85.4129  | 84.5473   | 83.0944   | 80.3000   | 80.3000   | 80.3000   | 80.3000   | 84.3503  | 85.6065  | 86.1610    | (217)  |
| Fuel for water heating, kWh/month                                                                    | 275.8483 | 244.6693 | 261.5397 | 233.3037  | 230.7221  | 215.8501  | 213.7004  | 221.8866  | 223.9564  | 236.8895 | 247.1125 | 272.8228   | (219)  |
| Space cooling fuel requirement                                                                       |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (221)m                                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (221)  |
| Pumps and Fa                                                                                         | 7.3041   | 6.5973   | 7.3041   | 7.0685    | 7.3041    | 7.0685    | 7.3041    | 7.0685    | 7.3041    | 7.0685   | 7.3041   | 7.0685     | (231)  |
| Lighting                                                                                             | 25.3750  | 20.3568  | 18.3290  | 13.4286   | 10.3727   | 8.4745    | 9.4623    | 12.2994   | 15.9757   | 20.9610  | 23.6755  | 26.0803    | (232)  |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (233a)m                                                                                              | -39.8696 | -56.0257 | -80.2676 | -89.9369  | -96.7057  | -90.1510  | -89.0213  | -84.1676  | -75.5697  | -63.9045 | -43.7612 | -34.4899   | (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (234a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (234a) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (235a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (235a) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (235c)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (235c) |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (233b)m                                                                                              | -23.0762 | -48.4849 | -96.2662 | -144.4459 | -190.8693 | -191.7487 | -189.5061 | -160.5221 | -117.7385 | -69.3076 | -30.7987 | -18.2537   | (233b) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (234b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (234b) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (235b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (235b) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |           |           |           |           |           |           |          |          |            |        |
| (235d)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000     | (235d) |
| Annual totals kWh/year                                                                               |          |          |          |           |           |           |           |           |           |          |          |            |        |
| Space heating fuel - main system 1                                                                   |          |          |          |           |           |           |           |           |           |          |          | 3007.7372  | (211)  |
| Space heating fuel - main system 2                                                                   |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (213)  |
| Space heating fuel - secondary                                                                       |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (215)  |
| Efficiency of water heater                                                                           |          |          |          |           |           |           |           |           |           |          |          | 80.3000    |        |
| Water heating fuel used                                                                              |          |          |          |           |           |           |           |           |           |          |          | 2878.3014  | (219)  |
| Space cooling fuel                                                                                   |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (221)  |
| Electricity for pumps and fans:                                                                      |          |          |          |           |           |           |           |           |           |          |          |            |        |
| Total electricity for the above, kWh/year                                                            |          |          |          |           |           |           |           |           |           |          |          | 86.0000    | (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |          |          |          |           |           |           |           |           |           |          |          | 204.7908   | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |          |          |           |           |           |           |           |           |          |          |            |        |
| PV generation                                                                                        |          |          |          |           |           |           |           |           |           |          |          | -2124.8885 | (233)  |
| Wind generation                                                                                      |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (234)  |
| Hydro-electric generation (Appendix N)                                                               |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (235a) |
| Electricity generated - Micro CHP (Appendix N)                                                       |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (235)  |
| Appendix Q - special features                                                                        |          |          |          |           |           |           |           |           |           |          |          |            |        |
| Energy saved or generated                                                                            |          |          |          |           |           |           |           |           |           |          |          | -0.0000    | (236)  |
| Energy used                                                                                          |          |          |          |           |           |           |           |           |           |          |          | 0.0000     | (237)  |
| Total delivered energy for all uses                                                                  |          |          |          |           |           |           |           |           |           |          |          | 4051.9410  | (238)  |

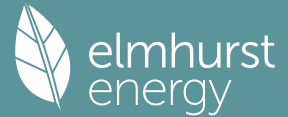
## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                               | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |       |
|-----------------------------------------------|--------------------|-------------------------------|--------------------------|-------|
| Space heating - main system 1                 | 3007.7372          | 0.2100                        | 631.6248                 | (261) |
| Total CO2 associated with community systems   |                    |                               | 0.0000                   | (373) |
| Water heating (other fuel)                    | 2878.3014          | 0.2100                        | 604.4433                 | (264) |
| Space and water heating                       |                    |                               | 1236.0681                | (265) |
| Pumps, fans and electric keep-hot             | 86.0000            | 0.1387                        | 11.9293                  | (267) |
| Energy for lighting                           | 204.7908           | 0.1443                        | 29.5576                  | (268) |
| Energy saving/generation technologies         |                    |                               |                          |       |
| PV Unit electricity used in dwelling          | -843.8706          | 0.1347                        | -113.6365                |       |
| PV Unit electricity exported                  | -1281.0179         | 0.1259                        | -161.3091                |       |
| Total                                         |                    |                               | -274.9456                | (269) |
| Total CO2, kg/year                            |                    |                               | 1002.6094                | (272) |
| EPC Target Carbon Dioxide Emission Rate (TER) |                    |                               | 11.6600                  | (273) |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |       |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|-------|
| Space heating - main system 1               | 3007.7372          | 1.1300                              | 3398.7431                  | (275) |
| Total CO2 associated with community systems |                    |                                     | 0.0000                     | (473) |
| Water heating (other fuel)                  | 2878.3014          | 1.1300                              | 3252.4806                  | (278) |
| Space and water heating                     |                    |                                     | 6651.2236                  | (279) |
| Pumps, fans and electric keep-hot           | 86.0000            | 1.5128                              | 130.1008                   | (281) |
| Energy for lighting                         | 204.7908           | 1.5338                              | 314.1150                   | (282) |
| Energy saving/generation technologies       |                    |                                     |                            |       |
| PV Unit electricity used in dwelling        | -843.8706          | 1.4977                              | -1263.8554                 |       |
| PV Unit electricity exported                | -1281.0179         | 0.4622                              | -592.1168                  |       |
| Total                                       |                    |                                     | -1855.9722                 | (283) |
| Total Primary energy kWh/year               |                    |                                     | 5239.4672                  | (286) |
| Target Primary Energy Rate (TPER)           |                    |                                     | 60.9400                    | (287) |

# Full SAP Calculation Printout



|                                    |                                                          |               |        |                |            |
|------------------------------------|----------------------------------------------------------|---------------|--------|----------------|------------|
| Plot Reference                     | 4907-R823-9471-006                                       |               |        | Issued on Date | 21/07/2026 |
| Assessment Reference               | Plot 6                                                   | Plot Type Ref | Plot 6 |                |            |
| Plot Address                       | Plot 6, Beaconsfield-Semi, K, WC, B, ES, 1012            |               |        | SAP Version    | 10.2       |
| SAP Rating                         | 90 B                                                     | DER           | 11.17  | TER            | 11.66      |
| Environmental                      | 91 B                                                     | % DER < TER   |        | 4.20           |            |
| CO <sub>2</sub> Emissions (t/year) | 0.85                                                     | DFEE          | 34.92  | TFEE           | 37.57      |
| Compliance Check                   | See BREL                                                 | % DFEE < TFEE |        | 7.06           |            |
| % DPER < TPER                      | 1.47                                                     | DPER          | 60.05  | TPER           | 60.94      |
| Assessor Details                   | Mr. Daniel Harris                                        |               |        | Assessor ID    | R823-0001  |
| Client                             | Crest Nicholson Head Office, Crest Nicholson Head Office |               |        |                |            |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF ENERGY RATING

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)              | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|-----------------------------------|-----------------------------|
| Main dwelling                                          |                           |                                   |                             |
| Ground floor                                           | 42.9900 (1b)              | x 2.4600 (2b)                     | = 105.7554 (1b) - (3b)      |
| First floor                                            | 42.9900 (1c)              | x 2.7600 (2c)                     | = 118.6524 (1c) - (3c)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 85.9800                   |                                   | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 224.4078 (5)                |

## 2. Ventilation rate

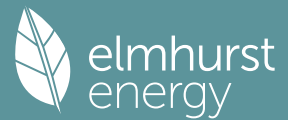
|                                                                                                    | m <sup>3</sup> per hour                 |
|----------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                    |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                    |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                    |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                    |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                    |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                    |
| Number of intermittent extract fans                                                                | 0 * 10 = 0.0000 (7a)                    |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)                    |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 0.0000 / (5) = 0.0000 (8)               |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 4.5000 (17)                             |
| Infiltration rate                                                                                  | 0.2250 (18)                             |
| Number of sides sheltered                                                                          | 1 (19)                                  |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 0.9250 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.2081 (21)        |

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor                                                                                             | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate                                                                                         | 0.2654 | 0.2602 | 0.2550 | 0.2289 | 0.2237 | 0.1977 | 0.1977 | 0.1925 | 0.2081 | 0.2237 | 0.2341 | 0.2445 (22b) |
| Mechanical extract ventilation - decentralised                                                          |        |        |        |        |        |        |        |        |        |        |        |              |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| Effective ac                                                                                            | 0.5154 | 0.5102 | 0.5050 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 (25)  |

## 3. Heat losses and heat loss parameter

| Element                                                     | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K   |
|-------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|-----------------|
| Main dwelling                                               |                         |                            |                           |                               |              |                                |                 |
| Front Door                                                  |                         |                            | 2.5500                    | 1.2000                        | 3.0600       |                                | (26)            |
| Windows                                                     |                         |                            | 10.2500                   | 1.2357                        | 12.6663      |                                | (27)            |
| French Doors                                                |                         |                            | 3.3300                    | 1.2357                        | 4.1150       |                                | (27)            |
| GF SPVL 125TS P/A                                           |                         |                            | 42.9900                   | 0.1300                        | 5.5887       | 75.0000                        | 3224.2500 (28a) |
| EW Brick AAC011                                             | 97.2486                 | 16.1300                    | 81.1186                   | 0.1800                        | 14.6013      | 60.0000                        | 4867.1160 (29a) |
| PR 500mm MW044                                              | 42.9900                 |                            | 42.9900                   | 0.0900                        | 3.8691       | 9.0000                         | 386.9100 (30)   |
| Total net area of external elements Aum(A, m <sup>2</sup> ) |                         |                            | 183.2286                  |                               |              |                                | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                         |                         |                            | (26)...(30) + (32) =      |                               | 43.9005      |                                | (33)            |
| Main dwelling                                               |                         |                            |                           |                               |              |                                |                 |
| E-WM-30                                                     |                         |                            | 43.8000                   | 0.0000                        | 0.0000       | 45.0000                        | 1971.0000 (32)  |
| Timber - GF                                                 |                         |                            | 88.6100                   |                               |              | 9.0000                         | 797.4900 (32c)  |
| Timber - FF                                                 |                         |                            | 126.9000                  |                               |              | 9.0000                         | 1142.1000 (32c) |
| Internal Floor FF                                           |                         |                            | 42.9900                   |                               |              | 18.0000                        | 773.8200 (32d)  |
| Internal Ceiling GF                                         |                         |                            | 42.9900                   |                               |              | 9.0000                         | 386.9100 (32e)  |

# Full SAP Calculation Printout



Heat capacity  $C_m = \text{Sum}(A \times k)$   
Thermal mass parameter (TMP) =  $C_m / \text{TFA}$  in  $\text{kJ/m}^2\text{K}$   
List of Thermal Bridges

(28)...(30) + (32) + (32a)...(32e) = 13549.5960 (34)  
157.5901 (35)

|                                                      | Length  | Psi-value | Total  |
|------------------------------------------------------|---------|-----------|--------|
| K1 Element                                           |         |           |        |
| E2 Other lintels (including other steel lintels)     | 10.7800 | 0.0410    | 0.4420 |
| E3 Sill                                              | 9.2000  | 0.0220    | 0.2024 |
| E4 Jamb                                              | 21.1500 | 0.0190    | 0.4018 |
| E5 Ground floor (normal)                             | 10.2300 | 0.0928    | 0.9493 |
| E6 Intermediate floor within a dwelling              | 18.6300 | 0.0020    | 0.0373 |
| E10 Eaves (insulation at ceiling level)              | 10.2500 | 0.0390    | 0.3997 |
| E18 Party wall between dwellings                     | 10.4400 | 0.0330    | 0.3445 |
| E4 Jamb                                              | 4.8000  | 0.1000    | 0.4800 |
| E2 Other lintels (including other steel lintels)     | 1.0600  | 0.0410    | 0.0435 |
| P1 Party wall - Ground floor                         | 8.3900  | 0.1000    | 0.8390 |
| P2 Party wall - Intermediate floor within a dwelling | 8.3900  | 0.0000    | 0.0000 |
| P4 Party wall - Roof (insulation at ceiling level)   | 8.3900  | 0.0350    | 0.2937 |
| E5 Ground floor (normal)                             | 8.3900  | 0.0980    | 0.8222 |
| E12 Gable (insulation at ceiling level)              | 8.3900  | 0.0870    | 0.7299 |
| E16 Corner (normal)                                  | 10.4400 | 0.0420    | 0.4385 |

Thermal bridges (Sum(L x Psi) calculated using Appendix K)  
Point Thermal bridges (36a) = 0.0000  
Total fabric heat loss (33) + (36) + (36a) = 50.3244 (37)

|                                                                                        |         |         |         |         |         |         |         |         |         |         |         |         |      |
|----------------------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)\text{m} \times (5)$ | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |      |
| (38)m                                                                                  | 38.1647 | 37.7794 | 37.3941 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | (38) |
| Heat transfer coeff                                                                    | 88.4891 | 88.1038 | 87.7184 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | (39) |
| Average = Sum(39)m / 12 =                                                              |         |         |         |         |         |         |         |         |         |         |         | 87.5397 |      |
| HLP                                                                                    | 1.0292  | 1.0247  | 1.0202  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | 1.0160  | (40) |
| HLP (average)                                                                          |         |         |         |         |         |         |         |         |         |         |         | 1.0181  |      |
| Days in mont                                                                           | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31      |      |

