

# Full SAP Calculation Printout



|                                    |                      |               |               |         |                |            |
|------------------------------------|----------------------|---------------|---------------|---------|----------------|------------|
| Property Reference                 | OP-D320 APT Mid      |               |               |         | Issued on Date | 29/11/2024 |
| Assessment Reference               | APT Mid              |               | Prop Type Ref | APT Mid |                |            |
| Property                           | APT Mid              |               |               |         |                |            |
|                                    |                      |               |               |         |                |            |
| SAP Rating                         | 83 B                 | DER           | 4.87          | TER     | 14.14          |            |
| Environmental                      | 97 A                 | % DER < TER   |               |         |                | 65.56      |
| CO <sub>2</sub> Emissions (t/year) | 0.24                 | DFEE          | 31.56         | TFEE    | 32.28          |            |
| Compliance Check                   | See BREL             | % DFEE < TFEE |               |         |                | 2.22       |
| % DPER < TPER                      | 30.81                | DPER          | 51.74         | TPER    | 74.77          |            |
|                                    |                      |               |               |         |                |            |
| Assessor Details                   | Mr. Matthew Stainrod |               |               |         | Assessor ID    | AU83-0001  |
| Client                             |                      |               |               |         |                |            |

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> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Ground floor                                           | 51.5000 (1b)              | 2.3700 (2b)                     | 122.0550 (1b) - (3b)        |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 51.5000                   |                                 | 122.0550 (4)                |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | 122.0550 (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)    |

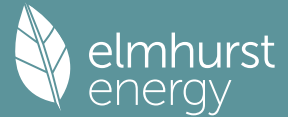
|                                                                                                    |                             |             |
|----------------------------------------------------------------------------------------------------|-----------------------------|-------------|
| Infiltration 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                                                                               | 3.5000                      | (17)        |
| Infiltration rate                                                                                  | 0.1750                      | (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) =        | 0.1487 (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                                                                                         | 0.1897 | 0.1859 | 0.1822 | 0.1636 | 0.1599 | 0.1413 | 0.1413 | 0.1376 | 0.1487 | 0.1599 | 0.1673 | 0.1748 (22b)  |
| Balanced mechanical ventilation with heat recovery                                                      |        |        |        |        |        |        |        |        |        |        |        |               |
| 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)  |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =            |        |        |        |        |        |        |        |        |        |        |        | 72.8000 (23c) |
| Effective ac                                                                                            | 0.3257 | 0.3219 | 0.3182 | 0.2996 | 0.2959 | 0.2773 | 0.2773 | 0.2736 | 0.2848 | 0.2959 | 0.3033 | 0.3108 (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 |
|----------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|---------------|
| Front Door                                                     |                         |                            | 2.1400                    | 1.0000                        | 2.1400       |                                | (26)          |
| Windows (Uw = 1.30)                                            |                         |                            | 10.2100                   | 1.2357                        | 12.6169      |                                | (27)          |
| External Wall                                                  | 52.3800                 | 10.2100                    | 42.1700                   | 0.1700                        | 7.1689       |                                | (29a)         |
| Semi Exposed Wall                                              | 15.8800                 | 2.1400                     | 13.7400                   | 0.1700                        | 2.3358       |                                | (29a)         |
| Total net area of external elements Aum(A, m <sup>2</sup> )    |                         |                            | 68.2600                   |                               |              |                                | (31)          |
| Fabric heat loss, W/K = Sum (A x U)                            |                         |                            |                           | (26)...(30) + (32) =          | 24.2616      |                                | (33)          |
| Party Floor                                                    |                         |                            | 52.3800                   |                               |              |                                | (32d)         |
| Party Ceiling                                                  |                         |                            | 51.5900                   |                               |              |                                | (32b)         |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K |                         |                            |                           |                               |              |                                | 100.0000 (35) |
| List of Thermal Bridges                                        |                         |                            |                           |                               |              |                                |               |
| K1 Element                                                     |                         |                            |                           | Length                        | Psi-value    | Total                          |               |
| E2 Other lintels (including other steel lintels)               |                         |                            |                           | 7.8300                        | 0.0500       | 0.3915                         |               |
| E3 Sill                                                        |                         |                            |                           | 6.8100                        | 0.0500       | 0.3405                         |               |
| E4 Jamb                                                        |                         |                            |                           | 19.2000                       | 0.0500       | 0.9600                         |               |

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|                                                                     |         |         |         |         |         |         |         |         |         |         |         |              |
|---------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| E16 Corner (normal)                                                 |         |         |         |         |         |         |         |         |         |         |         |              |
| E7 Party floor between dwellings (in blocks of flats)               |         |         |         |         |         |         |         |         |         |         |         |              |
| 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) |         |         |         |         |         |         |         |         |         |         |         |              |
| (38)m                                                               | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| Heat transfer coeff                                                 | 13.1168 | 12.9670 | 12.8173 | 12.0683 | 11.9186 | 11.1696 | 11.1696 | 11.0199 | 11.4692 | 11.9186 | 12.2181 | 12.5177 (38) |
| Average = Sum(39)m / 12 =                                           | 43.9557 | 43.8059 | 43.6561 | 42.9072 | 42.7574 | 42.0085 | 42.0085 | 41.8587 | 42.3080 | 42.7574 | 43.0569 | 43.3565 (39) |
|                                                                     |         |         |         |         |         |         |         |         |         |         |         | 42.8697      |
| HLP                                                                 | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| HLP (average)                                                       | 0.8535  | 0.8506  | 0.8477  | 0.8331  | 0.8302  | 0.8157  | 0.8157  | 0.8128  | 0.8215  | 0.8302  | 0.8361  | 0.8419 (40)  |
| Days in mont                                                        | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31           |

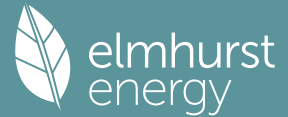
|                                                                 |          |          |          |          |          |          |          |          |          |          |          |               |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| 4. Water heating energy requirements (kWh/year)                 |          |          |          |          |          |          |          |          |          |          |          |               |
| Assumed occupancy                                               |          |          |          |          |          |          |          |          |          |          |          | 1.7343 (42)   |
| Hot water usage for mixer showers                               |          |          |          |          |          |          |          |          |          |          |          |               |
| Hot water usage for baths                                       |          |          |          |          |          |          |          |          |          |          |          |               |
| Hot water usage for other uses                                  |          |          |          |          |          |          |          |          |          |          |          |               |
| Average daily hot water use (litres/day)                        |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                 | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
| Daily hot water use                                             | 131.6372 | 128.9358 | 125.5838 | 120.3380 | 116.1317 | 111.5882 | 109.7324 | 113.0687 | 116.6029 | 121.3871 | 126.7181 | 131.2745 (44) |
| Energy conte                                                    | 208.4812 | 183.6029 | 193.0176 | 164.7367 | 156.3356 | 137.2107 | 132.7118 | 140.0026 | 143.7830 | 164.7211 | 180.5331 | 205.5441 (45) |
| Energy content (annual)                                         |          |          |          |          |          |          |          |          |          |          |          |               |
| Distribution loss (46)m = 0.15 x (45)m                          |          |          |          |          |          |          |          |          |          |          |          |               |
| Water storage loss:                                             |          |          |          |          |          |          |          |          |          |          |          |               |
| Store volume                                                    |          |          |          |          |          |          |          |          |          |          |          | 230.0000 (47) |
| a) If manufacturer declared loss factor is known (kWh/day):     |          |          |          |          |          |          |          |          |          |          |          | 1.8000 (48)   |
| Temperature factor from Table 2b                                |          |          |          |          |          |          |          |          |          |          |          | 0.7800 (49)   |
| Enter (49) or (54) in (55)                                      |          |          |          |          |          |          |          |          |          |          |          | 1.4040 (55)   |
| Total storage loss                                              |          |          |          |          |          |          |          |          |          |          |          |               |
| If cylinder contains dedicated solar storage                    |          |          |          |          |          |          |          |          |          |          |          |               |
| Primary loss                                                    |          |          |          |          |          |          |          |          |          |          |          |               |
| Combi loss                                                      |          |          |          |          |          |          |          |          |          |          |          |               |
| Total heat required for water heating calculated for each month |          |          |          |          |          |          |          |          |          |          |          |               |
| WWHRS                                                           |          |          |          |          |          |          |          |          |          |          |          |               |
| PV diverter                                                     |          |          |          |          |          |          |          |          |          |          |          |               |
| Solar input                                                     |          |          |          |          |          |          |          |          |          |          |          |               |
| FGHRS                                                           |          |          |          |          |          |          |          |          |          |          |          |               |
| Output from w/h                                                 |          |          |          |          |          |          |          |          |          |          |          |               |
| 12Total per year (kWh/year)                                     |          |          |          |          |          |          |          |          |          |          |          |               |
| Electric shower(s)                                              |          |          |          |          |          |          |          |          |          |          |          |               |
| Heat gains from water heating, kWh/month                        |          |          |          |          |          |          |          |          |          |          |          |               |

|                                                                                     |     |     |     |     |     |     |     |     |     |     |     |     |
|-------------------------------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 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 |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     |     |     |     |     |     |     |     |     |     |     |     |     |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 |     |     |     |     |     |     |     |     |     |     |     |     |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    |     |     |     |     |     |     |     |     |     |     |     |     |
| Pumps, fans                                                                         |     |     |     |     |     |     |     |     |     |     |     |     |
| Losses e.g. evaporation (negative values) (Table 5)                                 |     |     |     |     |     |     |     |     |     |     |     |     |
| Water heating gains (Table 5)                                                       |     |     |     |     |     |     |     |     |     |     |     |     |
| Total internal gains                                                                |     |     |     |     |     |     |     |     |     |     |     |     |

|                |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------|--|--|--|--|--|--|--|--|--|--|--|--|
| 6. Solar gains |  |  |  |  |  |  |  |  |  |  |  |  |
| [Jan]          |  |  |  |  |  |  |  |  |  |  |  |  |
| Area           |  |  |  |  |  |  |  |  |  |  |  |  |
| Solar flux     |  |  |  |  |  |  |  |  |  |  |  |  |
| Specific data  |  |  |  |  |  |  |  |  |  |  |  |  |
| Specific data  |  |  |  |  |  |  |  |  |  |  |  |  |
| Access factor  |  |  |  |  |  |  |  |  |  |  |  |  |
| Gains W        |  |  |  |  |  |  |  |  |  |  |  |  |
| East           |  |  |  |  |  |  |  |  |  |  |  |  |
| South          |  |  |  |  |  |  |  |  |  |  |  |  |
| West           |  |  |  |  |  |  |  |  |  |  |  |  |
| Solar gains    |  |  |  |  |  |  |  |  |  |  |  |  |
| Total gains    |  |  |  |  |  |  |  |  |  |  |  |  |

|                                               |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------------------|--|--|--|--|--|--|--|--|--|--|--|--|
| 7. Mean internal temperature (heating season) |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------------------|--|--|--|--|--|--|--|--|--|--|--|--|

