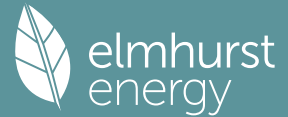


# Full SAP Calculation Printout



|                                    |                      |               |               |        |                |            |  |
|------------------------------------|----------------------|---------------|---------------|--------|----------------|------------|--|
| Property Reference                 | OP-D320 F2BULL       |               |               |        | Issued on Date | 29/11/2024 |  |
| Assessment Reference               | F2BULL               |               | Prop Type Ref | F2BULL |                |            |  |
| Property                           | F2BULL               |               |               |        |                |            |  |
|                                    |                      |               |               |        |                |            |  |
| SAP Rating                         | 77 C                 | DER           | 5.33          | TER    | 11.96          |            |  |
| Environmental                      | 95 A                 | % DER < TER   |               |        |                | 55.43      |  |
| CO <sub>2</sub> Emissions (t/year) | 0.44                 | DFEE          | 49.79         | TFEE   | 50.66          |            |  |
| Compliance Check                   | See BREL             | % DFEE < TFEE |               |        |                | 1.71       |  |
| % DPER < TPER                      | 11.86                | DPER          | 56.05         | TPER   | 63.59          |            |  |
|                                    |                      |               |               |        |                |            |  |
| 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                                           | 14.2700 (1b)              | x 2.5000 (2b)                     | = 35.6750 (1b) - (3b)       |
| First floor                                            | 74.4800 (1c)              | x 2.3600 (2c)                     | = 175.7728 (1c) - (3c)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 88.7500                   |                                   | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 211.4478 (5)                |

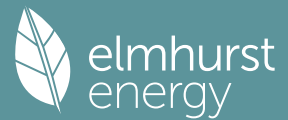
## 2. Ventilation rate

|                                                                                                         | 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) =            | 71.2000 (23c)                                                                                                                            |
| Effective ac                                                                                            | 0.3337 0.3299 0.3262 0.3076 0.3039 0.2853 0.2853 0.2816 0.2927 0.3039 0.3113 0.3188 (25)                                                 |

## 3. Heat losses and heat loss parameter

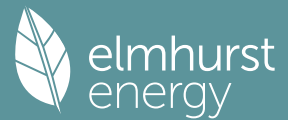
| Element                                                        | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K |
|----------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|---------------|
| Front Door                                                     |                         |                            | 6.4200                    | 1.0000                        | 6.4200       |                                | (26)          |
| Windows (Uw = 1.30)                                            |                         |                            | 10.9600                   | 1.2357                        | 13.5437      |                                | (27)          |
| Ground Floor                                                   |                         |                            | 14.2700                   | 0.1100                        | 1.5697       |                                | (28a)         |
| Exposed Floor                                                  |                         |                            | 60.2100                   | 0.1400                        | 8.4294       |                                | (28b)         |
| External Wall                                                  | 104.5100                | 15.2400                    | 89.2700                   | 0.1700                        | 15.1759      |                                | (29a)         |
| Semi Exposed                                                   | 30.7900                 | 2.1400                     | 28.6500                   | 0.1700                        | 4.8705       |                                | (29a)         |
| Roof - ceiling                                                 | 74.4800                 |                            | 74.4800                   | 0.1100                        | 8.1928       |                                | (30)          |
| Total net area of external elements Aum (A, m <sup>2</sup> )   |                         |                            | 284.2600                  |                               |              |                                | (31)          |
| Fabric heat loss, W/K = Sum (A x U)                            |                         |                            |                           | (26)...(30) + (32) =          | 58.2020      |                                | (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)               |                         |                            |                           | 12.3700                       | 0.0500       | 0.6185                         |               |