## 4. Water heating energy requirements (kWh/year)

|                                                                                |          |          |          |          |          |          |          |          |          |                    |          |           |               |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------------------|----------|-----------|---------------|
| Assumed occupancy                                                              |          |          |          |          |          |          |          |          |          |                    |          |           | 2.5666 (42)   |
| Hot water usage for mixer showers                                              |          |          |          |          |          |          |          |          |          |                    |          |           |               |
| 67.2533                                                                        | 66.2426  | 64.7698  | 61.9519  | 59.8724  | 57.5533  | 56.2352  | 57.6968  | 59.2990  | 61.7890  | 64.6674            | 66.9956  | (42a)     |               |
| Hot water usage for baths                                                      |          |          |          |          |          |          |          |          |          |                    |          |           |               |
| 29.0443                                                                        | 28.6130  | 28.0055  | 26.8856  | 26.0469  | 25.1170  | 24.6147  | 25.2179  | 25.8746  | 26.8697  | 28.0127            | 28.9461  | (42b)     |               |
| Hot water usage for other uses                                                 |          |          |          |          |          |          |          |          |          |                    |          |           |               |
| 40.9146                                                                        | 39.4268  | 37.9390  | 36.4512  | 34.9634  | 33.4756  | 33.4756  | 34.9634  | 36.4512  | 37.9390  | 39.4268            | 40.9146  | (42c)     |               |
| Average daily hot water use (litres/day)                                       |          |          |          |          |          |          |          |          |          |                    |          |           | 126.1290 (43) |
| Daily hot water use                                                            | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct                | Nov      | Dec       |               |
| 137.2122                                                                       | 134.2823 | 130.7143 | 125.2887 | 120.8827 | 116.1459 | 114.3255 | 117.8781 | 121.6248 | 126.5977 | 132.1069           | 136.8563 | (44)      |               |
| Energy content (annual)                                                        | 217.3105 | 191.2162 | 200.9030 | 171.5139 | 162.7313 | 142.8150 | 138.2667 | 145.9577 | 149.9756 | 171.7918           | 188.2105 | 214.2839  | (45)          |
| Distribution loss (46)m = 0.15 x (45)m                                         |          |          |          |          |          |          |          |          |          | Total = Sum(45)m = |          | 2094.9763 |               |
| 32.5966                                                                        | 28.6824  | 30.1355  | 25.7271  | 24.4097  | 21.4222  | 20.7400  | 21.8937  | 22.4963  | 25.7688  | 28.2316            | 32.1426  | (46)      |               |
| Water storage loss (or HIU loss):                                              |          |          |          |          |          |          |          |          |          |                    |          |           |               |
| Total storage loss                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | 0.0000    | (56)          |
| If cylinder contains dedicated solar storage                                   |          |          |          |          |          |          |          |          |          |                    |          |           |               |
| 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | 0.0000    | (57)          |
| Primary loss                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | 0.0000    | (59)          |
| Combi loss                                                                     | 11.9874  | 10.8167  | 11.9530  | 11.5193  | 11.8728  | 11.4590  | 11.8214  | 11.8376  | 11.4740  | 11.8918            | 11.5543  | 11.9811   | (61)          |
| Total heat required for water heating calculated for each month                |          |          |          |          |          |          |          |          |          |                    |          |           |               |
| 229.2979                                                                       | 202.0330 | 212.8560 | 183.0332 | 174.6042 | 154.2740 | 150.0882 | 157.7953 | 161.4496 | 183.6836 | 199.7649           | 226.2650 | (62)      |               |
| WWHRS                                                                          | -29.9438 | -26.4825 | -27.7310 | -22.9624 | -21.4001 | -18.3122 | -17.1648 | -18.2530 | -18.9465 | -22.3359           | -25.3038 | -29.3893  | (63a)         |
| PV diverter                                                                    | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000            | -0.0000  | -0.0000   | (63b)         |
| Solar input                                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | 0.0000    | (63c)         |
| FGHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | 0.0000    | (63d)         |
| Output from w/h                                                                | 199.3541 | 175.5504 | 185.1250 | 160.0708 | 153.2041 | 135.9618 | 132.9234 | 139.5422 | 142.5031 | 161.3478           | 174.4610 | 196.8757  | (64)          |
| Electric shower(s)                                                             |          |          |          |          |          |          |          |          |          |                    |          |           |               |
| 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | 0.0000    | (64a)         |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |          |          |          |          |          |          |                    |          | 0.0000    | (64a)         |
| Heat gains from water heating, kWh/month                                       |          |          |          |          |          |          |          |          |          |                    |          |           |               |
| 75.2526                                                                        | 66.2836  | 69.7885  | 59.9082  | 57.0764  | 50.3507  | 48.9291  | 51.4903  | 52.7354  | 60.0937  | 65.4686            | 74.2447  | (65)      |               |

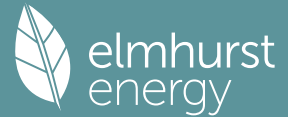
## 5. Internal gains (see Table 5 and 5a)

| Metabolic gains (Table 5), Watts                                                    |           |           |           |           |           |           |           |           |           |           |           |           |      |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------|
|                                                                                     | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec       |      |
| (66)m                                                                               | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     |           |           |           |           |           |           |           |           |           |           |           |           |      |
|                                                                                     | 26.7460   | 23.7556   | 19.3193   | 14.6260   | 10.9331   | 9.2302    | 9.9735    | 12.9640   | 17.4002   | 22.0936   | 25.7865   | 27.4894   | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 |           |           |           |           |           |           |           |           |           |           |           |           |      |
|                                                                                     | 345.4995  | 349.0847  | 340.0501  | 320.8165  | 296.5375  | 273.7188  | 258.4744  | 254.8892  | 263.9238  | 283.1574  | 307.4363  | 330.2551  | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    |           |           |           |           |           |           |           |           |           |           |           |           |      |
|                                                                                     | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | (69) |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 3.0000    | 3.0000    | 3.0000    | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 |           |           |           |           |           |           |           |           |           |           |           |           |      |
|                                                                                     | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | (71) |
| Water heating gains (Table 5)                                                       |           |           |           |           |           |           |           |           |           |           |           |           |      |
|                                                                                     | 101.1460  | 98.6363   | 93.8018   | 83.2058   | 76.7156   | 69.9316   | 65.7649   | 69.2074   | 73.2436   | 80.7712   | 90.9286   | 99.7912   | (72) |
| Total internal gains                                                                |           |           |           |           |           |           |           |           |           |           |           |           |      |
|                                                                                     | 580.6898  | 578.7749  | 560.4695  | 525.9466  | 491.4845  | 457.1788  | 438.5111  | 441.3589  | 458.8659  | 493.3204  | 531.4497  | 564.8340  | (73) |

## 6. Solar gains

| [Jan] | Area<br>m <sup>2</sup> | Solar flux<br>Table 6a<br>W/m <sup>2</sup> | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W   |
|-------|------------------------|--------------------------------------------|-----------------------------------|------------------------------------|------------------------------|--------------|
| North | 4.1200                 | 10.6334                                    | 0.4500                            | 0.0000                             | 0.7700                       | 15.1800 (74) |

# Full SAP Calculation Printout



|       |        |         |        |        |        |              |
|-------|--------|---------|--------|--------|--------|--------------|
| South | 5.6100 | 46.7521 | 0.4500 | 0.0000 | 0.7700 | 90.8797 (78) |
| West  | 0.5200 | 19.6403 | 0.4500 | 0.0000 | 0.7700 | 3.5388 (80)  |
| North | 3.3300 | 10.6334 | 0.4500 | 0.0000 | 0.7700 | 12.2693 (74) |

|             |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Solar gains | 121.8678 | 208.2172 | 290.1305 | 374.0852 | 436.5439 | 442.2258 | 422.5917 | 373.8995 | 318.4831 | 231.1927 | 145.9981 | 104.3216 (83) |
| Total gains | 702.5576 | 786.9920 | 850.6000 | 900.0318 | 928.0284 | 899.4046 | 861.1028 | 815.2584 | 777.3491 | 724.5132 | 677.4478 | 669.1557 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |                           |         |         |              |             |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|--------------|-------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |                           |         |         | 21.0000 (85) |             |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |                           |         |         |              |             |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep                       | Oct     | Nov     | Dec          |             |
| tau                                                                         | 42.5338 | 42.7198 | 42.9075 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876                   | 43.0876 | 43.0876 | 43.0876      |             |
| alpha                                                                       | 3.8356  | 3.8480  | 3.8605  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725                    | 3.8725  | 3.8725  | 3.8725       |             |
| util living area                                                            | 0.9689  | 0.9511  | 0.9184  | 0.8533  | 0.7388  | 0.5802  | 0.4353  | 0.4762  | 0.6838                    | 0.8738  | 0.9510  | 0.9734 (86)  |             |
| MIT                                                                         | 19.3667 | 19.6255 | 19.9920 | 20.4058 | 20.7394 | 20.9235 | 20.9804 | 20.9720 | 20.8537                   | 20.4337 | 19.8280 | 19.3218 (87) |             |
| Th 2                                                                        | 20.0591 | 20.0628 | 20.0665 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701                   | 20.0701 | 20.0701 | 20.0701 (88) |             |
| util rest of house                                                          | 0.9629  | 0.9419  | 0.9030  | 0.8256  | 0.6912  | 0.5087  | 0.3480  | 0.3867  | 0.6160                    | 0.8438  | 0.9402  | 0.9683 (89)  |             |
| MIT 2                                                                       | 18.3840 | 18.6739 | 19.0799 | 19.5253 | 19.8602 | 20.0226 | 20.0619 | 20.0577 | 19.9701                   | 19.5647 | 18.9089 | 18.3415 (90) |             |
| Living area fraction                                                        |         |         |         |         |         |         |         |         | fLA = Living area / (4) = |         |         |              | 0.1933 (91) |
| MIT                                                                         | 18.5740 | 18.8579 | 19.2562 | 19.6955 | 20.0301 | 20.1967 | 20.2395 | 20.2344 | 20.1409                   | 19.7327 | 19.0866 | 18.5310 (92) |             |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |                           |         |         | 0.0000       |             |
| adjusted MIT                                                                | 18.5740 | 18.8579 | 19.2562 | 19.6955 | 20.0301 | 20.1967 | 20.2395 | 20.2344 | 20.1409                   | 19.7327 | 19.0866 | 18.5310 (93) |             |

## 8. Space heating requirement

|                                                                                |           |           |           |          |          |          |          |          |          |               |           |                |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|---------------|-----------|----------------|
|                                                                                | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov       | Dec            |
| Utilisation                                                                    | 0.9503    | 0.9270    | 0.8870    | 0.8129   | 0.6890   | 0.5189   | 0.3642   | 0.4030   | 0.6215   | 0.8312        | 0.9257    | 0.9568 (94)    |
| Useful gains                                                                   | 667.6465  | 729.5267  | 754.4704  | 731.6128 | 639.4299 | 466.6920 | 313.6505 | 328.5616 | 483.1279 | 602.1921      | 627.1172  | 640.2463 (95)  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000       | 7.1000    | 4.2000 (96)    |
| Heat loss rate W                                                               | 1263.0895 | 1229.7413 | 1118.9531 | 943.0032 | 727.6503 | 488.8847 | 317.9143 | 334.9425 | 527.6850 | 797.7572      | 1047.0466 | 1251.8360 (97) |
| Space heating kWh                                                              | 443.0096  | 336.1442  | 271.1752  | 152.2010 | 65.6360  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 145.5005      | 302.3492  | 455.0227 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |          |          |          |          |          |          |               |           | 2171.0385      |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |          |          |          |          |          |          |               |           | 0.0000         |
| Space heating kWh                                                              | 443.0096  | 336.1442  | 271.1752  | 152.2010 | 65.6360  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 145.5005      | 302.3492  | 455.0227 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |          |          |          |          |          |          |               |           | 2171.0385      |
| Space heating per m2                                                           |           |           |           |          |          |          |          |          |          | (98c) / (4) = |           | 25.2505 (99)   |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                                                              |          |          |          |          |          |          |          |          |          |          |          |                 |
|--------------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                        |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (201)    |
| Fraction of space heat from main system(s)                                                                   |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (202)    |
| Efficiency of main space heating system 1 (in %)                                                             |          |          |          |          |          |          |          |          |          |          |          | 91.7000 (206)   |
| Efficiency of main space heating system 2 (in %)                                                             |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)    |
| Efficiency of secondary/supplementary heating system, %                                                      |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)    |
|                                                                                                              | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec             |
| Space heating requirement                                                                                    | 443.0096 | 336.1442 | 271.1752 | 152.2010 | 65.6360  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 145.5005 | 302.3492 | 455.0227 (98)   |
| Space heating efficiency (main heating system 1)                                                             | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 91.7000  | 91.7000  | 91.7000 (210)   |
| Space heating fuel (main heating system)                                                                     | 483.1076 | 366.5695 | 295.7199 | 165.9771 | 71.5769  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 158.6701 | 329.7156 | 496.2080 (211)  |
| Space heating efficiency (main heating system 2)                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)    |
| Space heating fuel (main heating system 2)                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)    |
| Space heating fuel (secondary)                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)    |
| Water heating                                                                                                |          |          |          |          |          |          |          |          |          |          |          |                 |
| Water heating requirement                                                                                    | 199.3541 | 175.5504 | 185.1250 | 160.0708 | 153.2041 | 135.9618 | 132.9234 | 139.5422 | 142.5031 | 161.3478 | 174.4610 | 196.8757 (64)   |
| Efficiency of water heater (217)m                                                                            | 88.1375  | 88.0682  | 87.9359  | 87.7110  | 87.3193  | 86.7000  | 86.7000  | 86.7000  | 86.7000  | 87.6832  | 88.0199  | 86.7000 (216)   |
| Fuel for water heating, kWh/month                                                                            | 226.1855 | 199.3347 | 210.5228 | 182.4980 | 175.4526 | 156.8186 | 153.3142 | 160.9484 | 164.3635 | 184.0121 | 198.2063 | 223.3286 (219)  |
| Space cooling fuel requirement (221)m                                                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)    |
| Pumps and Fa                                                                                                 | 10.9478  | 9.8883   | 10.9478  | 10.5947  | 10.9478  | 10.5947  | 10.9478  | 10.9478  | 10.5947  | 10.9478  | 10.5947  | 10.9478 (231)   |
| Lighting                                                                                                     | 23.4106  | 18.7809  | 16.9101  | 12.3891  | 9.5697   | 7.8185   | 8.7298   | 11.3473  | 14.7390  | 19.3384  | 21.8427  | 24.0613 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity) (233a)m                                        | -14.6942 | -22.4007 | -34.8599 | -42.5373 | -48.8442 | -46.7030 | -46.0948 | -41.9719 | -35.2991 | -26.9662 | -16.7286 | -12.5110 (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)   |
| Electricity generated by PVs (Appendix M) (negative quantity) (233b)m                                        | -4.0882  | -8.9418  | -18.5200 | -29.0022 | -39.5369 | -40.1897 | -39.6495 | -32.9433 | -23.3746 | -13.1010 | -5.5501  | -3.2067 (233b)  |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234b)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235d)   |
| Annual totals kWh/year                                                                                       |          |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating fuel - main system 1                                                                           |          |          |          |          |          |          |          |          |          |          |          | 2367.5447 (211) |
| Space heating fuel - main system 2                                                                           |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)    |
| Space heating fuel - secondary                                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)    |
| Efficiency of water heater                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 86.7000         |
| Water heating fuel used                                                                                      |          |          |          |          |          |          |          |          |          |          |          | 2234.9852 (219) |