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|                                                                                                              |          |          |          |          |          |          |          |          |                           |               |          |                 |
|--------------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|---------------------------|---------------|----------|-----------------|
| 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                                                                                                        | 32.5454  | 32.6567  | 32.7688  | 33.3407  | 33.4575  | 34.0540  | 34.0540  | 34.1758  | 33.8129                   | 33.4575       | 33.2247  | 32.9952         |
| util living area                                                                                             | 3.1697   | 3.1771   | 3.1846   | 3.2227   | 3.2305   | 3.2703   | 3.2703   | 3.2784   | 3.2542                    | 3.2305        | 3.2150   | 3.1997          |
|                                                                                                              | 0.8753   | 0.8246   | 0.7535   | 0.6356   | 0.5020   | 0.3768   | 0.2748   | 0.3018   | 0.4693                    | 0.6731        | 0.8216   | 0.8857 (86)     |
| Living                                                                                                       | 19.7418  | 20.0266  | 20.3518  | 20.6884  | 20.8808  | 20.9661  | 20.9909  | 20.9876  | 20.9292                   | 20.6840       | 20.1926  | 19.7013         |
| Non living                                                                                                   | 18.7525  | 19.1014  | 19.4952  | 19.8984  | 20.1137  | 20.2127  | 20.2342  | 20.2344  | 20.1749                   | 19.9050       | 19.3208  | 18.7102         |
| 24 / 16                                                                                                      | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0                         | 0             | 0        | 0               |
| 24 / 9                                                                                                       | 3        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0                         | 0             | 0        | 0               |
| 16 / 9                                                                                                       | 28       | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0                         | 0             | 0        | 10              |
| MIT                                                                                                          | 20.3563  | 20.0266  | 20.3518  | 20.6884  | 20.8808  | 20.9661  | 20.9909  | 20.9876  | 20.9292                   | 20.6840       | 20.1926  | 19.8830 (87)    |
| Th 2                                                                                                         | 20.2072  | 20.2097  | 20.2122  | 20.2247  | 20.2272  | 20.2397  | 20.2397  | 20.2423  | 20.2347                   | 20.2272       | 20.2222  | 20.2172 (88)    |
| util rest of house                                                                                           | 0.8624   | 0.8080   | 0.7315   | 0.6068   | 0.4666   | 0.3349   | 0.2284   | 0.2536   | 0.4234                    | 0.6398        | 0.8021   | 0.8737 (89)     |
| MIT 2                                                                                                        | 19.6273  | 19.1014  | 19.4952  | 19.8984  | 20.1137  | 20.2127  | 20.2342  | 20.2344  | 20.1749                   | 19.9050       | 19.3208  | 18.9818 (90)    |
| Living area fraction                                                                                         |          |          |          |          |          |          |          |          | fLA = Living area / (4) = |               |          |                 |
| MIT                                                                                                          | 19.9515  | 19.5128  | 19.8761  | 20.2497  | 20.4548  | 20.5477  | 20.5707  | 20.5693  | 20.5103                   | 20.2514       | 19.7084  | 19.3825 (92)    |
| Temperature adjustment                                                                                       |          |          |          |          |          |          |          |          |                           |               |          | 0.0000          |
| adjusted MIT                                                                                                 | 19.9515  | 19.5128  | 19.8761  | 20.2497  | 20.4548  | 20.5477  | 20.5707  | 20.5693  | 20.5103                   | 20.2514       | 19.7084  | 19.3825 (93)    |
| -----                                                                                                        |          |          |          |          |          |          |          |          |                           |               |          |                 |
| 8. Space heating requirement                                                                                 |          |          |          |          |          |          |          |          |                           |               |          |                 |
| -----                                                                                                        |          |          |          |          |          |          |          |          |                           |               |          |                 |
| Utilisation                                                                                                  | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep                       | Oct           | Nov      | Dec             |
| Useful gains                                                                                                 | 0.8579   | 0.7918   | 0.7215   | 0.6077   | 0.4772   | 0.3520   | 0.2487   | 0.2745   | 0.4402                    | 0.6409        | 0.7879   | 0.8592 (94)     |
| Ext temp.                                                                                                    | 440.0144 | 465.6466 | 465.8484 | 429.4274 | 352.5677 | 244.1081 | 165.4434 | 172.6258 | 258.9931                  | 355.8445      | 399.7050 | 422.4005 (95)   |
| Heat loss rate W                                                                                             | 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)     |
|                                                                                                              | 687.9701 | 640.1272 | 583.9495 | 486.9828 | 374.3320 | 249.8556 | 166.8022 | 174.5202 | 271.2077                  | 412.6681      | 542.8798 | 658.2600 (97)   |
| Space heating kWh                                                                                            | 184.4790 | 117.2509 | 87.8672  | 41.4399  | 16.1926  | 0.0000   | 0.0000   | 0.0000   | 0.0000                    | 42.2767       | 103.0858 | 175.4794 (98a)  |
| Space heating requirement - total per year (kWh/year)                                                        |          |          |          |          |          |          |          |          |                           |               |          | 768.0717        |
| 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                                                                                            | 184.4790 | 117.2509 | 87.8672  | 41.4399  | 16.1926  | 0.0000   | 0.0000   | 0.0000   | 0.0000                    | 42.2767       | 103.0858 | 175.4794 (98c)  |
| Space heating requirement after solar contribution - total per year (kWh/year)                               |          |          |          |          |          |          |          |          |                           |               |          | 768.0717        |
| Space heating per m2                                                                                         |          |          |          |          |          |          |          |          |                           | (98c) / (4) = |          | 14.9140 (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 %)                                                             |          |          |          |          |          |          |          |          |                           |               |          | 240.1133 (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                                                                                    | 184.4790 | 117.2509 | 87.8672  | 41.4399  | 16.1926  | 0.0000   | 0.0000   | 0.0000   | 0.0000                    | 42.2767       | 103.0858 | 175.4794 (98)   |
| Space heating efficiency (main heating system 1)                                                             | 240.1133 | 240.1133 | 240.1133 | 240.1133 | 240.1133 | 0.0000   | 0.0000   | 0.0000   | 0.0000                    | 240.1133      | 240.1133 | 240.1133 (210)  |
| Space heating fuel (main heating system)                                                                     | 76.8300  | 48.8315  | 36.5941  | 17.2585  | 6.7437   | 0.0000   | 0.0000   | 0.0000   | 0.0000                    | 17.6070       | 42.9322  | 73.0819 (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                                                                                    | 306.8628 | 272.4637 | 291.3992 | 259.9447 | 254.7172 | 201.8427 | 199.4982 | 206.7890 | 208.4150                  | 263.1027      | 275.7411 | 303.9257 (64)   |
| Efficiency of water heater (217)m                                                                            | 273.4325 | 273.4325 | 273.4325 | 273.4325 | 273.4325 | 273.4325 | 273.4325 | 273.4325 | 273.4325                  | 273.4325      | 273.4325 | 273.4325 (216)  |
| Fuel for water heating, kWh/month                                                                            | 112.2262 | 99.6457  | 106.5708 | 95.0672  | 93.1554  | 73.8181  | 72.9607  | 75.6271  | 76.2218                   | 96.2222       | 100.8443 | 111.1520 (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                                                                                                 | 12.3940  | 11.1946  | 12.3940  | 11.9942  | 12.3940  | 11.9942  | 12.3940  | 12.3940  | 11.9942                   | 12.3940       | 11.9942  | 12.3940 (231)   |
| Lighting                                                                                                     | 19.5572  | 15.6895  | 14.1267  | 10.3498  | 7.9945   | 6.5316   | 7.2928   | 9.4795   | 12.3130                   | 16.1553       | 18.2473  | 20.1008 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity) (233a)m                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                    | 0.0000        | 0.0000   | 0.0000 (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                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                    | 0.0000        | 0.0000   | 0.0000 (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                                                                           |          |          |          |          |          |          |          |          |                           |               |          | 319.8789 (211)  |
| Space heating fuel - main system 2                                                                           |          |          |          |          |          |          |          |          |                           |               |          | 0.0000 (213)    |
| Space heating fuel - secondary                                                                               |          |          |          |          |          |          |          |          |                           |               |          | 0.0000 (215)    |
| Efficiency of water heater                                                                                   |          |          |          |          |          |          |          |          |                           |               |          | 273.4325        |
| Water heating fuel used                                                                                      |          |          |          |          |          |          |          |          |                           |               |          | 1113.5114 (219) |
| Space cooling fuel                                                                                           |          |          |          |          |          |          |          |          |                           |               |          | 0.0000 (221)    |
| Electricity for pumps and fans:                                                                              |          |          |          |          |          |          |          |          |                           |               |          |                 |
| (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9800)                                   |          |          |          |          |          |          |          |          |                           |               |          |                 |
| mechanical ventilation fans (SFP = 0.9800)                                                                   |          |          |          |          |          |          |          |          |                           |               |          | 145.9290 (230a) |
| Total electricity for the above, kWh/year                                                                    |          |          |          |          |          |          |          |          |                           |               |          | 145.9290 (231)  |
| Electricity for lighting (calculated in Appendix L)                                                          |          |          |          |          |          |          |          |          |                           |               |          | 157.8380 (232)  |

# Full SAP Calculation Printout



Energy saving/generation technologies (Appendices M ,N and Q)

|                                                |                 |
|------------------------------------------------|-----------------|
| PV generation                                  | 0.0000 (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            | 1737.1573 (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                   | 319.8789           | 0.1566                        | 50.0830 (261)            |
| Total CO2 associated with community systems     |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                      | 1113.5114          | 0.1415                        | 157.5902 (264)           |
| Space and water heating                         |                    |                               | 207.6732 (265)           |
| Pumps, fans and electric keep-hot               | 145.9290           | 0.1387                        | 20.2421 (267)            |
| Energy for lighting                             | 157.8380           | 0.1443                        | 22.7809 (268)            |
| Total CO2, kg/year                              |                    |                               | 250.6963 (272)           |
| EPC Dwelling Carbon Dioxide Emission Rate (DER) |                    |                               | 4.8700 (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               | 319.8789           | 1.5796                              | 505.2758 (275)             |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 1113.5114          | 1.5234                              | 1696.2742 (278)            |
| Space and water heating                     |                    |                                     | 2201.5500 (279)            |
| Pumps, fans and electric keep-hot           | 145.9290           | 1.5128                              | 220.7613 (281)             |
| Energy for lighting                         | 157.8380           | 1.5338                              | 242.0972 (282)             |
| Total Primary energy kWh/year               |                    |                                     | 2664.4085 (286)            |
| Dwelling Primary energy Rate (DPER)         |                    |                                     | 51.7400 (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)         |
|--------------------------------------------------------|--------------|---------------------------------|------------------------|
| Ground floor                                           | 51.5000 (1b) | x 2.3700 (2b)                   | = 122.0550 (1b) - (3b) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 51.5000      |                                 | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 122.0550 (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                | 2 * 10 = 20.0000 (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) = | 20.0000 / (5) = | 0.1639 (8) |
| Pressure test                                |                                                       | Yes             |            |
| Pressure Test Method                         |                                                       | Blower Door     |            |
| Measured/design AP50                         |                                                       | 5.0000          | (17)       |
| Infiltration rate                            |                                                       | 0.4139          | (18)       |
| Number of sides sheltered                    |                                                       | 2               | (19)       |

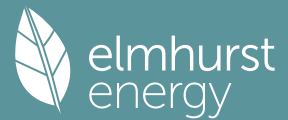
|                                                      |                             |             |
|------------------------------------------------------|-----------------------------|-------------|
| Shelter factor                                       | (20) = 1 - [0.075 x (19)] = | 0.8500 (20) |
| Infiltration rate adjusted to include shelter factor | (21) = (18) x (20) =        | 0.3518 (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 | 0.4485 | 0.4397 | 0.4309 | 0.3870 | 0.3782 | 0.3342 | 0.3342 | 0.3254 | 0.3518 | 0.3782 | 0.3958 | 0.4133 (22b) |
| Effective ac    | 0.6006 | 0.5967 | 0.5929 | 0.5749 | 0.5715 | 0.5558 | 0.5558 | 0.5529 | 0.5619 | 0.5715 | 0.5783 | 0.5854 (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 |
|------------------------------|-------------|----------------|---------------|------------------|--------------|-------------------|---------------|
| TER Opaque door              |             |                | 2.1400        | 1.0000           | 2.1400       |                   | (26)          |
| TER Opening Type (Uw = 1.20) |             |                | 10.2100       | 1.1450           | 11.6908      |                   | (27)          |

# Full SAP Calculation Printout



|                                                |         |         |                      |         |        |       |
|------------------------------------------------|---------|---------|----------------------|---------|--------|-------|
| External Wall                                  | 52.3800 | 10.2100 | 42.1700              | 0.1800  | 7.5906 | (29a) |
| Semi Exposed Wall                              | 15.8800 | 2.1400  | 13.7400              | 0.1800  | 2.4732 | (29a) |
| Total net area of external elements Aum(A, m2) |         |         | 68.2600              |         |        | (31)  |
| Fabric heat loss, W/K = Sum (A x U)            |         |         | (26)...(30) + (32) = | 23.8946 |        | (33)  |

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 100.0000 (35)

|                                                            |  |  |         |           |                       |              |
|------------------------------------------------------------|--|--|---------|-----------|-----------------------|--------------|
| List of Thermal Bridges                                    |  |  |         |           |                       |              |
| K1 Element                                                 |  |  | Length  | Psi-value | Total                 |              |
| E2 Other lintels (including other steel lintels)           |  |  | 7.8300  | 0.0500    | 0.3915                |              |
| E3 Sill                                                    |  |  | 6.8100  | 0.0500    | 0.3405                |              |
| E4 Jamb                                                    |  |  | 19.2000 | 0.0500    | 0.9600                |              |
| E16 Corner (normal)                                        |  |  | 9.4800  | 0.0900    | 0.8532                |              |
| E7 Party floor between dwellings (in blocks of flats)      |  |  | 57.6000 | 0.0700    | 4.0320                |              |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |  |  |         |           | 6.5772                | (36)         |
| Point Thermal Bridges                                      |  |  |         |           | 0.0000                |              |
| Total fabric heat loss                                     |  |  |         |           | (33) + (36) + (36a) = | 30.4718 (37) |

