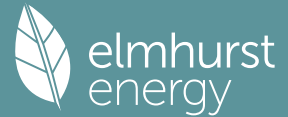


# Full SAP Calculation Printout



|                                    |                      |               |       |               |                |            |  |
|------------------------------------|----------------------|---------------|-------|---------------|----------------|------------|--|
| Property Reference                 | OP-D320 P3TORT       |               |       |               | Issued on Date | 29/11/2024 |  |
| Assessment Reference               | P3TORT               |               |       | Prop Type Ref | P3TORT         |            |  |
| Property                           | P3TORT               |               |       |               |                |            |  |
|                                    |                      |               |       |               |                |            |  |
| SAP Rating                         | 81 B                 | DER           | 4.02  | TER           | 9.46           |            |  |
| Environmental                      | 96 A                 | % DER < TER   |       |               |                | 57.51      |  |
| CO <sub>2</sub> Emissions (t/year) | 0.48                 | DFEE          | 36.00 | TFEE          | 37.35          |            |  |
| Compliance Check                   | See BREL             | % DFEE < TFEE |       |               |                | 3.63       |  |
| % DPER < TPER                      | 14.10                | DPER          | 42.45 | TPER          | 49.42          |            |  |
|                                    |                      |               |       |               |                |            |  |
| 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                                           | 64.2500 (1b)              | x 2.3100 (2b)                   | = 148.4175 (1b) - (3b)      |
| First floor                                            | 64.2500 (1c)              | x 2.6100 (2c)                   | = 167.6925 (1c) - (3c)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 128.5000                  |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 316.1100 (5)              |

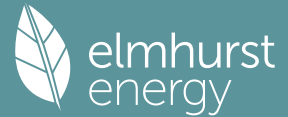
## 2. Ventilation rate

|                                                                                                         |        |        |        |        |        |        |        |        |        |        |                             |              |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-----------------------------|--------------|
|                                                                                                         |        |        |        |        |        |        |        |        |        |        | m3 per hour                 |              |
| Number of open chimneys                                                                                 |        |        |        |        |        |        |        |        |        |        | 0 * 80 =                    | 0.0000 (6a)  |
| Number of open flues                                                                                    |        |        |        |        |        |        |        |        |        |        | 0 * 20 =                    | 0.0000 (6b)  |
| Number of chimneys / flues attached to closed fire                                                      |        |        |        |        |        |        |        |        |        |        | 0 * 10 =                    | 0.0000 (6c)  |
| Number of flues attached to solid fuel boiler                                                           |        |        |        |        |        |        |        |        |        |        | 0 * 20 =                    | 0.0000 (6d)  |
| Number of flues attached to other heater                                                                |        |        |        |        |        |        |        |        |        |        | 0 * 35 =                    | 0.0000 (6e)  |
| Number of blocked chimneys                                                                              |        |        |        |        |        |        |        |        |        |        | 0 * 20 =                    | 0.0000 (6f)  |
| Number of intermittent extract fans                                                                     |        |        |        |        |        |        |        |        |        |        | 0 * 10 =                    | 0.0000 (7a)  |
| Number of passive vents                                                                                 |        |        |        |        |        |        |        |        |        |        | 0 * 10 =                    | 0.0000 (7b)  |
| Number of flueless gas fires                                                                            |        |        |        |        |        |        |        |        |        |        | 0 * 40 =                    | 0.0000 (7c)  |
|                                                                                                         |        |        |        |        |        |        |        |        |        |        | Air changes per hour        |              |
| 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)  |
|                                                                                                         |        |        |        |        |        |        |        |        |        |        |                             |              |
| 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)  |
| 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                                                                               |        |        |        |        |        |        |        |        |        |        |                             |              |
|                                                                                                         |        |        |        |        |        |        |        |        |        |        |                             |              |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |                             |              |
|                                                                                                         |        |        |        |        |        |        |        |        |        |        |                             |              |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =            |        |        |        |        |        |        |        |        |        |        |                             |              |
|                                                                                                         |        |        |        |        |        |        |        |        |        |        |                             |              |
| Effective ac                                                                                            | 0.3417 | 0.3379 | 0.3342 | 0.3156 | 0.3119 | 0.2933 | 0.2933 | 0.2896 | 0.3007 | 0.3119 | 0.3193                      | 0.3268 (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                                                     |                         |                            | 4.2800                    | 1.0000                        | 4.2800                       |                                | (26)          |
| Windows (Uw = 1.30)                                            |                         |                            | 18.2800                   | 1.2357                        | 22.5894                      |                                | (27)          |
| Ground Floor                                                   |                         |                            | 64.2500                   | 0.1100                        | 7.0675                       |                                | (28a)         |
| External Wall                                                  | 160.7900                | 22.5600                    | 138.2300                  | 0.1700                        | 23.4991                      |                                | (29a)         |
| Roof - ceiling                                                 | 64.2500                 |                            | 64.2500                   | 0.1100                        | 7.0675                       |                                | (30)          |
| Total net area of external elements Aum(A, m <sup>2</sup> )    |                         |                            | 289.2900                  |                               |                              |                                | (31)          |
| Fabric heat loss, W/K = Sum (A x U)                            |                         |                            |                           |                               | (26)...(30) + (32) = 64.5035 |                                | (33)          |
| 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)               |                         |                            |                           | 15.1000                       | 0.0500                       | 0.7550                         |               |
| E3 Sill                                                        |                         |                            |                           | 11.2500                       | 0.0500                       | 0.5625                         |               |
| E4 Jamb                                                        |                         |                            |                           | 34.8000                       | 0.0500                       | 1.7400                         |               |

# Full SAP Calculation Printout



|                                                            |         |                       |                |
|------------------------------------------------------------|---------|-----------------------|----------------|
| E5 Ground floor (normal)                                   | 32.6800 | 0.1600                | 5.2288         |
| E6 Intermediate floor within a dwelling                    | 32.6800 | 0.0000                | 0.0000         |
| E10 Eaves (insulation at ceiling level)                    | 19.5000 | 0.0600                | 1.1700         |
| E12 Gable (insulation at ceiling level)                    | 13.1800 | 0.0600                | 0.7908         |
| E16 Corner (normal)                                        | 19.6800 | 0.0900                | 1.7712         |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |         |                       | 12.0183 (36)   |
| Point Thermal bridges                                      |         |                       | (36a) = 0.0000 |
| Total fabric heat loss                                     |         | (33) + (36) + (36a) = | 76.5218 (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                                                 | 35.6403  | 35.2524  | 34.8645  | 32.9248  | 32.5369  | 30.5973  | 30.5973  | 30.2093  | 31.3731  | 32.5369  | 33.3128  | 34.0886 (38)  |
| Average = Sum(39)m / 12 =                                           | 112.1621 | 111.7741 | 111.3862 | 109.4466 | 109.0587 | 107.1190 | 107.1190 | 106.7311 | 107.8949 | 109.0587 | 109.8345 | 110.6104 (39) |
|                                                                     |          |          |          |          |          |          |          |          |          |          |          | 109.3496      |
| HLP                                                                 | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
| HLP (average)                                                       | 0.8729   | 0.8698   | 0.8668   | 0.8517   | 0.8487   | 0.8336   | 0.8336   | 0.8306   | 0.8396   | 0.8487   | 0.8547   | 0.8608 (40)   |
| Days in mont                                                        | 31       | 28       | 31       | 30       | 31       | 30       | 31       | 31       | 30       | 31       | 30       | 31            |

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

|                                                                                |          |          |          |          |          |          |          |          |          |          |          |                              |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------------------------------|
| Assumed occupancy                                                              |          |          |          |          |          |          |          |          |          |          |          | 2.8910 (42)                  |
| Hot water usage for mixer showers                                              |          |          |          |          |          |          |          |          |          |          |          |                              |
|                                                                                | 99.9519  | 98.4498  | 96.2610  | 92.0731  | 88.9825  | 85.5359  | 83.5768  | 85.7491  | 88.1303  | 91.8309  | 96.1088  | 99.5689 (42a)                |
| Hot water usage for baths                                                      |          |          |          |          |          |          |          |          |          |          |          |                              |
|                                                                                | 33.0350  | 32.5444  | 31.8535  | 30.5797  | 29.6258  | 28.5681  | 27.9968  | 28.6829  | 29.4298  | 30.5616  | 31.8617  | 32.9234 (42b)                |
| Hot water usage for other uses                                                 |          |          |          |          |          |          |          |          |          |          |          |                              |
|                                                                                | 46.5649  | 44.8716  | 43.1784  | 41.4851  | 39.7918  | 38.0986  | 38.0986  | 39.7918  | 41.4851  | 43.1784  | 44.8716  | 46.5649 (42c)                |
| Average daily hot water use (litres/day)                                       |          |          |          |          |          |          |          |          |          |          |          | 165.1127 (43)                |
| Daily hot water use                                                            | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec                          |
|                                                                                | 179.5519 | 175.8659 | 171.2929 | 164.1378 | 158.4001 | 152.2026 | 149.6722 | 154.2238 | 159.0453 | 165.5709 | 172.8421 | 179.0572 (44)                |
| Energy conte                                                                   | 284.3663 | 250.4307 | 263.2708 | 224.6965 | 213.2370 | 187.1508 | 181.0156 | 190.9613 | 196.1187 | 224.6781 | 246.2453 | 280.3603 (45)                |
| Energy content (annual)                                                        |          |          |          |          |          |          |          |          |          |          |          | Total = Sum(45)m = 2742.5313 |
| Distribution loss (46)m = 0.15 x (45)m                                         |          |          |          |          |          |          |          |          |          |          |          |                              |
|                                                                                | 42.6549  | 37.5646  | 39.4906  | 33.7045  | 31.9855  | 28.0726  | 27.1523  | 28.6442  | 29.4178  | 33.7017  | 36.9368  | 42.0541 (46)                 |
| 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                                                             |          |          |          |          |          |          |          |          |          |          |          |                              |
|                                                                                | 43.5240  | 39.3120  | 43.5240  | 42.1200  | 43.5240  | 42.1200  | 43.5240  | 43.5240  | 42.1200  | 43.5240  | 42.1200  | 43.5240 (56)                 |
| If cylinder contains dedicated solar storage                                   |          |          |          |          |          |          |          |          |          |          |          |                              |
|                                                                                | 43.5240  | 39.3120  | 43.5240  | 42.1200  | 43.5240  | 42.1200  | 43.5240  | 43.5240  | 42.1200  | 43.5240  | 42.1200  | 43.5240 (57)                 |
| Primary loss                                                                   | 54.8576  | 49.5488  | 54.8576  | 53.0880  | 54.8576  | 22.5120  | 23.2624  | 23.2624  | 22.5120  | 54.8576  | 53.0880  | 54.8576 (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                |          |          |          |          |          |          |          |          |          |          |          |                              |
|                                                                                | 382.7479 | 339.2915 | 361.6524 | 319.9045 | 311.6186 | 251.7828 | 247.8020 | 257.7477 | 260.7507 | 323.0597 | 341.4533 | 378.7419 (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                                                                |          |          |          |          |          |          |          |          |          |          |          |                              |
|                                                                                | 382.7479 | 339.2915 | 361.6524 | 319.9045 | 311.6186 | 251.7828 | 247.8020 | 257.7477 | 260.7507 | 323.0597 | 341.4533 | 378.7419 (64)                |
| 12Total per year (kWh/year)                                                    |          |          |          |          |          |          |          |          |          |          |          | 3776.5529 (64)               |
| Electric shower(s)                                                             |          |          |          |          |          |          |          |          |          |          |          | 3777 (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                                       |          |          |          |          |          |          |          |          |          |          |          |                              |
|                                                                                | 138.4379 | 122.9072 | 131.4236 | 117.1820 | 114.7874 | 80.2372  | 78.7976  | 82.1045  | 83.2191  | 118.5916 | 124.3470 | 137.1059 (65)                |

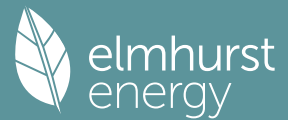
## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |           |           |           |           |           |           |           |           |           |           |           |                |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
| 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     | 144.5497  | 144.5497  | 144.5497  | 144.5497  | 144.5497  | 144.5497  | 144.5497  | 144.5497  | 144.5497  | 144.5497  | 144.5497  | 144.5497 (66)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 159.5628  | 176.6588  | 159.5628  | 164.8815  | 159.5628  | 164.8815  | 159.5628  | 159.5628  | 164.8815  | 159.5628  | 164.8815  | 159.5628 (67)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 295.9035  | 298.9740  | 291.2363  | 274.7637  | 253.9700  | 234.4268  | 221.3707  | 218.3002  | 226.0379  | 242.5105  | 263.3042  | 282.8474 (68)  |
| Pumps, fans                                                                         | 37.4550   | 37.4550   | 37.4550   | 37.4550   | 37.4550   | 37.4550   | 37.4550   | 37.4550   | 37.4550   | 37.4550   | 37.4550   | 37.4550 (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)                                                       | -115.6398 | -115.6398 | -115.6398 | -115.6398 | -115.6398 | -115.6398 | -115.6398 | -115.6398 | -115.6398 | -115.6398 | -115.6398 | -115.6398 (71) |
| Total internal gains                                                                | 186.0724  | 182.8977  | 176.6447  | 162.7527  | 154.2841  | 111.4406  | 105.9107  | 110.3556  | 115.5820  | 159.3973  | 172.7041  | 184.2821 (72)  |
|                                                                                     | 707.9035  | 724.8954  | 693.8086  | 668.7629  | 634.1817  | 577.1138  | 553.2091  | 554.5834  | 572.8663  | 627.8354  | 667.2548  | 693.0572 (73)  |