# Full SAP Calculation Printout



|                                                                                     |               |           |           |           |           |           |           |           |           |                       |           |           |
|-------------------------------------------------------------------------------------|---------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------------------|-----------|-----------|
| E3 Sill                                                                             |               |           |           |           |           | 9.3100    | 0.0500    | 0.4655    |           |                       |           |           |
| E4 Jamb                                                                             |               |           |           |           |           | 28.8000   | 0.0500    | 1.4400    |           |                       |           |           |
| E5 Ground floor (normal)                                                            |               |           |           |           |           | 18.3200   | 0.1600    | 2.9312    |           |                       |           |           |
| E6 Intermediate floor within a dwelling                                             |               |           |           |           |           | 6.0200    | 0.0000    | 0.0000    |           |                       |           |           |
| E10 Baves (insulation at ceiling level)                                             |               |           |           |           |           | 23.6100   | 0.0600    | 1.4166    |           |                       |           |           |
| E12 Gable (insulation at ceiling level)                                             |               |           |           |           |           | 14.2900   | 0.0600    | 0.8574    |           |                       |           |           |
| E16 Corner (normal)                                                                 |               |           |           |           |           | 24.1700   | 0.0900    | 2.1753    |           |                       |           |           |
| E20 Exposed floor (normal)                                                          |               |           |           |           |           | 31.8800   | 0.3200    | 10.2016   |           |                       |           |           |
| E21 Exposed floor (inverted)                                                        |               |           |           |           |           | 12.3000   | 0.3200    | 3.9360    |           |                       |           |           |
| E17 Corner (inverted - internal area greater than external area)                    |               |           |           |           |           | 4.7200    | -0.0900   | -0.4248   |           |                       |           |           |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)                          |               |           |           |           |           |           |           |           |           |                       | 23.6173   | (36)      |
| Point Thermal bridges                                                               |               |           |           |           |           |           |           |           |           |                       | 0.0000    |           |
| Total fabric heat loss                                                              |               |           |           |           |           |           |           |           |           | (33) + (36) + (36a) = | 81.8193   | (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                                                                 | 23.2818       | 23.0223   | 22.7628   | 21.4654   | 21.2059   | 19.9085   | 19.9085   | 19.6490   | 20.4274   | 21.2059               | 21.7249   | 22.2438   |
| Average = Sum(39)m / 12 =                                                           | 105.1011      | 104.8416  | 104.5821  | 103.2847  | 103.0252  | 101.7278  | 101.7278  | 101.4683  | 102.2468  | 103.0252              | 103.5442  | 104.0632  |
|                                                                                     |               |           |           |           |           |           |           |           |           |                       |           | 103.2198  |
| HLP                                                                                 | Jan           | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct                   | Nov       | Dec       |
| HLP (average)                                                                       | 1.1842        | 1.1813    | 1.1784    | 1.1638    | 1.1608    | 1.1462    | 1.1462    | 1.1433    | 1.1521    | 1.1608                | 1.1667    | 1.1725    |
| Days in mont                                                                        | 31            | 28        | 31        | 30        | 31        | 30        | 31        | 31        | 30        | 31                    | 30        | 31        |
|                                                                                     |               |           |           |           |           |           |           |           |           |                       |           | 1.1630    |
|                                                                                     |               |           |           |           |           |           |           |           |           |                       |           |           |
| 4. Water heating energy requirements (kWh/year)                                     |               |           |           |           |           |           |           |           |           |                       |           |           |
| Assumed occupancy                                                                   |               |           |           |           |           |           |           |           |           |                       |           | 2.6082    |
| Hot water usage for mixer showers                                                   |               |           |           |           |           |           |           |           |           |                       |           | 93.0747   |
| Hot water usage for baths                                                           |               |           |           |           |           |           |           |           |           |                       |           | 30.7844   |
| Hot water usage for other uses                                                      |               |           |           |           |           |           |           |           |           |                       |           | 43.5166   |
| Average daily hot water use (litres/day)                                            |               |           |           |           |           |           |           |           |           |                       |           | 154.3412  |
| Daily hot water use                                                                 | Jan           | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct                   | Nov       | Dec       |
| Energy conte                                                                        | 167.8382      | 164.3929  | 160.1184  | 153.4301  | 148.0667  | 142.2736  | 139.9081  | 144.1626  | 148.6694  | 154.7692              | 161.5662  | 167.3758  |
| Energy content (annual)                                                             | 265.8146      | 234.0933  | 246.0960  | 210.0381  | 199.3263  | 174.9419  | 169.2067  | 178.5034  | 183.3242  | 210.0204              | 230.1806  | 262.0700  |
| Distribution loss (46)m = 0.15 x (45)m                                              |               |           |           |           |           |           |           |           |           |                       |           | 2563.6155 |
| Water storage loss:                                                                 |               |           |           |           |           |           |           |           |           |                       |           |           |
| Store volume                                                                        |               |           |           |           |           |           |           |           |           |                       |           | 230.0000  |
| a) If manufacturer declared loss factor is known (kWh/day):                         |               |           |           |           |           |           |           |           |           |                       |           | 1.8000    |
| Temperature factor from Table 2b                                                    |               |           |           |           |           |           |           |           |           |                       |           | 0.7800    |