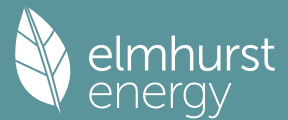
|                                                                     |         |         |         |         |         |         |         |         |         |         |         |         |      |
|---------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| 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                                                 | 24.1905 | 24.0332 | 23.8790 | 23.1547 | 23.0191 | 22.3883 | 22.3883 | 22.2715 | 22.6313 | 23.0191 | 23.2933 | 23.5799 | (38) |
| Average = Sum(39)m / 12 =                                           | 54.6623 | 54.5050 | 54.3508 | 53.6265 | 53.4910 | 52.8601 | 52.8601 | 52.7433 | 53.1031 | 53.4910 | 53.7651 | 54.0517 | (39) |
|                                                                     |         |         |         |         |         |         |         |         |         |         |         | 53.6258 |      |
| HLP                                                                 | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |      |
| HLP (average)                                                       | 1.0614  | 1.0583  | 1.0554  | 1.0413  | 1.0387  | 1.0264  | 1.0264  | 1.0241  | 1.0311  | 1.0387  | 1.0440  | 1.0495  | (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                                                              |          |          |          |          |          |          |          |          |          |          |          |          | 1.7343 (42)    |
| Hot water usage for mixer showers                                              |          |          |          |          |          |          |          |          |          |          |          |          |                |
|                                                                                | 53.2983  | 52.4974  | 51.3302  | 49.0970  | 47.4490  | 45.6111  | 44.5665  | 45.7248  | 46.9946  | 48.9679  | 51.2490  | 53.0941  | (42a)          |
| Hot water usage for baths                                                      |          |          |          |          |          |          |          |          |          |          |          |          |                |
|                                                                                | 23.0433  | 22.7010  | 22.2191  | 21.3305  | 20.6652  | 19.9274  | 19.5289  | 20.0074  | 20.5285  | 21.3179  | 22.2248  | 22.9654  | (42b)          |
| Hot water usage for other uses                                                 |          |          |          |          |          |          |          |          |          |          |          |          |                |
|                                                                                | 32.3912  | 31.2133  | 30.0354  | 28.8576  | 27.6797  | 26.5019  | 26.5019  | 27.6797  | 28.8576  | 30.0354  | 31.2133  | 32.3912  | (42c)          |
| Average daily hot water use (litres/day)                                       |          |          |          |          |          |          |          |          |          |          |          |          | 99.9505 (43)   |
|                                                                                |          |          |          |          |          |          |          |          |          |          |          |          |                |
| Daily hot water use                                                            | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |                |
| Energy conte                                                                   | 108.7328 | 106.4117 | 103.5848 | 99.2851  | 95.7939  | 92.0404  | 90.5972  | 93.4120  | 96.3807  | 100.3213 | 104.6872 | 108.4507 | (44)           |
| Energy content (annual)                                                        | 172.2061 | 151.5289 | 159.2059 | 135.9164 | 128.9570 | 113.1744 | 109.5695 | 115.6636 | 118.8470 | 136.1350 | 149.1461 | 169.8075 | (45)           |
| Distribution loss (46)m = 0.15 x (45)m                                         |          |          |          |          |          |          |          |          |          |          |          |          |                |
|                                                                                | 25.8309  | 22.7293  | 23.8809  | 20.3875  | 19.3435  | 16.9762  | 16.4354  | 17.3495  | 17.8271  | 20.4203  | 22.3719  | 25.4711  | (46)           |
| Water storage loss:                                                            |          |          |          |          |          |          |          |          |          |          |          |          |                |
| Store volume                                                                   |          |          |          |          |          |          |          |          |          |          |          |          | 230.0000 (47)  |
| a) If manufacturer declared loss factor is known (kWh/day):                    |          |          |          |          |          |          |          |          |          |          |          |          | 1.7973 (48)    |
| Temperature factor from Table 2b                                               |          |          |          |          |          |          |          |          |          |          |          |          | 0.5400 (49)    |
| Enter (49) or (54) in (55)                                                     |          |          |          |          |          |          |          |          |          |          |          |          | 0.9706 (55)    |
| Total storage loss                                                             |          |          |          |          |          |          |          |          |          |          |          |          |                |
|                                                                                | 30.0872  | 27.1756  | 30.0872  | 29.1167  | 30.0872  | 29.1167  | 30.0872  | 30.0872  | 29.1167  | 30.0872  | 29.1167  | 30.0872  | (56)           |
| If cylinder contains dedicated solar storage                                   |          |          |          |          |          |          |          |          |          |          |          |          |                |
|                                                                                | 30.0872  | 27.1756  | 30.0872  | 29.1167  | 30.0872  | 29.1167  | 30.0872  | 30.0872  | 29.1167  | 30.0872  | 29.1167  | 30.0872  | (57)           |
| Primary loss                                                                   | 23.2624  | 21.0112  | 23.2624  | 22.5120  | 23.2624  | 22.5120  | 23.2624  | 23.2624  | 22.5120  | 23.2624  | 22.5120  | 23.2624  | (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                |          |          |          |          |          |          |          |          |          |          |          |          |                |
| WWHRS                                                                          | 225.5557 | 199.7156 | 212.5555 | 187.5451 | 182.3066 | 164.8031 | 162.9191 | 169.0132 | 170.4757 | 189.4847 | 200.7747 | 223.1571 | (62)           |
| PV diverter                                                                    | -24.3658 | -21.5493 | -22.5652 | -18.6849 | -17.4136 | -14.9010 | -13.9673 | -14.8528 | -15.4171 | -18.1751 | -20.5901 | -23.9146 | (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                                                                |          |          |          |          |          |          |          |          |          |          |          |          |                |
|                                                                                | 201.1900 | 178.1663 | 189.9904 | 168.8602 | 164.8930 | 149.9021 | 148.9519 | 154.1604 | 155.0586 | 171.3096 | 180.1846 | 199.2426 | (64)           |
| 12Total per year (kWh/year)                                                    |          |          |          |          |          |          |          |          |          |          |          |          | 2061.9095 (64) |
| Electric shower(s)                                                             |          |          |          |          |          |          |          |          |          |          |          |          | 2062 (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   | (64a)          |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (64a)   |
| Heat gains from water heating, kWh/month                                       |          |          |          |          |          |          |          |          |          |          |          |          |                |
|                                                                                | 99.9382  | 88.9327  | 95.6157  | 86.4951  | 85.5579  | 78.9334  | 79.1116  | 81.1378  | 80.8196  | 87.9446  | 90.8940  | 99.1407  | (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      |      |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 86.7160  | 86.7160  | 86.7160  | 86.7160  | 86.7160  | 86.7160  | 86.7160  | 86.7160  | 86.7160  | 86.7160  | 86.7160  | 86.7160  | (66) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 76.8362  | 85.0687  | 76.8362  | 79.3974  | 76.8362  | 79.3974  | 76.8362  | 76.8362  | 79.3974  | 76.8362  | 79.3974  | 76.8362  | (67) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 151.1287 | 152.6969 | 148.7450 | 140.3318 | 129.7117 | 119.7303 | 113.0621 | 111.4939 | 115.4458 | 123.8589 | 134.4791 | 144.4605 | (68) |
| Pumps, fans                                                                         | 31.6716  | 31.6716  | 31.6716  | 31.6716  | 31.6716  | 31.6716  | 31.6716  | 31.6716  | 31.6716  | 31.6716  | 31.6716  | 31.6716  | (69) |
| Losses e.g. evaporation (negative values) (Table 5)                                 | 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) |
| Water heating gains (Table 5)                                                       | -69.3728 | -69.3728 | -69.3728 | -69.3728 | -69.3728 | -69.3728 | -69.3728 | -69.3728 | -69.3728 | -69.3728 | -69.3728 | -69.3728 | (71) |
| Total internal gains                                                                | 134.3256 | 132.3404 | 128.5157 | 120.1321 | 114.9972 | 109.6298 | 106.3327 | 109.0562 | 112.2494 | 118.2051 | 126.2417 | 133.2536 | (72) |
|                                                                                     | 414.3053 | 422.1208 | 406.1117 | 391.8762 | 373.5599 | 357.7723 | 345.2458 | 346.4011 | 356.1074 | 370.9150 | 392.1329 | 406.5651 | (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 |         |      |  |  |  |  |  |  |
| East           | 3.7500 | 19.6403    | 0.6300        | 0.7000        | 0.7700   | 22.5087 | (76) |  |  |  |  |  |  |
| South          | 2.7100 | 46.7521    | 0.6300        | 0.7000        | 0.7700   | 38.7206 | (78) |  |  |  |  |  |  |

# Full SAP Calculation Printout



|                                                                                                      |          |          |          |          |          |          |          |          |          |               |          |                 |        |  |  |              |  |  |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|----------|-----------------|--------|--|--|--------------|--|--|
| West                                                                                                 | 3.7500   |          |          | 19.6403  |          |          | 0.6300   |          |          | 0.7000        |          |                 | 0.7700 |  |  | 22.5087 (80) |  |  |
| Solar gains                                                                                          | 83.7380  | 151.4779 | 225.8068 | 302.8123 | 354.3570 | 356.9142 | 342.0876 | 303.8811 | 253.0566 | 172.8932      | 102.0285 | 70.4783 (83)    |        |  |  |              |  |  |
| Total gains                                                                                          | 498.0432 | 573.5987 | 631.9185 | 694.6885 | 727.9169 | 714.6865 | 687.3335 | 650.2822 | 609.1640 | 543.8082      | 494.1614 | 477.0434 (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                                                                                                  | 26.1708  | 26.2463  | 26.3208  | 26.6763  | 26.7439  | 27.0630  | 27.0630  | 27.1230  | 26.9392  | 26.7439       | 26.6075  | 26.4664         |        |  |  |              |  |  |
| alpha                                                                                                | 2.7447   | 2.7498   | 2.7547   | 2.7784   | 2.7829   | 2.8042   | 2.8042   | 2.8082   | 2.7959   | 2.7829        | 2.7738   | 2.7644          |        |  |  |              |  |  |
| util living area                                                                                     | 0.9039   | 0.8650   | 0.8087   | 0.7098   | 0.5851   | 0.4409   | 0.3275   | 0.3581   | 0.5338   | 0.7440        | 0.8639   | 0.9121 (86)     |        |  |  |              |  |  |
| MIT                                                                                                  | 19.1100  | 19.4404  | 19.8656  | 20.3589  | 20.7053  | 20.9039  | 20.9690  | 20.9595  | 20.8297  | 20.3751       | 19.6828  | 19.0598 (87)    |        |  |  |              |  |  |
| Th 2                                                                                                 | 20.0325  | 20.0350  | 20.0375  | 20.0491  | 20.0512  | 20.0614  | 20.0614  | 20.0633  | 20.0575  | 20.0512       | 20.0468  | 20.0422 (88)    |        |  |  |              |  |  |
| util rest of house                                                                                   | 0.8921   | 0.8492   | 0.7867   | 0.6780   | 0.5414   | 0.3844   | 0.2614   | 0.2901   | 0.4757   | 0.7083        | 0.8454   | 0.9012 (89)     |        |  |  |              |  |  |
| MIT 2                                                                                                | 17.8535  | 18.2623  | 18.7839  | 19.3792  | 19.7730  | 19.9871  | 20.0438  | 20.0391  | 19.9168  | 19.4150       | 18.5788  | 17.7976 (90)    |        |  |  |              |  |  |
| Living area fraction                                                                                 | 0.8921   | 0.8492   | 0.7867   | 0.6780   | 0.5414   | 0.3844   | 0.2614   | 0.2901   | 0.4757   | 0.7083        | 0.8454   | 0.9012 (89)     |        |  |  |              |  |  |
| MIT                                                                                                  | 18.4122  | 18.7861  | 19.2649  | 19.8148  | 20.1876  | 20.3948  | 20.4552  | 20.4484  | 20.3227  | 19.8419       | 19.0697  | 18.3588 (92)    |        |  |  |              |  |  |
| Temperature adjustment                                                                               | 18.4122  | 18.7861  | 19.2649  | 19.8148  | 20.1876  | 20.3948  | 20.4552  | 20.4484  | 20.3227  | 19.8419       | 19.0697  | 18.3588 (93)    |        |  |  |              |  |  |
| adjusted MIT                                                                                         | 18.4122  | 18.7861  | 19.2649  | 19.8148  | 20.1876  | 20.3948  | 20.4552  | 20.4484  | 20.3227  | 19.8419       | 19.0697  | 18.3588 (93)    |        |  |  |              |  |  |
| -----                                                                                                |          |          |          |          |          |          |          |          |          |               |          |                 |        |  |  |              |  |  |
| 8. Space heating requirement                                                                         |          |          |          |          |          |          |          |          |          |               |          |                 |        |  |  |              |  |  |
| -----                                                                                                |          |          |          |          |          |          |          |          |          |               |          |                 |        |  |  |              |  |  |
|                                                                                                      | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov      | Dec             |        |  |  |              |  |  |
| Utilisation                                                                                          | 0.8676   | 0.8252   | 0.7669   | 0.6696   | 0.5479   | 0.4049   | 0.2895   | 0.3186   | 0.4927   | 0.6997        | 0.8232   | 0.8773 (94)     |        |  |  |              |  |  |
| Useful gains                                                                                         | 432.1253 | 473.3538 | 484.6368 | 465.1768 | 398.8337 | 289.3715 | 199.0000 | 207.1481 | 300.1292 | 380.4868      | 406.7814 | 418.5237 (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                                                                                     | 771.4052 | 756.8635 | 693.7833 | 585.3244 | 454.0081 | 306.3131 | 203.7878 | 213.5264 | 330.4452 | 494.3586      | 643.5533 | 765.3098 (97)   |        |  |  |              |  |  |
| Space heating kWh                                                                                    | 252.4243 | 190.5185 | 155.6050 | 86.5063  | 41.0497  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 84.7206       | 170.4758 | 258.0089 (98a)  |        |  |  |              |  |  |
| Space heating requirement - total per year (kWh/year)                                                |          |          |          |          |          |          |          |          |          |               |          | 1239.3090       |        |  |  |              |  |  |
| 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                                                                                    | 252.4243 | 190.5185 | 155.6050 | 86.5063  | 41.0497  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 84.7206       | 170.4758 | 258.0089 (98c)  |        |  |  |              |  |  |
| Space heating requirement after solar contribution - total per year (kWh/year)                       |          |          |          |          |          |          |          |          |          |               |          | 1239.3090       |        |  |  |              |  |  |
| Space heating per m2                                                                                 |          |          |          |          |          |          |          |          |          | (98c) / (4) = |          | 24.0643 (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 %)                                                     |          |          |          |          |          |          |          |          |          |               |          | 92.3000 (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                                                                            | 252.4243 | 190.5185 | 155.6050 | 86.5063  | 41.0497  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 84.7206       | 170.4758 | 258.0089 (98)   |        |  |  |              |  |  |
| Space heating efficiency (main heating system 1)                                                     | 92.3000  | 92.3000  | 92.3000  | 92.3000  | 92.3000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 92.3000       | 92.3000  | 92.3000 (210)   |        |  |  |              |  |  |
| Space heating fuel (main heating system)                                                             | 273.4824 | 206.4122 | 168.5861 | 93.7229  | 44.4742  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 91.7883       | 184.6975 | 279.5330 (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                                                                                        | 201.1900 | 178.1663 | 189.9904 | 168.8602 | 164.8930 | 149.9021 | 148.9519 | 154.1604 | 155.0586 | 171.3096      | 180.1846 | 199.2426 (64)   |        |  |  |              |  |  |
| Water heating requirement                                                                            | 201.1900 | 178.1663 | 189.9904 | 168.8602 | 164.8930 | 149.9021 | 148.9519 | 154.1604 | 155.0586 | 171.3096      | 180.1846 | 199.2426 (64)   |        |  |  |              |  |  |
| Efficiency of water heater                                                                           | 84.5697  | 84.2104  | 83.6157  | 82.6372  | 81.4454  | 79.8000  | 79.8000  | 79.8000  | 79.8000  | 82.5691       | 83.9357  | 79.8000 (216)   |        |  |  |              |  |  |
| (217)m                                                                                               | 84.5697  | 84.2104  | 83.6157  | 82.6372  | 81.4454  | 79.8000  | 79.8000  | 79.8000  | 79.8000  | 82.5691       | 83.9357  | 84.6405 (217)   |        |  |  |              |  |  |
| Fuel for water heating, kWh/month                                                                    | 237.8985 | 211.5728 | 227.2185 | 204.3392 | 202.4584 | 187.8473 | 186.6565 | 193.1835 | 194.3090 | 207.4741      | 214.6697 | 235.3987 (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)    |        |  |  |              |  |  |
| (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   | 7.3041   | 7.0685   | 7.3041        | 7.0685   | 7.3041 (231)    |        |  |  |              |  |  |
| Lighting                                                                                             | 15.9650  | 12.8078  | 11.5320  | 8.4488   | 6.5261   | 5.3319   | 5.9533   | 7.3384   | 10.0514  | 13.1879       | 14.8957  | 16.4088 (232)   |        |  |  |              |  |  |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | -17.7164 | -25.8887 | -38.5678 | -45.0158 | -50.0051 | -47.2409 | -46.6923 | -43.3696 | -37.7320 | -30.3608      | -19.8088 | -15.2144 (233a) |        |  |  |              |  |  |
| (233a)m                                                                                              | -17.7164 | -25.8887 | -38.5678 | -45.0158 | -50.0051 | -47.2409 | -46.6923 | -43.3696 | -37.7320 | -30.3608      | -19.8088 | -15.2144 (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)   |        |  |  |              |  |  |
| (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)                  | 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)   |        |  |  |              |  |  |
| (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) | 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)   |        |  |  |              |  |  |
| (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)                                        | -7.4190  | -15.8442 | -31.9252 | -48.5774 | -64.8287 | -65.3266 | -64.5286 | -54.3394 | -39.4593 | -22.8331      | -9.9643  | -5.8471 (233b)  |        |  |  |              |  |  |
| (233b)m                                                                                              | -7.4190  | -15.8442 | -31.9252 | -48.5774 | -64.8287 | -65.3266 | -64.5286 | -54.3394 | -39.4593 | -22.8331      | -9.9643  | -5.8471 (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)   |        |  |  |              |  |  |
| (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)                  | 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)   |        |  |  |              |  |  |
| (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) | 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)   |        |  |  |              |  |  |
| (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                                                                   |          |          |          |          |          |          |          |          |          |               |          | 1342.6967 (211) |        |  |  |              |  |  |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |               |          | 0.0000 (213)    |        |  |  |              |  |  |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |               |          | 0.0000 (215)    |        |  |  |              |  |  |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |               |          | 79.8000         |        |  |  |              |  |  |
| Water heating fuel used                                                                              |          |          |          |          |          |          |          |          |          |               |          | 2503.0263 (219) |        |  |  |              |  |  |
| Space cooling fuel                                                                                   |          |          |          |          |          |          |          |          |          |               |          | 0.0000 (221)    |        |  |  |              |  |  |