## 6. Solar gains

| [Jan]       |          |          |           |           |                        |                                            |           |                                   |                                    |                              |               |               |
|-------------|----------|----------|-----------|-----------|------------------------|--------------------------------------------|-----------|-----------------------------------|------------------------------------|------------------------------|---------------|---------------|
|             |          |          |           |           | Area<br>m <sup>2</sup> | Solar flux<br>Table 6a<br>W/m <sup>2</sup> |           | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W    |               |
| North       |          |          |           |           | 9.1500                 | 10.6334                                    |           | 0.6300                            | 0.7000                             | 0.7700                       | 29.7348 (74)  |               |
| South       |          |          |           |           | 9.1300                 | 46.7521                                    |           | 0.6300                            | 0.7000                             | 0.7700                       | 130.4498 (78) |               |
|             |          |          |           |           |                        |                                            |           |                                   |                                    |                              |               |               |
| Solar gains | 160.1846 | 270.4678 | 368.7025  | 462.6798  | 529.4506               | 532.1235                                   | 510.2024  | 458.3557                          | 400.3812                           | 298.0766                     | 191.3092      | 137.5090 (83) |
| Total gains | 868.0881 | 995.3632 | 1062.5111 | 1131.4426 | 1163.6323              | 1109.2373                                  | 1063.4116 | 1012.9391                         | 973.2476                           | 925.9120                     | 858.5640      | 830.5662 (84) |

# Full SAP Calculation Printout



## 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                                                                         | 31.8240 | 31.9344 | 32.0457 | 32.6136 | 32.7296 | 33.3222 | 33.3222 | 33.4433 | 33.0826                   | 32.7296 | 32.4984 | 32.2704      |
| alpha                                                                       | 3.1216  | 3.1290  | 3.1364  | 3.1742  | 3.1820  | 3.2215  | 3.2215  | 3.2296  | 3.2055                    | 3.1820  | 3.1666  | 3.1514       |
| util living area                                                            | 0.9492  | 0.9233  | 0.8882  | 0.8165  | 0.7063  | 0.5604  | 0.4247  | 0.4594  | 0.6523                    | 0.8317  | 0.9222  | 0.9547 (86)  |
| Living                                                                      | 19.1583 | 19.4524 | 19.8187 | 20.2912 | 20.6591 | 20.8860 | 20.9649 | 20.9543 | 20.8050                   | 20.3547 | 19.7008 | 19.1211      |
| Non living                                                                  | 18.0192 | 18.3895 | 18.8486 | 19.4365 | 19.8711 | 20.1289 | 20.2020 | 20.1965 | 20.0455                   | 19.5244 | 18.7152 | 17.9791      |
| 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                                                                         | 20.0579 | 19.4524 | 19.8187 | 20.2912 | 20.6591 | 20.8860 | 20.9649 | 20.9543 | 20.8050                   | 20.3547 | 19.7008 | 19.3839 (87) |
| Th 2                                                                        | 20.1906 | 20.1932 | 20.1958 | 20.2087 | 20.2113 | 20.2243 | 20.2243 | 20.2269 | 20.2191                   | 20.2113 | 20.2061 | 20.2010 (88) |
| util rest of house                                                          | 0.9427  | 0.9138  | 0.8742  | 0.7934  | 0.6691  | 0.5056  | 0.3559  | 0.3901  | 0.6002                    | 0.8058  | 0.9111  | 0.9489 (89)  |
| MIT 2                                                                       | 19.3250 | 18.3895 | 18.8486 | 19.4365 | 19.8711 | 20.1289 | 20.2020 | 20.1965 | 20.0455                   | 19.5244 | 18.7152 | 18.3795 (90) |
| Living area fraction                                                        |         |         |         |         |         |         |         |         | fLA = Living area / (4) = |         |         |              |
| MIT                                                                         | 19.4647 | 18.5922 | 19.0336 | 19.5995 | 20.0214 | 20.2733 | 20.3475 | 20.3410 | 20.1903                   | 19.6827 | 18.9031 | 18.5710 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |                           |         |         | 0.0000       |
| adjusted MIT                                                                | 19.4647 | 18.5922 | 19.0336 | 19.5995 | 20.0214 | 20.2733 | 20.3475 | 20.3410 | 20.1903                   | 19.6827 | 18.9031 | 18.5710 (93) |

## 8. Space heating requirement

|                                                                                |           |           |           |           |          |          |          |          |          |          |           |                            |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|-----------|----------------------------|
|                                                                                | Jan       | Feb       | Mar       | Apr       | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov       | Dec                        |
| Utilisation                                                                    | 0.9360    | 0.8905    | 0.8501    | 0.7733    | 0.6595   | 0.5092   | 0.3671   | 0.4007   | 0.5981   | 0.7859   | 0.8884    | 0.9338 (94)                |
| Useful gains                                                                   | 812.5486  | 886.3381  | 903.1880  | 874.9910  | 767.4153 | 564.7838 | 390.4127 | 405.8766 | 582.1394 | 727.6644 | 762.7073  | 775.5708 (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                                                               | 1700.9037 | 1530.4290 | 1396.0665 | 1171.0200 | 907.5169 | 607.7166 | 401.4262 | 420.6297 | 657.1128 | 990.5451 | 1296.3917 | 1589.5798 (97)             |
| Space heating kWh                                                              | 660.9362  | 432.8291  | 366.7016  | 213.1409  | 104.2355 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 195.5832 | 384.2528  | 605.6227 (98a)             |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |          |          |          |          |          |          |           | 2963.3021                  |
| 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                                                              | 660.9362  | 432.8291  | 366.7016  | 213.1409  | 104.2355 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 195.5832 | 384.2528  | 605.6227 (98c)             |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |          |          |          |          |          |          |           | 2963.3021                  |
| Space heating per m2                                                           |           |           |           |           |          |          |          |          |          |          |           | (98c) / (4) = 23.0607 (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 %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 249.4037 (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                                                                            | 660.9362 | 432.8291 | 366.7016 | 213.1409 | 104.2355 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 195.5832 | 384.2528 | 605.6227 (98)   |
| Space heating efficiency (main heating system 1)                                                     | 249.4037 | 249.4037 | 249.4037 | 249.4037 | 249.4037 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 249.4037 | 249.4037 | 249.4037 (210)  |
| Space heating fuel (main heating system)                                                             | 265.0066 | 173.5456 | 147.0313 | 85.4602  | 41.7939  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 78.4203  | 154.0686 | 242.8283 (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                                                                            | 382.7479 | 339.2915 | 361.6524 | 319.9045 | 311.6186 | 251.7828 | 247.8020 | 257.7477 | 260.7507 | 323.0597 | 341.4533 | 378.7419 (64)   |
| Efficiency of water heater                                                                           | 269.4200 | 269.4200 | 269.4200 | 269.4200 | 269.4200 | 269.4200 | 269.4200 | 269.4200 | 269.4200 | 269.4200 | 269.4200 | 269.4200 (216)  |
| Fuel for water heating, kWh/month                                                                    | 142.0636 | 125.9340 | 134.2337 | 118.7382 | 115.6627 | 93.4536  | 91.9761  | 95.6676  | 96.7822  | 119.9093 | 126.7364 | 140.5768 (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                                                                                         | 58.2370  | 52.6011  | 58.2370  | 56.3583  | 58.2370  | 56.3583  | 58.2370  | 58.2370  | 56.3583  | 58.2370  | 56.3583  | 58.2370 (231)   |
| Lighting                                                                                             | 33.1540  | 26.5974  | 23.9480  | 17.5453  | 13.5525  | 11.0725  | 12.3630  | 16.0700  | 20.8733  | 27.3869  | 30.9334  | 34.0754 (232)   |
| Electricity generated by PVs (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 (233a)   |
| (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)                              | 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)                                        | 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)   |
| (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)                              | 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                                                                   |          |          |          |          |          |          |          |          |          |          |          | 1188.1548 (211) |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)    |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)    |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          | 269.4200        |
| Water heating fuel used                                                                              |          |          |          |          |          |          |          |          |          |          |          | 1401.7344 (219) |
| Space cooling fuel                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (221)    |
| Electricity for pumps and fans:                                                                      |          |          |          |          |          |          |          |          |          |          |          |                 |
| (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.7780)                           |          |          |          |          |          |          |          |          |          |          |          |                 |
| mechanical ventilation fans (SFP = 1.7780)                                                           |          |          |          |          |          |          |          |          |          |          |          | 685.6932 (230a) |
| Total electricity for the above, kWh/year                                                            |          |          |          |          |          |          |          |          |          |          |          | 685.6932 (231)  |

# Full SAP Calculation Printout



|                                                               |           |        |
|---------------------------------------------------------------|-----------|--------|
| Electricity for lighting (calculated in Appendix L)           | 267.5717  | (232)  |
| 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                           | 3543.1541 | (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                   | 1188.1548          | 0.1555                        | 184.7073                 | (261) |
| Total CO2 associated with community systems     |                    |                               | 0.0000                   | (262) |
| Water heating (other fuel)                      | 1401.7344          | 0.1415                        | 198.3955                 | (263) |
| Space and water heating                         |                    |                               | 383.1028                 | (264) |
| Pumps, fans and electric keep-hot               | 685.6932           | 0.1387                        | 95.1141                  | (265) |
| Energy for lighting                             | 267.5717           | 0.1443                        | 38.6189                  | (266) |
| Total CO2, kg/year                              |                    |                               | 516.8358                 | (267) |
| EPC Dwelling Carbon Dioxide Emission Rate (DER) |                    |                               | 4.0200                   | (268) |

## 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               | 1188.1548          | 1.5755                              | 1871.9251                  | (275) |
| Total CO2 associated with community systems |                    |                                     | 0.0000                     | (276) |
| Water heating (other fuel)                  | 1401.7344          | 1.5234                              | 2135.3902                  | (277) |
| Space and water heating                     |                    |                                     | 4007.3153                  | (278) |
| Pumps, fans and electric keep-hot           | 685.6932           | 1.5128                              | 1037.3166                  | (279) |
| Energy for lighting                         | 267.5717           | 1.5338                              | 410.4104                   | (280) |
| Total Primary energy kWh/year               |                    |                                     | 5455.0423                  | (281) |
| Dwelling Primary energy Rate (DPER)         |                    |                                     | 42.4500                    | (282) |

## 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                                           | 64.2500 (1b) | x 2.3100 (2b)                   | = 148.4175     | (1b) - (3b) |
| First floor                                            | 64.2500 (1c) | x 2.6100 (2c)                   | = 167.6925     | (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 128.5000     |                                 |                | (4)         |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 316.1100     | (5)         |

### 2. Ventilation rate

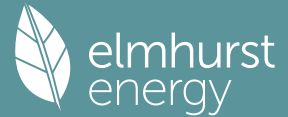
|                                                                                                    | m3 per hour                 |              |
|----------------------------------------------------------------------------------------------------|-----------------------------|--------------|
| Number 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                                                                | 4 * 10 =                    | 40.0000 (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) = | 40.0000 / (5) =             | 0.1265 (8)   |
| Pressure test                                                                                      | Yes                         |              |
| Pressure Test Method                                                                               | Blower Door                 |              |
| Measured/design AP50                                                                               | 5.0000                      | (17)         |
| Infiltration rate                                                                                  | 0.3765                      | (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) =        | 0.3201 (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 | 0.4081 | 0.4001 | 0.3921 | 0.3521 | 0.3441 | 0.3041 | 0.3041 | 0.2961 | 0.3201 | 0.3441 | 0.3601 | 0.3761 | (22b) |
| Effective ac    | 0.5833 | 0.5800 | 0.5769 | 0.5620 | 0.5592 | 0.5462 | 0.5462 | 0.5438 | 0.5512 | 0.5592 | 0.5648 | 0.5707 | (25)  |

### 3. Heat losses and heat loss parameter

| Element | Gross | Openings | NetArea | U-value | A x U | K-value | A x K |
|---------|-------|----------|---------|---------|-------|---------|-------|
|---------|-------|----------|---------|---------|-------|---------|-------|

# Full SAP Calculation Printout



|                                                |          |         |                      |        |         |        |      |       |
|------------------------------------------------|----------|---------|----------------------|--------|---------|--------|------|-------|
| TER Opaque door                                | m2       | m2      | m2                   | W/m2K  | W/K     | kJ/m2K | kJ/K | (26)  |
| TER Opening Type (Uw = 1.20)                   |          |         | 4.2800               | 1.0000 | 4.2800  |        |      | (27)  |
| Ground Floor                                   |          |         | 18.2800              | 1.1450 | 20.9313 |        |      | (28a) |
| External Wall                                  | 160.7900 | 22.5600 | 64.2500              | 0.1300 | 8.3525  |        |      | (29a) |
| Roof - ceiling                                 | 64.2500  |         | 138.2300             | 0.1800 | 24.8814 |        |      | (30)  |
| Total net area of external elements Aum(A, m2) |          |         | 64.2500              | 0.1100 | 7.0675  |        |      | (31)  |
| Fabric heat loss, W/K = Sum (A x U)            |          |         | 289.2900             |        |         |        |      | (32)  |
|                                                |          |         | (26)...(30) + (32) = |        | 65.5127 |        |      | (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) | 15.1000 | 0.0500    | 0.7550 |
| E3 Sill                                          | 11.2500 | 0.0500    | 0.5625 |
| E4 Jamb                                          | 34.8000 | 0.0500    | 1.7400 |
| E5 Ground floor (normal)                         | 32.6800 | 0.1600    | 5.2288 |
| E6 Intermediate floor within a dwelling          | 32.6800 | 0.0000    | 0.0000 |
| E10 Eaves (insulation at ceiling level)          | 19.5000 | 0.0600    | 1.1700 |
| E12 Gable (insulation at ceiling level)          | 13.1800 | 0.0600    | 0.7908 |
| E16 Corner (normal)                              | 19.6800 | 0.0900    | 1.7712 |