# Full SAP Calculation Printout



|                                                                                                                            |                 |
|----------------------------------------------------------------------------------------------------------------------------|-----------------|
| Space cooling fuel                                                                                                         | 0.0000 (221)    |
| Electricity for pumps and fans:<br>(MEVDecentralised, Database: total watage = 5.7980, total flow = 37.0000, SFP = 0.1567) |                 |
| mechanical ventilation fans (SFP = 0.1567)                                                                                 | 42.9017 (230a)  |
| central heating pump                                                                                                       | 41.0000 (230c)  |
| main heating flue fan                                                                                                      | 45.0000 (230e)  |
| Total electricity for the above, kWh/year                                                                                  | 128.9017 (231)  |
| Electricity for lighting (calculated in Appendix L)                                                                        | 188.9373 (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                                              |                 |
| PV generation                                                                                                              | -647.7148 (233) |
| Wind generation                                                                                                            | 0.0000 (234)    |
| Hydro-electric generation (Appendix N)                                                                                     | 0.0000 (235a)   |
| Electricity generated - Micro CHP (Appendix N)                                                                             | 0.0000 (235)    |
| Appendix Q - special features                                                                                              |                 |
| Energy saved or generated                                                                                                  | -0.0000 (236)   |
| Energy used                                                                                                                | 0.0000 (237)    |
| Total delivered energy for all uses                                                                                        | 4272.6541 (238) |

## 10a. Fuel costs - using Table 12 prices

|                                             | Fuel<br>kWh/year | Fuel price<br>p/kWh | Fuel cost<br>£/year |
|---------------------------------------------|------------------|---------------------|---------------------|
| Space heating - main system 1               | 2367.5447        | 3.6400              | 86.1786 (240)       |
| Total CO2 associated with community systems |                  |                     | 0.0000 (473)        |
| Water heating (other fuel)                  | 2234.9852        | 3.6400              | 81.3535 (247)       |
| Energy for instantaneous electric shower(s) | 0.0000           | 16.4900             | 0.0000 (247a)       |
| Pumps, fans and electric keep-hot           | 128.9017         | 16.4900             | 21.2559 (249)       |
| Energy for lighting                         | 188.9373         | 16.4900             | 31.1558 (250)       |
| Additional standing charges                 |                  |                     | 92.0000 (251)       |
| Energy saving/generation technologies       |                  |                     |                     |
| PV Unit electricity used in dwelling        | -389.6109        | 16.4900             | -64.2468            |
| PV Unit electricity exported                | -258.1039        | 5.5900              | -14.4280            |
| Total                                       |                  |                     | -78.6748 (252)      |
| Total energy cost                           |                  |                     | 233.2689 (255)      |

## 11a. SAP rating - Individual heating systems

|                                  |              |
|----------------------------------|--------------|
| Energy cost deflator (Table 12): | 0.3600 (256) |
| Energy cost factor (ECF)         | 0.6411 (257) |
| SAP value                        | 89.6071      |
| SAP rating (Section 12)          | 90 (258)     |
| SAP band                         | B            |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|---------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1               | 2367.5447          | 0.2100                        | 497.1844 (261)           |
| Total CO2 associated with community systems |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                  | 2234.9852          | 0.2100                        | 469.3469 (264)           |
| Space and water heating                     |                    |                               | 966.5313 (265)           |
| Pumps, fans and electric keep-hot           | 128.9017           | 0.1387                        | 17.8803 (267)            |
| Energy for lighting                         | 188.9373           | 0.1443                        | 27.2695 (268)            |
| Energy saving/generation technologies       |                    |                               |                          |
| PV Unit electricity used in dwelling        | -389.6109          | 0.1330                        | -51.8040                 |
| PV Unit electricity exported                | -258.1039          | 0.1248                        | -32.1992                 |
| Total                                       |                    |                               | -84.0033 (269)           |
| Total CO2, kg/year                          |                    |                               | 927.6778 (272)           |
| CO2 emissions per m2                        |                    |                               | 10.7900 (273)            |
| EI value                                    |                    |                               | 90.5093                  |
| EI rating                                   |                    |                               | 91 (274)                 |
| EI band                                     |                    |                               | B                        |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

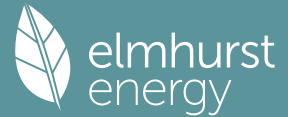
## 1. Overall dwelling characteristics

|                                                        | Area<br>(m2) | Storey height<br>(m)              | Volume<br>(m3)         |
|--------------------------------------------------------|--------------|-----------------------------------|------------------------|
| Main dwelling                                          |              |                                   |                        |
| Ground floor                                           | 42.9900 (1b) | x 2.4600 (2b)                     | = 105.7554 (1b) - (3b) |
| First floor                                            | 42.9900 (1c) | x 2.7600 (2c)                     | = 118.6524 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 85.9800      |                                   | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 224.4078 (5)           |

## 2. Ventilation rate

|                                                    | m3 per hour          |
|----------------------------------------------------|----------------------|
| Number of open chimneys                            | 0 * 80 = 0.0000 (6a) |
| Number of open flues                               | 0 * 20 = 0.0000 (6b) |
| Number of chimneys / flues attached to closed fire | 0 * 10 = 0.0000 (6c) |

# Full SAP Calculation Printout



Number of flues attached to solid fuel boiler 0 \* 20 = 0.0000 (6d)  
Number of flues attached to other heater 0 \* 35 = 0.0000 (6e)  
Number of blocked chimneys 0 \* 20 = 0.0000 (6f)  
Number of intermittent extract fans 0 \* 10 = 0.0000 (7a)  
Number of passive vents 0 \* 10 = 0.0000 (7b)  
Number of flueless gas fires 0 \* 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 0.0000 / (5) = 0.0000 (8)  
Pressure test Yes  
Pressure Test Method Blower Door  
Measured/design AP50 4.5000 (17)  
Infiltration rate 0.2250 (18)  
Number of sides sheltered 1 (19)  
Shelter factor (20) = 1 - [0.075 x (19)] = 0.9250 (20)  
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.2081 (21)

|                                                                                                         |        |        |        |        |        |        |        |        |        |        |        |              |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|                                                                                                         | 4.2000 | 4.0000 | 4.0000 | 3.7000 | 3.7000 | 3.3000 | 3.4000 | 3.2000 | 3.3000 | 3.5000 | 3.5000 | 3.8000       |
| Wind factor                                                                                             | 1.0500 | 1.0000 | 1.0000 | 0.9250 | 0.9250 | 0.8250 | 0.8500 | 0.8000 | 0.8250 | 0.8750 | 0.8750 | 0.9500       |
| Adj infilt rate                                                                                         | 0.2185 | 0.2081 | 0.2081 | 0.1925 | 0.1925 | 0.1717 | 0.1769 | 0.1665 | 0.1717 | 0.1821 | 0.1821 | 0.1977       |
| Mechanical extract ventilation - decentralised                                                          |        |        |        |        |        |        |        |        |        |        |        |              |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 (25)  |

## 3. Heat losses and heat loss parameter

| Element                                        | Gross m2 | Openings m2 | NetArea m2 | U-value W/m2K | A x U W/K | K-value kJ/m2K | A x K kJ/K      |
|------------------------------------------------|----------|-------------|------------|---------------|-----------|----------------|-----------------|
| Main dwelling                                  |          |             |            |               |           |                |                 |
| Front Door                                     |          |             | 2.5500     | 1.2000        | 3.0600    |                | (26)            |
| Windows                                        |          |             | 10.2500    | 1.2357        | 12.6663   |                | (27)            |
| French Doors                                   |          |             | 3.3300     | 1.2357        | 4.1150    |                | (27)            |
| GF SPVL 125TS P/A                              |          |             | 42.9900    | 0.1300        | 5.5887    | 75.0000        | 3224.2500 (28a) |
| EW Brick AAC011                                | 97.2486  | 16.1300     | 81.1186    | 0.1800        | 14.6013   | 60.0000        | 4867.1160 (29a) |
| PR 500mm MW044                                 | 42.9900  |             | 42.9900    | 0.0900        | 3.8691    | 9.0000         | 386.9100 (30)   |
| Total net area of external elements Aum(A, m2) |          |             | 183.2286   |               |           |                | (31)            |
| Fabric heat loss, W/K = Sum (A x U)            |          |             |            |               | 43.9005   |                | (33)            |
| Main dwelling                                  |          |             |            |               |           |                |                 |
| E-WM-30                                        |          |             | 43.8000    | 0.0000        | 0.0000    | 45.0000        | 1971.0000 (32)  |
| Timber - GF                                    |          |             | 88.6100    |               |           | 9.0000         | 797.4900 (32c)  |
| Timber - FF                                    |          |             | 126.9000   |               |           | 9.0000         | 1142.1000 (32c) |
| Internal Floor FF                              |          |             | 42.9900    |               |           | 18.0000        | 773.8200 (32d)  |
| Internal Ceiling GF                            |          |             | 42.9900    |               |           | 9.0000         | 386.9100 (32e)  |

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13549.5960 (34)  
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 157.5901 (35)

List of Thermal Bridges

| K1 Element                                           | Length  | Psi-value | Total  |
|------------------------------------------------------|---------|-----------|--------|
| E2 Other lintels (including other steel lintels)     | 10.7800 | 0.0410    | 0.4420 |
| E3 Sill                                              | 9.2000  | 0.0220    | 0.2024 |
| E4 Jamb                                              | 21.1500 | 0.0190    | 0.4018 |
| E5 Ground floor (normal)                             | 10.2300 | 0.0928    | 0.9493 |
| E6 Intermediate floor within a dwelling              | 18.6300 | 0.0020    | 0.0373 |
| E10 Eaves (insulation at ceiling level)              | 10.2500 | 0.0390    | 0.3997 |
| E18 Party wall between dwellings                     | 10.4400 | 0.0330    | 0.3445 |
| E4 Jamb                                              | 4.8000  | 0.1000    | 0.4800 |
| E2 Other lintels (including other steel lintels)     | 1.0600  | 0.0410    | 0.0435 |
| P1 Party wall - Ground floor                         | 8.3900  | 0.1000    | 0.8390 |
| P2 Party wall - Intermediate floor within a dwelling | 8.3900  | 0.0000    | 0.0000 |
| P4 Party wall - Roof (insulation at ceiling level)   | 8.3900  | 0.0350    | 0.2937 |
| E5 Ground floor (normal)                             | 8.3900  | 0.0980    | 0.8222 |
| E12 Gable (insulation at ceiling level)              | 8.3900  | 0.0870    | 0.7299 |
| E16 Corner (normal)                                  | 10.4400 | 0.0420    | 0.4385 |

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.4238 (36)  
Point Thermal bridges (36a) = 0.0000  
Total fabric heat loss (33) + (36) + (36a) = 50.3244 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

|                           |         |         |         |         |         |         |         |         |         |         |         |         |
|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| (38)m                     | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |
|                           | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 |
| Heat transfer coeff       | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 |
| Average = Sum(39)m / 12 = |         |         |         |         |         |         |         |         |         |         |         | 87.3516 |

|               |        |        |        |        |        |        |        |        |        |        |        |        |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| HLP           | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |
|               | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 1.0160 |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31     |

## 4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5666 (42)

Hot water usage for mixer showers 67.2533 66.2426 64.7698 61.9519 59.8724 57.5533 56.2352 57.6968 59.2990 61.7890 64.6674 66.9956 (42a)

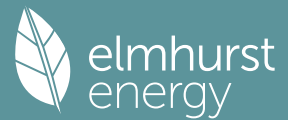
Hot water usage for baths 29.0443 28.6130 28.0055 26.8856 26.0469 25.1170 24.6147 25.2179 25.8746 26.8697 28.0127 28.9461 (42b)

Hot water usage for other uses 40.9146 39.4268 37.9390 36.4512 34.9634 33.4756 33.4756 34.9634 36.4512 37.9390 39.4268 40.9146 (42c)

Average daily hot water use (litres/day) 126.1290 (43)

|                                        |          |          |          |          |          |          |          |          |          |          |          |          |
|----------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| Daily hot water use                    | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |
|                                        | 137.2122 | 134.2823 | 130.7143 | 125.2887 | 120.8827 | 116.1459 | 114.3255 | 117.8781 | 121.6248 | 126.5977 | 132.1069 | 136.8563 |
| Energy conte                           | 217.3105 | 191.2162 | 200.9030 | 171.5139 | 162.7313 | 142.8150 | 138.2667 | 145.9577 | 149.9756 | 171.7918 | 188.2105 | 214.2839 |
| Energy content (annual)                |          |          |          |          |          |          |          |          |          |          |          |          |
| Distribution loss (46)m = 0.15 x (45)m |          |          |          |          |          |          |          |          |          |          |          |          |
|                                        | 32.5966  | 28.6824  | 30.1355  | 25.7271  | 24.4097  | 21.4222  | 20.7400  | 21.8937  | 22.4963  | 25.7688  | 28.2316  | 32.1426  |
| Water storage loss (or HIU loss):      |          |          |          |          |          |          |          |          |          |          |          |          |
| Total storage loss                     |          |          |          |          |          |          |          |          |          |          |          |          |

# Full SAP Calculation Printout



|                                                                                             |          |          |          |          |          |          |          |          |          |          |          |                |
|---------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| If cylinder contains dedicated solar storage                                                | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (56)    |
| Primary loss                                                                                | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (57)    |
| Combi loss                                                                                  | 11.9874  | 10.8167  | 11.9530  | 11.5193  | 11.8728  | 11.4590  | 11.8214  | 11.8376  | 11.4740  | 11.8918  | 11.5543  | 11.9811 (61)   |
| Total heat required for water heating calculated for each month                             |          |          |          |          |          |          |          |          |          |          |          |                |
| WWHRS                                                                                       | 229.2979 | 202.0330 | 212.8560 | 183.0332 | 174.6042 | 154.2740 | 150.0882 | 157.7953 | 161.4496 | 183.6836 | 199.7649 | 226.2650 (62)  |
| PV diverter                                                                                 | -29.9438 | -26.4825 | -27.7310 | -22.9624 | -21.4001 | -18.3122 | -17.1648 | -18.2530 | -18.9465 | -22.3359 | -25.3038 | -29.3893 (63a) |
| Solar input                                                                                 | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000 (63b)  |
| FGHRS                                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63c)   |
| Output from w/h                                                                             | 199.3541 | 175.5504 | 185.1250 | 160.0708 | 153.2041 | 135.9618 | 132.9234 | 139.5422 | 142.5031 | 161.3478 | 174.4610 | 196.8757 (64)  |
| Electric shower(s)                                                                          |          |          |          |          |          |          |          |          |          |          |          |                |
|                                                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (64a)   |
| Heat gains from water heating, kWh/month                                                    | 75.2526  | 66.2836  | 69.7885  | 59.9082  | 57.0764  | 50.3507  | 48.9291  | 51.4903  | 52.7354  | 60.0937  | 65.4686  | 74.2447 (65)   |
| Total per year (kWh/year) = Sum(64)m = 1956.9195 (64)                                       |          |          |          |          |          |          |          |          |          |          |          |                |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a) |          |          |          |          |          |          |          |          |          |          |          |                |

## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |           |           |           |           |           |           |           |           |           |           |           |                |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
| Metabolic gains (Table 5), Watts                                                    | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec            |
| (66)m                                                                               | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 26.7460   | 23.7556   | 19.3193   | 14.6260   | 10.9331   | 9.2302    | 9.9735    | 12.9640   | 17.4002   | 22.0936   | 25.7865   | 27.4894 (67)   |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 345.4995  | 349.0847  | 340.0501  | 320.8165  | 296.5375  | 273.7188  | 258.4744  | 254.8892  | 263.9238  | 283.1574  | 307.4363  | 330.2551 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662 (69)   |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 3.0000    | 3.0000    | 3.0000 (70)    |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 (71) |
| Water heating gains (Table 5)                                                       | 101.1460  | 98.6363   | 93.8018   | 83.2058   | 76.7156   | 69.9316   | 65.7649   | 69.2074   | 73.2436   | 80.7712   | 90.9286   | 99.7912 (72)   |
| Total internal gains                                                                | 580.6898  | 578.7749  | 560.4695  | 525.9466  | 491.4845  | 457.1788  | 438.5111  | 441.3589  | 458.8659  | 493.3204  | 531.4497  | 564.8340 (73)  |

## 6. Solar gains

| [Jan]       |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W   |          |          |               |
|-------------|----------|----------|----------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|--------------|----------|----------|---------------|
| <hr/>       |          |          |          |            |                                |                                   |                                    |                              |              |          |          |               |
| North       |          |          |          | 4.1200     | 11.9814                        | 0.4500                            | 0.0000                             | 0.7700                       | 17.1045 (74) |          |          |               |
| South       |          |          |          | 5.6100     | 50.9848                        | 0.4500                            | 0.0000                             | 0.7700                       | 99.1076 (78) |          |          |               |
| West        |          |          |          | 0.5200     | 22.3313                        | 0.4500                            | 0.0000                             | 0.7700                       | 4.0237 (80)  |          |          |               |
| North       |          |          |          | 3.3300     | 11.9814                        | 0.4500                            | 0.0000                             | 0.7700                       | 13.8247 (74) |          |          |               |
| <hr/>       |          |          |          |            |                                |                                   |                                    |                              |              |          |          |               |
| Solar gains | 134.0605 | 206.4061 | 285.4873 | 382.3913   | 437.4205                       | 475.2993                          | 448.8592                           | 404.2252                     | 340.7223     | 245.0438 | 164.5793 | 113.6339 (83) |
| Total gains | 714.7502 | 785.1810 | 845.9568 | 908.3379   | 928.9050                       | 932.4781                          | 887.3703                           | 845.5841                     | 799.5882     | 738.3643 | 696.0290 | 678.4680 (84) |

## 7. Mean internal temperature (heating season)

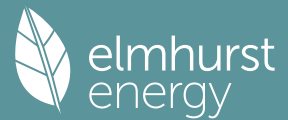
|                                                                             |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| tau                                                                         | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876      |
| alpha                                                                       | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725       |
| util living area                                                            | 0.9614  | 0.9442  | 0.9044  | 0.8199  | 0.6698  | 0.4548  | 0.3030  | 0.3275  | 0.5892  | 0.8347  | 0.9360  | 0.9671 (86)  |
| MIT                                                                         | 19.5571 | 19.7583 | 20.1304 | 20.5375 | 20.8424 | 20.9740 | 20.9961 | 20.9947 | 20.9269 | 20.5789 | 20.0045 | 19.4932 (87) |
| Th 2                                                                        | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 (88) |
| util rest of house                                                          | 0.9539  | 0.9335  | 0.8860  | 0.7858  | 0.6117  | 0.3756  | 0.2132  | 0.2339  | 0.5094  | 0.7956  | 0.9216  | 0.9605 (89)  |
| MIT 2                                                                       | 18.6048 | 18.8270 | 19.2337 | 19.6614 | 19.9545 | 20.0576 | 20.0692 | 20.0688 | 20.0276 | 19.7132 | 19.1034 | 18.5343 (90) |
| Living area fraction                                                        | 18.7889 | 19.0070 | 19.4070 | 19.8308 | 20.1261 | 20.2348 | 20.2483 | 20.2477 | 20.2015 | 19.8805 | 19.2776 | 18.7196 (92) |
| MIT                                                                         | 18.7889 | 19.0070 | 19.4070 | 19.8308 | 20.1261 | 20.2348 | 20.2483 | 20.2477 | 20.2015 | 19.8805 | 19.2776 | 18.7196 (93) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT                                                                | 18.7889 | 19.0070 | 19.4070 | 19.8308 | 20.1261 | 20.2348 | 20.2483 | 20.2477 | 20.2015 | 19.8805 | 19.2776 | 18.7196 (93) |

## 8. Space heating requirement

|                                                                                |           |           |           |          |          |          |          |          |          |          |          |                |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| Utilisation                                                                    | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec            |
| Useful gains                                                                   | 0.9403    | 0.9183    | 0.8704    | 0.7761   | 0.6154   | 0.3900   | 0.2306   | 0.2519   | 0.5212   | 0.7865   | 0.9063   | 0.9478 (94)    |
| Ext temp.                                                                      | 672.0801  | 721.0175  | 736.3113  | 704.9447 | 571.6785 | 363.6273 | 204.5887 | 213.0356 | 416.7486 | 580.7270 | 630.8218 | 643.0463 (95)  |
| Heat loss rate W                                                               | 5.1000    | 5.6000    | 7.4000    | 9.9000   | 13.0000  | 16.0000  | 17.9000  | 17.8000  | 15.2000  | 11.6000  | 8.0000   | 5.1000 (96)    |
| Space heating kWh                                                              | 1195.7455 | 1171.1221 | 1048.8342 | 867.4680 | 622.4803 | 369.9152 | 205.1320 | 213.8147 | 436.8853 | 723.3159 | 985.1178 | 1189.6985 (97) |
| Space heating requirement - total per year (kWh/year)                          | 389.6070  | 302.4703  | 232.5170  | 117.0167 | 37.7965  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 106.0861 | 255.0931 | 406.7093 (98a) |
| Solar heating kWh                                                              |           |           |           |          |          |          |          |          |          |          |          | 1847.2961      |
| Solar heating contribution - total per year (kWh/year)                         | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (98b)   |
| Space heating kWh                                                              | 389.6070  | 302.4703  | 232.5170  | 117.0167 | 37.7965  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 106.0861 | 255.0931 | 406.7093 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |          |          |          |          |          |          |          |          | 1847.2961      |
| Space heating per m2                                                           |           |           |           |          |          |          |          |          |          |          |          | 21.4852 (99)   |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

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|                                                                                                      |          |          |          |          |          |          |          |          |          |          |          |                 |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (201)    |
| Fraction of space heat from main system(s)                                                           |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (202)    |
| Efficiency of main space heating system 1 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 91.7000 (206)   |
| Efficiency of main space heating system 2 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)    |
| Efficiency of secondary/supplementary heating system, %                                              |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)    |
|                                                                                                      | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec             |
| Space heating requirement                                                                            | 389.6070 | 302.4703 | 232.5170 | 117.0167 | 37.7965  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 106.0861 | 255.0931 | 406.7093 (98)   |
| Space heating efficiency (main heating system 1)                                                     | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 91.7000  | 91.7000  | 91.7000 (210)   |
| Space heating fuel (main heating system)                                                             | 424.8713 | 329.8477 | 253.5628 | 127.6082 | 41.2176  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 115.6882 | 278.1823 | 443.5216 (211)  |
| Space heating efficiency (main heating system 2)                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)    |
| Space heating fuel (main heating system 2)                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)    |
| Space heating fuel (secondary)                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)    |
| Water heating                                                                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| Water heating requirement                                                                            | 199.3541 | 175.5504 | 185.1250 | 160.0708 | 153.2041 | 135.9618 | 132.9234 | 139.5422 | 142.5031 | 161.3478 | 174.4610 | 196.8757 (64)   |
| Efficiency of water heater                                                                           | 88.0779  | 88.0171  | 87.8567  | 87.5746  | 87.1076  | 86.7000  | 86.7000  | 86.7000  | 86.7000  | 87.5210  | 87.9349  | 86.7000 (216)   |
| Fuel for water heating, kWh/month                                                                    | 226.3385 | 199.4504 | 210.7124 | 182.7822 | 175.8790 | 156.8186 | 153.3142 | 160.9484 | 164.3635 | 184.3532 | 198.3978 | 88.1039 (217)   |
| Space cooling fuel requirement                                                                       |          |          |          |          |          |          |          |          |          |          |          |                 |
| (221)m                                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)    |
| Pumps and Fa                                                                                         | 10.9478  | 9.8883   | 10.9478  | 10.5947  | 10.9478  | 10.5947  | 10.9478  | 10.9478  | 10.5947  | 10.9478  | 10.5947  | 10.9478 (231)   |
| Lighting                                                                                             | 23.4106  | 18.7809  | 16.9101  | 12.3891  | 9.5697   | 7.8185   | 8.7298   | 11.3473  | 14.7390  | 19.3384  | 21.8427  | 24.0613 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| (233a)m                                                                                              | -16.2309 | -22.5799 | -34.8167 | -43.4616 | -48.9761 | -49.0347 | -48.0402 | -44.4687 | -37.4200 | -28.6331 | -18.8171 | -13.7131 (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |          |          |          |          |          |          |          |          |                 |
| (234a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |          |          |          |          |          |          |          |          |                 |
| (235a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |          |          |          |          |          |          |          |          |                 |
| (235c)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| (233b)m                                                                                              | -4.8241  | -9.0657  | -18.4786 | -30.2089 | -39.7478 | -44.3434 | -43.0957 | -36.9163 | -26.1012 | -14.5792 | -6.7758  | -3.7312 (233b)  |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |          |          |          |          |          |          |          |          |                 |
| (234b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234b)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |          |          |          |          |          |          |          |          |                 |
| (235b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |          |          |          |          |          |          |          |          |                 |
| (235d)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235d)   |
| Annual totals kWh/year                                                                               |          |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating fuel - main system 1                                                                   |          |          |          |          |          |          |          |          |          |          |          | 2014.4996 (211) |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)    |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)    |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          | 86.7000         |
| Water heating fuel used                                                                              |          |          |          |          |          |          |          |          |          |          |          | 2236.8166 (219) |
| Space cooling fuel                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (221)    |
| Electricity for pumps and fans:                                                                      |          |          |          |          |          |          |          |          |          |          |          |                 |
| (MEV)Decentralised, Database: total watage = 5.7980, total flow = 37.0000, SFP = 0.1567)             |          |          |          |          |          |          |          |          |          |          |          |                 |
| mechanical ventilation fans (SFP = 0.1567)                                                           |          |          |          |          |          |          |          |          |          |          |          | 42.9017 (230a)  |
| central heating pump                                                                                 |          |          |          |          |          |          |          |          |          |          |          | 41.0000 (230c)  |
| main heating flue fan                                                                                |          |          |          |          |          |          |          |          |          |          |          | 45.0000 (230e)  |
| Total electricity for the above, kWh/year                                                            |          |          |          |          |          |          |          |          |          |          |          | 128.9017 (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |          |          |          |          |          |          |          |          |          |          |          | 188.9373 (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| PV generation                                                                                        |          |          |          |          |          |          |          |          |          |          |          | -684.0599 (233) |
| Wind generation                                                                                      |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (234)    |
| Hydro-electric generation (Appendix N)                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (235a)   |
| Electricity generated - Micro CHP (Appendix N)                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (235)    |
| Appendix Q - special features                                                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| Energy saved or generated                                                                            |          |          |          |          |          |          |          |          |          |          |          | -0.0000 (236)   |
| Energy used                                                                                          |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (237)    |
| Total delivered energy for all uses                                                                  |          |          |          |          |          |          |          |          |          |          |          | 3885.0953 (238) |

## 10a. Fuel costs - using BEDF prices (596)

|                                             | Fuel kWh/year | Fuel price p/kWh | Fuel cost £/year |
|---------------------------------------------|---------------|------------------|------------------|
| Space heating - main system 1               | 2014.4996     | 7.3200           | 147.4614 (240)   |
| Total CO2 associated with community systems |               |                  | 0.0000 (473)     |
| Water heating (other fuel)                  | 2236.8166     | 7.3200           | 163.7350 (247)   |
| Energy for instantaneous electric shower(s) | 0.0000        | 27.6700          | 0.0000 (247a)    |
| Pumps, fans and electric keep-hot           | 128.9017      | 27.6700          | 35.6671 (249)    |
| Energy for lighting                         | 188.9373      | 27.6700          | 52.2789 (250)    |
| Additional standing charges                 |               |                  | 108.0000 (251)   |
| Energy saving/generation technologies       |               |                  |                  |
| PV Unit electricity used in dwelling        | -406.1918     | 27.6700          | -112.3933        |
| PV Unit electricity exported                | -277.8681     | 5.8100           | -16.1441         |
| Total                                       |               |                  | -128.5374 (252)  |
| Total energy cost                           |               |                  | 378.6050 (255)   |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                             | Energy kWh/year | Emission factor kg CO2/kWh | Emissions kg CO2/year |
|---------------------------------------------|-----------------|----------------------------|-----------------------|
| Space heating - main system 1               | 2014.4996       | 0.2100                     | 423.0449 (261)        |
| Total CO2 associated with community systems |                 |                            | 0.0000 (373)          |
| Water heating (other fuel)                  | 2236.8166       | 0.2100                     | 469.7315 (264)        |
| Space and water heating                     |                 |                            | 892.7764 (265)        |
| Pumps, fans and electric keep-hot           | 128.9017        | 0.1387                     | 17.8803 (267)         |
| Energy for lighting                         | 188.9373        | 0.1443                     | 27.2695 (268)         |
| Energy saving/generation technologies       |                 |                            |                       |
| PV Unit electricity used in dwelling        | -406.1918       | 0.1329                     | -53.9983              |
| PV Unit electricity exported                | -277.8681       | 0.1242                     | -34.5129              |

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Total  
Total CO<sub>2</sub>, kg/year

-88.5111 (269)  
849.4150 (272)

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                                         | Energy kWh/year | Primary energy factor kg CO <sub>2</sub> /kWh | Primary energy kWh/year |
|---------------------------------------------------------|-----------------|-----------------------------------------------|-------------------------|
| Space heating - main system 1                           | 2014.4996       | 1.1300                                        | 2276.3846 (275)         |
| Total CO <sub>2</sub> associated with community systems |                 |                                               | 0.0000 (473)            |
| Water heating (other fuel)                              | 2236.8166       | 1.1300                                        | 2527.6028 (278)         |
| Space and water heating                                 |                 |                                               | 4803.9873 (279)         |
| Pumps, fans and electric keep-hot                       | 128.9017        | 1.5128                                        | 195.0025 (281)          |
| Energy for lighting                                     | 188.9373        | 1.5338                                        | 289.7983 (282)          |
| Energy saving/generation technologies                   |                 |                                               |                         |
| PV Unit electricity used in dwelling                    | -406.1918       | 1.4912                                        | -605.7161               |
| PV Unit electricity exported                            | -277.8681       | 0.4558                                        | -126.6402               |
| Total                                                   |                 |                                               | -732.3563 (283)         |
| Total Primary energy kWh/year                           |                 |                                               | 4556.4318 (286)         |