# Full SAP Calculation Printout



|                                                     |                |
|-----------------------------------------------------|----------------|
| Electricity for pumps and fans:                     | 86.0000 (231)  |
| Total electricity for the above, kWh/year           | 128.8471 (232) |
| Electricity for lighting (calculated in Appendix L) |                |

|                                                               |                 |
|---------------------------------------------------------------|-----------------|
| Energy saving/generation technologies (Appendices M ,N and Q) |                 |
| PV generation                                                 | -848.5055 (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                           | 3212.0645 (238) |

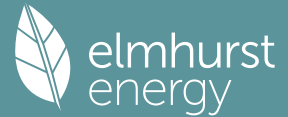
## ----- 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP -----

|                                               | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|-----------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1                 | 1342.6967          | 0.2100                        | 281.9663 (261)           |
| Total CO2 associated with community systems   |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                    | 2503.0263          | 0.2100                        | 525.6355 (264)           |
| Space and water heating                       |                    |                               | 807.6018 (265)           |
| Pumps, fans and electric keep-hot             | 86.0000            | 0.1387                        | 11.9293 (267)            |
| Energy for lighting                           | 128.8471           | 0.1443                        | 18.5966 (268)            |
| Energy saving/generation technologies         |                    |                               |                          |
| PV Unit electricity used in dwelling          | -417.6126          | 0.1338                        | -55.8814                 |
| PV Unit electricity exported                  | -430.8929          | 0.1255                        | -54.0888                 |
| Total                                         |                    |                               | -109.9702 (269)          |
| Total CO2, kg/year                            |                    |                               | 728.1575 (272)           |
| EPC Target Carbon Dioxide Emission Rate (TER) |                    |                               | 14.1400 (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               | 1342.6967          | 1.1300                              | 1517.2472 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 2503.0263          | 1.1300                              | 2828.4197 (278)            |
| Space and water heating                     |                    |                                     | 4345.6669 (279)            |
| Pumps, fans and electric keep-hot           | 86.0000            | 1.5128                              | 130.1008 (281)             |
| Energy for lighting                         | 128.8471           | 1.5338                              | 197.6299 (282)             |
| Energy saving/generation technologies       |                    |                                     |                            |
| PV Unit electricity used in dwelling        | -417.6126          | 1.4945                              | -624.1223                  |
| PV Unit electricity exported                | -430.8929          | 0.4608                              | -198.5361                  |
| Total                                       |                    |                                     | -822.6585 (283)            |
| Total Primary energy kWh/year               |                    |                                     | 3850.7392 (286)            |
| Target Primary Energy Rate (TPER)           |                    |                                     | 74.7700 (287)              |

# Full SAP Calculation Printout



|                                    |                      |               |       |               |                |            |  |
|------------------------------------|----------------------|---------------|-------|---------------|----------------|------------|--|
| Property Reference                 | OP-D320 APT Mid      |               |       |               | Issued on Date | 29/11/2024 |  |
| Assessment Reference               | APT Mid              |               |       | Prop Type Ref | APT Mid        |            |  |
| Property                           | APT Mid              |               |       |               |                |            |  |
|                                    |                      |               |       |               |                |            |  |
| SAP Rating                         | 83 B                 | DER           | 4.87  | TER           | 14.14          |            |  |
| Environmental                      | 97 A                 | % DER < TER   |       |               |                | 65.56      |  |
| CO <sub>2</sub> Emissions (t/year) | 0.24                 | DFEE          | 31.56 | TFEE          | 32.28          |            |  |
| Compliance Check                   | See BREL             | % DFEE < TFEE |       |               |                | 2.22       |  |
| % DPER < TPER                      | 30.81                | DPER          | 51.74 | TPER          | 74.77          |            |  |
|                                    |                      |               |       |               |                |            |  |
| Assessor Details                   | Mr. Matthew Stainrod |               |       |               | Assessor ID    | AU83-0001  |  |
| Client                             |                      |               |       |               |                |            |  |

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> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Ground floor                                           | 51.5000 (1b)              | 2.3700 (2b)                     | 122.0550 (1b) - (3b)        |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 51.5000                   |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | 122.0550 (5)                |

## 2. Ventilation rate

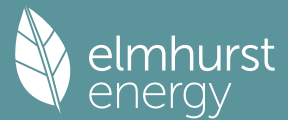
|                                                                                                    | m <sup>3</sup> per hour                 |
|----------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of 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                                                                | 2 * 10 = 20.0000 (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) = | 20.0000 / (5) = 0.1639 (8)              |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 3.5000 (17)                             |
| Infiltration rate                                                                                  | 0.3389 (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) = 0.2880 (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                                                                                         | 0.3672 | 0.3600 | 0.3528 | 0.3168 | 0.3096 | 0.2736 | 0.2736 | 0.2664 | 0.2880 | 0.3096 | 0.3240 | 0.3384 (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                                                                                            | 0.5674 | 0.5648 | 0.5622 | 0.5502 | 0.5479 | 0.5374 | 0.5374 | 0.5355 | 0.5415 | 0.5479 | 0.5525 | 0.5573 (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 |
|----------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|----------------------|--------------------------------|---------------|
| Front Door                                                     |                         |                            | 2.1400                    | 1.0000                        | 2.1400               |                                | (26)          |
| Windows (Uw = 1.30)                                            |                         |                            | 10.2100                   | 1.2357                        | 12.6169              |                                | (27)          |
| External Wall                                                  | 52.3800                 | 10.2100                    | 42.1700                   | 0.1700                        | 7.1689               |                                | (29a)         |
| Semi Exposed Wall                                              | 15.8800                 | 2.1400                     | 13.7400                   | 0.1700                        | 2.3358               |                                | (29a)         |
| Total net area of external elements Aum(A, m <sup>2</sup> )    |                         |                            | 68.2600                   |                               |                      |                                | (31)          |
| Fabric heat loss, W/K = Sum (A x U)                            |                         |                            |                           |                               | (26)...(30) + (32) = | 24.2616                        | (33)          |
| Party Floor                                                    |                         |                            | 52.3800                   |                               |                      |                                | (32d)         |
| Party Ceiling                                                  |                         |                            | 51.5900                   |                               |                      |                                | (32b)         |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K |                         |                            |                           |                               |                      |                                | 100.0000 (35) |
| List of Thermal Bridges                                        |                         |                            |                           |                               |                      |                                |               |
| K1 Element                                                     |                         |                            |                           | Length                        | Psi-value            | Total                          |               |
| E2 Other lintels (including other steel lintels)               |                         |                            |                           | 7.8300                        | 0.0500               | 0.3915                         |               |
| E3 Sill                                                        |                         |                            |                           | 6.8100                        | 0.0500               | 0.3405                         |               |
| E4 Jamb                                                        |                         |                            |                           | 19.2000                       | 0.0500               | 0.9600                         |               |
| E16 Corner (normal)                                            |                         |                            |                           | 9.4800                        | 0.0900               | 0.8532                         |               |
| E7 Party floor between dwellings (in blocks of flats)          |                         |                            |                           | 57.6000                       | 0.0700               | 4.0320                         |               |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)     |                         |                            |                           |                               |                      |                                | 6.5772 (36)   |

# Full SAP Calculation Printout



Point Thermal bridges  
Total fabric heat loss (33) + (36) + (36a) = 0.0000  
30.8388 (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                                                               | 22.8551 | 22.7497 | 22.6463 | 22.1607 | 22.0699 | 21.6470 | 21.6470 | 21.5686 | 21.8099 | 22.0699 | 22.2537 | 22.4458 (38) |
| Heat transfer coeff                                                 | 53.6940 | 53.5885 | 53.4851 | 52.9995 | 52.9087 | 52.4858 | 52.4858 | 52.4075 | 52.6487 | 52.9087 | 53.0925 | 53.2846 (39) |
| Average = Sum(39)m / 12 =                                           |         |         |         |         |         |         |         |         |         |         |         | 52.9991      |
| HLP                                                                 | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| HLP (average)                                                       | 1.0426  | 1.0406  | 1.0385  | 1.0291  | 1.0274  | 1.0191  | 1.0191  | 1.0176  | 1.0223  | 1.0274  | 1.0309  | 1.0347 (40)  |
| Days in mont                                                        | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31           |

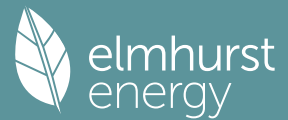
|                                                                                |         |         |         |         |         |         |         |         |         |         |         |                |
|--------------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|----------------|
| 4. Water heating energy requirements (kWh/year)                                |         |         |         |         |         |         |         |         |         |         |         |                |
| Assumed occupancy                                                              |         |         |         |         |         |         |         |         |         |         |         | 1.7343 (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                                                      | 23.0433 | 22.7010 | 22.2191 | 21.3305 | 20.6652 | 19.9274 | 19.5289 | 20.0074 | 20.5285 | 21.3179 | 22.2248 | 22.9654 (42b)  |
| Hot water usage for other uses                                                 | 32.3912 | 31.2133 | 30.0354 | 28.8576 | 27.6797 | 26.5019 | 26.5019 | 27.6797 | 28.8576 | 30.0354 | 31.2133 | 32.3912 (42c)  |
| Average daily hot water use (litres/day)                                       |         |         |         |         |         |         |         |         |         |         |         | 50.8112 (43)   |
| Daily hot water use                                                            | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec            |
| Energy conte                                                                   | 55.4344 | 53.9143 | 52.2546 | 50.1881 | 48.3449 | 46.4293 | 46.0307 | 47.6872 | 49.3861 | 51.3534 | 53.4381 | 55.3565 (44)   |
| Energy content (annual)                                                        | 87.7946 | 76.7733 | 80.3133 | 68.7050 | 65.0815 | 57.0902 | 55.6702 | 59.0467 | 60.8980 | 69.6861 | 76.1324 | 86.6749 (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:                                                            |         |         |         |         |         |         |         |         |         |         |         |                |
| 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                | 74.6254 | 65.2573 | 68.2663 | 58.3993 | 55.3193 | 48.5267 | 47.3197 | 50.1897 | 51.7633 | 59.2331 | 64.7125 | 73.6737 (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                                                                | 74.6254 | 65.2573 | 68.2663 | 58.3993 | 55.3193 | 48.5267 | 47.3197 | 50.1897 | 51.7633 | 59.2331 | 64.7125 | 73.6737 (64)   |
| 12Total per year (kWh/year)                                                    |         |         |         |         |         |         |         |         |         |         |         | 717 (64)       |
| Electric shower(s)                                                             | 42.6831 | 38.0310 | 41.5284 | 39.6300 | 40.3737 | 38.5126 | 39.7963 | 40.3737 | 39.6300 | 41.5284 | 40.7475 | 42.6831 (64a)  |
| Heat gains from water heating, kWh/month                                       | 29.3271 | 25.8221 | 27.4487 | 24.5073 | 23.9232 | 21.7598 | 21.7790 | 22.6408 | 22.8483 | 25.1904 | 26.3650 | 29.0892 (65)   |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |         |         |         |         |         |         |         |         |         |         |         | 485.5176 (64a) |

|                                                                                     |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| 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           |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 86.7160  | 86.7160  | 86.7160  | 86.7160  | 86.7160  | 86.7160  | 86.7160  | 86.7160  | 86.7160  | 86.7160  | 86.7160  | 86.7160 (66)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 76.8362  | 85.0687  | 76.8362  | 79.3974  | 76.8362  | 79.3974  | 76.8362  | 76.8362  | 79.3974  | 76.8362  | 79.3974  | 76.8362 (67)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 151.1287 | 152.6969 | 148.7450 | 140.3318 | 129.7117 | 119.7303 | 113.0621 | 111.4939 | 115.4458 | 123.8589 | 134.4791 | 144.4605 (68) |
| Pumps, fans                                                                         | 31.6716  | 31.6716  | 31.6716  | 31.6716  | 31.6716  | 31.6716  | 31.6716  | 31.6716  | 31.6716  | 31.6716  | 31.6716  | 31.6716 (69)  |
| Losses e.g. evaporation (negative values) (Table 5)                                 | 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)   |
| Water heating gains (Table 5)                                                       | -69.3728 | -69.3728 | -69.3728 | -69.3728 | -69.3728 | -69.3728 | -69.3728 | -69.3728 | -69.3728 | -69.3728 | -69.3728 | -69.3728 (71) |
| Total internal gains                                                                | 39.4182  | 38.4257  | 36.8934  | 34.0379  | 32.1549  | 30.2219  | 29.2728  | 30.4312  | 31.7338  | 33.8580  | 36.6181  | 39.0984 (72)  |
|                                                                                     | 316.3978 | 325.2061 | 311.4894 | 302.7820 | 287.7176 | 278.3644 | 268.1859 | 267.7761 | 275.5918 | 283.5680 | 299.5093 | 309.4099 (73) |

|                |          |            |          |               |             |              |          |          |          |          |          |               |
|----------------|----------|------------|----------|---------------|-------------|--------------|----------|----------|----------|----------|----------|---------------|
| 6. Solar gains |          |            |          |               |             |              |          |          |          |          |          |               |
| [Jan]          | Area     | Solar flux | g        | FF            | Access      | Gains        |          |          |          |          |          |               |
|                | m2       | Table 6a   | W/m2     | Specific data | factor      | W            |          |          |          |          |          |               |
|                |          |            |          | or Table 6b   | or Table 6c |              |          |          |          |          |          |               |
| East           | 3.7500   | 19.6403    | 0.6300   | 0.7000        | 0.7700      | 22.5087 (76) |          |          |          |          |          |               |
| South          | 2.7100   | 46.7521    | 0.6300   | 0.7000        | 0.7700      | 38.7206 (78) |          |          |          |          |          |               |
| West           | 3.7500   | 19.6403    | 0.6300   | 0.7000        | 0.7700      | 22.5087 (80) |          |          |          |          |          |               |
| Solar gains    | 83.7380  | 151.4779   | 225.8068 | 302.8123      | 354.3570    | 356.9142     | 342.0876 | 303.8811 | 253.0566 | 172.8932 | 102.0285 | 70.4783 (83)  |
| Total gains    | 400.1358 | 476.6840   | 537.2962 | 605.5943      | 642.0746    | 635.2787     | 610.2736 | 571.6572 | 528.6483 | 456.4612 | 401.5378 | 379.8881 (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                                                                         | 26.6428 | 26.6952 | 26.7468 | 26.9918 | 27.0382 | 27.2561 | 27.2561 | 27.2968 | 27.1717 | 27.0382 | 26.9446 | 26.8474      |
| alpha                                                                       | 2.7762  | 2.7797  | 2.7831  | 2.7995  | 2.8025  | 2.8171  | 2.8171  | 2.8198  | 2.8114  | 2.8025  | 2.7963  | 2.7898       |
| util living area                                                            | 0.9381  | 0.9038  | 0.8526  | 0.7575  | 0.6329  | 0.4834  | 0.3628  | 0.3995  | 0.5888  | 0.8015  | 0.9077  | 0.9452 (86)  |