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 12.0183 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 77.5310 (37)

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

|                           |          |          |          |          |          |          |          |          |          |          |          |          |      |
|---------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| (38)m                     | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      | (38) |
| Heat transfer coeff       | 60.8437  | 60.5065  | 60.1759  | 58.6231  | 58.3326  | 56.9801  | 56.9801  | 56.7297  | 57.5011  | 58.3326  | 58.9203  | 59.5347  | (39) |
| Average = Sum(39)m / 12 = | 138.3747 | 138.0375 | 137.7069 | 136.1541 | 135.8636 | 134.5111 | 134.5111 | 134.2607 | 135.0321 | 135.8636 | 136.4513 | 137.0657 | (39) |
|                           |          |          |          |          |          |          |          |          |          |          |          | 136.1527 |      |

|               |        |        |        |        |        |        |        |        |        |        |        |        |      |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| HLP           | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    | (40) |
| HLP (average) | 1.0768 | 1.0742 | 1.0716 | 1.0596 | 1.0573 | 1.0468 | 1.0468 | 1.0448 | 1.0508 | 1.0573 | 1.0619 | 1.0667 | (40) |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31     |      |

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

Assumed occupancy 2.8910 (42)

Hot water usage for mixer showers 72.4138 (42a)

Hot water usage for baths 31.2772 (42b)

Hot water usage for other uses 44.2367 (42c)

Average daily hot water use (litres/day) 136.3323 (43)

Daily hot water use

Energy conte 148.3123 145.1451 141.2883 135.4237 130.6613 125.5412 123.5737 127.4139 131.4640 136.8391 142.7940 147.9276 (44)

Energy content (annual) 234.8904 206.6847 217.1549 185.3883 175.8952 154.3676 149.4517 157.7651 162.1082 185.6894 203.4362 231.6189 (45)

Distribution loss (46)m = 0.15 x (45)m 35.2336 31.0027 32.5732 27.8083 26.3843 23.1551 22.4178 23.6648 24.3162 27.8534 30.5154 34.7428 (46)

Water storage loss: 230.0000 (47)

Store volume 1.7973 (48)

a) If manufacturer declared loss factor is known (kWh/day): 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 22.5120 23.2624 22.5120 23.2624 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 288.2400 254.8715 270.5045 237.0170 229.2448 205.9963 202.8014 211.1147 213.7369 239.0390 255.0649 284.9686 (62)

WWHRS -33.2319 -29.3905 -30.7761 -25.4838 -23.7500 -20.3230 -19.0496 -20.2574 -21.0270 -24.7885 -28.0824 -32.6165 (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 255.0081 225.4809 239.7284 211.5332 205.4948 185.6732 183.7517 190.8573 192.7099 214.2505 226.9825 252.3521 (64)

12Total per year (kWh/year) Total per year (kWh/year) = Sum(64)m = 2583.8227 (64)

Electric shower(s) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)

Heat gains from water heating, kWh/month 120.7807 107.2721 114.8837 102.9446 101.1648 92.6302 92.3724 95.1366 95.2039 104.4214 108.9455 119.6930 (65)

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

Metabolic gains (Table 5), Watts

(66)m 144.5497 144.5497 144.5497 144.5497 144.5497 144.5497 144.5497 144.5497 144.5497 144.5497 144.5497 144.5497 (66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 159.5628 176.6588 159.5628 164.8815 159.5628 164.8815 159.5628 164.8815 159.5628 164.8815 159.5628 164.8815 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 295.9035 298.9740 291.2363 274.7637 221.3707 218.3002 226.0379 242.5105 263.3042 282.8474 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 37.4550 37.4550 37.4550 37.4550 37.4550 37.4550 37.4550 37.4550 37.4550 37.4550 37.4550 37.4550 (69)

Pumps, fans 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 (70)

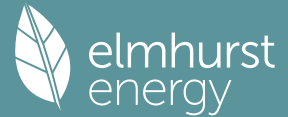
Losses e.g. evaporation (negative values) (Table 5) -115.6398 -115.6398 -115.6398 -115.6398 -115.6398 -115.6398 -115.6398 -115.6398 -115.6398 -115.6398 -115.6398 -115.6398 (71)

Water heating gains (Table 5) 162.3397 159.6311 154.4136 142.9786 135.9743 128.6530 124.1565 127.8718 132.2277 140.3514 151.3132 160.8777 (72)

Total internal gains 687.1708 704.6288 674.5775 651.9887 618.8719 594.3262 571.4548 572.0996 589.5120 611.7895 648.8638 672.6528 (73)

6. Solar gains

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| [Jan] |  |  | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W    |
|-------|--|--|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|---------------|
| North |  |  | 9.1500     | 10.6334                        | 0.6300                            | 0.7000                             | 0.7700                       | 29.7348 (74)  |
| South |  |  | 9.1300     | 46.7521                        | 0.6300                            | 0.7000                             | 0.7700                       | 130.4498 (78) |

|             |          |          |           |           |           |           |           |           |          |          |          |               |
|-------------|----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|----------|----------|---------------|
| Solar gains | 160.1846 | 270.4678 | 368.7025  | 462.6798  | 529.4506  | 532.1235  | 510.2024  | 458.3557  | 400.3812 | 298.0766 | 191.3092 | 137.5090 (83) |
| Total gains | 847.3554 | 975.0966 | 1043.2801 | 1114.6684 | 1148.3225 | 1126.4497 | 1081.6573 | 1030.4552 | 989.8932 | 909.8661 | 840.1730 | 810.1618 (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                    | 25.7955 | 25.8585 | 25.9206 | 26.2162 | 26.2723 | 26.5364 | 26.5364 | 26.5859 | 26.4341 | 26.2723 | 26.1591 | 26.0418      |
| alpha                  | 2.7197  | 2.7239  | 2.7280  | 2.7477  | 2.7515  | 2.7691  | 2.7691  | 2.7724  | 2.7623  | 2.7515  | 2.7439  | 2.7361       |
| util living area       | 0.9576  | 0.9376  | 0.9108  | 0.8562  | 0.7675  | 0.6299  | 0.4952  | 0.5314  | 0.7116  | 0.8688  | 0.9374  | 0.9620 (86)  |
| MIT                    | 18.5586 | 18.8680 | 19.2929 | 19.8645 | 20.3733 | 20.7510 | 20.9074 | 20.8847 | 20.6264 | 19.9793 | 19.1845 | 18.5107 (87) |
| Th 2                   | 20.0198 | 20.0219 | 20.0241 | 20.0340 | 20.0359 | 20.0445 | 20.0445 | 20.0461 | 20.0412 | 20.0359 | 20.0321 | 20.0282 (88) |
| util rest of house     | 0.9515  | 0.9288  | 0.8977  | 0.8338  | 0.7283  | 0.5641  | 0.4039  | 0.4414  | 0.6531  | 0.8439  | 0.9271  | 0.9566 (89)  |
| MIT 2                  | 17.1597 | 17.5507 | 18.0862 | 18.8009 | 19.4127 | 19.8399 | 19.9888 | 19.9727 | 19.7128 | 18.9540 | 17.9617 | 17.1040 (90) |
| Living area fraction   | 17.4264 | 17.8018 | 18.3162 | 19.0037 | 19.5959 | 20.0136 | 20.1639 | 20.1466 | 19.8870 | 19.1495 | 18.1948 | 17.3722 (92) |
| MIT                    | 17.4264 | 17.8018 | 18.3162 | 19.0037 | 19.5959 | 20.0136 | 20.1639 | 20.1466 | 19.8870 | 19.1495 | 18.1948 | 17.3722 (93) |
| Temperature adjustment |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT           | 17.4264 | 17.8018 | 18.3162 | 19.0037 | 19.5959 | 20.0136 | 20.1639 | 20.1466 | 19.8870 | 19.1495 | 18.1948 | 17.3722 (93) |

## 8. Space heating requirement

|                                                                                | Jan       | Feb       | Mar       | Apr       | May       | Jun      | Jul      | Aug      | Sep      | Oct           | Nov       | Dec            |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|---------------|-----------|----------------|
| Utilisation                                                                    | 0.9288    | 0.9019    | 0.8681    | 0.8049    | 0.7080    | 0.5618   | 0.4160   | 0.4515   | 0.6426   | 0.8156        | 0.9006    | 0.9352 (94)    |
| Useful gains                                                                   | 786.9821  | 879.4217  | 905.6889  | 897.1681  | 813.0231  | 632.8562 | 449.9784 | 465.2365 | 636.0916 | 742.0450      | 756.6501  | 757.6762 (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                                                               | 1816.3649 | 1780.9350 | 1627.1783 | 1375.6608 | 1072.7622 | 728.1914 | 479.3879 | 503.0231 | 781.4308 | 1161.5676     | 1513.9030 | 1805.4619 (97) |
| Space heating kWh                                                              | 765.8608  | 605.8169  | 536.7881  | 344.5147  | 193.2459  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 312.1248      | 545.2221  | 779.5525 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |           |          |          |          |          |               |           | 4083.1259      |
| 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                                                              | 765.8608  | 605.8169  | 536.7881  | 344.5147  | 193.2459  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 312.1248      | 545.2221  | 779.5525 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |           |          |          |          |          |               |           | 4083.1259      |
| Space heating per m2                                                           |           |           |           |           |           |          |          |          |          | (98c) / (4) = |           | 31.7753 (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                        | 765.8608 | 605.8169 | 536.7881 | 344.5147 | 193.2459 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 312.1248 | 545.2221 | 779.5525 (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)         | 829.7517 | 656.3564 | 581.5689 | 373.2554 | 209.3672 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 338.1634 | 590.7065 | 844.5856 (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                                                                            | 255.0081 | 225.4809 | 239.7284  | 211.5332  | 205.4948  | 185.6732  | 183.7517  | 190.8573  | 192.7099  | 214.2505  | 226.9825 | 252.3521 (64)   |
| Efficiency of water heater (217)m                                                                    | 86.3668  | 86.1642  | 85.8122   | 85.1468   | 83.9222   | 79.8000   | 79.8000   | 79.8000   | 79.8000   | 84.9025   | 85.9506  | 79.8000 (216)   |
| Fuel for water heating, kWh/month                                                                    | 295.2616 | 261.6876 | 279.3641  | 248.4335  | 244.8635  | 232.6732  | 230.2653  | 239.1696  | 241.4911  | 252.3488  | 264.0847 | 86.4166 (217)   |
| Space cooling fuel requirement                                                                       |          |          |           |           |           |           |           |           |           |           |          | 292.0182 (219)  |
| (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                                                                                             | 33.1540  | 26.5974  | 23.9480   | 17.5453   | 13.5525   | 11.0725   | 12.3630   | 16.0700   | 20.8733   | 27.3869   | 30.9334  | 34.0754 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | -57.1618 | -79.1092 | -111.6100 | -123.0350 | -130.5561 | -121.0145 | -119.4251 | -113.7220 | -103.4205 | -89.2166  | -62.2788 | -49.5870 (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000 (235a)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000 (235c)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | -36.9129 | -77.0854 | -152.2256 | -227.2579 | -299.2343 | -300.2941 | -296.8434 | -251.9749 | -185.4851 | -109.8734 | -49.1536 | -29.2400 (233b) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000 (234b)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000 (235b)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000 (235d)   |
| Annual totals kWh/year                                                                               |          |          |           |           |           |           |           |           |           |           |          |                 |
| Space heating fuel - main system 1                                                                   |          |          |           |           |           |           |           |           |           |           |          | 4423.7550 (211) |

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|                                                               |            |        |
|---------------------------------------------------------------|------------|--------|
| 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                                       | 3081.6614  | (219)  |
| Space cooling fuel                                            | 0.0000     | (221)  |
| Electricity for pumps and fans:                               |            |        |
| Total electricity for the above, kWh/year                     | 86.0000    | (231)  |
| Electricity for lighting (calculated in Appendix L)           | 267.5717   | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q) |            |        |
| PV generation                                                 | -3175.7172 | (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                           | 4683.2709  | (238)  |