## SAP 10 EPC IMPROVEMENTS

Plot 6

Current energy efficiency rating: B 90  
Current environmental impact rating: B 91

|                                                         |            |             |                        |
|---------------------------------------------------------|------------|-------------|------------------------|
| N Solar water heating                                   |            |             | SAP increase too small |
| U Solar photovoltaic panels                             |            |             | Already installed      |
| V2 Wind turbine                                         |            |             | Not applicable         |
| Recommended measures:<br>(none)                         | SAP change | Cost change | CO <sub>2</sub> change |
| Measures omitted - SAP change or cost saving too small: |            |             |                        |
| N Solar water heating                                   | + 0.5      | -£ 31       | -140 kg (16.5%)        |

| Recommended measures<br>(none)         | Typical annual savings | Energy efficiency      | Environmental impact |
|----------------------------------------|------------------------|------------------------|----------------------|
| Total Savings                          | £0                     | 0.00 kg/m <sup>2</sup> |                      |
| Potential energy efficiency rating:    |                        | B 90                   |                      |
| Potential environmental impact rating: |                        |                        | B 91                 |

Fuel prices for cost data on this page from database revision number 596 TEST (30 Jun 2026)  
Recommendation texts revision number 6.1 (11 Jun 2019)

## Typical heating and lighting costs of this home (per year, Thames Valley):

|                                              | Current               | Potential             | Saving               |
|----------------------------------------------|-----------------------|-----------------------|----------------------|
| Electricity                                  | £88                   | £88                   | £0                   |
| Mains gas                                    | £419                  | £419                  | £0                   |
| Space heating                                | £291                  | £291                  | £0                   |
| Water heating                                | £164                  | £164                  | £0                   |
| Lighting                                     | £52                   | £52                   | £0                   |
| Generated (PV)                               | -£129                 | -£129                 | £0                   |
| Total cost of fuels                          | £378                  | £378                  | £0                   |
| Total cost of uses                           | £378                  | £378                  | £0                   |
| Delivered energy                             | 45 kWh/m <sup>2</sup> | 45 kWh/m <sup>2</sup> | 0 kWh/m <sup>2</sup> |
| Carbon dioxide emissions                     | 0.8 tonnes            | 0.8 tonnes            | 0.0 tonnes           |
| CO <sub>2</sub> emissions per m <sup>2</sup> | 10 kg/m <sup>2</sup>  | 10 kg/m <sup>2</sup>  | 0 kg/m <sup>2</sup>  |
| Primary energy                               | 53 kWh/m <sup>2</sup> | 53 kWh/m <sup>2</sup> | 0 kWh/m <sup>2</sup> |

## SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022) CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

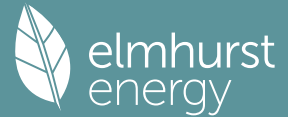
### 1. Overall dwelling characteristics

|                                                        | Area (m <sup>2</sup> ) | Storey height (m)               | Volume (m <sup>3</sup> ) |
|--------------------------------------------------------|------------------------|---------------------------------|--------------------------|
| Main dwelling                                          |                        |                                 |                          |
| Ground floor                                           | 42.9900 (1b)           | x 2.4600 (2b)                   | = 105.7554 (1b) - (3b)   |
| First floor                                            | 42.9900 (1c)           | x 2.7600 (2c)                   | = 118.6524 (1c) - (3c)   |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 85.9800                |                                 | (4)                      |
| Dwelling volume                                        |                        | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 224.4078 (5)           |

### 2. Ventilation rate

|                         | m <sup>3</sup> per hour |
|-------------------------|-------------------------|
| Number of open chimneys | 0 * 80 = 0.0000 (6a)    |
| Number of open flues    | 0 * 20 = 0.0000 (6b)    |

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Number of chimneys / flues attached to closed fire 0 \* 10 = 0.0000 (6c)  
Number of flues attached to solid fuel boiler 0 \* 20 = 0.0000 (6d)  
Number of flues attached to other heater 0 \* 35 = 0.0000 (6e)  
Number of blocked chimneys 0 \* 20 = 0.0000 (6f)  
Number of intermittent extract fans 0 \* 10 = 0.0000 (7a)  
Number of passive vents 0 \* 10 = 0.0000 (7b)  
Number of flueless gas fires 0 \* 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 0.0000 / (5) = 0.0000 (8)  
Pressure test Yes  
Pressure Test Method Blower Door  
Measured/design AP50 4.5000 (17)  
Infiltration rate 0.2250 (18)  
Number of sides sheltered 1 (19)  
Shelter factor (20) = 1 - [0.075 x (19)] = 0.9250 (20)  
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.2081 (21)

|                                                                                                         |        |        |        |        |        |        |        |        |        |        |        |        |              |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |              |
|                                                                                                         | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 | (22)         |
| Wind factor                                                                                             | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 | (22a)        |
| Adj infilt rate                                                                                         |        |        |        |        |        |        |        |        |        |        |        |        |              |
|                                                                                                         | 0.2654 | 0.2602 | 0.2550 | 0.2289 | 0.2237 | 0.1977 | 0.1977 | 0.1925 | 0.2081 | 0.2237 | 0.2341 | 0.2445 | (22b)        |
| Mechanical extract ventilation - decentralised                                                          |        |        |        |        |        |        |        |        |        |        |        |        |              |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| Effective ac                                                                                            | 0.5154 | 0.5102 | 0.5050 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | (25)         |

### 3. Heat losses and heat loss parameter

| Element                                        | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K | A x U<br>W/K | K-value<br>kJ/m2K | A x K<br>kJ/K |       |
|------------------------------------------------|-------------|----------------|---------------|------------------|--------------|-------------------|---------------|-------|
| Main dwelling                                  |             |                |               |                  |              |                   |               |       |
| Front Door                                     |             |                | 2.5500        | 1.2000           | 3.0600       |                   |               | (26)  |
| Windows                                        |             |                | 10.2500       | 1.2357           | 12.6663      |                   |               | (27)  |
| French Doors                                   |             |                | 3.3300        | 1.2357           | 4.1150       |                   |               | (27)  |
| GF SPVL 125TS P/A                              |             |                | 42.9900       | 0.1300           | 5.5887       | 75.0000           | 3224.2500     | (28a) |
| EW Brick AAC011                                | 97.2486     | 16.1300        | 81.1186       | 0.1800           | 14.6013      | 60.0000           | 4867.1160     | (29a) |
| PR 500mm MW044                                 | 42.9900     |                | 42.9900       | 0.0900           | 3.8691       | 9.0000            | 386.9100      | (30)  |
| Total net area of external elements Aum(A, m2) |             |                | 183.2286      |                  |              |                   |               | (31)  |
| Fabric heat loss, W/K = Sum (A x U)            |             |                |               |                  | 43.9005      |                   |               | (33)  |
| Main dwelling                                  |             |                |               |                  |              |                   |               |       |
| E-WM-30                                        |             |                | 43.8000       | 0.0000           | 0.0000       | 45.0000           | 1971.0000     | (32)  |
| Timber - GF                                    |             |                | 88.6100       |                  |              | 9.0000            | 797.4900      | (32c) |
| Timber - FF                                    |             |                | 126.9000      |                  |              | 9.0000            | 1142.1000     | (32c) |
| Internal Floor FF                              |             |                | 42.9900       |                  |              | 18.0000           | 773.8200      | (32d) |
| Internal Ceiling GF                            |             |                | 42.9900       |                  |              | 9.0000            | 386.9100      | (32e) |

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13549.5960 (34)  
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 157.5901 (35)

List of Thermal Bridges

| K1 Element                                           | Length  | Psi-value | Total  |
|------------------------------------------------------|---------|-----------|--------|
| E2 Other lintels (including other steel lintels)     | 10.7800 | 0.0410    | 0.4420 |
| E3 Sill                                              | 9.2000  | 0.0220    | 0.2024 |
| E4 Jamb                                              | 21.1500 | 0.0190    | 0.4018 |
| E5 Ground floor (normal)                             | 10.2300 | 0.0928    | 0.9493 |
| E6 Intermediate floor within a dwelling              | 18.6300 | 0.0020    | 0.0373 |
| E10 Eaves (insulation at ceiling level)              | 10.2500 | 0.0390    | 0.3997 |
| E18 Party wall between dwellings                     | 10.4400 | 0.0330    | 0.3445 |
| E4 Jamb                                              | 4.8000  | 0.1000    | 0.4800 |
| E2 Other lintels (including other steel lintels)     | 1.0600  | 0.0410    | 0.0435 |
| P1 Party wall - Ground floor                         | 8.3900  | 0.1000    | 0.8390 |
| P2 Party wall - Intermediate floor within a dwelling | 8.3900  | 0.0000    | 0.0000 |
| P4 Party wall - Roof (insulation at ceiling level)   | 8.3900  | 0.0350    | 0.2937 |
| E5 Ground floor (normal)                             | 8.3900  | 0.0980    | 0.8222 |
| E12 Gable (insulation at ceiling level)              | 8.3900  | 0.0870    | 0.7299 |
| E16 Corner (normal)                                  | 10.4400 | 0.0420    | 0.4385 |

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.4238 (36)  
Point Thermal bridges (36a) = 0.0000  
Total fabric heat loss (33) + (36) + (36a) = 50.3244 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

|                           |         |         |         |         |         |         |         |         |         |         |         |         |         |
|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| (38)m                     | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |         |
|                           | 38.1647 | 37.7794 | 37.3941 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | 37.0273 | (38)    |
| Heat transfer coeff       | 88.4891 | 88.1038 | 87.7184 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | 87.3516 | (39)    |
| Average = Sum(39)m / 12 = |         |         |         |         |         |         |         |         |         |         |         |         | 87.5397 |

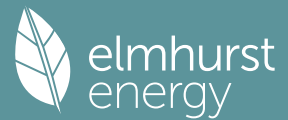
|               |        |        |        |        |        |        |        |        |        |        |        |        |        |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| HLP           | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |        |
|               | 1.0292 | 1.0247 | 1.0202 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | 1.0160 | (40)   |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        |        | 1.0181 |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31     |        |

### 4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5666 (42)  
Hot water usage for mixer showers 67.2533 66.2426 64.7698 61.9519 59.8724 57.5533 56.2352 57.6968 59.2990 61.7890 64.6674 66.9956 (42a)  
Hot water usage for baths 29.0443 28.6130 28.0055 26.8856 26.0469 25.1170 24.6147 25.2179 25.8746 26.8697 28.0127 28.9461 (42b)  
Hot water usage for other uses 40.9146 39.4268 37.9390 36.4512 34.9634 33.4756 33.4756 34.9634 36.4512 37.9390 39.4268 40.9146 (42c)  
Average daily hot water use (litres/day) 126.1290 (43)

|                                        |          |          |          |          |          |          |          |          |          |          |          |          |                              |
|----------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------------------------------|
| Daily hot water use                    | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |                              |
|                                        | 137.2122 | 134.2823 | 130.7143 | 125.2887 | 120.8827 | 116.1459 | 114.3255 | 117.8781 | 121.6248 | 126.5977 | 132.1069 | 136.8563 | (44)                         |
| Energy conte                           | 217.3105 | 191.2162 | 200.9030 | 171.5139 | 162.7313 | 142.8150 | 138.2667 | 145.9577 | 149.9756 | 171.7918 | 188.2105 | 214.2839 | (45)                         |
| Energy content (annual)                |          |          |          |          |          |          |          |          |          |          |          |          | Total = Sum(45)m = 2094.9763 |
| Distribution loss (46)m = 0.15 x (45)m |          |          |          |          |          |          |          |          |          |          |          |          |                              |
|                                        | 32.5966  | 28.6824  | 30.1355  | 25.7271  | 24.4097  | 21.4222  | 20.7400  | 21.8937  | 22.4963  | 25.7688  | 28.2316  | 32.1426  | (46)                         |
| Water storage loss (or HIU loss):      |          |          |          |          |          |          |          |          |          |          |          |          |                              |

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|                                                                                |          |          |          |          |          |          |          |          |          |          |          |              |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------------|
| Total storage loss                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (56)         |
| If cylinder contains dedicated solar storage                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (57)         |
| Primary loss                                                                   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (59)         |
| Combi loss                                                                     | 11.9874  | 10.8167  | 11.9530  | 11.5193  | 11.8728  | 11.4590  | 11.8214  | 11.8376  | 11.4740  | 11.8918  | 11.5543  | (61)         |
| Total heat required for water heating calculated for each month                | 229.2979 | 202.0330 | 212.8560 | 183.0332 | 174.6042 | 154.2740 | 150.0882 | 157.7953 | 161.4496 | 183.6836 | 199.7649 | (62)         |
| WWHRS                                                                          | -29.9438 | -26.4825 | -27.7310 | -22.9624 | -21.4001 | -18.3122 | -17.1648 | -18.2530 | -18.9465 | -22.3359 | -25.3038 | (63a)        |
| PV diverter                                                                    | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | (63b)        |
| Solar input                                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (63c)        |
| FGHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (63d)        |
| Output from w/h                                                                | 199.3541 | 175.5504 | 185.1250 | 160.0708 | 153.2041 | 135.9618 | 132.9234 | 139.5422 | 142.5031 | 161.3478 | 174.4610 | (64)         |
| Electric shower(s)                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (64a)        |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (64a) |
| Heat gains from water heating, kWh/month                                       | 75.2526  | 66.2836  | 69.7885  | 59.9082  | 57.0764  | 50.3507  | 48.9291  | 51.4903  | 52.7354  | 60.0937  | 65.4686  | (65)         |

## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |           |           |           |           |           |           |           |           |           |           |           |           |      |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------|
| Metabolic gains (Table 5), Watts                                                    | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec       |      |
| (66)m                                                                               | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | 153.9962  | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 26.7460   | 23.7556   | 19.3193   | 14.6260   | 10.9331   | 9.2302    | 9.9735    | 12.9640   | 17.4002   | 22.0936   | 25.7865   | 27.4894   | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 345.4995  | 349.0847  | 340.0501  | 320.8165  | 296.5375  | 273.7188  | 258.4744  | 254.8892  | 263.9238  | 283.1574  | 307.4363  | 330.2551  | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | 52.9662   | (69) |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | -102.6642 | (71) |
| Water heating gains (Table 5)                                                       | 101.1460  | 98.6363   | 93.8018   | 83.2058   | 76.7156   | 69.9316   | 65.7649   | 69.2074   | 73.2436   | 80.7712   | 90.9286   | 99.7912   | (72) |
| Total internal gains                                                                | 580.6898  | 578.7749  | 560.4695  | 525.9466  | 491.4845  | 457.1788  | 438.5111  | 441.3589  | 458.8659  | 493.3204  | 531.4497  | 564.8340  | (73) |