| Enter (49) or (54) in (55)                                                          |               |           |           |           |           |           |           |           |           |                       |           | 1.4040    |
| Total storage loss                                                                  |               |           |           |           |           |           |           |           |           |                       |           |           |
| If cylinder contains dedicated solar storage                                        |               |           |           |           |           |           |           |           |           |                       |           |           |
| Primary 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   |
| Combi 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   |
| Total heat required for water heating calculated for each month                     | 0.0000        | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000                | 0.0000    | 0.0000    |
| WWHRS                                                                               | 364.1962      | 322.9541  | 344.4776  | 305.2461  | 297.7079  | 239.5739  | 235.9931  | 245.2898  | 247.9562  | 308.4020              | 325.3886  | 360.4516  |
| PV diverter                                                                         | 0.0000        | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000                | 0.0000    | 0.0000    |
| Solar input                                                                         | 0.0000        | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000                | 0.0000    | 0.0000    |
| FGHRS                                                                               | 0.0000        | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000                | 0.0000    | 0.0000    |
| Output from w/h                                                                     | 364.1962      | 322.9541  | 344.4776  | 305.2461  | 297.7079  | 239.5739  | 235.9931  | 245.2898  | 247.9562  | 308.4020              | 325.3886  | 360.4516  |
| 12Total per year (kWh/year)                                                         |               |           |           |           |           |           |           |           |           |                       |           | 3597.6371 |
| Electric shower(s)                                                                  | 0.0000        | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000                | 0.0000    | 0.0000    |
| Heat gains from water heating, kWh/month                                            | 132.2694      | 117.4751  | 125.7130  | 112.3081  | 110.1621  | 76.1778   | 74.8712   | 77.9623   | 78.9649   | 113.7179              | 119.0055  | 131.0243  |
| 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     | 130.4111      | 130.4111  | 130.4111  | 130.4111  | 130.4111  | 130.4111  | 130.4111  | 130.4111  | 130.4111  | 130.4111              | 130.4111  | 130.4111  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 131.7092      | 145.8209  | 131.7092  | 136.0995  | 131.7092  | 136.0995  | 131.7092  | 131.7092  | 136.0995  | 131.7092              | 136.0995  | 131.7092  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 236.7592      | 239.2160  | 233.0249  | 219.8448  | 203.2072  | 187.5703  | 177.1238  | 174.6670  | 180.8581  | 194.0382              | 210.6758  | 226.3127  |
| Pumps, fans                                                                         | 36.0411       | 36.0411   | 36.0411   | 36.0411   | 36.0411   | 36.0411   | 36.0411   | 36.0411   | 36.0411   | 36.0411               | 36.0411   | 36.0411   |
| 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    |
| Water heating gains (Table 5)                                                       | -104.3289     | -104.3289 | -104.3289 | -104.3289 | -104.3289 | -104.3289 | -104.3289 | -104.3289 | -104.3289 | -104.3289             | -104.3289 | -104.3289 |
| Total internal gains                                                                | 177.7815      | 174.8141  | 168.9691  | 155.9834  | 148.0673  | 105.8025  | 100.6333  | 104.7880  | 109.6735  | 152.8466              | 165.2854  | 176.1080  |
|                                                                                     | 608.3732      | 621.9743  | 595.8265  | 574.0510  | 545.1070  | 491.5956  | 471.5896  | 473.2876  | 488.7544  | 540.7174              | 574.1840  | 596.2533  |
| 6. Solar gains                                                                      |               |           |           |           |           |           |           |           |           |                       |           |           |
| [Jan]                                                                               |               |           |           |           |           |           |           |           |           |                       |           |           |
|                                                                                     | Area          |           |           |           |           |           |           |           |           |                       |           |           |
|                                                                                     | m2            |           |           |           |           |           |           |           |           |                       |           |           |
|                                                                                     | Solar flux    |           |           |           |           |           |           |           |           |                       |           |           |
|                                                                                     | Table 6a      |           |           |           |           |           |           |           |           |                       |           |           |
|                                                                                     | W/m2          |           |           |           |           |           |           |           |           |                       |           |           |
|                                                                                     | Specific data |           |           |           |           |           |           |           |           |                       |           |           |
|                                                                                     | or Table 6b   |           |           |           |           |           |           |           |           |                       |           |           |
|                                                                                     | Specific data |           |           |           |           |           |           |           |           |                       |           |           |
|                                                                                     | or Table 6c   |           |           |           |           |           |           |           |           |                       |           |           |
|                                                                                     | Access        |           |           |           |           |           |           |           |           |                       |           |           |
|                                                                                     | factor        |           |           |           |           |           |           |           |           |                       |           |           |
|                                                                                     | Table 6d      |           |           |           |           |           |           |           |           |                       |           |           |
|                                                                                     | Gains         |           |           |           |           |           |           |           |           |                       |           |           |
|                                                                                     | W             |           |           |           |           |           |           |           |           |                       |           |           |
| North                                                                               | 6.5200        |           |           |           |           |           |           |           |           |                       |           | 21.1881   |
| South                                                                               | 3.7200        |           |           |           |           |           |           |           |           |                       |           | 53.1515   |
| West                                                                                | 0.7200        |           |           |           |           |           |           |           |           |                       |           | 4.3217    |