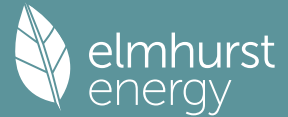
## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                               | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|-----------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1                 | 4423.7550          | 0.2100                        | 928.9886 (261)           |
| Total CO2 associated with community systems   |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                    | 3081.6614          | 0.2100                        | 647.1489 (264)           |
| Space and water heating                       |                    |                               | 1576.1374 (265)          |
| Pumps, fans and electric keep-hot             | 86.0000            | 0.1387                        | 11.9293 (267)            |
| Energy for lighting                           | 267.5717           | 0.1443                        | 38.6189 (268)            |
| Energy saving/generation technologies         |                    |                               |                          |
| PV Unit electricity used in dwelling          | -1160.1367         | 0.1350                        | -156.6309                |
| PV Unit electricity exported                  | -2015.5805         | 0.1261                        | -254.0999                |
| Total                                         |                    |                               | -410.7308 (269)          |
| Total CO2, kg/year                            |                    |                               | 1215.9548 (272)          |
| EPC Target Carbon Dioxide Emission Rate (TER) |                    |                               | 9.4600 (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               | 4423.7550          | 1.1300                              | 4998.8432 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 3081.6614          | 1.1300                              | 3482.2774 (278)            |
| Space and water heating                     |                    |                                     | 8481.1206 (279)            |
| Pumps, fans and electric keep-hot           | 86.0000            | 1.5128                              | 130.1008 (281)             |
| Energy for lighting                         | 267.5717           | 1.5338                              | 410.4104 (282)             |
| Energy saving/generation technologies       |                    |                                     |                            |
| PV Unit electricity used in dwelling        | -1160.1367         | 1.4990                              | -1739.0457                 |
| PV Unit electricity exported                | -2015.5805         | 0.4628                              | -932.7358                  |
| Total                                       |                    |                                     | -2671.7815 (283)           |
| Total Primary energy kWh/year               |                    |                                     | 6349.8502 (286)            |
| Target Primary Energy Rate (TPER)           |                    |                                     | 49.4200 (287)              |

# Full SAP Calculation Printout



|                                    |                      |               |       |               |                |            |  |
|------------------------------------|----------------------|---------------|-------|---------------|----------------|------------|--|
| Property Reference                 | OP-D320 P3TORT       |               |       |               | Issued on Date | 29/11/2024 |  |
| Assessment Reference               | P3TORT               |               |       | Prop Type Ref | P3TORT         |            |  |
| Property                           | P3TORT               |               |       |               |                |            |  |
|                                    |                      |               |       |               |                |            |  |
| SAP Rating                         | 81 B                 | DER           | 4.02  | TER           | 9.46           |            |  |
| Environmental                      | 96 A                 | % DER < TER   |       |               |                | 57.51      |  |
| CO <sub>2</sub> Emissions (t/year) | 0.48                 | DFEE          | 36.00 | TFEE          | 37.35          |            |  |
| Compliance Check                   | See BREL             | % DFEE < TFEE |       |               |                | 3.63       |  |
| % DPER < TPER                      | 14.10                | DPER          | 42.45 | TPER          | 49.42          |            |  |
|                                    |                      |               |       |               |                |            |  |
| 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                                           | 64.2500 (1b)              | x 2.3100 (2b)                   | = 148.4175 (1b) - (3b)      |
| First floor                                            | 64.2500 (1c)              | x 2.6100 (2c)                   | = 167.6925 (1c) - (3c)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 128.5000                  |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 316.1100 (5)              |

## 2. Ventilation rate

|                                                                                                    |                             |              |
|----------------------------------------------------------------------------------------------------|-----------------------------|--------------|
| 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                                                                | 4 * 10 =                    | 40.0000 (7a) |
| Number of passive vents                                                                            | 0 * 10 =                    | 0.0000 (7b)  |
| Number of flueless gas fires                                                                       | 0 * 40 =                    | 0.0000 (7c)  |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | Air changes per hour        |              |
| Pressure test                                                                                      | 40.0000 / (5) =             | 0.1265 (8)   |
| Pressure Test Method                                                                               | Yes                         |              |
| Measured/design AP50                                                                               | Blower Door                 | 3.5000 (17)  |
| Infiltration rate                                                                                  |                             | 0.3015 (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) =        | 0.2563 (21)  |

|                                                                                                         |        |        |        |        |        |        |        |        |        |        |        |              |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed                                                                                              | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
| Wind factor                                                                                             | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Adj infilt rate                                                                                         | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
|                                                                                                         | 0.3268 | 0.3204 | 0.3140 | 0.2819 | 0.2755 | 0.2435 | 0.2435 | 0.2371 | 0.2563 | 0.2755 | 0.2883 | 0.3012 (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                                                                                            | 0.5534 | 0.5513 | 0.5493 | 0.5397 | 0.5380 | 0.5296 | 0.5296 | 0.5281 | 0.5328 | 0.5380 | 0.5416 | 0.5453 (25)  |

## 3. Heat losses and heat loss parameter

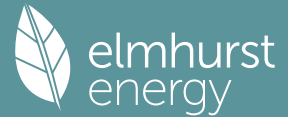
| Element                                                     | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K |
|-------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|---------------|
| Front Door                                                  |                         |                            | 4.2800                    | 1.0000                        | 4.2800       |                                | (26)          |
| Windows (Uw = 1.30)                                         |                         |                            | 18.2800                   | 1.2357                        | 22.5894      |                                | (27)          |
| Ground Floor                                                |                         |                            | 64.2500                   | 0.1100                        | 7.0675       |                                | (28a)         |
| External Wall                                               | 160.7900                | 22.5600                    | 138.2300                  | 0.1700                        | 23.4991      |                                | (29a)         |
| Roof - ceiling                                              | 64.2500                 |                            | 64.2500                   | 0.1100                        | 7.0675       |                                | (30)          |
| Total net area of external elements Aum(A, m <sup>2</sup> ) |                         |                            | 289.2900                  |                               |              |                                | (31)          |
| Fabric heat loss, W/K = Sum (A x U)                         |                         |                            | (26)...(30) + (32) =      |                               | 64.5035      |                                | (33)          |

Thermal mass parameter (TMP = Cm / TFA) in kJ/m<sup>2</sup>K

List of Thermal Bridges

| K1 Element                                       | Length  | Psi-value | Total  |
|--------------------------------------------------|---------|-----------|--------|
| E2 Other lintels (including other steel lintels) | 15.1000 | 0.0500    | 0.7550 |
| E3 Sill                                          | 11.2500 | 0.0500    | 0.5625 |
| E4 Jamb                                          | 34.8000 | 0.0500    | 1.7400 |
| E5 Ground floor (normal)                         | 32.6800 | 0.1600    | 5.2288 |
| E6 Intermediate floor within a dwelling          | 32.6800 | 0.0000    | 0.0000 |
| E10 Eaves (insulation at ceiling level)          | 19.5000 | 0.0600    | 1.1700 |

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|                                                            |         |                       |              |
|------------------------------------------------------------|---------|-----------------------|--------------|
| E12 Gable (insulation at ceiling level)                    | 13.1800 | 0.0600                | 0.7908       |
| E16 Corner (normal)                                        | 19.6800 | 0.0900                | 1.7712       |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |         |                       | 12.0183 (36) |
| Point Thermal bridges                                      |         |                       | 0.0000       |
| Total fabric heat loss                                     |         | (33) + (36) + (36a) = | 76.5218 (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                                                 | 57.7283  | 57.5120  | 57.3000  | 56.3042  | 56.1178  | 55.2505  | 55.2505  | 55.0899  | 55.5846  | 56.1178  | 56.4948  | 56.8888 (38)  |
| Average = Sum(39)m / 12 =                                           | 134.2500 | 134.0337 | 133.8217 | 132.8259 | 132.6396 | 131.7723 | 131.7723 | 131.6117 | 132.1064 | 132.6396 | 133.0165 | 133.4106 (39) |
|                                                                     |          |          |          |          |          |          |          |          |          |          |          | 132.8250      |
| HLP                                                                 | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
| HLP (average)                                                       | 1.0447   | 1.0431   | 1.0414   | 1.0337   | 1.0322   | 1.0255   | 1.0255   | 1.0242   | 1.0281   | 1.0322   | 1.0351   | 1.0382 (40)   |
| Days in mont                                                        | 31       | 28       | 31       | 30       | 31       | 30       | 31       | 31       | 30       | 31       | 30       | 31            |

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

|                                                                                |          |          |          |         |         |         |         |         |         |         |          |                |
|--------------------------------------------------------------------------------|----------|----------|----------|---------|---------|---------|---------|---------|---------|---------|----------|----------------|
| Assumed occupancy                                                              |          |          |          |         |         |         |         |         |         |         |          | 2.8910 (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                                                      |          |          |          |         |         |         |         |         |         |         |          |                |
| 31.3833                                                                        | 30.9172  | 30.2609  | 29.0507  | 28.1445 | 27.1397 | 26.5970 | 27.2487 | 27.9583 | 29.0335 | 30.2686 | 31.2772  | (42b)          |
| Hot water usage for other uses                                                 |          |          |          |         |         |         |         |         |         |         |          |                |
| 44.2367                                                                        | 42.6281  | 41.0195  | 39.4109  | 37.8022 | 36.1936 | 36.1936 | 37.8022 | 39.4109 | 41.0195 | 42.6281 | 44.2367  | (42c)          |
| Average daily hot water use (litres/day)                                       |          |          |          |         |         |         |         |         |         |         |          | 69.3124 (43)   |
| Daily hot water use                                                            | Jan      | Feb      | Mar      | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov      | Dec            |
| 75.6200                                                                        | 73.5453  | 71.2803  | 68.4615  | 65.9467 | 63.3333 | 62.7906 | 65.0510 | 67.3692 | 70.0530 | 72.8967 | 75.5139  | (44)           |
| Energy conte                                                                   | 119.7635 | 104.7275 | 109.5552 | 93.7204 | 88.7770 | 77.8757 | 75.9398 | 80.5467 | 83.0730 | 95.0612 | 103.8547 | 118.2365 (45)  |
| Energy content (annual)                                                        |          |          |          |         |         |         |         |         |         |         |          | 1151.1311      |
| 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   | (59)           |
| Combi loss                                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000   | (61)           |
| Total heat required for water heating calculated for each month                |          |          |          |         |         |         |         |         |         |         |          |                |
| 101.7990                                                                       | 89.0184  | 93.1219  | 79.6623  | 75.4604 | 66.1944 | 64.5488 | 68.4647 | 70.6120 | 80.8020 | 88.2765 | 100.5010 | (62)           |
| WWHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000   | (63a)          |
| PV diverter                                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000   | (63b)          |
| Solar input                                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000   | (63c)          |
| FGHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000   | (63d)          |
| Output from w/h                                                                | 101.7990 | 89.0184  | 93.1219  | 79.6623 | 75.4604 | 66.1944 | 64.5488 | 68.4647 | 70.6120 | 80.8020 | 88.2765  | 100.5010 (64)  |
| 12Total per year (kWh/year)                                                    |          |          |          |         |         |         |         |         |         |         |          | 978.4614 (64)  |
| Electric shower(s)                                                             | 58.2144  | 51.8695  | 56.6395  | 54.0504 | 55.0646 | 52.5263 | 54.2772 | 55.0646 | 54.0504 | 56.6395 | 55.5745  | 58.2144 (64a)  |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |         |         |         |         |         |         |         |          | 662.1856 (64a) |
| Heat gains from water heating, kWh/month                                       |          |          |          |         |         |         |         |         |         |         |          |                |
| 40.0034                                                                        | 35.2220  | 37.4404  | 33.4282  | 32.6313 | 29.6802 | 29.7065 | 30.8823 | 31.1656 | 34.3604 | 35.9627 | 39.6788  | (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                                                                               | 144.5497  | 144.5497  | 144.5497  | 144.5497  | 144.5497  | 144.5497  | 144.5497  | 144.5497  | 144.5497  | 144.5497  | 144.5497  | 144.5497 (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     |           |           |           |           |           |           |           |           |           |           |           |               |
| 159.5628                                                                            | 176.6588  | 159.5628  | 164.8815  | 159.5628  | 164.8815  | 159.5628  | 159.5628  | 159.5628  | 164.8815  | 159.5628  | 164.8815  | 159.5628 (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 |           |           |           |           |           |           |           |           |           |           |           |               |
| 295.9035                                                                            | 298.9740  | 291.2363  | 274.7637  | 253.9700  | 234.4268  | 221.3707  | 218.3002  | 226.0379  | 242.5105  | 263.3042  | 282.8474  | (68)          |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    |           |           |           |           |           |           |           |           |           |           |           |               |
| 37.4550                                                                             | 37.4550   | 37.4550   | 37.4550   | 37.4550   | 37.4550   | 37.4550   | 37.4550   | 37.4550   | 37.4550   | 37.4550   | 37.4550   | (69)          |
| Pumps, fans                                                                         | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | (70)          |
| Losses e.g. evaporation (negative values) (Table 5)                                 |           |           |           |           |           |           |           |           |           |           |           |               |
| -115.6398                                                                           | -115.6398 | -115.6398 | -115.6398 | -115.6398 | -115.6398 | -115.6398 | -115.6398 | -115.6398 | -115.6398 | -115.6398 | -115.6398 | (71)          |
| Water heating gains (Table 5)                                                       |           |           |           |           |           |           |           |           |           |           |           |               |
| 53.7679                                                                             | 52.4136   | 50.3231   | 46.4280   | 43.8592   | 41.2225   | 39.9281   | 41.5085   | 43.2856   | 46.1833   | 49.9483   | 53.3318   | (72)          |
| Total internal gains                                                                | 575.5991  | 594.4113  | 567.4870  | 552.4382  | 523.7569  | 506.8957  | 487.2265  | 485.7363  | 500.5699  | 514.6215  | 544.4989  | 562.1069 (73) |