## 6. Solar gains

| [Jan]       |          |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d |          | Gains<br>W   |               |
|-------------|----------|----------|----------|----------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|----------|--------------|---------------|
| North       |          |          |          |          | 4.1200     | 10.6334                        | 0.4500                            | 0.0000                             | 0.7700                       |          | 15.1800 (74) |               |
| South       |          |          |          |          | 5.6100     | 46.7521                        | 0.4500                            | 0.0000                             | 0.7700                       |          | 90.8797 (78) |               |
| West        |          |          |          |          | 0.5200     | 19.6403                        | 0.4500                            | 0.0000                             | 0.7700                       |          | 3.5388 (80)  |               |
| North       |          |          |          |          | 3.3300     | 10.6334                        | 0.4500                            | 0.0000                             | 0.7700                       |          | 12.2693 (74) |               |
|             |          |          |          |          |            |                                |                                   |                                    |                              |          |              |               |
| Solar gains | 121.8678 | 208.2172 | 290.1305 | 374.0852 | 436.5439   | 442.2258                       | 422.5917                          | 373.8995                           | 318.4831                     | 231.1927 | 145.9981     | 104.3216 (83) |
| Total gains | 702.5576 | 786.9920 | 850.6000 | 900.0318 | 928.0284   | 899.4046                       | 861.1028                          | 815.2584                           | 777.3491                     | 724.5132 | 677.4478     | 669.1557 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |              |
| tau                                                                         | 42.5338 | 42.7198 | 42.9075 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 |              |
| alpha                                                                       | 3.8356  | 3.8480  | 3.8605  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  |              |
| util living area                                                            | 0.9689  | 0.9511  | 0.9184  | 0.8533  | 0.7388  | 0.5802  | 0.4353  | 0.4762  | 0.6838  | 0.8738  | 0.9510  | 0.9734  | (86)         |
| MIT                                                                         | 19.3667 | 19.6255 | 19.9920 | 20.4058 | 20.7394 | 20.9235 | 20.9804 | 20.9720 | 20.8537 | 20.4337 | 19.8280 | 19.3218 | (87)         |
| Th 2                                                                        | 20.0591 | 20.0628 | 20.0665 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | (88)         |
| util rest of house                                                          | 0.9629  | 0.9419  | 0.9030  | 0.8256  | 0.6912  | 0.5087  | 0.3480  | 0.3867  | 0.6160  | 0.8438  | 0.9402  | 0.9683  | (89)         |
| MIT 2                                                                       | 18.3840 | 18.6739 | 19.0799 | 19.5253 | 19.8602 | 20.0226 | 20.0619 | 20.0577 | 19.9701 | 19.5647 | 18.9089 | 18.3415 | (90)         |
| Living area fraction                                                        | 18.5740 | 18.8579 | 19.2562 | 19.6955 | 20.0301 | 20.1967 | 20.2395 | 20.2344 | 20.1409 | 19.7327 | 19.0866 | 18.5310 | (91)         |
| MIT                                                                         | 18.5740 | 18.8579 | 19.2562 | 19.6955 | 20.0301 | 20.1967 | 20.2395 | 20.2344 | 20.1409 | 19.7327 | 19.0866 | 18.5310 | (92)         |
| Temperature adjustment                                                      | 18.5740 | 18.8579 | 19.2562 | 19.6955 | 20.0301 | 20.1967 | 20.2395 | 20.2344 | 20.1409 | 19.7327 | 19.0866 | 18.5310 | (93)         |

## 8. Space heating requirement

|                                                                                |           |           |           |          |          |          |          |          |          |          |           |           |       |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|-----------|-----------|-------|
| Utilisation                                                                    | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov       | Dec       |       |
| Useful gains                                                                   | 667.6465  | 729.5267  | 754.4704  | 731.6128 | 639.4299 | 466.6920 | 313.6505 | 328.5616 | 483.1279 | 602.1921 | 627.1172  | 640.2463  | (94)  |
| Ext temp.                                                                      | 4.3000    | 4.9000    | 6.5000    | 8.9000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000  | 7.1000    | 4.2000    | (95)  |
| Heat loss rate W                                                               | 1263.0895 | 1229.7413 | 1118.9531 | 943.0032 | 727.6503 | 488.8847 | 317.9143 | 334.9425 | 527.6850 | 797.7572 | 1047.0466 | 1251.8360 | (97)  |
| Space heating kWh                                                              | 443.0096  | 336.1442  | 271.1752  | 152.2010 | 65.6360  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 145.5005 | 302.3492  | 455.0227  | (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |          |          |          |          |          |          |          |           | 2171.0385 |       |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | (98b) |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |          |          |          |          |          |          |          |           | 0.0000    |       |
| Space heating kWh                                                              | 443.0096  | 336.1442  | 271.1752  | 152.2010 | 65.6360  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 145.5005 | 302.3492  | 455.0227  | (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |          |          |          |          |          |          |          |           | 2171.0385 |       |
| Space heating per m <sup>2</sup>                                               |           |           |           |          |          |          |          |          |          |          |           | 25.2505   | (99)  |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

# Full SAP Calculation Printout



|                                                                                                      |          |          |          |          |          |          |          |          |          |          |          |                 |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (201)    |
| Fraction of space heat from main system(s)                                                           |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (202)    |
| Efficiency of main space heating system 1 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 91.7000 (206)   |
| Efficiency of main space heating system 2 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)    |
| Efficiency of secondary/supplementary heating system, %                                              |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)    |
|                                                                                                      | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec             |
| Space heating requirement                                                                            | 443.0096 | 336.1442 | 271.1752 | 152.2010 | 65.6360  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 145.5005 | 302.3492 | 455.0227 (98)   |
| Space heating efficiency (main heating system 1)                                                     | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 91.7000  | 91.7000  | 91.7000 (210)   |
| Space heating fuel (main heating system)                                                             | 483.1076 | 366.5695 | 295.7199 | 165.9771 | 71.5769  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 158.6701 | 329.7156 | 496.2080 (211)  |
| Space heating efficiency (main heating system 2)                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)    |
| Space heating fuel (main heating system 2)                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)    |
| Space heating fuel (secondary)                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)    |
| Water heating                                                                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| Water heating requirement                                                                            | 199.3541 | 175.5504 | 185.1250 | 160.0708 | 153.2041 | 135.9618 | 132.9234 | 139.5422 | 142.5031 | 161.3478 | 174.4610 | 196.8757 (64)   |
| Efficiency of water heater                                                                           | 88.1375  | 88.0682  | 87.9359  | 87.7110  | 87.3193  | 86.7000  | 86.7000  | 86.7000  | 86.7000  | 87.6832  | 88.0199  | 88.1551 (217)   |
| Fuel for water heating, kWh/month                                                                    | 226.1855 | 199.3347 | 210.5228 | 182.4980 | 175.4526 | 156.8186 | 153.3142 | 160.9484 | 164.3635 | 184.0121 | 198.2063 | 223.3286 (219)  |
| Space cooling fuel requirement                                                                       |          |          |          |          |          |          |          |          |          |          |          |                 |
| (221)m                                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)    |
| Pumps and Fa                                                                                         | 10.9478  | 9.8883   | 10.9478  | 10.5947  | 10.9478  | 10.5947  | 10.9478  | 10.9478  | 10.5947  | 10.9478  | 10.5947  | 10.9478 (231)   |
| Lighting                                                                                             | 23.4106  | 18.7809  | 16.9101  | 12.3891  | 9.5697   | 7.8185   | 8.7298   | 11.3473  | 14.7390  | 19.3384  | 21.8427  | 24.0613 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| (233a)m                                                                                              | -14.6942 | -22.4007 | -34.8599 | -42.5373 | -48.8442 | -46.7030 | -46.0948 | -41.9719 | -35.2991 | -26.9662 | -16.7286 | -12.5110 (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |          |          |          |          |          |          |          |          |                 |
| (234a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |          |          |          |          |          |          |          |          |                 |
| (235a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |          |          |          |          |          |          |          |          |                 |
| (235c)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| (233b)m                                                                                              | -4.0882  | -8.9418  | -18.5200 | -29.0022 | -39.5369 | -40.1897 | -39.6495 | -32.9433 | -23.3746 | -13.1010 | -5.5501  | -3.2067 (233b)  |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |          |          |          |          |          |          |          |          |                 |
| (234b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234b)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |          |          |          |          |          |          |          |          |                 |
| (235b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |          |          |          |          |          |          |          |          |                 |
| (235d)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235d)   |
| Annual totals kWh/year                                                                               |          |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating fuel - main system 1                                                                   |          |          |          |          |          |          |          |          |          |          |          | 2367.5447 (211) |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)    |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)    |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          | 86.7000         |
| Water heating fuel used                                                                              |          |          |          |          |          |          |          |          |          |          |          | 2234.9852 (219) |
| Space cooling fuel                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (221)    |
| Electricity for pumps and fans:                                                                      |          |          |          |          |          |          |          |          |          |          |          |                 |
| (MEV)Decentralised, Database: total watage = 5.7980, total flow = 37.0000, SFP = 0.1567)             |          |          |          |          |          |          |          |          |          |          |          |                 |
| mechanical ventilation fans (SFP = 0.1567)                                                           |          |          |          |          |          |          |          |          |          |          |          | 42.9017 (230a)  |
| central heating pump                                                                                 |          |          |          |          |          |          |          |          |          |          |          | 41.0000 (230c)  |
| main heating flue fan                                                                                |          |          |          |          |          |          |          |          |          |          |          | 45.0000 (230e)  |
| Total electricity for the above, kWh/year                                                            |          |          |          |          |          |          |          |          |          |          |          | 128.9017 (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |          |          |          |          |          |          |          |          |          |          |          | 188.9373 (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| PV generation                                                                                        |          |          |          |          |          |          |          |          |          |          |          | -647.7148 (233) |
| Wind generation                                                                                      |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (234)    |
| Hydro-electric generation (Appendix N)                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (235a)   |
| Electricity generated - Micro CHP (Appendix N)                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (235)    |
| Appendix Q - special features                                                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| Energy saved or generated                                                                            |          |          |          |          |          |          |          |          |          |          |          | -0.0000 (236)   |
| Energy used                                                                                          |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (237)    |
| Total delivered energy for all uses                                                                  |          |          |          |          |          |          |          |          |          |          |          | 4272.6541 (238) |

## 10a. Fuel costs - using Table 12 prices

|                                             | Fuel<br>kWh/year | Fuel price<br>p/kWh | Fuel cost<br>£/year |  |
|---------------------------------------------|------------------|---------------------|---------------------|--|
| Space heating - main system 1               | 2367.5447        | 3.6400              | 86.1786 (240)       |  |
| Total CO2 associated with community systems |                  |                     | 0.0000 (473)        |  |
| Water heating (other fuel)                  | 2234.9852        | 3.6400              | 81.3535 (247)       |  |
| Energy for instantaneous electric shower(s) | 0.0000           | 16.4900             | 0.0000 (247a)       |  |
| Pumps, fans and electric keep-hot           | 128.9017         | 16.4900             | 21.2559 (249)       |  |
| Energy for lighting                         | 188.9373         | 16.4900             | 31.1558 (250)       |  |
| Additional standing charges                 |                  |                     | 92.0000 (251)       |  |
| Energy saving/generation technologies       |                  |                     |                     |  |
| PV Unit electricity used in dwelling        | -389.6109        | 16.4900             | -64.2468            |  |
| PV Unit electricity exported                | -258.1039        | 5.5900              | -14.4280            |  |
| Total                                       |                  |                     | -78.6748 (252)      |  |
| Total energy cost                           |                  |                     | 233.2689 (255)      |  |

## 11a. SAP rating - Individual heating systems

|                                  |                                         |              |
|----------------------------------|-----------------------------------------|--------------|
| Energy cost deflator (Table 12): |                                         | 0.3600 (256) |
| Energy cost factor (ECF)         |                                         | 0.6411 (257) |
| SAP value                        | $[(255) \times (256)] / [(4) + 45.0] =$ | 89.6071      |
| SAP rating (Section 12)          |                                         | 90 (258)     |
| SAP band                         |                                         | B            |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

# Full SAP Calculation Printout



|                                             | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|---------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1               | 2367.5447          | 0.2100                        | 497.1844 (261)           |
| Total CO2 associated with community systems |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                  | 2234.9852          | 0.2100                        | 469.3469 (264)           |
| Space and water heating                     |                    |                               | 966.5313 (265)           |
| Pumps, fans and electric keep-hot           | 128.9017           | 0.1387                        | 17.8803 (267)            |
| Energy for lighting                         | 188.9373           | 0.1443                        | 27.2695 (268)            |
| Energy saving/generation technologies       |                    |                               |                          |
| PV Unit electricity used in dwelling        | -389.6109          | 0.1330                        | -51.8040                 |
| PV Unit electricity exported                | -258.1039          | 0.1248                        | -32.1992                 |
| Total                                       |                    |                               | -84.0033 (269)           |
| Total CO2, kg/year                          |                    |                               | 927.6778 (272)           |
| CO2 emissions per m2                        |                    |                               | 10.7900 (273)            |
| EI value                                    |                    |                               | 90.5093                  |
| EI rating                                   |                    |                               | 91 (274)                 |
| EI band                                     |                    |                               | B                        |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)  
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m2) | Storey height<br>(m)            | Volume<br>(m3)         |
|--------------------------------------------------------|--------------|---------------------------------|------------------------|
| Main dwelling                                          |              |                                 |                        |
| Ground floor                                           | 42.9900 (1b) | x 2.4600 (2b)                   | = 105.7554 (1b) - (3b) |
| First floor                                            | 42.9900 (1c) | x 2.7600 (2c)                   | = 118.6524 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 85.9800      |                                 | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 224.4078 (5)         |

## 2. Ventilation rate

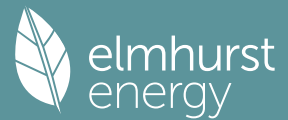
|                                                                                                    | m3 per hour                             |
|----------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                    |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                    |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                    |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                    |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                    |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                    |
| Number of intermittent extract fans                                                                | 0 * 10 = 0.0000 (7a)                    |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)                    |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 0.0000 / (5) = 0.0000 (8)               |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 4.5000 (17)                             |
| Infiltration rate                                                                                  | 0.2250 (18)                             |
| Number of sides sheltered                                                                          | 1 (19)                                  |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = 0.9250 (20) |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) = 0.2081 (21)        |

|                                                                                                         | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | 4.2000 | 4.0000 | 4.0000 | 3.7000 | 3.7000 | 3.3000 | 3.4000 | 3.2000 | 3.3000 | 3.5000 | 3.5000 | 3.8000 (22)  |
| Wind factor                                                                                             | 1.0500 | 1.0000 | 1.0000 | 0.9250 | 0.9250 | 0.8250 | 0.8500 | 0.8000 | 0.8250 | 0.8750 | 0.8750 | 0.9500 (22a) |
| Adj infilt rate                                                                                         | 0.2185 | 0.2081 | 0.2081 | 0.1925 | 0.1925 | 0.1717 | 0.1769 | 0.1665 | 0.1717 | 0.1821 | 0.1821 | 0.1977 (22b) |
| Mechanical extract ventilation - decentralised                                                          |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        |              |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 (25)  |