# Full SAP Calculation Printout



|                        |         |         |         |         |         |         |         |         |                           |         |         |              |
|------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|--------------|
| MIT                    | 18.8560 | 19.2222 | 19.6926 | 20.2456 | 20.6457 | 20.8804 | 20.9605 | 20.9474 | 20.7844                   | 20.2375 | 19.4574 | 18.7888 (87) |
| Th 2                   | 20.0480 | 20.0497 | 20.0513 | 20.0591 | 20.0606 | 20.0674 | 20.0674 | 20.0687 | 20.0648                   | 20.0606 | 20.0576 | 20.0546 (88) |
| util rest of house     | 0.9298  | 0.8915  | 0.8341  | 0.7280  | 0.5894  | 0.4240  | 0.2912  | 0.3258  | 0.5294                    | 0.7700  | 0.8939  | 0.9378 (89)  |
| MIT 2                  | 18.1006 | 18.4574 | 18.9119 | 19.4370 | 19.7962 | 19.9943 | 20.0497 | 20.0438 | 19.9232                   | 19.4441 | 18.6987 | 18.0396 (90) |
| Living area fraction   |         |         |         |         |         |         |         |         | fLA = Living area / (4) = |         |         | 0.4447 (91)  |
| MIT                    | 18.4365 | 18.7975 | 19.2591 | 19.7965 | 20.1739 | 20.3883 | 20.4547 | 20.4456 | 20.3062                   | 19.7969 | 19.0361 | 18.3727 (92) |
| Temperature adjustment |         |         |         |         |         |         |         |         |                           |         |         | 0.0000       |
| adjusted MIT           | 18.4365 | 18.7975 | 19.2591 | 19.7965 | 20.1739 | 20.3883 | 20.4547 | 20.4456 | 20.3062                   | 19.7969 | 19.0361 | 18.3727 (93) |

## 8. Space heating requirement

|                                                                                | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov      | Dec       |       |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|----------|-----------|-------|
| Utilisation                                                                    | 0.9122   | 0.8722   | 0.8164   | 0.7191   | 0.5949   | 0.4450   | 0.3215   | 0.3563   | 0.5454   | 0.7601        | 0.8757   | 0.9211    | (94)  |
| Useful gains                                                                   | 365.0186 | 415.7647 | 438.6238 | 435.4663 | 381.9601 | 282.7009 | 196.1958 | 203.6926 | 288.3459 | 346.9572      | 351.6433 | 349.9051  | (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                                                               | 759.0438 | 744.7446 | 682.4195 | 577.5121 | 448.3451 | 303.8060 | 202.3168 | 212.0175 | 326.7457 | 486.5951      | 633.7168 | 755.1878  | (97)  |
| Space heating kWh                                                              | 293.1548 | 221.0745 | 181.3840 | 102.2729 | 49.3904  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 103.8906      | 203.0929 | 301.5303  | (98a) |
| Space heating requirement - total per year (kWh/year)                          |          |          |          |          |          |          |          |          |          |               |          | 1455.7904 |       |
| 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                                                              | 293.1548 | 221.0745 | 181.3840 | 102.2729 | 49.3904  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 103.8906      | 203.0929 | 301.5303  | (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |          |          |          |          |          |          |          |          |          |               |          | 1455.7904 |       |
| Space heating per m2                                                           |          |          |          |          |          |          |          |          |          | (98c) / (4) = |          | 28.2678   | (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  | 493.3663 | 388.3947 | 398.2967 | 0.0000                   | 0.0000  | 0.0000 | 0.0000   | (100) |
| Utilisation                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 0.8560   | 0.9017   | 0.8826   | 0.0000                   | 0.0000  | 0.0000 | 0.0000   | (101) |
| Useful loss                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 422.3033 | 350.2007 | 351.5551 | 0.0000                   | 0.0000  | 0.0000 | 0.0000   | (102) |
| Total gains                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 714.6458 | 686.9559 | 643.2947 | 0.0000                   | 0.0000  | 0.0000 | 0.0000   | (103) |
| Space cooling kWh                | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 210.4867 | 250.5459 | 217.0543 | 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  | 52.6217  | 62.6365  | 54.2636  | 0.0000                   | 0.0000  | 0.0000 | 0.0000   | (107) |
| Space cooling requirement        |        |        |        |        |         |          |          |          |                          |         |        | 169.5217 | (107) |
| Energy for space heating         |        |        |        |        |         |          |          |          |                          |         |        | 28.2678  | (99)  |
| Energy for space cooling         |        |        |        |        |         |          |          |          |                          |         |        | 3.2917   | (108) |
| Total                            |        |        |        |        |         |          |          |          |                          |         |        | 31.5595  | (109) |
| Fabric Energy Efficiency (DFEE)  |        |        |        |        |         |          |          |          |                          |         |        | 31.6     | (109) |

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

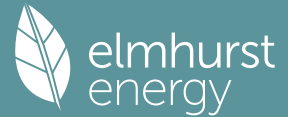
## 1. Overall dwelling characteristics

|                                                        | Area (m2)    | Storey height (m)               | Volume (m3)          |     |
|--------------------------------------------------------|--------------|---------------------------------|----------------------|-----|
| Ground floor                                           | 51.5000 (1b) | 2.3700 (2b)                     | 122.0550 (1b) - (3b) |     |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 51.5000      |                                 |                      | (4) |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | 122.0550 (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                                                                | 2 * 10 =                    | 20.0000 (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) = | 20.0000 / (5) =             | 0.1639 (8)   |
| Pressure test                                                                                      | Yes                         |              |
| Pressure Test Method                                                                               | Blower Door                 |              |
| Measured/design AP50                                                                               | 5.0000                      | (17)         |
| Infiltration rate                                                                                  | 0.4139                      | (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) =        | 0.3518 (21)  |

# Full SAP Calculation Printout



|                                                                                                         |        |        |        |        |        |        |        |        |        |        |        |        |              |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| 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)        |
|                                                                                                         | 0.4485 | 0.4397 | 0.4309 | 0.3870 | 0.3782 | 0.3342 | 0.3342 | 0.3254 | 0.3518 | 0.3782 | 0.3958 | 0.4133 | (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                                                                                            | 0.6006 | 0.5967 | 0.5929 | 0.5749 | 0.5715 | 0.5558 | 0.5558 | 0.5529 | 0.5619 | 0.5715 | 0.5783 | 0.5854 | (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 |       |
|------------------------------------------------|-------------|----------------|---------------|------------------|----------------------|-------------------|---------------|-------|
| TER Opaque door                                |             |                | 2.1400        | 1.0000           | 2.1400               |                   |               | (26)  |
| TER Opening Type (Uw = 1.20)                   |             |                | 10.2100       | 1.1450           | 11.6908              |                   |               | (27)  |
| External Wall                                  | 52.3800     | 10.2100        | 42.1700       | 0.1800           | 7.5906               |                   |               | (29a) |
| Semi Exposed Wall                              | 15.8800     | 2.1400         | 13.7400       | 0.1800           | 2.4732               |                   |               | (29a) |
| Total net area of external elements Aum(A, m2) |             |                | 68.2600       |                  |                      |                   |               | (31)  |
| Fabric heat loss, W/K = Sum (A x U)            |             |                |               |                  | (26)...(30) + (32) = | 23.8946           |               | (33)  |

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

100.0000 (35)

### List of Thermal Bridges

| K1 Element                                            | Length  | Psi-value | Total  |  |
|-------------------------------------------------------|---------|-----------|--------|--|
| E2 Other lintels (including other steel lintels)      | 7.8300  | 0.0500    | 0.3915 |  |
| E3 Sill                                               | 6.8100  | 0.0500    | 0.3405 |  |
| E4 Jamb                                               | 19.2000 | 0.0500    | 0.9600 |  |
| E16 Corner (normal)                                   | 9.4800  | 0.0900    | 0.8532 |  |
| E7 Party floor between dwellings (in blocks of flats) | 57.6000 | 0.0700    | 4.0320 |  |

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

6.5772 (36)

### Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 30.4718 (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       | 24.1905 | 24.0332 | 23.8790 | 23.1547 | 23.0191 | 22.3883 | 22.3883 | 22.2715 | 22.6313 | 23.0191 | 23.2933 | 23.5799 | (38) |
| Average = Sum(39)m / 12 = | 54.6623 | 54.5050 | 54.3508 | 53.6265 | 53.4910 | 52.8601 | 52.8601 | 52.7433 | 53.1031 | 53.4910 | 53.7651 | 54.0517 | (39) |
|                           |         |         |         |         |         |         |         |         |         |         |         | 53.6258 |      |

|               |        |        |        |        |        |        |        |        |        |        |        |        |      |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| HLP           | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |      |
| HLP (average) | 1.0614 | 1.0583 | 1.0554 | 1.0413 | 1.0387 | 1.0264 | 1.0264 | 1.0241 | 1.0311 | 1.0387 | 1.0440 | 1.0495 | (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                        |         |         |         |         |         |         |         |         |         |         |         |         | 1.7343 (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                | 23.0433 | 22.7010 | 22.2191 | 21.3305 | 20.6652 | 19.9274 | 19.5289 | 20.0074 | 20.5285 | 21.3179 | 22.2248 | 22.9654 | (42b)        |
| Hot water usage for other uses           | 32.3912 | 31.2133 | 30.0354 | 28.8576 | 27.6797 | 26.5019 | 26.5019 | 27.6797 | 28.8576 | 30.0354 | 31.2133 | 32.3912 | (42c)        |
| Average daily hot water use (litres/day) |         |         |         |         |         |         |         |         |         |         |         |         | 50.8112 (43) |

|                                        |         |         |         |         |         |         |         |         |         |         |         |         |      |
|----------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| Daily hot water use                    | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |      |
| Energy conte                           | 55.4344 | 53.9143 | 52.2546 | 50.1881 | 48.3449 | 46.4293 | 46.0307 | 47.6872 | 49.3861 | 51.3534 | 53.4381 | 55.3565 | (44) |
| Energy content (annual)                | 87.7946 | 76.7733 | 80.3133 | 68.7050 | 65.0815 | 57.0902 | 55.6702 | 59.0467 | 60.8980 | 69.6861 | 76.1324 | 86.6749 | (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:

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 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 0.0000 (61)

Total heat required for water heating calculated for each month

74.6254 65.2573 68.2663 58.3993 55.3193 48.5267 47.3197 50.1897 51.7633 59.2331 64.7125 73.6737 (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 0.0000 (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 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 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 0.0000 (63d)

Output from w/h 74.6254 65.2573 68.2663 58.3993 55.3193 48.5267 47.3197 50.1897 51.7633 59.2331 64.7125 73.6737 (64)

Total per year (kWh/year) = Sum(64)m = 717.2862 (64)

Electric shower(s) 42.6831 38.0310 41.5284 39.6300 40.3737 38.5126 39.7963 40.3737 39.6300 41.5284 40.7475 42.6831 (64a)

Total Energy used by instantaneous electric shower (s) = Sum(64a)m = 485.5176 (64a)

Heat gains from water heating, kWh/month 29.3271 25.8221 27.4487 24.5073 23.9232 21.7598 21.7790 22.6408 22.8483 25.1904 26.3650 29.0892 (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                                                                               | 86.7160  | 86.7160  | 86.7160  | 86.7160  | 86.7160  | 86.7160  | 86.7160  | 86.7160  | 86.7160  | 86.7160  | 86.7160  | 86.7160  | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 76.8362  | 85.0687  | 76.8362  | 79.3974  | 76.8362  | 79.3974  | 76.8362  | 76.8362  | 79.3974  | 76.8362  | 79.3974  | 76.8362  | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 151.1287 | 152.6969 | 148.7450 | 140.3318 | 129.7117 | 119.7303 | 113.0621 | 111.4939 | 115.4458 | 123.8589 | 134.4791 | 144.4605 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 31.6716  | 31.6716  | 31.6716  | 31.6716  | 31.6716  | 31.6716  | 31.6716  | 31.6716  | 31.6716  | 31.6716  | 31.6716  | 31.6716  | (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)                                 | -69.3728 | -69.3728 | -69.3728 | -69.3728 | -69.3728 | -69.3728 | -69.3728 | -69.3728 | -69.3728 | -69.3728 | -69.3728 | -69.3728 | (71) |
| Water heating gains (Table 5)                                                       |          |          |          |          |          |          |          |          |          |          |          |          |      |