## 6. Solar gains

| [Jan]       |          |          |          |            |                                |           |                                   |                                    |          |                              |               |               |
|-------------|----------|----------|----------|------------|--------------------------------|-----------|-----------------------------------|------------------------------------|----------|------------------------------|---------------|---------------|
|             |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 |           | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c |          | Access<br>factor<br>Table 6d | Gains<br>W    |               |
| North       |          |          |          | 9.1500     | 10.6334                        |           | 0.6300                            | 0.7000                             |          | 0.7700                       | 29.7348 (74)  |               |
| South       |          |          |          | 9.1300     | 46.7521                        |           | 0.6300                            | 0.7000                             |          | 0.7700                       | 130.4498 (78) |               |
|             |          |          |          |            |                                |           |                                   |                                    |          |                              |               |               |
| Solar gains | 160.1846 | 270.4678 | 368.7025 | 462.6798   | 529.4506                       | 532.1235  | 510.2024                          | 458.3557                           | 400.3812 | 298.0766                     | 191.3092      | 137.5090 (83) |
| Total gains | 735.7836 | 864.8792 | 936.1896 | 1015.1179  | 1053.2075                      | 1039.0191 | 997.4289                          | 944.0920                           | 900.9511 | 812.6980                     | 735.8081      | 699.6159 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |         |         |         |              |
| tau                                                                         | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| alpha                                                                       | 26.5880 | 26.6309 | 26.6731 | 26.8731 | 26.9109 | 27.0880 | 27.0880 | 27.1210 | 27.0195 | 26.9109 | 26.8346 | 26.7553      |
|                                                                             | 2.7725  | 2.7754  | 2.7782  | 2.7915  | 2.7941  | 2.8059  | 2.8059  | 2.8081  | 2.8013  | 2.7941  | 2.7890  | 2.7837       |

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|                        |         |         |         |         |         |         |         |         |         |         |         |              |
|------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| util living area       | 0.9689  | 0.9511  | 0.9270  | 0.8762  | 0.7916  | 0.6564  | 0.5205  | 0.5603  | 0.7412  | 0.8918  | 0.9525  | 0.9728 (86)  |
| MIT                    | 18.4817 | 18.7993 | 19.2314 | 19.8131 | 20.3384 | 20.7323 | 20.8994 | 20.8732 | 20.5962 | 19.9168 | 19.1025 | 18.4234 (87) |
| Th 2                   | 20.0462 | 20.0476 | 20.0490 | 20.0554 | 20.0566 | 20.0622 | 20.0622 | 20.0632 | 20.0600 | 20.0566 | 20.0541 | 20.0516 (88) |
| util rest of house     | 0.9644  | 0.9440  | 0.9160  | 0.8561  | 0.7549  | 0.5918  | 0.4283  | 0.4696  | 0.6855  | 0.8703  | 0.9444  | 0.9687 (89)  |
| MIT 2                  | 17.7332 | 18.0472 | 18.4732 | 19.0423 | 19.5382 | 19.8882 | 20.0140 | 19.9989 | 19.7787 | 19.1515 | 18.3548 | 17.6793 (90) |
| Living area fraction   | 17.8759 | 18.1906 | 18.6178 | 19.1893 | 19.6908 | 20.0492 | 20.1828 | 20.1656 | 19.9346 | 19.2974 | 18.4974 | 17.8211 (91) |
| MIT                    | 17.8759 | 18.1906 | 18.6178 | 19.1893 | 19.6908 | 20.0492 | 20.1828 | 20.1656 | 19.9346 | 19.2974 | 18.4974 | 17.8211 (92) |
| Temperature adjustment |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT           | 17.8759 | 18.1906 | 18.6178 | 19.1893 | 19.6908 | 20.0492 | 20.1828 | 20.1656 | 19.9346 | 19.2974 | 18.4974 | 17.8211 (93) |

## 8. Space heating requirement

|                                                                                |           |           |           |           |           |          |          |          |          |               |           |           |       |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|---------------|-----------|-----------|-------|
| Utilisation                                                                    | Jan       | Feb       | Mar       | Apr       | May       | Jun      | Jul      | Aug      | Sep      | Oct           | Nov       | Dec       |       |
|                                                                                | 0.9501    | 0.9259    | 0.8949    | 0.8341    | 0.7388    | 0.5908   | 0.4409   | 0.4803   | 0.6771   | 0.8490        | 0.9267    | 0.9557    | (94)  |
| Useful gains                                                                   | 699.1036  | 800.7940  | 837.8407  | 846.7466  | 778.0639  | 613.8576 | 439.7454 | 453.4318 | 610.0259 | 689.9542      | 681.8929  | 668.5940  | (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                                                               | 1822.5693 | 1781.3895 | 1621.6191 | 1366.6824 | 1059.8964 | 718.0473 | 472.1125 | 495.5974 | 770.7841 | 1153.6238     | 1516.0366 | 1817.2027 | (97)  |
| Space heating kWh                                                              | 835.8585  | 658.9602  | 583.1311  | 374.3537  | 209.6833  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 344.9702      | 600.5835  | 854.5648  | (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |           |          |          |          |          |               |           | 4462.1053 |       |
| 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                                                              | 835.8585  | 658.9602  | 583.1311  | 374.3537  | 209.6833  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 344.9702      | 600.5835  | 854.5648  | (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |           |          |          |          |          |               |           | 4462.1053 |       |
| Space heating per m2                                                           |           |           |           |           |           |          |          |          |          | (98c) / (4) = |           | 34.7246   | (99)  |

## 8c. Space cooling requirement

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

|                                  |        |        |        |        |         |           |           |           |                          |         |        |          |       |
|----------------------------------|--------|--------|--------|--------|---------|-----------|-----------|-----------|--------------------------|---------|--------|----------|-------|
| Ext. temp.                       | Jan    | Feb    | Mar    | Apr    | May     | Jun       | Jul       | Aug       | Sep                      | Oct     | Nov    | Dec      |       |
|                                  | 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  | 1238.6594 | 975.1149  | 1000.2486 | 0.0000                   | 0.0000  | 0.0000 | 0.0000   | (100) |
| Utilisation                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 0.7060    | 0.7783    | 0.7501    | 0.0000                   | 0.0000  | 0.0000 | 0.0000   | (101) |
| Useful loss                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 874.4562  | 758.9474  | 750.3017  | 0.0000                   | 0.0000  | 0.0000 | 0.0000   | (102) |
| Total gains                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 1140.0936 | 1094.8150 | 1035.7356 | 0.0000                   | 0.0000  | 0.0000 | 0.0000   | (103) |
| Space cooling kWh                | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 191.2590  | 249.8855  | 212.3628  | 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  | 47.8147   | 62.4714   | 53.0907   | 0.0000                   | 0.0000  | 0.0000 | 0.0000   | (107) |
| Space cooling requirement        |        |        |        |        |         |           |           |           |                          |         |        | 163.3768 | (107) |
| Energy for space heating         |        |        |        |        |         |           |           |           |                          |         |        | 34.7246  | (99)  |
| Energy for space cooling         |        |        |        |        |         |           |           |           |                          |         |        | 1.2714   | (108) |
| Total                            |        |        |        |        |         |           |           |           |                          |         |        | 35.9960  | (109) |
| Fabric Energy Efficiency (DFEE)  |        |        |        |        |         |           |           |           |                          |         |        | 36.0     | (109) |

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

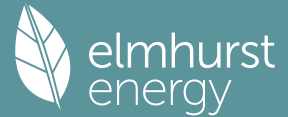
## 1. Overall dwelling characteristics

|                                                        |              |                                   |                        |  |
|--------------------------------------------------------|--------------|-----------------------------------|------------------------|--|
|                                                        | Area (m2)    | Storey height (m)                 | Volume (m3)            |  |
| Ground floor                                           | 64.2500 (1b) | x 2.3100 (2b)                     | = 148.4175 (1b) - (3b) |  |
| First floor                                            | 64.2500 (1c) | x 2.6100 (2c)                     | = 167.6925 (1c) - (3c) |  |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 128.5000     |                                   | (4)                    |  |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 316.1100 (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                | 4 * 10 =             | 40.0000 (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       | 40.0000 / (5) =      | 0.1265 (8)   |
| Pressure test                                      | Yes                  |              |
| Pressure Test Method                               | Blower Door          |              |
| Measured/design AP50                               | 5.0000               | (17)         |
| Infiltration rate                                  | 0.3765               | (18)         |
| Number of sides sheltered                          | 2                    | (19)         |

# Full SAP Calculation Printout



Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)  
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3201 (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                                                                                         |        |        |        |        |        |        |        |        |        |        |        |        |       |
|                                                                                                         | 0.4081 | 0.4001 | 0.3921 | 0.3521 | 0.3441 | 0.3041 | 0.3041 | 0.2961 | 0.3201 | 0.3441 | 0.3601 | 0.3761 | (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                                                                                            | 0.5833 | 0.5800 | 0.5769 | 0.5620 | 0.5592 | 0.5462 | 0.5462 | 0.5438 | 0.5512 | 0.5592 | 0.5648 | 0.5707 | (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                                |             |                | 4.2800        | 1.0000           | 4.2800               |                   |               | (26)  |
| TER Opening Type (Uw = 1.20)                   |             |                | 18.2800       | 1.1450           | 20.9313              |                   |               | (27)  |
| Ground Floor                                   |             |                | 64.2500       | 0.1300           | 8.3525               |                   |               | (28a) |
| External Wall                                  | 160.7900    | 22.5600        | 138.2300      | 0.1800           | 24.8814              |                   |               | (29a) |
| Roof - ceiling                                 | 64.2500     |                | 64.2500       | 0.1100           | 7.0675               |                   |               | (30)  |
| Total net area of external elements Aum(A, m2) |             |                | 289.2900      |                  |                      |                   |               | (31)  |
| Fabric heat loss, W/K = Sum (A x U)            |             |                |               |                  | (26)...(30) + (32) = | 65.5127           |               | (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) | 15.1000 | 0.0500    | 0.7550 |  |
| E3 Sill                                          | 11.2500 | 0.0500    | 0.5625 |  |
| E4 Jamb                                          | 34.8000 | 0.0500    | 1.7400 |  |
| E5 Ground floor (normal)                         | 32.6800 | 0.1600    | 5.2288 |  |
| E6 Intermediate floor within a dwelling          | 32.6800 | 0.0000    | 0.0000 |  |
| E10 Eaves (insulation at ceiling level)          | 19.5000 | 0.0600    | 1.1700 |  |
| E12 Gable (insulation at ceiling level)          | 13.1800 | 0.0600    | 0.7908 |  |
| E16 Corner (normal)                              | 19.6800 | 0.0900    | 1.7712 |  |

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 12.0183 (36)

### Point Thermal bridges

Total fabric heat loss (33) + (36) + (36a) = 77.5310 (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                     | 60.8437  | 60.5065  | 60.1759  | 58.6231  | 58.3326  | 56.9801  | 56.9801  | 56.7297  | 57.5011  | 58.3326  | 58.9203  | 59.5347  | (38) |
| Heat transfer coeff       | 138.3747 | 138.0375 | 137.7069 | 136.1541 | 135.8636 | 134.5111 | 134.5111 | 134.2607 | 135.0321 | 135.8636 | 136.4513 | 137.0657 | (39) |
| Average = Sum(39)m / 12 = |          |          |          |          |          |          |          |          |          |          |          | 136.1527 |      |

|               | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |      |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| HLP           | 1.0768 | 1.0742 | 1.0716 | 1.0596 | 1.0573 | 1.0468 | 1.0468 | 1.0448 | 1.0508 | 1.0573 | 1.0619 | 1.0667 | (40) |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 1.0596 |      |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31     |      |

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

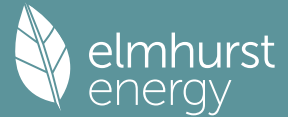
|                                          |         |         |         |         |         |         |         |         |         |         |         |         |              |
|------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Assumed occupancy                        |         |         |         |         |         |         |         |         |         |         |         |         | 2.8910 (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                |         |         |         |         |         |         |         |         |         |         |         |         |              |
|                                          | 31.3833 | 30.9172 | 30.2609 | 29.0507 | 28.1445 | 27.1397 | 26.5970 | 27.2487 | 27.9583 | 29.0335 | 30.2686 | 31.2772 | (42b)        |
| Hot water usage for other uses           |         |         |         |         |         |         |         |         |         |         |         |         |              |
|                                          | 44.2367 | 42.6281 | 41.0195 | 39.4109 | 37.8022 | 36.1936 | 36.1936 | 37.8022 | 39.4109 | 41.0195 | 42.6281 | 44.2367 | (42c)        |
| Average daily hot water use (litres/day) |         |         |         |         |         |         |         |         |         |         |         |         | 69.3124 (43) |

|                                                                                | Jan      | Feb      | Mar      | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct                                    | Nov      | Dec       |       |
|--------------------------------------------------------------------------------|----------|----------|----------|---------|---------|---------|---------|---------|---------|----------------------------------------|----------|-----------|-------|
| Daily hot water use                                                            | 75.6200  | 73.5453  | 71.2803  | 68.4615 | 65.9467 | 63.3333 | 62.7906 | 65.0510 | 67.3692 | 70.0530                                | 72.8967  | 75.5139   | (44)  |
| Energy conte                                                                   | 119.7635 | 104.7275 | 109.5552 | 93.7204 | 88.7770 | 77.8757 | 75.9398 | 80.5467 | 83.0730 | 95.0612                                | 103.8547 | 118.2365  | (45)  |
| Energy content (annual)                                                        |          |          |          |         |         |         |         |         |         | Total = Sum(45)m =                     |          | 1151.1311 |       |
| 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                |          |          |          |         |         |         |         |         |         |                                        |          |           |       |
|                                                                                | 101.7990 | 89.0184  | 93.1219  | 79.6623 | 75.4604 | 66.1944 | 64.5488 | 68.4647 | 70.6120 | 80.8020                                | 88.2765  | 100.5010  | (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                                                                | 101.7990 | 89.0184  | 93.1219  | 79.6623 | 75.4604 | 66.1944 | 64.5488 | 68.4647 | 70.6120 | 80.8020                                | 88.2765  | 100.5010  | (64)  |
| 12Total per year (kWh/year)                                                    |          |          |          |         |         |         |         |         |         | Total per year (kWh/year) = Sum(64)m = |          | 978.4614  | (64)  |
| Electric shower(s)                                                             |          |          |          |         |         |         |         |         |         |                                        |          | 978       | (64)  |
|                                                                                | 58.2144  | 51.8695  | 56.6395  | 54.0504 | 55.0646 | 52.5263 | 54.2772 | 55.0646 | 54.0504 | 56.6395                                | 55.5745  | 58.2144   | (64a) |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |         |         |         |         |         |         |                                        |          | 662.1856  | (64a) |
| Heat gains from water heating, kWh/month                                       |          |          |          |         |         |         |         |         |         |                                        |          |           |       |
|                                                                                | 40.0034  | 35.2220  | 37.4404  | 33.4282 | 32.6313 | 29.6802 | 29.7065 | 30.8823 | 31.1656 | 34.3604                                | 35.9627  | 39.6788   | (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                                                                               | 144.5497 | 144.5497 | 144.5497 | 144.5497 | 144.5497 | 144.5497 | 144.5497 | 144.5497 | 144.5497 | 144.5497 | 144.5497 | 144.5497 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     |          |          |          |          |          |          |          |          |          |          |          |          |      |
|                                                                                     | 159.5628 | 176.6588 | 159.5628 | 164.8815 | 159.5628 | 164.8815 | 159.5628 | 159.5628 | 164.8815 | 159.5628 | 164.8815 | 159.5628 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 |          |          |          |          |          |          |          |          |          |          |          |          |      |