## 3. Heat losses and heat loss parameter

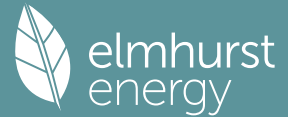
| Element                                           | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2        | U-value<br>W/m2K | A x U<br>W/K                         | K-value<br>kJ/m2K | A x K<br>kJ/K   |
|---------------------------------------------------|-------------|----------------|----------------------|------------------|--------------------------------------|-------------------|-----------------|
| Main dwelling                                     |             |                |                      |                  |                                      |                   |                 |
| Front Door                                        |             |                | 2.5500               | 1.2000           | 3.0600                               |                   | (26)            |
| Windows                                           |             |                | 10.2500              | 1.2357           | 12.6663                              |                   | (27)            |
| French Doors                                      |             |                | 3.3300               | 1.2357           | 4.1150                               |                   | (27)            |
| GF SPVL 125TS P/A                                 |             |                | 42.9900              | 0.1300           | 5.5887                               | 75.0000           | 3224.2500 (28a) |
| EW Brick AAC011                                   | 97.2486     | 16.1300        | 81.1186              | 0.1800           | 14.6013                              | 60.0000           | 4867.1160 (29a) |
| PR 500mm MW044                                    | 42.9900     |                | 42.9900              | 0.0900           | 3.8691                               | 9.0000            | 386.9100 (30)   |
| Total net area of external elements Aum(A, m2)    |             |                | 183.2286             |                  |                                      |                   | (31)            |
| Fabric heat loss, W/K = Sum (A x U)               |             |                | (26)...(30) + (32) = | 43.9005          |                                      |                   | (33)            |
| Main dwelling                                     |             |                |                      |                  |                                      |                   |                 |
| E-WM-30                                           |             |                | 43.8000              | 0.0000           | 0.0000                               | 45.0000           | 1971.0000 (32)  |
| Timber - GF                                       |             |                | 88.6100              |                  |                                      | 9.0000            | 797.4900 (32c)  |
| Timber - FF                                       |             |                | 126.9000             |                  |                                      | 9.0000            | 1142.1000 (32c) |
| Internal Floor FF                                 |             |                | 42.9900              |                  |                                      | 18.0000           | 773.8200 (32d)  |
| Internal Ceiling GF                               |             |                | 42.9900              |                  |                                      | 9.0000            | 386.9100 (32e)  |
| Heat capacity Cm = Sum(A x k)                     |             |                |                      |                  | (28)...(30) + (32) + (32a)...(32e) = |                   | 13549.5960 (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K |             |                |                      |                  |                                      |                   | 157.5901 (35)   |
| List of Thermal Bridges                           |             |                |                      |                  |                                      |                   |                 |
| K1 Element                                        |             |                |                      | Length           | Psi-value                            | Total             |                 |
| E2 Other lintels (including other steel lintels)  |             |                |                      | 10.7800          | 0.0410                               | 0.4420            |                 |

# Full SAP Calculation Printout



|                                                                                     |           |           |           |            |               |               |           |              |           |                       |           |                                                                                             |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|------------|---------------|---------------|-----------|--------------|-----------|-----------------------|-----------|---------------------------------------------------------------------------------------------|
| E3 Sill                                                                             |           |           |           |            |               |               |           |              | 9.2000    | 0.0220                | 0.2024    |                                                                                             |
| E4 Jamb                                                                             |           |           |           |            |               |               |           |              | 21.1500   | 0.0190                | 0.4018    |                                                                                             |
| E5 Ground floor (normal)                                                            |           |           |           |            |               |               |           |              | 10.2300   | 0.0928                | 0.9493    |                                                                                             |
| E6 Intermediate floor within a dwelling                                             |           |           |           |            |               |               |           |              | 18.6300   | 0.0020                | 0.0373    |                                                                                             |
| E10 Eaves (insulation at ceiling level)                                             |           |           |           |            |               |               |           |              | 10.2500   | 0.0390                | 0.3997    |                                                                                             |
| E18 Party wall between dwellings                                                    |           |           |           |            |               |               |           |              | 10.4400   | 0.0330                | 0.3445    |                                                                                             |
| E4 Jamb                                                                             |           |           |           |            |               |               |           |              | 4.8000    | 0.1000                | 0.4800    |                                                                                             |
| E2 Other lintels (including other steel lintels)                                    |           |           |           |            |               |               |           |              | 1.0600    | 0.0410                | 0.0435    |                                                                                             |
| P1 Party wall - Ground floor                                                        |           |           |           |            |               |               |           |              | 8.3900    | 0.1000                | 0.8390    |                                                                                             |
| P2 Party wall - Intermediate floor within a dwelling                                |           |           |           |            |               |               |           |              | 8.3900    | 0.0000                | 0.0000    |                                                                                             |
| P4 Party wall - Roof (insulation at ceiling level)                                  |           |           |           |            |               |               |           |              | 8.3900    | 0.0350                | 0.2937    |                                                                                             |
| E5 Ground floor (normal)                                                            |           |           |           |            |               |               |           |              | 8.3900    | 0.0980                | 0.8222    |                                                                                             |
| E12 Gable (insulation at ceiling level)                                             |           |           |           |            |               |               |           |              | 8.3900    | 0.0870                | 0.7299    |                                                                                             |
| E16 Corner (normal)                                                                 |           |           |           |            |               |               |           |              | 10.4400   | 0.0420                | 0.4385    |                                                                                             |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)                          |           |           |           |            |               |               |           |              |           |                       |           | 6.4238 (36)                                                                                 |
| Point Thermal bridges                                                               |           |           |           |            |               |               |           |              |           |                       | (36a) =   | 0.0000                                                                                      |
| Total fabric heat loss                                                              |           |           |           |            |               |               |           |              |           | (33) + (36) + (36a) = |           | 50.3244 (37)                                                                                |
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)                 |           |           |           |            |               |               |           |              |           |                       |           |                                                                                             |
| (38)m                                                                               | Jan       | Feb       | Mar       | Apr        | May           | Jun           | Jul       | Aug          | Sep       | Oct                   | Nov       | Dec                                                                                         |
| Heat transfer coeff                                                                 | 37.0273   | 37.0273   | 37.0273   | 37.0273    | 37.0273       | 37.0273       | 37.0273   | 37.0273      | 37.0273   | 37.0273               | 37.0273   | 37.0273 (38)                                                                                |
| Average = Sum(39)m / 12 =                                                           | 87.3516   | 87.3516   | 87.3516   | 87.3516    | 87.3516       | 87.3516       | 87.3516   | 87.3516      | 87.3516   | 87.3516               | 87.3516   | 87.3516 (39)                                                                                |
| HLP                                                                                 | Jan       | Feb       | Mar       | Apr        | May           | Jun           | Jul       | Aug          | Sep       | Oct                   | Nov       | Dec                                                                                         |
| HLP (average)                                                                       | 1.0160    | 1.0160    | 1.0160    | 1.0160     | 1.0160        | 1.0160        | 1.0160    | 1.0160       | 1.0160    | 1.0160                | 1.0160    | 1.0160 (40)                                                                                 |
| Days in mont                                                                        | 31        | 28        | 31        | 30         | 31            | 30            | 31        | 31           | 30        | 31                    | 30        | 31                                                                                          |
| -----                                                                               |           |           |           |            |               |               |           |              |           |                       |           |                                                                                             |
| 4. Water heating energy requirements (kWh/year)                                     |           |           |           |            |               |               |           |              |           |                       |           |                                                                                             |
| -----                                                                               |           |           |           |            |               |               |           |              |           |                       |           |                                                                                             |
| Assumed occupancy                                                                   |           |           |           |            |               |               |           |              |           |                       |           | 2.5666 (42)                                                                                 |
| Hot water usage for mixer showers                                                   |           |           |           |            |               |               |           |              |           |                       |           |                                                                                             |
| Hot water usage for baths                                                           | 67.2533   | 66.2426   | 64.7698   | 61.9519    | 59.8724       | 57.5533       | 56.2352   | 57.6968      | 59.2990   | 61.7890               | 64.6674   | 66.9956 (42a)                                                                               |
| Hot water usage for other uses                                                      | 29.0443   | 28.6130   | 28.0055   | 26.8856    | 26.0469       | 25.1170       | 24.6147   | 25.2179      | 25.8746   | 26.8697               | 28.0127   | 28.9461 (42b)                                                                               |
| Average daily hot water use (litres/day)                                            | 40.9146   | 39.4268   | 37.9390   | 36.4512    | 34.9634       | 33.4756       | 33.4756   | 34.9634      | 36.4512   | 37.9390               | 39.4268   | 40.9146 (42c)                                                                               |
|                                                                                     |           |           |           |            |               |               |           |              |           |                       |           | 126.1290 (43)                                                                               |
| Daily hot water use                                                                 | Jan       | Feb       | Mar       | Apr        | May           | Jun           | Jul       | Aug          | Sep       | Oct                   | Nov       | Dec                                                                                         |
| Energy conte                                                                        | 137.2122  | 134.2823  | 130.7143  | 125.2887   | 120.8827      | 116.1459      | 114.3255  | 117.8781     | 121.6248  | 126.5977              | 132.1069  | 136.8563 (44)                                                                               |
| Energy content (annual)                                                             | 217.3105  | 191.2162  | 200.9030  | 171.5139   | 162.7313      | 142.8150      | 138.2667  | 145.9577     | 149.9756  | 171.7918              | 188.2105  | 214.2839 (45)                                                                               |
| Distribution loss (46)m = 0.15 x (45)m                                              |           |           |           |            |               |               |           |              |           |                       |           | Total = Sum(45)m = 2094.9763                                                                |
| Water storage loss (or HIU loss):                                                   | 32.5966   | 28.6824   | 30.1355   | 25.7271    | 24.4097       | 21.4222       | 20.7400   | 21.8937      | 22.4963   | 25.7688               | 28.2316   | 32.1426 (46)                                                                                |
| Total storage loss                                                                  | 0.0000    | 0.0000    | 0.0000    | 0.0000     | 0.0000        | 0.0000        | 0.0000    | 0.0000       | 0.0000    | 0.0000                | 0.0000    | 0.0000 (56)                                                                                 |
| If cylinder contains dedicated solar storage                                        | 0.0000    | 0.0000    | 0.0000    | 0.0000     | 0.0000        | 0.0000        | 0.0000    | 0.0000       | 0.0000    | 0.0000                | 0.0000    | 0.0000 (57)                                                                                 |
| Primary loss                                                                        | 0.0000    | 0.0000    | 0.0000    | 0.0000     | 0.0000        | 0.0000        | 0.0000    | 0.0000       | 0.0000    | 0.0000                | 0.0000    | 0.0000 (59)                                                                                 |
| Combi loss                                                                          | 11.9874   | 10.8167   | 11.9530   | 11.5193    | 11.8728       | 11.4590       | 11.8214   | 11.8376      | 11.4740   | 11.8918               | 11.5543   | 11.9811 (61)                                                                                |
| Total heat required for water heating calculated for each month                     | 229.2979  | 202.0330  | 212.8560  | 183.0332   | 174.6042      | 154.2740      | 150.0882  | 157.7953     | 161.4496  | 183.6836              | 199.7649  | 226.2650 (62)                                                                               |
| WWHRS                                                                               | -29.9438  | -26.4825  | -27.7310  | -22.9624   | -21.4001      | -18.3122      | -17.1648  | -18.2530     | -18.9465  | -22.3359              | -25.3038  | -29.3893 (63a)                                                                              |
| FV diverter                                                                         | -0.0000   | -0.0000   | -0.0000   | -0.0000    | -0.0000       | -0.0000       | -0.0000   | -0.0000      | -0.0000   | -0.0000               | -0.0000   | -0.0000 (63b)                                                                               |
| Solar input                                                                         | 0.0000    | 0.0000    | 0.0000    | 0.0000     | 0.0000        | 0.0000        | 0.0000    | 0.0000       | 0.0000    | 0.0000                | 0.0000    | 0.0000 (63c)                                                                                |
| FGHRS                                                                               | 0.0000    | 0.0000    | 0.0000    | 0.0000     | 0.0000        | 0.0000        | 0.0000    | 0.0000       | 0.0000    | 0.0000                | 0.0000    | 0.0000 (63d)                                                                                |
| Output from w/h                                                                     | 199.3541  | 175.5504  | 185.1250  | 160.0708   | 153.2041      | 135.9618      | 132.9234  | 139.5422     | 142.5031  | 161.3478              | 174.4610  | 196.8757 (64)                                                                               |
|                                                                                     |           |           |           |            |               |               |           |              |           |                       |           | Total per year (kWh/year) = Sum(64)m = 1956.9195 (64)                                       |
| Electric shower(s)                                                                  | 0.0000    | 0.0000    | 0.0000    | 0.0000     | 0.0000        | 0.0000        | 0.0000    | 0.0000       | 0.0000    | 0.0000                | 0.0000    | 0.0000 (64a)                                                                                |
|                                                                                     |           |           |           |            |               |               |           |              |           |                       |           | Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a) |
| Heat gains from water heating, kWh/month                                            | 75.2526   | 66.2836   | 69.7885   | 59.9082    | 57.0764       | 50.3507       | 48.9291   | 51.4903      | 52.7354   | 60.0937               | 65.4686   | 74.2447 (65)                                                                                |
| -----                                                                               |           |           |           |            |               |               |           |              |           |                       |           |                                                                                             |
| 5. Internal gains (see Table 5 and 5a)                                              |           |           |           |            |               |               |           |              |           |                       |           |                                                                                             |
| -----                                                                               |           |           |           |            |               |               |           |              |           |                       |           |                                                                                             |
| Metabolic gains (Table 5), Watts                                                    | Jan       | Feb       | Mar       | Apr        | May           | Jun           | Jul       | Aug          | Sep       | Oct                   | Nov       | Dec                                                                                         |
| (66)m                                                                               | 153.9962  | 153.9962  | 153.9962  | 153.9962   | 153.9962      | 153.9962      | 153.9962  | 153.9962     | 153.9962  | 153.9962              | 153.9962  | 153.9962 (66)                                                                               |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 26.7460   | 23.7556   | 19.3193   | 14.6260    | 10.9331       | 9.2302        | 9.9735    | 12.9640      | 17.4002   | 22.0936               | 25.7865   | 27.4894 (67)                                                                                |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 345.4995  | 349.0847  | 340.0501  | 320.8165   | 296.5375      | 273.7188      | 258.4744  | 254.8892     | 263.9238  | 283.1574              | 307.4363  | 330.2551 (68)                                                                               |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 52.9662   | 52.9662   | 52.9662   | 52.9662    | 52.9662       | 52.9662       | 52.9662   | 52.9662      | 52.9662   | 52.9662               | 52.9662   | 52.9662 (69)                                                                                |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000     | 3.0000        | 3.0000        | 3.0000    | 3.0000       | 3.0000    | 3.0000                | 3.0000    | 3.0000 (70)                                                                                 |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -102.6642 | -102.6642 | -102.6642 | -102.6642  | -102.6642     | -102.6642     | -102.6642 | -102.6642    | -102.6642 | -102.6642             | -102.6642 | -102.6642 (71)                                                                              |
| Water heating gains (Table 5)                                                       | 101.1460  | 98.6363   | 93.8018   | 83.2058    | 76.7156       | 69.9316       | 65.7649   | 69.2074      | 73.2436   | 80.7712               | 90.9286   | 99.7912 (72)                                                                                |
| Total internal gains                                                                | 580.6898  | 578.7749  | 560.4695  | 525.9466   | 491.4845      | 457.1788      | 438.5111  | 441.3589     | 458.8659  | 493.3204              | 531.4497  | 564.8340 (73)                                                                               |
| -----                                                                               |           |           |           |            |               |               |           |              |           |                       |           |                                                                                             |
| 6. Solar gains                                                                      |           |           |           |            |               |               |           |              |           |                       |           |                                                                                             |
| -----                                                                               |           |           |           |            |               |               |           |              |           |                       |           |                                                                                             |
| [Jan]                                                                               |           |           | Area      | Solar flux | g             | FF            | Access    | Gains        |           |                       |           |                                                                                             |
|                                                                                     |           |           | m2        | Table 6a   | Specific data | Specific data | factor    | W            |           |                       |           |                                                                                             |
|                                                                                     |           |           |           | W/m2       | or Table 6b   | or Table 6c   | Table 6d  |              |           |                       |           |                                                                                             |
| North                                                                               |           |           | 4.1200    | 11.9814    | 0.4500        | 0.0000        | 0.7700    | 17.1045 (74) |           |                       |           |                                                                                             |
| South                                                                               |           |           | 5.6100    | 50.9848    | 0.4500        | 0.0000        | 0.7700    | 99.1076 (78) |           |                       |           |                                                                                             |
| West                                                                                |           |           | 0.5200    | 22.3313    | 0.4500        | 0.0000        | 0.7700    | 4.0237 (80)  |           |                       |           |                                                                                             |
| North                                                                               |           |           | 3.3300    | 11.9814    | 0.4500        | 0.0000        | 0.7700    | 13.8247 (74) |           |                       |           |                                                                                             |