# Full SAP Calculation Printout



|                      |          |          |          |          |          |          |          |          |          |          |          |               |
|----------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Total internal gains | 39.4182  | 38.4257  | 36.8934  | 34.0379  | 32.1549  | 30.2219  | 29.2728  | 30.4312  | 31.7338  | 33.8580  | 36.6181  | 39.0984 (72)  |
|                      | 316.3978 | 325.2061 | 311.4894 | 302.7820 | 287.7176 | 278.3644 | 268.1859 | 267.7761 | 275.5918 | 283.5680 | 299.5093 | 309.4099 (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   |               |
|-------------|------------|----------|--------------------------------|----------|------------------------------|----------|------------------------------|----------|------------------------------|----------|--------------|---------------|
| East        | 3.7500     |          | 19.6403                        |          | 0.6300                       |          | 0.7000                       |          | 0.7700                       |          | 22.5087 (76) |               |
| South       | 2.7100     |          | 46.7521                        |          | 0.6300                       |          | 0.7000                       |          | 0.7700                       |          | 38.7206 (78) |               |
| West        | 3.7500     |          | 19.6403                        |          | 0.6300                       |          | 0.7000                       |          | 0.7700                       |          | 22.5087 (80) |               |
| Solar gains | 83.7380    | 151.4779 | 225.8068                       | 302.8123 | 354.3570                     | 356.9142 | 342.0876                     | 303.8811 | 253.0566                     | 172.8932 | 102.0285     | 70.4783 (83)  |
| Total gains | 400.1358   | 476.6840 | 537.2962                       | 605.5943 | 642.0746                     | 635.2787 | 610.2736                     | 571.6572 | 528.6483                     | 456.4612 | 401.5378     | 379.8881 (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                                                                         | 26.1708 | 26.2463 | 26.3208 | 26.6763 | 26.7439 | 27.0630 | 27.0630 | 27.1230 | 26.9392 | 26.7439 | 26.6075 | 26.4664      |
| alpha                                                                       | 2.7447  | 2.7498  | 2.7547  | 2.7784  | 2.7829  | 2.8042  | 2.8042  | 2.8082  | 2.7959  | 2.7829  | 2.7738  | 2.7644       |
| util living area                                                            | 0.9388  | 0.9051  | 0.8547  | 0.7602  | 0.6362  | 0.4857  | 0.3649  | 0.4015  | 0.5915  | 0.8035  | 0.9086  | 0.9457 (86)  |
| MIT                                                                         | 18.8055 | 19.1757 | 19.6538 | 20.2243 | 20.6336 | 20.8770 | 20.9591 | 20.9458 | 20.7782 | 20.2195 | 19.4278 | 18.7485 (87) |
| Th 2                                                                        | 20.0325 | 20.0350 | 20.0375 | 20.0491 | 20.0512 | 20.0614 | 20.0614 | 20.0633 | 20.0575 | 20.0512 | 20.0468 | 20.0422 (88) |
| util rest of house                                                          | 0.9306  | 0.8929  | 0.8362  | 0.7306  | 0.5924  | 0.4259  | 0.2926  | 0.3272  | 0.5317  | 0.7720  | 0.8948  | 0.9383 (89)  |
| MIT 2                                                                       | 18.0405 | 18.4020 | 18.8647 | 19.4095 | 19.7780 | 19.9863 | 20.0431 | 20.0377 | 19.9119 | 19.4204 | 18.6624 | 17.9916 (90) |
| Living area fraction                                                        | 18.3807 | 18.7460 | 19.2156 | 19.7718 | 20.1585 | 20.3824 | 20.4504 | 20.4415 | 20.2971 | 19.7757 | 19.0027 | 18.3282 (92) |
| MIT                                                                         | 18.3807 | 18.7460 | 19.2156 | 19.7718 | 20.1585 | 20.3824 | 20.4504 | 20.4415 | 20.2971 | 19.7757 | 19.0027 | 18.3282 (93) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT                                                                | 18.3807 | 18.7460 | 19.2156 | 19.7718 | 20.1585 | 20.3824 | 20.4504 | 20.4415 | 20.2971 | 19.7757 | 19.0027 | 18.3282 (93) |

## 8. Space heating requirement

|                                                                                |          |          |          |          |          |          |          |          |          |               |          |                |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|----------|----------------|
|                                                                                | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov      | Dec            |
| Utilisation                                                                    | 0.9127   | 0.8732   | 0.8181   | 0.7212   | 0.5976   | 0.4469   | 0.3231   | 0.3579   | 0.5477   | 0.7617        | 0.8765   | 0.9214 (94)    |
| Useful gains                                                                   | 365.2230 | 416.2511 | 439.5385 | 436.7653 | 383.7191 | 283.9284 | 197.1979 | 204.5873 | 289.5322 | 347.7050      | 351.9339 | 350.0287 (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                                                               | 769.6822 | 754.6765 | 691.1011 | 583.0177 | 452.4518 | 305.6570 | 203.5346 | 213.1619 | 329.0854 | 490.8185      | 639.9528 | 763.6514 (97)  |
| Space heating kWh                                                              | 300.9177 | 227.4219 | 187.1625 | 105.3017 | 51.1371  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 106.4764      | 207.3736 | 307.7353 (98a) |
| Space heating requirement - total per year (kWh/year)                          |          |          |          |          |          |          |          |          |          |               |          | 1493.5262      |
| 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                                                              | 300.9177 | 227.4219 | 187.1625 | 105.3017 | 51.1371  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 106.4764      | 207.3736 | 307.7353 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |          |          |          |          |          |          |          |          |          |               |          | 1493.5262      |
| Space heating per m2                                                           |          |          |          |          |          |          |          |          |          | (98c) / (4) = |          | 29.0005 (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  | 496.8853 | 391.1650 | 400.8492 | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (100)   |
| Utilisation                                         | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 0.8532   | 0.8994   | 0.8804   | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (101)   |
| Useful loss                                         | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 423.9352 | 351.8260 | 352.9141 | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (102)   |
| Total gains                                         | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 714.6458 | 686.9559 | 643.2947 | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (103)   |
| Space cooling kWh                                   | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 209.3116 | 249.3366 | 216.0431 | 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  | 52.3279  | 62.3342  | 54.0108  | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (107)   |
| Space cooling requirement                           |        |        |        |        |         |          |          |          |                          |         |        | 168.6729 (107) |
| Energy for space heating                            |        |        |        |        |         |          |          |          |                          |         |        | 29.0005 (99)   |
| Energy for space cooling                            |        |        |        |        |         |          |          |          |                          |         |        | 3.2752 (108)   |
| Total                                               |        |        |        |        |         |          |          |          |                          |         |        | 32.2757 (109)  |
| Fabric Energy Efficiency (TFEE)                     |        |        |        |        |         |          |          |          |                          |         |        | 32.3 (109)     |

# Full SAP Calculation Printout



|                                    |                      |               |               |         |                |            |
|------------------------------------|----------------------|---------------|---------------|---------|----------------|------------|
| Property Reference                 | OP-D320 APT Mid      |               |               |         | Issued on Date | 29/11/2024 |
| Assessment Reference               | APT Mid              |               | Prop Type Ref | APT Mid |                |            |
| Property                           | APT Mid              |               |               |         |                |            |
|                                    |                      |               |               |         |                |            |
| SAP Rating                         | 83 B                 | DER           | 4.87          | TER     | 14.14          |            |
| Environmental                      | 97 A                 | % DER < TER   |               |         |                | 65.56      |
| CO <sub>2</sub> Emissions (t/year) | 0.24                 | DFEE          | 31.56         | TFEE    | 32.28          |            |
| Compliance Check                   | See BREL             | % DFEE < TFEE |               |         |                | 2.22       |
| % DPER < TPER                      | 30.81                | DPER          | 51.74         | TPER    | 74.77          |            |
|                                    |                      |               |               |         |                |            |
| Assessor Details                   | Mr. Matthew Stainrod |               |               |         | Assessor ID    | AU83-0001  |
| Client                             |                      |               |               |         |                |            |

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> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Ground floor                                           | 51.5000 (1b)              | 2.3700 (2b)                     | 122.0550 (1b) - (3b)        |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 51.5000                   |                                 | 122.0550 (4)                |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | 122.0550 (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                                                                               | 3.5000                      | (17)        |
| Infiltration rate                                                                                  | 0.1750                      | (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) =        | 0.1487 (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                                                                                         | 0.1897 | 0.1859 | 0.1822 | 0.1636 | 0.1599 | 0.1413 | 0.1413 | 0.1376 | 0.1487 | 0.1599 | 0.1673 | 0.1748 (22b)  |
| Balanced mechanical ventilation with heat recovery                                                      |        |        |        |        |        |        |        |        |        |        |        |               |
| 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)  |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =            |        |        |        |        |        |        |        |        |        |        |        | 72.8000 (23c) |
| Effective ac                                                                                            | 0.3257 | 0.3219 | 0.3182 | 0.2996 | 0.2959 | 0.2773 | 0.2773 | 0.2736 | 0.2848 | 0.2959 | 0.3033 | 0.3108 (25)   |

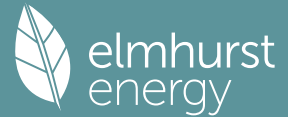
## 3. Heat losses and heat loss parameter

| 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 |
|----------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|---------------|
| Front Door                                                     |                         |                            | 2.1400                    | 1.0000                        | 2.1400       |                                | (26)          |
| Windows (Uw = 1.30)                                            |                         |                            | 10.2100                   | 1.2357                        | 12.6169      |                                | (27)          |
| External Wall                                                  | 52.3800                 | 10.2100                    | 42.1700                   | 0.1700                        | 7.1689       |                                | (29a)         |
| Semi Exposed Wall                                              | 15.8800                 | 2.1400                     | 13.7400                   | 0.1700                        | 2.3358       |                                | (29a)         |
| Total net area of external elements Aum(A, m <sup>2</sup> )    |                         |                            | 68.2600                   |                               |              |                                | (31)          |
| Fabric heat loss, W/K = Sum (A x U)                            |                         |                            |                           | (26)...(30) + (32) =          | 24.2616      |                                | (33)          |
| Party Floor                                                    |                         |                            | 52.3800                   |                               |              |                                | (32d)         |
| Party Ceiling                                                  |                         |                            | 51.5900                   |                               |              |                                | (32b)         |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K |                         |                            |                           |                               |              |                                | 100.0000 (35) |
| List of Thermal Bridges                                        |                         |                            |                           |                               |              |                                |               |
| K1 Element                                                     |                         |                            |                           | Length                        | Psi-value    | Total                          |               |
| E2 Other lintels (including other steel lintels)               |                         |                            |                           | 7.8300                        | 0.0500       | 0.3915                         |               |
| E3 Sill                                                        |                         |                            |                           | 6.8100                        | 0.0500       | 0.3405                         |               |
| E4 Jamb                                                        |                         |                            |                           | 19.2000                       | 0.0500       | 0.9600                         |               |



7. Mean internal temperature (heating season)

# Full SAP Calculation Printout



|                                                                                                              |          |          |          |          |          |          |          |          |                           |               |          |                 |
|--------------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|---------------------------|---------------|----------|-----------------|
| 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                                                                                                        | 32.5454  | 32.6567  | 32.7688  | 33.3407  | 33.4575  | 34.0540  | 34.0540  | 34.1758  | 33.8129                   | 33.4575       | 33.2247  | 32.9952         |
| util living area                                                                                             | 3.1697   | 3.1771   | 3.1846   | 3.2227   | 3.2305   | 3.2703   | 3.2703   | 3.2784   | 3.2542                    | 3.2305        | 3.2150   | 3.1997          |
|                                                                                                              | 0.8753   | 0.8246   | 0.7535   | 0.6356   | 0.5020   | 0.3768   | 0.2748   | 0.3018   | 0.4693                    | 0.6731        | 0.8216   | 0.8857 (86)     |
| Living                                                                                                       | 19.7418  | 20.0266  | 20.3518  | 20.6884  | 20.8808  | 20.9661  | 20.9909  | 20.9876  | 20.9292                   | 20.6840       | 20.1926  | 19.7013         |
| Non living                                                                                                   | 18.7525  | 19.1014  | 19.4952  | 19.8984  | 20.1137  | 20.2127  | 20.2342  | 20.2344  | 20.1749                   | 19.9050       | 19.3208  | 18.7102         |
| 24 / 16                                                                                                      | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0                         | 0             | 0        | 0               |
| 24 / 9                                                                                                       | 3        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0                         | 0             | 0        | 0               |
| 16 / 9                                                                                                       | 28       | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0                         | 0             | 0        | 10              |
| MIT                                                                                                          | 20.3563  | 20.0266  | 20.3518  | 20.6884  | 20.8808  | 20.9661  | 20.9909  | 20.9876  | 20.9292                   | 20.6840       | 20.1926  | 19.8830 (87)    |
| Th 2                                                                                                         | 20.2072  | 20.2097  | 20.2122  | 20.2247  | 20.2272  | 20.2397  | 20.2397  | 20.2423  | 20.2347                   | 20.2272       | 20.2222  | 20.2172 (88)    |
| util rest of house                                                                                           | 0.8624   | 0.8080   | 0.7315   | 0.6068   | 0.4666   | 0.3349   | 0.2284   | 0.2536   | 0.4234                    | 0.6398        | 0.8021   | 0.8737 (89)     |
| MIT 2                                                                                                        | 19.6273  | 19.1014  | 19.4952  | 19.8984  | 20.1137  | 20.2127  | 20.2342  | 20.2344  | 20.1749                   | 19.9050       | 19.3208  | 18.9818 (90)    |
| Living area fraction                                                                                         |          |          |          |          |          |          |          |          | fLA = Living area / (4) = |               |          |                 |
| MIT                                                                                                          | 19.9515  | 19.5128  | 19.8761  | 20.2497  | 20.4548  | 20.5477  | 20.5707  | 20.5693  | 20.5103                   | 20.2514       | 19.7084  | 19.3825 (92)    |
| Temperature adjustment                                                                                       |          |          |          |          |          |          |          |          |                           |               |          | 0.0000          |
| adjusted MIT                                                                                                 | 19.9515  | 19.5128  | 19.8761  | 20.2497  | 20.4548  | 20.5477  | 20.5707  | 20.5693  | 20.5103                   | 20.2514       | 19.7084  | 19.3825 (93)    |
| -----                                                                                                        |          |          |          |          |          |          |          |          |                           |               |          |                 |
| 8. Space heating requirement                                                                                 |          |          |          |          |          |          |          |          |                           |               |          |                 |
| -----                                                                                                        |          |          |          |          |          |          |          |          |                           |               |          |                 |
| Utilisation                                                                                                  | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep                       | Oct           | Nov      | Dec             |
| Useful gains                                                                                                 | 0.8579   | 0.7918   | 0.7215   | 0.6077   | 0.4772   | 0.3520   | 0.2487   | 0.2745   | 0.4402                    | 0.6409        | 0.7879   | 0.8592 (94)     |
| Ext temp.                                                                                                    | 440.0144 | 465.6466 | 465.8484 | 429.4274 | 352.5677 | 244.1081 | 165.4434 | 172.6258 | 258.9931                  | 355.8445      | 399.7050 | 422.4005 (95)   |
| Heat loss rate W                                                                                             | 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)     |
|                                                                                                              | 687.9701 | 640.1272 | 583.9495 | 486.9828 | 374.3320 | 249.8556 | 166.8022 | 174.5202 | 271.2077                  | 412.6681      | 542.8798 | 658.2600 (97)   |
| Space heating kWh                                                                                            | 184.4790 | 117.2509 | 87.8672  | 41.4399  | 16.1926  | 0.0000   | 0.0000   | 0.0000   | 0.0000                    | 42.2767       | 103.0858 | 175.4794 (98a)  |
| Space heating requirement - total per year (kWh/year)                                                        |          |          |          |          |          |          |          |          |                           |               |          | 768.0717        |
| 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                                                                                            | 184.4790 | 117.2509 | 87.8672  | 41.4399  | 16.1926  | 0.0000   | 0.0000   | 0.0000   | 0.0000                    | 42.2767       | 103.0858 | 175.4794 (98c)  |
| Space heating requirement after solar contribution - total per year (kWh/year)                               |          |          |          |          |          |          |          |          |                           |               |          | 768.0717        |
| Space heating per m2                                                                                         |          |          |          |          |          |          |          |          |                           | (98c) / (4) = |          | 14.9140 (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 %)                                                             |          |          |          |          |          |          |          |          |                           |               |          | 240.1133 (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                                                                                    | 184.4790 | 117.2509 | 87.8672  | 41.4399  | 16.1926  | 0.0000   | 0.0000   | 0.0000   | 0.0000                    | 42.2767       | 103.0858 | 175.4794 (98)   |
| Space heating efficiency (main heating system 1)                                                             | 240.1133 | 240.1133 | 240.1133 | 240.1133 | 240.1133 | 0.0000   | 0.0000   | 0.0000   | 0.0000                    | 240.1133      | 240.1133 | 240.1133 (210)  |
| Space heating fuel (main heating system)                                                                     | 76.8300  | 48.8315  | 36.5941  | 17.2585  | 6.7437   | 0.0000   | 0.0000   | 0.0000   | 0.0000                    | 17.6070       | 42.9322  | 73.0819 (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                                                                                    | 306.8628 | 272.4637 | 291.3992 | 259.9447 | 254.7172 | 201.8427 | 199.4982 | 206.7890 | 208.4150                  | 263.1027      | 275.7411 | 303.9257 (64)   |
| Efficiency of water heater (217)m                                                                            | 273.4325 | 273.4325 | 273.4325 | 273.4325 | 273.4325 | 273.4325 | 273.4325 | 273.4325 | 273.4325                  | 273.4325      | 273.4325 | 273.4325 (216)  |
| Fuel for water heating, kWh/month                                                                            | 112.2262 | 99.6457  | 106.5708 | 95.0672  | 93.1554  | 73.8181  | 72.9607  | 75.6271  | 76.2218                   | 96.2222       | 100.8443 | 111.1520 (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                                                                                                 | 12.3940  | 11.1946  | 12.3940  | 11.9942  | 12.3940  | 11.9942  | 12.3940  | 12.3940  | 11.9942                   | 12.3940       | 11.9942  | 12.3940 (231)   |
| Lighting                                                                                                     | 19.5572  | 15.6895  | 14.1267  | 10.3498  | 7.9945   | 6.5316   | 7.2928   | 9.4795   | 12.3130                   | 16.1553       | 18.2473  | 20.1008 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity) (233a)m                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                    | 0.0000        | 0.0000   | 0.0000 (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                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                    | 0.0000        | 0.0000   | 0.0000 (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                                                                           |          |          |          |          |          |          |          |          |                           |               |          | 319.8789 (211)  |
| Space heating fuel - main system 2                                                                           |          |          |          |          |          |          |          |          |                           |               |          | 0.0000 (213)    |
| Space heating fuel - secondary                                                                               |          |          |          |          |          |          |          |          |                           |               |          | 0.0000 (215)    |
| Efficiency of water heater                                                                                   |          |          |          |          |          |          |          |          |                           |               |          | 273.4325        |
| Water heating fuel used                                                                                      |          |          |          |          |          |          |          |          |                           |               |          | 1113.5114 (219) |
| Space cooling fuel                                                                                           |          |          |          |          |          |          |          |          |                           |               |          | 0.0000 (221)    |
| Electricity for pumps and fans:                                                                              |          |          |          |          |          |          |          |          |                           |               |          |                 |
| (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.9800)                                   |          |          |          |          |          |          |          |          |                           |               |          |                 |
| mechanical ventilation fans (SFP = 0.9800)                                                                   |          |          |          |          |          |          |          |          |                           |               |          | 145.9290 (230a) |
| Total electricity for the above, kWh/year                                                                    |          |          |          |          |          |          |          |          |                           |               |          | 145.9290 (231)  |
| Electricity for lighting (calculated in Appendix L)                                                          |          |          |          |          |          |          |          |          |                           |               |          | 157.8380 (232)  |