# Full SAP Calculation Printout



|                                                     |           |           |           |           |           |           |           |           |           |           |           |                |
|-----------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
| Cooking gains                                       | 295.9035  | 298.9740  | 291.2363  | 274.7637  | 253.9700  | 234.4268  | 221.3707  | 218.3002  | 226.0379  | 242.5105  | 263.3042  | 282.8474 (68)  |
|                                                     | 37.4550   | 37.4550   | 37.4550   | 37.4550   | 37.4550   | 37.4550   | 37.4550   | 37.4550   | 37.4550   | 37.4550   | 37.4550   | 37.4550 (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) | -115.6398 | -115.6398 | -115.6398 | -115.6398 | -115.6398 | -115.6398 | -115.6398 | -115.6398 | -115.6398 | -115.6398 | -115.6398 | -115.6398 (71) |
| Water heating gains (Table 5)                       | 53.7679   | 52.4136   | 50.3231   | 46.4280   | 43.8592   | 41.2225   | 39.9281   | 41.5085   | 43.2856   | 46.1833   | 49.9483   | 53.3318 (72)   |
| Total internal gains                                | 575.5991  | 594.4113  | 567.4870  | 552.4382  | 523.7569  | 506.8957  | 487.2265  | 485.7363  | 500.5699  | 514.6215  | 544.4989  | 562.1069 (73)  |

## 6. Solar gains

| [Jan]       |            |          |          |           |                                |           |                                   |          |                                    |          |                              |               |               |  |
|-------------|------------|----------|----------|-----------|--------------------------------|-----------|-----------------------------------|----------|------------------------------------|----------|------------------------------|---------------|---------------|--|
|             | Area<br>m2 |          |          |           | Solar flux<br>Table 6a<br>W/m2 |           | g<br>Specific data<br>or Table 6b |          | FF<br>Specific data<br>or Table 6c |          | Access<br>factor<br>Table 6d |               | Gains<br>W    |  |
| North       | 9.1500     |          |          |           | 10.6334                        |           | 0.6300                            |          | 0.7000                             |          | 0.7700                       |               | 29.7348 (74)  |  |
| South       | 9.1300     |          |          |           | 46.7521                        |           | 0.6300                            |          | 0.7000                             |          | 0.7700                       |               | 130.4498 (78) |  |
| Solar gains | 160.1846   | 270.4678 | 368.7025 | 462.6798  | 529.4506                       | 532.1235  | 510.2024                          | 458.3557 | 400.3812                           | 298.0766 | 191.3092                     | 137.5090 (83) |               |  |
| Total gains | 735.7836   | 864.8792 | 936.1896 | 1015.1179 | 1053.2075                      | 1039.0191 | 997.4289                          | 944.0920 | 900.9511                           | 812.6980 | 735.8081                     | 699.6159 (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                                                                         | 25.7955                   | 25.8585     | 25.9206 | 26.2162 | 26.2723 | 26.5364 | 26.5364 | 26.5859 | 26.4341 | 26.2723 | 26.1591 | 26.0418      |
| alpha                                                                       | 2.7197                    | 2.7239      | 2.7280  | 2.7477  | 2.7515  | 2.7691  | 2.7691  | 2.7724  | 2.7623  | 2.7515  | 2.7439  | 2.7361       |
| util living area                                                            | 0.9692                    | 0.9518      | 0.9285  | 0.8788  | 0.7962  | 0.6624  | 0.5273  | 0.5668  | 0.7464  | 0.8939  | 0.9531  | 0.9729 (86)  |
| MIT                                                                         | 18.3986                   | 18.7197     | 19.1608 | 19.7625 | 20.3032 | 20.7158 | 20.8915 | 20.8641 | 20.5740 | 19.8744 | 19.0433 | 18.3494 (87) |
| Th 2                                                                        | 20.0198                   | 20.0219     | 20.0241 | 20.0340 | 20.0359 | 20.0445 | 20.0445 | 20.0461 | 20.0412 | 20.0359 | 20.0321 | 20.0282 (88) |
| util rest of house                                                          | 0.9647                    | 0.9448      | 0.9175  | 0.8588  | 0.7595  | 0.5970  | 0.4330  | 0.4744  | 0.6903  | 0.8725  | 0.9450  | 0.9689 (89)  |
| MIT 2                                                                       | 17.6338                   | 17.9518     | 18.3872 | 18.9787 | 19.4904 | 19.8601 | 19.9928 | 19.9775 | 19.7448 | 19.0965 | 18.2818 | 17.5906 (90) |
| Living area fraction                                                        | FLA = Living area / (4) = | 0.1907 (91) |         |         |         |         |         |         |         |         |         |              |
| MIT                                                                         | 17.7796                   | 18.0982     | 18.5347 | 19.1282 | 19.6454 | 20.0233 | 20.1641 | 20.1466 | 19.9029 | 19.2448 | 18.4270 | 17.7353 (92) |
| Temperature adjustment                                                      | 0.0000                    |             |         |         |         |         |         |         |         |         |         |              |
| adjusted MIT                                                                | 17.7796                   | 18.0982     | 18.5347 | 19.1282 | 19.6454 | 20.0233 | 20.1641 | 20.1466 | 19.9029 | 19.2448 | 18.4270 | 17.7353 (93) |

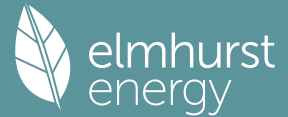
## 8. Space heating requirement

|                                                                                |                            |           |           |           |           |          |          |          |          |           |           |                |
|--------------------------------------------------------------------------------|----------------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|-----------|-----------|----------------|
| Utilisation                                                                    | Jan                        | Feb       | Mar       | Apr       | May       | Jun      | Jul      | Aug      | Sep      | Oct       | Nov       | Dec            |
|                                                                                | 0.9502                     | 0.9264    | 0.8960    | 0.8362    | 0.7424    | 0.5954   | 0.4456   | 0.4849   | 0.6811   | 0.8506    | 0.9271    | 0.9556 (94)    |
| Useful gains                                                                   | 699.1366                   | 801.2019  | 838.8436  | 848.8582  | 781.9137  | 618.6566 | 444.4635 | 457.7890 | 613.6437 | 691.3166  | 682.1742  | 668.5749 (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                                                               | 1865.2327                  | 1821.8427 | 1657.2651 | 1392.6079 | 1079.4904 | 729.4926 | 479.4170 | 503.0182 | 783.5796 | 1174.5164 | 1545.5854 | 1855.2272 (97) |
| Space heating kWh                                                              | 867.5756                   | 685.8706  | 608.9056  | 391.4997  | 221.3971  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 359.5007  | 621.6560  | 882.8693 (98a) |
| Space heating requirement - total per year (kWh/year)                          | 4639.2746                  |           |           |           |           |          |          |          |          |           |           |                |
| 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                                                              | 867.5756                   | 685.8706  | 608.9056  | 391.4997  | 221.3971  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 359.5007  | 621.6560  | 882.8693 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) | 4639.2746                  |           |           |           |           |          |          |          |          |           |           |                |
| Space heating per m2                                                           | (98c) / (4) = 36.1033 (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  | 1264.4046 | 995.3823  | 1020.3812 | 0.0000  | 0.0000  | 0.0000 | 0.0000 (100) |
| Utilisation                                         | 0.0000                                | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 0.6956    | 0.7686    | 0.7404    | 0.0000  | 0.0000  | 0.0000 | 0.0000 (101) |
| Useful loss                                         | 0.0000                                | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 879.5274  | 765.0596  | 755.4699  | 0.0000  | 0.0000  | 0.0000 | 0.0000 (102) |
| Total gains                                         | 0.0000                                | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 1140.0936 | 1094.8150 | 1035.7356 | 0.0000  | 0.0000  | 0.0000 | 0.0000 (103) |
| Space cooling kWh                                   | 0.0000                                | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 187.6077  | 245.3380  | 208.5176  | 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  | 46.9019   | 61.3345   | 52.1294   | 0.0000  | 0.0000  | 0.0000 | 0.0000 (107) |
| Space cooling requirement                           | 160.3658 (107)                        |        |        |        |         |           |           |           |         |         |        |              |
| Energy for space heating                            | 36.1033 (99)                          |        |        |        |         |           |           |           |         |         |        |              |
| Energy for space cooling                            | 1.2480 (108)                          |        |        |        |         |           |           |           |         |         |        |              |
| Total                                               | 37.3513 (109)                         |        |        |        |         |           |           |           |         |         |        |              |
| Fabric Energy Efficiency (TFEE)                     | 37.4 (109)                            |        |        |        |         |           |           |           |         |         |        |              |

# Full SAP Calculation Printout



|                                    |                      |               |        |      |                |            |
|------------------------------------|----------------------|---------------|--------|------|----------------|------------|
| Property Reference                 | OP-D320 P3TORT       |               |        |      | Issued on Date | 29/11/2024 |
| Assessment Reference               | P3TORT               | Prop Type Ref | P3TORT |      |                |            |
| Property                           | P3TORT               |               |        |      |                |            |
|                                    |                      |               |        |      |                |            |
| SAP Rating                         | 81 B                 | DER           | 4.02   | TER  | 9.46           |            |
| Environmental                      | 96 A                 | % DER < TER   |        |      |                | 57.51      |
| CO <sub>2</sub> Emissions (t/year) | 0.48                 | DFEE          | 36.00  | TFEE | 37.35          |            |
| Compliance Check                   | See BREL             | % DFEE < TFEE |        |      |                | 3.63       |
| % DPER < TPER                      | 14.10                | DPER          | 42.45  | TPER | 49.42          |            |
|                                    |                      |               |        |      |                |            |
| 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                                           | 64.2500 (1b)              | x 2.3100 (2b)                   | = 148.4175 (1b) - (3b)      |
| First floor                                            | 64.2500 (1c)              | x 2.6100 (2c)                   | = 167.6925 (1c) - (3c)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 128.5000                  |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 316.1100 (5)              |

## 2. Ventilation rate

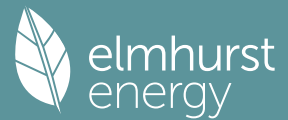
|                                                                                                         | m <sup>3</sup> per hour                                                                                                                  |
|---------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| 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)                                                                                                         |
| Wind speed                                                                                              | Jan 5.1000 Feb 5.0000 Mar 4.9000 Apr 4.4000 May 4.3000 Jun 3.8000 Jul 3.8000 Aug 3.7000 Sep 4.0000 Oct 4.3000 Nov 4.5000 Dec 4.7000 (22) |
| Wind factor                                                                                             | 1.2750 1.2500 1.2250 1.1000 1.0750 0.9500 0.9500 0.9250 1.0000 1.0750 1.1250 1.1750 (22a)                                                |
| Adj infilt rate                                                                                         | 0.1897 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) =            | 69.6000 (23c)                                                                                                                            |
| Effective ac                                                                                            | 0.3417 0.3379 0.3342 0.3156 0.3119 0.2933 0.2933 0.2896 0.3007 0.3119 0.3193 0.3268 (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                                                     |                         |                            | 4.2800                    | 1.0000                        | 4.2800       |                                | (26)          |
| Windows (Uw = 1.30)                                            |                         |                            | 18.2800                   | 1.2357                        | 22.5894      |                                | (27)          |
| Ground Floor                                                   |                         |                            | 64.2500                   | 0.1100                        | 7.0675       |                                | (28a)         |
| External Wall                                                  | 160.7900                | 22.5600                    | 138.2300                  | 0.1700                        | 23.4991      |                                | (29a)         |
| Roof - ceiling                                                 | 64.2500                 |                            | 64.2500                   | 0.1100                        | 7.0675       |                                | (30)          |
| Total net area of external elements Aum(A, m <sup>2</sup> )    |                         |                            | 289.2900                  |                               |              |                                | (31)          |
| Fabric heat loss, W/K = Sum (A x U)                            |                         |                            |                           | (26)...(30) + (32) =          | 64.5035      |                                | (33)          |
| 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)               |                         |                            |                           | 15.1000                       | 0.0500       | 0.7550                         |               |
| E3 Sill                                                        |                         |                            |                           | 11.2500                       | 0.0500       | 0.5625                         |               |
| E4 Jamb                                                        |                         |                            |                           | 34.8000                       | 0.0500       | 1.7400                         |               |