# Full SAP Calculation Printout



|             |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Solar gains | 134.0605 | 206.4061 | 285.4873 | 382.3913 | 437.4205 | 475.2993 | 448.8592 | 404.2252 | 340.7223 | 245.0438 | 164.5793 | 113.6339 (83) |
| Total gains | 714.7502 | 785.1810 | 845.9568 | 908.3379 | 928.9050 | 932.4781 | 887.3703 | 845.5841 | 799.5882 | 738.3643 | 696.0290 | 678.4680 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |                           |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |                           |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |                           |         |         |              |
|                                                                             | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep                       | Oct     | Nov     | Dec          |
| tau                                                                         | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876 | 43.0876                   | 43.0876 | 43.0876 | 43.0876      |
| alpha                                                                       | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725  | 3.8725                    | 3.8725  | 3.8725  | 3.8725       |
| util living area                                                            | 0.9614  | 0.9442  | 0.9044  | 0.8199  | 0.6698  | 0.4548  | 0.3030  | 0.3275  | 0.5892                    | 0.8347  | 0.9360  | 0.9671 (86)  |
| MIT                                                                         | 19.5571 | 19.7583 | 20.1304 | 20.5375 | 20.8424 | 20.9740 | 20.9961 | 20.9947 | 20.9269                   | 20.5789 | 20.0045 | 19.4932 (87) |
| Th 2                                                                        | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701 | 20.0701                   | 20.0701 | 20.0701 | 20.0701 (88) |
| util rest of house                                                          | 0.9539  | 0.9335  | 0.8860  | 0.7858  | 0.6117  | 0.3756  | 0.2132  | 0.2339  | 0.5094                    | 0.7956  | 0.9216  | 0.9605 (89)  |
| MIT 2                                                                       | 18.6048 | 18.8270 | 19.2337 | 19.6614 | 19.9545 | 20.0576 | 20.0692 | 20.0688 | 20.0276                   | 19.7132 | 19.1034 | 18.5343 (90) |
| Living area fraction                                                        |         |         |         |         |         |         |         |         | FLA = Living area / (4) = |         |         | 0.1933 (91)  |
| MIT                                                                         | 18.7889 | 19.0070 | 19.4070 | 19.8308 | 20.1261 | 20.2348 | 20.2483 | 20.2477 | 20.2015                   | 19.8805 | 19.2776 | 18.7196 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |                           |         |         | 0.0000       |
| adjusted MIT                                                                | 18.7889 | 19.0070 | 19.4070 | 19.8308 | 20.1261 | 20.2348 | 20.2483 | 20.2477 | 20.2015                   | 19.8805 | 19.2776 | 18.7196 (93) |

## 8. Space heating requirement

|                                                                                |           |           |           |          |          |          |          |          |          |               |          |                |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|---------------|----------|----------------|
|                                                                                | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov      | Dec            |
| Utilisation                                                                    | 0.9403    | 0.9183    | 0.8704    | 0.7761   | 0.6154   | 0.3900   | 0.2306   | 0.2519   | 0.5212   | 0.7865        | 0.9063   | 0.9478 (94)    |
| Useful gains                                                                   | 672.0801  | 721.0175  | 736.3113  | 704.9447 | 571.6785 | 363.6273 | 204.5887 | 213.0356 | 416.7486 | 580.7270      | 630.8218 | 643.0463 (95)  |
| Ext temp.                                                                      | 5.1000    | 5.6000    | 7.4000    | 9.9000   | 13.0000  | 16.0000  | 17.9000  | 17.8000  | 15.2000  | 11.6000       | 8.0000   | 5.1000 (96)    |
| Heat loss rate W                                                               | 1195.7455 | 1171.1221 | 1048.8342 | 867.4680 | 622.4803 | 369.9152 | 205.1320 | 213.8147 | 436.8853 | 723.3159      | 985.1178 | 1189.6985 (97) |
| Space heating kWh                                                              | 389.6070  | 302.4703  | 232.5170  | 117.0167 | 37.7965  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 106.0861      | 255.0931 | 406.7093 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |          |          |          |          |          |          |               |          | 1847.2961      |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000   | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |          |          |          |          |          |          |               |          | 0.0000         |
| Space heating kWh                                                              | 389.6070  | 302.4703  | 232.5170  | 117.0167 | 37.7965  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 106.0861      | 255.0931 | 406.7093 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |          |          |          |          |          |          |               |          | 1847.2961      |
| Space heating per m2                                                           |           |           |           |          |          |          |          |          |          | (98c) / (4) = |          | 21.4852 (99)   |

## 9a. Energy requirements - Individual heating systems, including micro-CHP

|                                                                                                      |          |          |          |          |          |          |          |          |          |          |          |                 |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (201)    |
| Fraction of space heat from main system(s)                                                           |          |          |          |          |          |          |          |          |          |          |          | 1.0000 (202)    |
| Efficiency of main space heating system 1 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 91.7000 (206)   |
| Efficiency of main space heating system 2 (in %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (207)    |
| Efficiency of secondary/supplementary heating system, %                                              |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)    |
|                                                                                                      | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec             |
| Space heating requirement                                                                            | 389.6070 | 302.4703 | 232.5170 | 117.0167 | 37.7965  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 106.0861 | 255.0931 | 406.7093 (98)   |
| Space heating efficiency (main heating system 1)                                                     | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 91.7000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 91.7000  | 91.7000  | 91.7000 (210)   |
| Space heating fuel (main heating system)                                                             | 424.8713 | 329.8477 | 253.5628 | 127.6082 | 41.2176  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 115.6882 | 278.1823 | 443.5216 (211)  |
| Space heating efficiency (main heating system 2)                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (212)    |
| Space heating fuel (main heating system 2)                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (213)    |
| Space heating fuel (secondary)                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)    |
| Water heating                                                                                        |          |          |          |          |          |          |          |          |          |          |          |                 |
| Water heating requirement                                                                            | 199.3541 | 175.5504 | 185.1250 | 160.0708 | 153.2041 | 135.9618 | 132.9234 | 139.5422 | 142.5031 | 161.3478 | 174.4610 | 196.8757 (64)   |
| Efficiency of water heater                                                                           | 88.0779  | 88.0171  | 87.8567  | 87.5746  | 87.1076  | 86.7000  | 86.7000  | 86.7000  | 86.7000  | 87.5210  | 87.9349  | 86.7000 (216)   |
| Fuel for water heating, kWh/month                                                                    | 226.3385 | 199.4504 | 210.7124 | 182.7822 | 175.8790 | 156.8186 | 153.3142 | 160.9484 | 164.3635 | 184.3532 | 198.3978 | 223.4584 (219)  |
| Space cooling fuel requirement                                                                       |          |          |          |          |          |          |          |          |          |          |          |                 |
| (221)m                                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)    |
| Pumps and Fa                                                                                         | 10.9478  | 9.8883   | 10.9478  | 10.5947  | 10.9478  | 10.5947  | 10.9478  | 10.9478  | 10.5947  | 10.9478  | 10.5947  | 10.9478 (231)   |
| Lighting                                                                                             | 23.4106  | 18.7809  | 16.9101  | 12.3891  | 9.5697   | 7.8185   | 8.7298   | 11.3473  | 14.7390  | 19.3384  | 21.8427  | 24.0613 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | -16.2309 | -22.5799 | -34.8167 | -43.4616 | -48.9761 | -49.0347 | -48.0402 | -44.4687 | -37.4200 | -28.6331 | -18.8171 | -13.7131 (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | -4.8241  | -9.0657  | -18.4786 | -30.2089 | -39.7478 | -44.3434 | -43.0957 | -36.9163 | -26.1012 | -14.5792 | -6.7758  | -3.7312 (233b)  |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234b)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235d)   |
| Annual totals kWh/year                                                                               |          |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating fuel - main system 1                                                                   |          |          |          |          |          |          |          |          |          |          |          | 2014.4996 (211) |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)    |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)    |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          | 86.7000         |
| Water heating fuel used                                                                              |          |          |          |          |          |          |          |          |          |          |          | 2236.8166 (219) |
| Space cooling fuel                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (221)    |

Electricity for pumps and fans:  
(MEV)Decentralised, Database: total watage = 5.7980, total flow = 37.0000, SFP = 0.1567)  
mechanical ventilation fans (SFP = 0.1567) 42.9017 (230a)

# Full SAP Calculation Printout



|                                                     |                |
|-----------------------------------------------------|----------------|
| central heating pump                                | 41.0000 (230c) |
| main heating flue fan                               | 45.0000 (230e) |
| Total electricity for the above, kWh/year           | 128.9017 (231) |
| Electricity for lighting (calculated in Appendix L) | 188.9373 (232) |

|                                                               |                 |
|---------------------------------------------------------------|-----------------|
| Energy saving/generation technologies (Appendices M ,N and Q) |                 |
| PV generation                                                 | -684.0599 (233) |
| Wind generation                                               | 0.0000 (234)    |
| Hydro-electric generation (Appendix N)                        | 0.0000 (235a)   |
| Electricity generated - Micro CHP (Appendix N)                | 0.0000 (235)    |
| Appendix Q - special features                                 |                 |
| Energy saved or generated                                     | -0.0000 (236)   |
| Energy used                                                   | 0.0000 (237)    |
| Total delivered energy for all uses                           | 3885.0953 (238) |

## 10a. Fuel costs - using BEDF prices (596)

|                                             | Fuel<br>kWh/year | Fuel price<br>p/kWh | Fuel cost<br>£/year |
|---------------------------------------------|------------------|---------------------|---------------------|
| Space heating - main system 1               | 2014.4996        | 7.3200              | 147.4614 (240)      |
| Total CO2 associated with community systems |                  |                     | 0.0000 (473)        |
| Water heating (other fuel)                  | 2236.8166        | 7.3200              | 163.7350 (247)      |
| Energy for instantaneous electric shower(s) | 0.0000           | 27.6700             | 0.0000 (247a)       |
| Pumps, fans and electric keep-hot           | 128.9017         | 27.6700             | 35.6671 (249)       |
| Energy for lighting                         | 188.9373         | 27.6700             | 52.2789 (250)       |
| Additional standing charges                 |                  |                     | 108.0000 (251)      |
| Energy saving/generation technologies       |                  |                     |                     |
| PV Unit electricity used in dwelling        | -406.1918        | 27.6700             | -112.3933           |
| PV Unit electricity exported                | -277.8681        | 5.8100              | -16.1441            |
| Total                                       |                  |                     | -128.5374 (252)     |
| Total energy cost                           |                  |                     | 378.6050 (255)      |

## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|---------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1               | 2014.4996          | 0.2100                        | 423.0449 (261)           |
| Total CO2 associated with community systems |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                  | 2236.8166          | 0.2100                        | 469.7315 (264)           |
| Space and water heating                     |                    |                               | 892.7764 (265)           |
| Pumps, fans and electric keep-hot           | 128.9017           | 0.1387                        | 17.8803 (267)            |
| Energy for lighting                         | 188.9373           | 0.1443                        | 27.2695 (268)            |
| Energy saving/generation technologies       |                    |                               |                          |
| PV Unit electricity used in dwelling        | -406.1918          | 0.1329                        | -53.9983                 |
| PV Unit electricity exported                | -277.8681          | 0.1242                        | -34.5129                 |
| Total                                       |                    |                               | -88.5111 (269)           |
| Total CO2, kg/year                          |                    |                               | 849.4150 (272)           |

## 13a. Primary energy - Individual heating systems including micro-CHP

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1               | 2014.4996          | 1.1300                              | 2276.3846 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 2236.8166          | 1.1300                              | 2527.6028 (278)            |
| Space and water heating                     |                    |                                     | 4803.9873 (279)            |
| Pumps, fans and electric keep-hot           | 128.9017           | 1.5128                              | 195.0025 (281)             |
| Energy for lighting                         | 188.9373           | 1.5338                              | 289.7983 (282)             |
| Energy saving/generation technologies       |                    |                                     |                            |
| PV Unit electricity used in dwelling        | -406.1918          | 1.4912                              | -605.7161                  |
| PV Unit electricity exported                | -277.8681          | 0.4558                              | -126.6402                  |
| Total                                       |                    |                                     | -732.3563 (283)            |
| Total Primary energy kWh/year               |                    |                                     | 4556.4318 (286)            |



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