# Full SAP Calculation Printout



Energy saving/generation technologies (Appendices M ,N and Q)

|                                                |                 |
|------------------------------------------------|-----------------|
| PV generation                                  | 0.0000 (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            | 1737.1573 (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                   | 319.8789           | 0.1566                        | 50.0830 (261)            |
| Total CO2 associated with community systems     |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                      | 1113.5114          | 0.1415                        | 157.5902 (264)           |
| Space and water heating                         |                    |                               | 207.6732 (265)           |
| Pumps, fans and electric keep-hot               | 145.9290           | 0.1387                        | 20.2421 (267)            |
| Energy for lighting                             | 157.8380           | 0.1443                        | 22.7809 (268)            |
| Total CO2, kg/year                              |                    |                               | 250.6963 (272)           |
| EPC Dwelling Carbon Dioxide Emission Rate (DER) |                    |                               | 4.8700 (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               | 319.8789           | 1.5796                              | 505.2758 (275)             |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 1113.5114          | 1.5234                              | 1696.2742 (278)            |
| Space and water heating                     |                    |                                     | 2201.5500 (279)            |
| Pumps, fans and electric keep-hot           | 145.9290           | 1.5128                              | 220.7613 (281)             |
| Energy for lighting                         | 157.8380           | 1.5338                              | 242.0972 (282)             |
| Total Primary energy kWh/year               |                    |                                     | 2664.4085 (286)            |
| Dwelling Primary energy Rate (DPER)         |                    |                                     | 51.7400 (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)         |
|--------------------------------------------------------|--------------|---------------------------------|------------------------|
| Ground floor                                           | 51.5000 (1b) | x 2.3700 (2b)                   | = 122.0550 (1b) - (3b) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 51.5000      |                                 | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 122.0550 (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                | 2 * 10 = 20.0000 (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) = 20.0000 / (5) = 0.1639 (8)

|                           |             |
|---------------------------|-------------|
| Pressure test             | Yes         |
| Pressure Test Method      | Blower Door |
| Measured/design AP50      | 5.0000 (17) |
| Infiltration rate         | 0.4139 (18) |
| Number of sides sheltered | 2 (19)      |

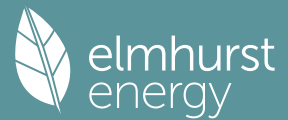
Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)  
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3518 (21)

|                 | 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 | 0.4485 | 0.4397 | 0.4309 | 0.3870 | 0.3782 | 0.3342 | 0.3342 | 0.3254 | 0.3518 | 0.3782 | 0.3958 | 0.4133 (22b) |
| Effective ac    | 0.6006 | 0.5967 | 0.5929 | 0.5749 | 0.5715 | 0.5558 | 0.5558 | 0.5529 | 0.5619 | 0.5715 | 0.5783 | 0.5854 (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 |
|------------------------------|-------------|----------------|---------------|------------------|--------------|-------------------|---------------|
| TER Opaque door              |             |                | 2.1400        | 1.0000           | 2.1400       |                   | (26)          |
| TER Opening Type (Uw = 1.20) |             |                | 10.2100       | 1.1450           | 11.6908      |                   | (27)          |

# Full SAP Calculation Printout



|                                                |         |         |                      |         |        |       |
|------------------------------------------------|---------|---------|----------------------|---------|--------|-------|
| External Wall                                  | 52.3800 | 10.2100 | 42.1700              | 0.1800  | 7.5906 | (29a) |
| Semi Exposed Wall                              | 15.8800 | 2.1400  | 13.7400              | 0.1800  | 2.4732 | (29a) |
| Total net area of external elements Aum(A, m2) |         |         | 68.2600              |         |        | (31)  |
| Fabric heat loss, W/K = Sum (A x U)            |         |         | (26)...(30) + (32) = | 23.8946 |        | (33)  |

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 100.0000 (35)

|                                                            |  |  |         |           |                       |         |      |
|------------------------------------------------------------|--|--|---------|-----------|-----------------------|---------|------|
| List of Thermal Bridges                                    |  |  |         |           |                       |         |      |
| K1 Element                                                 |  |  | Length  | Psi-value | Total                 |         |      |
| E2 Other lintels (including other steel lintels)           |  |  | 7.8300  | 0.0500    | 0.3915                |         |      |
| E3 Sill                                                    |  |  | 6.8100  | 0.0500    | 0.3405                |         |      |
| E4 Jamb                                                    |  |  | 19.2000 | 0.0500    | 0.9600                |         |      |
| E16 Corner (normal)                                        |  |  | 9.4800  | 0.0900    | 0.8532                |         |      |
| E7 Party floor between dwellings (in blocks of flats)      |  |  | 57.6000 | 0.0700    | 4.0320                |         |      |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |  |  |         |           |                       | 6.5772  | (36) |
| Point Thermal Bridges                                      |  |  |         |           | (36a) =               | 0.0000  |      |
| Total fabric heat loss                                     |  |  |         |           | (33) + (36) + (36a) = | 30.4718 | (37) |

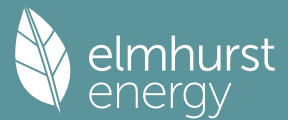
|                                                                     |         |         |         |         |         |         |         |         |         |         |         |         |      |
|---------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| 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                                                 | 24.1905 | 24.0332 | 23.8790 | 23.1547 | 23.0191 | 22.3883 | 22.3883 | 22.2715 | 22.6313 | 23.0191 | 23.2933 | 23.5799 | (38) |
| Average = Sum(39)m / 12 =                                           | 54.6623 | 54.5050 | 54.3508 | 53.6265 | 53.4910 | 52.8601 | 52.8601 | 52.7433 | 53.1031 | 53.4910 | 53.7651 | 54.0517 | (39) |
|                                                                     |         |         |         |         |         |         |         |         |         |         |         | 53.6258 |      |
| HLP                                                                 | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |      |
| HLP (average)                                                       | 1.0614  | 1.0583  | 1.0554  | 1.0413  | 1.0387  | 1.0264  | 1.0264  | 1.0241  | 1.0311  | 1.0387  | 1.0440  | 1.0495  | (40) |
| Days in mont                                                        | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31      |      |
|                                                                     |         |         |         |         |         |         |         |         |         |         |         | 1.0413  |      |
|                                                                     |         |         |         |         |         |         |         |         |         |         |         | 31      |      |

|                                                                 |          |          |          |          |          |          |          |          |          |          |          |          |                |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| 4. Water heating energy requirements (kWh/year)                 |          |          |          |          |          |          |          |          |          |          |          |          |                |
| Assumed occupancy                                               |          |          |          |          |          |          |          |          |          |          |          |          | 1.7343 (42)    |
| Hot water usage for mixer showers                               |          |          |          |          |          |          |          |          |          |          |          |          |                |
|                                                                 | 53.2983  | 52.4974  | 51.3302  | 49.0970  | 47.4490  | 45.6111  | 44.5665  | 45.7248  | 46.9946  | 48.9679  | 51.2490  | 53.0941  | (42a)          |
| Hot water usage for baths                                       |          |          |          |          |          |          |          |          |          |          |          |          |                |
|                                                                 | 23.0433  | 22.7010  | 22.2191  | 21.3305  | 20.6652  | 19.9274  | 19.5289  | 20.0074  | 20.5285  | 21.3179  | 22.2248  | 22.9654  | (42b)          |
| Hot water usage for other uses                                  |          |          |          |          |          |          |          |          |          |          |          |          |                |
|                                                                 | 32.3912  | 31.2133  | 30.0354  | 28.8576  | 27.6797  | 26.5019  | 26.5019  | 27.6797  | 28.8576  | 30.0354  | 31.2133  | 32.3912  | (42c)          |
| Average daily hot water use (litres/day)                        |          |          |          |          |          |          |          |          |          |          |          |          | 99.9505 (43)   |
|                                                                 |          |          |          |          |          |          |          |          |          |          |          |          |                |
| Daily hot water use                                             | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |                |
| Energy conte                                                    | 108.7328 | 106.4117 | 103.5848 | 99.2851  | 95.7939  | 92.0404  | 90.5972  | 93.4120  | 96.3807  | 100.3213 | 104.6872 | 108.4507 | (44)           |
| Energy content (annual)                                         | 172.2061 | 151.5289 | 159.2059 | 135.9164 | 128.9570 | 113.1744 | 109.5695 | 115.6636 | 118.8470 | 136.1350 | 149.1461 | 169.8075 | (45)           |
| Distribution loss (46)m = 0.15 x (45)m                          |          |          |          |          |          |          |          |          |          |          |          |          |                |
|                                                                 | 25.8309  | 22.7293  | 23.8809  | 20.3875  | 19.3435  | 16.9762  | 16.4354  | 17.3495  | 17.8271  | 20.4203  | 22.3719  | 25.4711  | (46)           |
| Water storage loss:                                             |          |          |          |          |          |          |          |          |          |          |          |          |                |
| Store volume                                                    |          |          |          |          |          |          |          |          |          |          |          |          | 230.0000 (47)  |
| a) If manufacturer declared loss factor is known (kWh/day):     |          |          |          |          |          |          |          |          |          |          |          |          | 1.7973 (48)    |
| Temperature factor from Table 2b                                |          |          |          |          |          |          |          |          |          |          |          |          | 0.5400 (49)    |
| Enter (49) or (54) in (55)                                      |          |          |          |          |          |          |          |          |          |          |          |          | 0.9706 (55)    |
| Total storage loss                                              |          |          |          |          |          |          |          |          |          |          |          |          |                |
|                                                                 | 30.0872  | 27.1756  | 30.0872  | 29.1167  | 30.0872  | 29.1167  | 30.0872  | 30.0872  | 29.1167  | 30.0872  | 29.1167  | 30.0872  | (56)           |
| If cylinder contains dedicated solar storage                    |          |          |          |          |          |          |          |          |          |          |          |          |                |
|                                                                 | 30.0872  | 27.1756  | 30.0872  | 29.1167  | 30.0872  | 29.1167  | 30.0872  | 30.0872  | 29.1167  | 30.0872  | 29.1167  | 30.0872  | (57)           |
| Primary loss                                                    | 23.2624  | 21.0112  | 23.2624  | 22.5120  | 23.2624  | 22.5120  | 23.2624  | 23.2624  | 22.5120  | 23.2624  | 22.5120  | 23.2624  | (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 |          |          |          |          |          |          |          |          |          |          |          |          |                |
| WWHRS                                                           | 225.5557 | 199.7156 | 212.5555 | 187.5451 | 182.3066 | 164.8031 | 162.9191 | 169.0132 | 170.4757 | 189.4847 | 200.7747 | 223.1571 | (62)           |
| PV diverter                                                     | -24.3658 | -21.5493 | -22.5652 | -18.6849 | -17.4136 | -14.9010 | -13.9673 | -14.8528 | -15.4171 | -18.1751 | -20.5901 | -23.9146 | (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                                                 |          |          |          |          |          |          |          |          |          |          |          |          |                |
|                                                                 | 201.1900 | 178.1663 | 189.9904 | 168.8602 | 164.8930 | 149.9021 | 148.9519 | 154.1604 | 155.0586 | 171.3096 | 180.1846 | 199.2426 | (64)           |
| 12Total per year (kWh/year)                                     |          |          |          |          |          |          |          |          |          |          |          |          | 2061.9095 (64) |
| Electric shower(s)                                              |          |          |          |          |          |          |          |          |          |          |          |          | 2062 (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   | (64a)          |
|                                                                 |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (64a)   |
| Heat gains from water heating, kWh/month                        |          |          |          |          |          |          |          |          |          |          |          |          |                |
|                                                                 | 99.9382  | 88.9327  | 95.6157  | 86.4951  | 85.5579  | 78.9334  | 79.1116  | 81.1378  | 80.8196  | 87.9446  | 90.8940  | 99.1407  | (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      |      |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 86.7160  | 86.7160  | 86.7160  | 86.7160  | 86.7160  | 86.7160  | 86.7160  | 86.7160  | 86.7160  | 86.7160  | 86.7160  | 86.7160  | (66) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 76.8362  | 85.0687  | 76.8362  | 79.3974  | 76.8362  | 79.3974  | 76.8362  | 76.8362  | 79.3974  | 76.8362  | 79.3974  | 76.8362  | (67) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 151.1287 | 152.6969 | 148.7450 | 140.3318 | 129.7117 | 119.7303 | 113.0621 | 111.4939 | 115.4458 | 123.8589 | 134.4791 | 144.4605 | (68) |
| Pumps, fans                                                                         | 31.6716  | 31.6716  | 31.6716  | 31.6716  | 31.6716  | 31.6716  | 31.6716  | 31.6716  | 31.6716  | 31.6716  | 31.6716  | 31.6716  | (69) |
| Losses e.g. evaporation (negative values) (Table 5)                                 | 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) |
| Water heating gains (Table 5)                                                       | -69.3728 | -69.3728 | -69.3728 | -69.3728 | -69.3728 | -69.3728 | -69.3728 | -69.3728 | -69.3728 | -69.3728 | -69.3728 | -69.3728 | (71) |
| Total internal gains                                                                | 134.3256 | 132.3404 | 128.5157 | 120.1321 | 114.9972 | 109.6298 | 106.3327 | 109.0562 | 112.2494 | 118.2051 | 126.2417 | 133.2536 | (72) |
|                                                                                     | 414.3053 | 422.1208 | 406.1117 | 391.8762 | 373.5599 | 357.7723 | 345.2458 | 346.4011 | 356.1074 | 370.9150 | 392.1329 | 406.5651 | (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 |         |      |  |  |  |  |  |
| East           |  | 3.7500 | 19.6403    | 0.6300        | 0.7000        | 0.7700   | 22.5087 | (76) |  |  |  |  |  |
| South          |  | 2.7100 | 46.7521    | 0.6300        | 0.7000        | 0.7700   | 38.7206 | (78) |  |  |  |  |  |