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# Full SAP Calculation Printout



## 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                                                                         | 31.8240 | 31.9344 | 32.0457 | 32.6136 | 32.7296 | 33.3222 | 33.3222 | 33.4433 | 33.0826                   | 32.7296 | 32.4984 | 32.2704      |             |
| alpha                                                                       | 3.1216  | 3.1290  | 3.1364  | 3.1742  | 3.1820  | 3.2215  | 3.2215  | 3.2296  | 3.2055                    | 3.1820  | 3.1666  | 3.1514       |             |
| util living area                                                            | 0.9492  | 0.9233  | 0.8882  | 0.8165  | 0.7063  | 0.5604  | 0.4247  | 0.4594  | 0.6523                    | 0.8317  | 0.9222  | 0.9547 (86)  |             |
| Living                                                                      | 19.1583 | 19.4524 | 19.8187 | 20.2912 | 20.6591 | 20.8860 | 20.9649 | 20.9543 | 20.8050                   | 20.3547 | 19.7008 | 19.1211      |             |
| Non living                                                                  | 18.0192 | 18.3895 | 18.8486 | 19.4365 | 19.8711 | 20.1289 | 20.2020 | 20.1965 | 20.0455                   | 19.5244 | 18.7152 | 17.9791      |             |
| 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                                                                         | 20.0579 | 19.4524 | 19.8187 | 20.2912 | 20.6591 | 20.8860 | 20.9649 | 20.9543 | 20.8050                   | 20.3547 | 19.7008 | 19.3839 (87) |             |
| Th 2                                                                        | 20.1906 | 20.1932 | 20.1958 | 20.2087 | 20.2113 | 20.2243 | 20.2243 | 20.2269 | 20.2191                   | 20.2113 | 20.2061 | 20.2010 (88) |             |
| util rest of house                                                          | 0.9427  | 0.9138  | 0.8742  | 0.7934  | 0.6691  | 0.5056  | 0.3559  | 0.3901  | 0.6002                    | 0.8058  | 0.9111  | 0.9489 (89)  |             |
| MIT 2                                                                       | 19.3250 | 18.3895 | 18.8486 | 19.4365 | 19.8711 | 20.1289 | 20.2020 | 20.1965 | 20.0455                   | 19.5244 | 18.7152 | 18.3795 (90) |             |
| Living area fraction                                                        |         |         |         |         |         |         |         |         | fLA = Living area / (4) = |         |         |              | 0.1907 (91) |
| MIT                                                                         | 19.4647 | 18.5922 | 19.0336 | 19.5995 | 20.0214 | 20.2733 | 20.3475 | 20.3410 | 20.1903                   | 19.6827 | 18.9031 | 18.5710 (92) |             |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |                           |         |         | 0.0000       |             |
| adjusted MIT                                                                | 19.4647 | 18.5922 | 19.0336 | 19.5995 | 20.0214 | 20.2733 | 20.3475 | 20.3410 | 20.1903                   | 19.6827 | 18.9031 | 18.5710 (93) |             |

## 8. Space heating requirement

|                                                                                |           |           |           |           |          |          |          |          |          |          |           |                            |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|-----------|----------------------------|
|                                                                                | Jan       | Feb       | Mar       | Apr       | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov       | Dec                        |
| Utilisation                                                                    | 0.9360    | 0.8905    | 0.8501    | 0.7733    | 0.6595   | 0.5092   | 0.3671   | 0.4007   | 0.5981   | 0.7859   | 0.8884    | 0.9338 (94)                |
| Useful gains                                                                   | 812.5486  | 886.3381  | 903.1880  | 874.9910  | 767.4153 | 564.7838 | 390.4127 | 405.8766 | 582.1394 | 727.6644 | 762.7073  | 775.5708 (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                                                               | 1700.9037 | 1530.4290 | 1396.0665 | 1171.0200 | 907.5169 | 607.7166 | 401.4262 | 420.6297 | 657.1128 | 990.5451 | 1296.3917 | 1589.5798 (97)             |
| Space heating kWh                                                              | 660.9362  | 432.8291  | 366.7016  | 213.1409  | 104.2355 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 195.5832 | 384.2528  | 605.6227 (98a)             |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |          |          |          |          |          |          |           | 2963.3021                  |
| 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                                                              | 660.9362  | 432.8291  | 366.7016  | 213.1409  | 104.2355 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 195.5832 | 384.2528  | 605.6227 (98c)             |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |          |          |          |          |          |          |           | 2963.3021                  |
| Space heating per m2                                                           |           |           |           |           |          |          |          |          |          |          |           | (98c) / (4) = 23.0607 (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 %)                                                     |          |          |          |          |          |          |          |          |          |          |          | 249.4037 (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                                                                            | 660.9362 | 432.8291 | 366.7016 | 213.1409 | 104.2355 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 195.5832 | 384.2528 | 605.6227 (98)   |
| Space heating efficiency (main heating system 1)                                                     | 249.4037 | 249.4037 | 249.4037 | 249.4037 | 249.4037 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 249.4037 | 249.4037 | 249.4037 (210)  |
| Space heating fuel (main heating system)                                                             | 265.0066 | 173.5456 | 147.0313 | 85.4602  | 41.7939  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 78.4203  | 154.0686 | 242.8283 (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                                                                            | 382.7479 | 339.2915 | 361.6524 | 319.9045 | 311.6186 | 251.7828 | 247.8020 | 257.7477 | 260.7507 | 323.0597 | 341.4533 | 378.7419 (64)   |
| Efficiency of water heater                                                                           | 269.4200 | 269.4200 | 269.4200 | 269.4200 | 269.4200 | 269.4200 | 269.4200 | 269.4200 | 269.4200 | 269.4200 | 269.4200 | 269.4200 (216)  |
| Fuel for water heating, kWh/month                                                                    | 142.0636 | 125.9340 | 134.2337 | 118.7382 | 115.6627 | 93.4536  | 91.9761  | 95.6676  | 96.7822  | 119.9093 | 126.7364 | 140.5768 (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                                                                                         | 58.2370  | 52.6011  | 58.2370  | 56.3583  | 58.2370  | 56.3583  | 58.2370  | 58.2370  | 56.3583  | 58.2370  | 56.3583  | 58.2370 (231)   |
| Lighting                                                                                             | 33.1540  | 26.5974  | 23.9480  | 17.5453  | 13.5525  | 11.0725  | 12.3630  | 16.0700  | 20.8733  | 27.3869  | 30.9334  | 34.0754 (232)   |
| Electricity generated by PVs (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 (233a)   |
| (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)                              | 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)                                        | 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)   |
| (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)                              | 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                                                                   |          |          |          |          |          |          |          |          |          |          |          | 1188.1548 (211) |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (213)    |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)    |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          | 269.4200        |
| Water heating fuel used                                                                              |          |          |          |          |          |          |          |          |          |          |          | 1401.7344 (219) |
| Space cooling fuel                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (221)    |
| Electricity for pumps and fans:                                                                      |          |          |          |          |          |          |          |          |          |          |          |                 |
| (BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.7780)                           |          |          |          |          |          |          |          |          |          |          |          |                 |
| mechanical ventilation fans (SFP = 1.7780)                                                           |          |          |          |          |          |          |          |          |          |          |          | 685.6932 (230a) |
| Total electricity for the above, kWh/year                                                            |          |          |          |          |          |          |          |          |          |          |          | 685.6932 (231)  |

# Full SAP Calculation Printout



|                                                               |           |        |
|---------------------------------------------------------------|-----------|--------|
| Electricity for lighting (calculated in Appendix L)           | 267.5717  | (232)  |
| 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                           | 3543.1541 | (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                   | 1188.1548          | 0.1555                        | 184.7073                 | (261) |
| Total CO2 associated with community systems     |                    |                               | 0.0000                   | (273) |
| Water heating (other fuel)                      | 1401.7344          | 0.1415                        | 198.3955                 | (264) |
| Space and water heating                         |                    |                               | 383.1028                 | (265) |
| Pumps, fans and electric keep-hot               | 685.6932           | 0.1387                        | 95.1141                  | (267) |
| Energy for lighting                             | 267.5717           | 0.1443                        | 38.6189                  | (268) |
| Total CO2, kg/year                              |                    |                               | 516.8358                 | (272) |
| EPC Dwelling Carbon Dioxide Emission Rate (DER) |                    |                               | 4.0200                   | (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               | 1188.1548          | 1.5755                              | 1871.9251                  | (275) |
| Total CO2 associated with community systems |                    |                                     | 0.0000                     | (473) |
| Water heating (other fuel)                  | 1401.7344          | 1.5234                              | 2135.3902                  | (278) |
| Space and water heating                     |                    |                                     | 4007.3153                  | (279) |
| Pumps, fans and electric keep-hot           | 685.6932           | 1.5128                              | 1037.3166                  | (281) |
| Energy for lighting                         | 267.5717           | 1.5338                              | 410.4104                   | (282) |
| Total Primary energy kWh/year               |                    |                                     | 5455.0423                  | (286) |
| Dwelling Primary energy Rate (DPER)         |                    |                                     | 42.4500                    | (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                                            | 64.2500 (1b) | x 2.3100 (2b)                    | = 148.4175 (1b) - (3b) |  |
| First floor                                             | 64.2500 (1c) | x 2.6100 (2c)                    | = 167.6925 (1c) - (3c) |  |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)... (1n) | 128.5000     |                                  | (4)                    |  |
| Dwelling volume                                         |              | (3a)+(3b)+(3c)+(3d)+(3e)... (3n) | = 316.1100 (5)         |  |

### 2. Ventilation rate

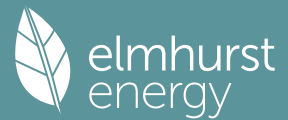
|                                                                                                    | m3 per hour                 |              |
|----------------------------------------------------------------------------------------------------|-----------------------------|--------------|
| Number 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                                                                | 4 * 10 =                    | 40.0000 (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) = | 40.0000 / (5) =             | 0.1265 (8)   |
| Pressure test                                                                                      | Yes                         |              |
| Pressure Test Method                                                                               | Blower Door                 |              |
| Measured/design AP50                                                                               | 5.0000                      | (17)         |
| Infiltration rate                                                                                  | 0.3765                      | (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) =        | 0.3201 (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 | 0.4081 | 0.4001 | 0.3921 | 0.3521 | 0.3441 | 0.3041 | 0.3041 | 0.2961 | 0.3201 | 0.3441 | 0.3601 | 0.3761 | (22b) |
| Effective ac    | 0.5833 | 0.5800 | 0.5769 | 0.5620 | 0.5592 | 0.5462 | 0.5462 | 0.5438 | 0.5512 | 0.5592 | 0.5648 | 0.5707 | (25)  |

### 3. Heat losses and heat loss parameter

| Element | Gross | Openings | NetArea | U-value | A x U | K-value | A x K |
|---------|-------|----------|---------|---------|-------|---------|-------|
|---------|-------|----------|---------|---------|-------|---------|-------|

# Full SAP Calculation Printout



|                                                |          |         |                      |        |         |        |      |       |
|------------------------------------------------|----------|---------|----------------------|--------|---------|--------|------|-------|
| TER Opaque door                                | m2       | m2      | m2                   | W/m2K  | W/K     | kJ/m2K | kJ/K | (26)  |
| TER Opening Type (Uw = 1.20)                   |          |         | 4.2800               | 1.0000 | 4.2800  |        |      | (27)  |
| Ground Floor                                   |          |         | 18.2800              | 1.1450 | 20.9313 |        |      | (28a) |
| External Wall                                  | 160.7900 | 22.5600 | 64.2500              | 0.1300 | 8.3525  |        |      | (29a) |
| Roof - ceiling                                 | 64.2500  |         | 138.2300             | 0.1800 | 24.8814 |        |      | (30)  |
| Total net area of external elements Aum(A, m2) |          |         | 64.2500              | 0.1100 | 7.0675  |        |      | (31)  |
| Fabric heat loss, W/K = Sum (A x U)            |          |         | 289.2900             |        |         |        |      | (32)  |
|                                                |          |         | (26)...(30) + (32) = |        | 65.5127 |        |      | (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) | 15.1000 | 0.0500    | 0.7550 |
| E3 Sill                                          | 11.2500 | 0.0500    | 0.5625 |
| E4 Jamb                                          | 34.8000 | 0.0500    | 1.7400 |
| E5 Ground floor (normal)                         | 32.6800 | 0.1600    | 5.2288 |
| E6 Intermediate floor within a dwelling          | 32.6800 | 0.0000    | 0.0000 |
| E10 Eaves (insulation at ceiling level)          | 19.5000 | 0.0600    | 1.1700 |
| E12 Gable (insulation at ceiling level)          | 13.1800 | 0.0600    | 0.7908 |
| E16 Corner (normal)                              | 19.6800 | 0.0900    | 1.7712 |

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 12.0183 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 77.5310 (37)

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

|                           |          |          |          |          |          |          |          |          |          |          |          |          |      |
|---------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| (38)m                     | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      | (38) |
| Heat transfer coeff       | 60.8437  | 60.5065  | 60.1759  | 58.6231  | 58.3326  | 56.9801  | 56.9801  | 56.7297  | 57.5011  | 58.3326  | 58.9203  | 59.5347  | (39) |
| Average = Sum(39)m / 12 = | 138.3747 | 138.0375 | 137.7069 | 136.1541 | 135.8636 | 134.5111 | 134.5111 | 134.2607 | 135.0321 | 135.8636 | 136.4513 | 137.0657 | (39) |
|                           |          |          |          |          |          |          |          |          |          |          |          | 136.1527 |      |

|               |        |        |        |        |        |        |        |        |        |        |        |        |      |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| HLP           | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    | (40) |
| HLP (average) | 1.0768 | 1.0742 | 1.0716 | 1.0596 | 1.0573 | 1.0468 | 1.0468 | 1.0448 | 1.0508 | 1.0573 | 1.0619 | 1.0667 | (40) |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31     |      |

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

Assumed occupancy 2.8910 (42)

Hot water usage for mixer showers 72.6923 71.5999 70.0080 66.9622 64.7145 62.2079 60.7832 62.3630 64.0948 66.7861 69.8973 72.4138 (42a)

Hot water usage for baths 31.3833 30.9172 30.2609 29.0507 28.1445 27.1397 26.5970 27.2487 27.9583 29.0335 30.2686 31.2772 (42b)

Hot water usage for other uses 44.2367 42.6281 41.0195 39.4109 37.8022 36.1936 36.1936 37.8022 39.4109 41.0195 42.6281 44.2367 (42c)

Average daily hot water use (litres/day) 136.3323 (43)

Daily hot water use 148.3123 145.1451 141.2883 135.4237 130.6613 125.5412 123.5737 127.4139 131.4640 136.8391 142.7940 147.9276 (44)

Energy conte 234.8904 206.6847 217.1549 185.3883 175.8952 154.3676 149.4517 157.7651 162.1082 185.6894 203.4362 231.6189 (45)

Energy content (annual) 2264.4506

Distribution loss (46)m = 0.15 x (45)m 34.7428 (46)

Water storage loss: 230.0000 (47)

Store volume 1.7973 (48)

a) If manufacturer declared loss factor is known (kWh/day): 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 22.5120 23.2624 22.5120 23.2624 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 288.2400 254.8715 270.5045 237.0170 229.2448 205.9963 202.8014 211.1147 213.7369 239.0390 255.0649 284.9686 (62)

WWHRS -33.2319 -29.3905 -30.7761 -25.4838 -23.7500 -20.3230 -19.0496 -20.2574 -21.0270 -24.7885 -28.0824 -32.6165 (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 255.0081 225.4809 239.7284 211.5332 205.4948 185.6732 183.7517 190.8573 192.7099 214.2505 226.9825 252.3521 (64)

12Total per year (kWh/year) 2583.8227 (64)

Electric shower(s) 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)

Heat gains from water heating, kWh/month 120.7807 107.2721 114.8837 102.9446 101.1648 92.6302 92.3724 95.1366 95.2039 104.4214 108.9455 119.6930 (65)

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Heat gains from water heating, kWh/month 120.7807 107.2721 114.8837 102.9446 101.1648 92.6302 92.3724 95.1366 95.2039 104.4214 108.9455 119.6930 (65)

Heat gains from water heating, kWh/month 120.7807 107.2721 114.8837 102.9446 101.1648 92.6302 92.3724 95.1366 95.2039 104.4214 108.9455 119.6930 (65)

Heat gains from water heating, kWh/month 120.7807 107.2721 114.8837 102.9446 101.1648 92.6302 92.3724 95.1366 95.2039 104.4214 108.9455 119.6930 (65)

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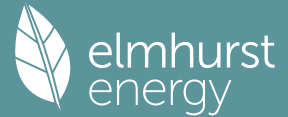
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Heat gains from water heating, kWh/month 120.7807 107.2721 114.8837 102.9446 101.1648 92.6302 92.3724 95.1366 95.2039 104.4214

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| [Jan] |  |  | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W    |
|-------|--|--|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|---------------|
| North |  |  | 9.1500     | 10.6334                        | 0.6300                            | 0.7000                             | 0.7700                       | 29.7348 (74)  |
| South |  |  | 9.1300     | 46.7521                        | 0.6300                            | 0.7000                             | 0.7700                       | 130.4498 (78) |

|             |          |          |           |           |           |           |           |           |          |          |          |               |
|-------------|----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|----------|----------|---------------|
| Solar gains | 160.1846 | 270.4678 | 368.7025  | 462.6798  | 529.4506  | 532.1235  | 510.2024  | 458.3557  | 400.3812 | 298.0766 | 191.3092 | 137.5090 (83) |
| Total gains | 847.3554 | 975.0966 | 1043.2801 | 1114.6684 | 1148.3225 | 1126.4497 | 1081.6573 | 1030.4552 | 989.8932 | 909.8661 | 840.1730 | 810.1618 (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                    | 25.7955 | 25.8585 | 25.9206 | 26.2162 | 26.2723 | 26.5364 | 26.5364 | 26.5859 | 26.4341 | 26.2723 | 26.1591 | 26.0418      |
| alpha                  | 2.7197  | 2.7239  | 2.7280  | 2.7477  | 2.7515  | 2.7691  | 2.7691  | 2.7724  | 2.7623  | 2.7515  | 2.7439  | 2.7361       |
| util living area       | 0.9576  | 0.9376  | 0.9108  | 0.8562  | 0.7675  | 0.6299  | 0.4952  | 0.5314  | 0.7116  | 0.8688  | 0.9374  | 0.9620 (86)  |
| MIT                    | 18.5586 | 18.8680 | 19.2929 | 19.8645 | 20.3733 | 20.7510 | 20.9074 | 20.8847 | 20.6264 | 19.9793 | 19.1845 | 18.5107 (87) |
| Th 2                   | 20.0198 | 20.0219 | 20.0241 | 20.0340 | 20.0359 | 20.0445 | 20.0445 | 20.0461 | 20.0412 | 20.0359 | 20.0321 | 20.0282 (88) |
| util rest of house     | 0.9515  | 0.9288  | 0.8977  | 0.8338  | 0.7283  | 0.5641  | 0.4039  | 0.4414  | 0.6531  | 0.8439  | 0.9271  | 0.9566 (89)  |
| MIT 2                  | 17.1597 | 17.5507 | 18.0862 | 18.8009 | 19.4127 | 19.8399 | 19.9888 | 19.9727 | 19.7128 | 18.9540 | 17.9617 | 17.1040 (90) |
| Living area fraction   | 17.4264 | 17.8018 | 18.3162 | 19.0037 | 19.5959 | 20.0136 | 20.1639 | 20.1466 | 19.8870 | 19.1495 | 18.1948 | 17.3722 (92) |
| MIT                    | 17.4264 | 17.8018 | 18.3162 | 19.0037 | 19.5959 | 20.0136 | 20.1639 | 20.1466 | 19.8870 | 19.1495 | 18.1948 | 17.3722 (93) |
| Temperature adjustment |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT           | 17.4264 | 17.8018 | 18.3162 | 19.0037 | 19.5959 | 20.0136 | 20.1639 | 20.1466 | 19.8870 | 19.1495 | 18.1948 | 17.3722 (93) |

## 8. Space heating requirement

|                                                                                | Jan       | Feb       | Mar       | Apr       | May       | Jun      | Jul      | Aug      | Sep      | Oct           | Nov       | Dec            |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|---------------|-----------|----------------|
| Utilisation                                                                    | 0.9288    | 0.9019    | 0.8681    | 0.8049    | 0.7080    | 0.5618   | 0.4160   | 0.4515   | 0.6426   | 0.8156        | 0.9006    | 0.9352 (94)    |
| Useful gains                                                                   | 786.9821  | 879.4217  | 905.6889  | 897.1681  | 813.0231  | 632.8562 | 449.9784 | 465.2365 | 636.0916 | 742.0450      | 756.6501  | 757.6762 (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                                                               | 1816.3649 | 1780.9350 | 1627.1783 | 1375.6608 | 1072.7622 | 728.1914 | 479.3879 | 503.0231 | 781.4308 | 1161.5676     | 1513.9030 | 1805.4619 (97) |
| Space heating kWh                                                              | 765.8608  | 605.8169  | 536.7881  | 344.5147  | 193.2459  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 312.1248      | 545.2221  | 779.5525 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |           |          |          |          |          |               |           | 4083.1259      |
| 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                                                              | 765.8608  | 605.8169  | 536.7881  | 344.5147  | 193.2459  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 312.1248      | 545.2221  | 779.5525 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |           |          |          |          |          |               |           | 4083.1259      |
| Space heating per m2                                                           |           |           |           |           |           |          |          |          |          | (98c) / (4) = |           | 31.7753 (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                        | 765.8608 | 605.8169 | 536.7881 | 344.5147 | 193.2459 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 312.1248 | 545.2221 | 779.5525 (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)         | 829.7517 | 656.3564 | 581.5689 | 373.2554 | 209.3672 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 338.1634 | 590.7065 | 844.5856 (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                                                                            | 255.0081 | 225.4809 | 239.7284  | 211.5332  | 205.4948  | 185.6732  | 183.7517  | 190.8573  | 192.7099  | 214.2505  | 226.9825 | 252.3521 (64)   |
| Efficiency of water heater (217)m                                                                    | 86.3668  | 86.1642  | 85.8122   | 85.1468   | 83.9222   | 79.8000   | 79.8000   | 79.8000   | 79.8000   | 84.9025   | 85.9506  | 79.8000 (216)   |
| Fuel for water heating, kWh/month                                                                    | 295.2616 | 261.6876 | 279.3641  | 248.4335  | 244.8635  | 232.6732  | 230.2653  | 239.1696  | 241.4911  | 252.3488  | 264.0847 | 86.4166 (217)   |
| Space cooling fuel requirement                                                                       |          |          |           |           |           |           |           |           |           |           |          | 292.0182 (219)  |
| (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                                                                                             | 33.1540  | 26.5974  | 23.9480   | 17.5453   | 13.5525   | 11.0725   | 12.3630   | 16.0700   | 20.8733   | 27.3869   | 30.9334  | 34.0754 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | -57.1618 | -79.1092 | -111.6100 | -123.0350 | -130.5561 | -121.0145 | -119.4251 | -113.7220 | -103.4205 | -89.2166  | -62.2788 | -49.5870 (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000 (235a)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000 (235c)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | -36.9129 | -77.0854 | -152.2256 | -227.2579 | -299.2343 | -300.2941 | -296.8434 | -251.9749 | -185.4851 | -109.8734 | -49.1536 | -29.2400 (233b) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000 (234b)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000 (235b)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000 (235d)   |
| Annual totals kWh/year                                                                               |          |          |           |           |           |           |           |           |           |           |          |                 |
| Space heating fuel - main system 1                                                                   |          |          |           |           |           |           |           |           |           |           |          | 4423.7550 (211) |

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|                                                               |            |        |
|---------------------------------------------------------------|------------|--------|
| 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                                       | 3081.6614  | (219)  |
| Space cooling fuel                                            | 0.0000     | (221)  |
| Electricity for pumps and fans:                               |            |        |
| Total electricity for the above, kWh/year                     | 86.0000    | (231)  |
| Electricity for lighting (calculated in Appendix L)           | 267.5717   | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q) |            |        |
| PV generation                                                 | -3175.7172 | (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                           | 4683.2709  | (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                 | 4423.7550          | 0.2100                        | 928.9886 (261)           |
| Total CO2 associated with community systems   |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                    | 3081.6614          | 0.2100                        | 647.1489 (264)           |
| Space and water heating                       |                    |                               | 1576.1374 (265)          |
| Pumps, fans and electric keep-hot             | 86.0000            | 0.1387                        | 11.9293 (267)            |
| Energy for lighting                           | 267.5717           | 0.1443                        | 38.6189 (268)            |
| Energy saving/generation technologies         |                    |                               |                          |
| PV Unit electricity used in dwelling          | -1160.1367         | 0.1350                        | -156.6309                |
| PV Unit electricity exported                  | -2015.5805         | 0.1261                        | -254.0999                |
| Total                                         |                    |                               | -410.7308 (269)          |
| Total CO2, kg/year                            |                    |                               | 1215.9548 (272)          |
| EPC Target Carbon Dioxide Emission Rate (TER) |                    |                               | 9.4600 (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               | 4423.7550          | 1.1300                              | 4998.8432 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 3081.6614          | 1.1300                              | 3482.2774 (278)            |
| Space and water heating                     |                    |                                     | 8481.1206 (279)            |
| Pumps, fans and electric keep-hot           | 86.0000            | 1.5128                              | 130.1008 (281)             |
| Energy for lighting                         | 267.5717           | 1.5338                              | 410.4104 (282)             |
| Energy saving/generation technologies       |                    |                                     |                            |
| PV Unit electricity used in dwelling        | -1160.1367         | 1.4990                              | -1739.0457                 |
| PV Unit electricity exported                | -2015.5805         | 0.4628                              | -932.7358                  |
| Total                                       |                    |                                     | -2671.7815 (283)           |
| Total Primary energy kWh/year               |                    |                                     | 6349.8502 (286)            |
| Target Primary Energy Rate (TPER)           |                    |                                     | 49.4200 (287)              |