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|                                                                                                      |          |          |          |          |          |          |          |          |          |               |              |                 |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|--------------|-----------------|
| West                                                                                                 | 3.7500   |          | 19.6403  |          | 0.6300   |          | 0.7000   |          | 0.7700   |               | 22.5087 (80) |                 |
| Solar gains                                                                                          | 83.7380  | 151.4779 | 225.8068 | 302.8123 | 354.3570 | 356.9142 | 342.0876 | 303.8811 | 253.0566 | 172.8932      | 102.0285     | 70.4783 (83)    |
| Total gains                                                                                          | 498.0432 | 573.5987 | 631.9185 | 694.6885 | 727.9169 | 714.6865 | 687.3335 | 650.2822 | 609.1640 | 543.8082      | 494.1614     | 477.0434 (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                                                                                                  | 26.1708  | 26.2463  | 26.3208  | 26.6763  | 26.7439  | 27.0630  | 27.0630  | 27.1230  | 26.9392  | 26.7439       | 26.6075      | 26.4664         |
| alpha                                                                                                | 2.7447   | 2.7498   | 2.7547   | 2.7784   | 2.7829   | 2.8042   | 2.8042   | 2.8082   | 2.7959   | 2.7829        | 2.7738       | 2.7644          |
| util living area                                                                                     |          |          |          |          |          |          |          |          |          |               |              |                 |
|                                                                                                      | 0.9039   | 0.8650   | 0.8087   | 0.7098   | 0.5851   | 0.4409   | 0.3275   | 0.3581   | 0.5338   | 0.7440        | 0.8639       | 0.9121 (86)     |
| MIT                                                                                                  | 19.1100  | 19.4404  | 19.8656  | 20.3589  | 20.7053  | 20.9039  | 20.9690  | 20.9595  | 20.8297  | 20.3751       | 19.6828      | 19.0598 (87)    |
| Th 2                                                                                                 | 20.0325  | 20.0350  | 20.0375  | 20.0491  | 20.0512  | 20.0614  | 20.0614  | 20.0633  | 20.0575  | 20.0512       | 20.0468      | 20.0422 (88)    |
| util rest of house                                                                                   |          |          |          |          |          |          |          |          |          |               |              |                 |
|                                                                                                      | 0.8921   | 0.8492   | 0.7867   | 0.6780   | 0.5414   | 0.3844   | 0.2614   | 0.2901   | 0.4757   | 0.7083        | 0.8454       | 0.9012 (89)     |
| MIT 2                                                                                                | 17.8535  | 18.2623  | 18.7839  | 19.3792  | 19.7730  | 19.9871  | 20.0438  | 20.0391  | 19.9168  | 19.4150       | 18.5788      | 17.7976 (90)    |
| Living area fraction                                                                                 |          |          |          |          |          |          |          |          |          |               |              |                 |
|                                                                                                      | 18.4122  | 18.7861  | 19.2649  | 19.8148  | 20.1876  | 20.3948  | 20.4552  | 20.4484  | 20.3227  | 19.8419       | 19.0697      | 18.3588 (92)    |
| Temperature adjustment                                                                               |          |          |          |          |          |          |          |          |          |               |              | 0.0000          |
| adjusted MIT                                                                                         | 18.4122  | 18.7861  | 19.2649  | 19.8148  | 20.1876  | 20.3948  | 20.4552  | 20.4484  | 20.3227  | 19.8419       | 19.0697      | 18.3588 (93)    |
| -----                                                                                                |          |          |          |          |          |          |          |          |          |               |              |                 |
| 8. Space heating requirement                                                                         |          |          |          |          |          |          |          |          |          |               |              |                 |
| -----                                                                                                |          |          |          |          |          |          |          |          |          |               |              |                 |
|                                                                                                      | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov          | Dec             |
| Utilisation                                                                                          | 0.8676   | 0.8252   | 0.7669   | 0.6696   | 0.5479   | 0.4049   | 0.2895   | 0.3186   | 0.4927   | 0.6997        | 0.8232       | 0.8773 (94)     |
| Useful gains                                                                                         | 432.1253 | 473.3538 | 484.6368 | 465.1768 | 398.8337 | 289.3715 | 199.0000 | 207.1481 | 300.1292 | 380.4868      | 406.7814     | 418.5237 (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                                                                                     |          |          |          |          |          |          |          |          |          |               |              |                 |
|                                                                                                      | 771.4052 | 756.8635 | 693.7833 | 585.3244 | 454.0081 | 306.3131 | 203.7878 | 213.5264 | 330.4452 | 494.3586      | 643.5533     | 765.3098 (97)   |
| Space heating kWh                                                                                    |          |          |          |          |          |          |          |          |          |               |              |                 |
|                                                                                                      | 252.4243 | 190.5185 | 155.6050 | 86.5063  | 41.0497  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 84.7206       | 170.4758     | 258.0089 (98a)  |
| Space heating requirement - total per year (kWh/year)                                                |          |          |          |          |          |          |          |          |          |               |              | 1239.3090       |
| 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                                                                                    |          |          |          |          |          |          |          |          |          |               |              |                 |
|                                                                                                      | 252.4243 | 190.5185 | 155.6050 | 86.5063  | 41.0497  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 84.7206       | 170.4758     | 258.0089 (98c)  |
| Space heating requirement after solar contribution - total per year (kWh/year)                       |          |          |          |          |          |          |          |          |          |               |              | 1239.3090       |
| Space heating per m2                                                                                 |          |          |          |          |          |          |          |          |          | (98c) / (4) = |              | 24.0643 (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 %)                                                     |          |          |          |          |          |          |          |          |          |               |              | 92.3000 (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                                                                            |          |          |          |          |          |          |          |          |          |               |              |                 |
|                                                                                                      | 252.4243 | 190.5185 | 155.6050 | 86.5063  | 41.0497  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 84.7206       | 170.4758     | 258.0089 (98)   |
| Space heating efficiency (main heating system 1)                                                     |          |          |          |          |          |          |          |          |          |               |              |                 |
|                                                                                                      | 92.3000  | 92.3000  | 92.3000  | 92.3000  | 92.3000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 92.3000       | 92.3000      | 92.3000 (210)   |
| Space heating fuel (main heating system)                                                             |          |          |          |          |          |          |          |          |          |               |              |                 |
|                                                                                                      | 273.4824 | 206.4122 | 168.5861 | 93.7229  | 44.4742  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 91.7883       | 184.6975     | 279.5330 (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                                                                            |          |          |          |          |          |          |          |          |          |               |              |                 |
|                                                                                                      | 201.1900 | 178.1663 | 189.9904 | 168.8602 | 164.8930 | 149.9021 | 148.9519 | 154.1604 | 155.0586 | 171.3096      | 180.1846     | 199.2426 (64)   |
| Efficiency of water heater (217)m                                                                    |          |          |          |          |          |          |          |          |          |               |              |                 |
|                                                                                                      | 84.5697  | 84.2104  | 83.6157  | 82.6372  | 81.4454  | 79.8000  | 79.8000  | 79.8000  | 79.8000  | 82.5691       | 83.9357      | 79.8000 (216)   |
| Fuel for water heating, kWh/month                                                                    |          |          |          |          |          |          |          |          |          |               |              |                 |
|                                                                                                      | 237.8985 | 211.5728 | 227.2185 | 204.3392 | 202.4584 | 187.8473 | 186.6565 | 193.1835 | 194.3090 | 207.4741      | 214.6697     | 84.6405 (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                                                                                         | 7.3041   | 6.5973   | 7.3041   | 7.0685   | 7.3041   | 7.0685   | 7.3041   | 7.3041   | 7.0685   | 7.3041        | 7.0685       | 7.3041 (231)    |
| Lighting                                                                                             | 15.9650  | 12.8078  | 11.5320  | 8.4488   | 6.5261   | 5.3319   | 5.9533   | 7.7384   | 10.0514  | 13.1879       | 14.8957      | 16.4088 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |          |          |          |          |          |               |              |                 |
| (233a)m                                                                                              | -17.7164 | -25.8887 | -38.5678 | -45.0158 | -50.0051 | -47.2409 | -46.6923 | -43.3696 | -37.7320 | -30.3608      | -19.8088     | -15.2144 (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                                                                                              | -7.4190  | -15.8442 | -31.9252 | -48.5774 | -64.8287 | -65.3266 | -64.5286 | -54.3394 | -39.4593 | -22.8331      | -9.9643      | -5.8471 (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                                                                   |          |          |          |          |          |          |          |          |          |               |              | 1342.6967 (211) |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |               |              | 0.0000 (213)    |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |               |              | 0.0000 (215)    |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |               |              | 79.8000         |
| Water heating fuel used                                                                              |          |          |          |          |          |          |          |          |          |               |              | 2503.0263 (219) |
| Space cooling fuel                                                                                   |          |          |          |          |          |          |          |          |          |               |              | 0.0000 (221)    |

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|                                                     |                |
|-----------------------------------------------------|----------------|
| Electricity for pumps and fans:                     | 86.0000 (231)  |
| Total electricity for the above, kWh/year           | 128.8471 (232) |
| Electricity for lighting (calculated in Appendix L) |                |

|                                                               |                 |
|---------------------------------------------------------------|-----------------|
| Energy saving/generation technologies (Appendices M ,N and Q) |                 |
| PV generation                                                 | -848.5055 (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                           | 3212.0645 (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                 | 1342.6967          | 0.2100                        | 281.9663 (261)           |
| Total CO2 associated with community systems   |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                    | 2503.0263          | 0.2100                        | 525.6355 (264)           |
| Space and water heating                       |                    |                               | 807.6018 (265)           |
| Pumps, fans and electric keep-hot             | 86.0000            | 0.1387                        | 11.9293 (267)            |
| Energy for lighting                           | 128.8471           | 0.1443                        | 18.5966 (268)            |
| Energy saving/generation technologies         |                    |                               |                          |
| PV Unit electricity used in dwelling          | -417.6126          | 0.1338                        | -55.8814                 |
| PV Unit electricity exported                  | -430.8929          | 0.1255                        | -54.0888                 |
| Total                                         |                    |                               | -109.9702 (269)          |
| Total CO2, kg/year                            |                    |                               | 728.1575 (272)           |
| EPC Target Carbon Dioxide Emission Rate (TER) |                    |                               | 14.1400 (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               | 1342.6967          | 1.1300                              | 1517.2472 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 2503.0263          | 1.1300                              | 2828.4197 (278)            |
| Space and water heating                     |                    |                                     | 4345.6669 (279)            |
| Pumps, fans and electric keep-hot           | 86.0000            | 1.5128                              | 130.1008 (281)             |
| Energy for lighting                         | 128.8471           | 1.5338                              | 197.6299 (282)             |
| Energy saving/generation technologies       |                    |                                     |                            |
| PV Unit electricity used in dwelling        | -417.6126          | 1.4945                              | -624.1223                  |
| PV Unit electricity exported                | -430.8929          | 0.4608                              | -198.5361                  |
| Total                                       |                    |                                     | -822.6585 (283)            |
| Total Primary energy kWh/year               |                    |                                     | 3850.7392 (286)            |
| Target Primary Energy Rate (TPER)           |                    |                                     | 74.7700 (287)              |