# Full SAP Calculation Printout



|             |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Solar gains | 78.6612  | 135.9940 | 193.6119 | 256.1471 | 304.3580 | 310.5325 | 295.8495 | 258.1392 | 214.7502 | 152.1213 | 94.5295  | 67.1451 (83)  |
| Total gains | 687.0344 | 757.9683 | 789.4384 | 830.1981 | 849.4651 | 802.1281 | 767.4391 | 731.4268 | 703.5046 | 692.8386 | 668.7135 | 663.3984 (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                                                                         | 23.4562 | 23.5143 | 23.5726 | 23.8688 | 23.9289 | 24.2341 | 24.2341 | 24.2960 | 24.1111 | 23.9289 | 23.8089 | 23.6902      |
| alpha                                                                       | 2.5637  | 2.5676  | 2.5715  | 2.5913  | 2.5953  | 2.6156  | 2.6156  | 2.6197  | 2.6074  | 2.5953  | 2.5873  | 2.5793       |
| util living area                                                            | 0.9430  | 0.9252  | 0.9009  | 0.8489  | 0.7638  | 0.6445  | 0.5141  | 0.5495  | 0.7238  | 0.8560  | 0.9213  | 0.9474 (86)  |
| Living                                                                      | 18.4856 | 18.7572 | 19.1678 | 19.7537 | 20.2919 | 20.6915 | 20.8779 | 20.8507 | 20.5493 | 19.9049 | 19.1194 | 18.4470      |
| Non living                                                                  | 17.0167 | 17.3591 | 17.8764 | 18.6090 | 19.2562 | 19.7132 | 19.8917 | 19.8729 | 19.5669 | 18.8068 | 17.8279 | 16.9735      |
| 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                                                                         | 19.7137 | 18.7572 | 19.1678 | 19.7537 | 20.2919 | 20.6915 | 20.8779 | 20.8507 | 20.5493 | 19.9049 | 19.1194 | 18.8042 (87) |
| Th 2                                                                        | 19.9326 | 19.9350 | 19.9373 | 19.9491 | 19.9514 | 19.9633 | 19.9633 | 19.9656 | 19.9585 | 19.9514 | 19.9467 | 19.9420 (88) |
| util rest of house                                                          | 0.9349  | 0.9145  | 0.8860  | 0.8245  | 0.7221  | 0.5746  | 0.4143  | 0.4518  | 0.6625  | 0.8281  | 0.9083  | 0.9398 (89)  |
| MIT 2                                                                       | 18.7701 | 17.3591 | 17.8764 | 18.6090 | 19.2562 | 19.7132 | 19.8917 | 19.8729 | 19.5669 | 18.8068 | 17.8279 | 17.5085 (90) |
| Living area fraction                                                        | 19.0391 | 17.7577 | 18.2446 | 18.9354 | 19.5515 | 19.9921 | 20.1729 | 20.1517 | 19.8470 | 19.1198 | 18.1961 | 0.2851 (91)  |
| MIT                                                                         | 19.0391 | 17.7577 | 18.2446 | 18.9354 | 19.5515 | 19.9921 | 20.1729 | 20.1517 | 19.8470 | 19.1198 | 18.1961 | 17.8778 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT                                                                | 19.0391 | 17.7577 | 18.2446 | 18.9354 | 19.5515 | 19.9921 | 20.1729 | 20.1517 | 19.8470 | 19.1198 | 18.1961 | 17.8778 (93) |

## 8. Space heating requirement

|                                                                                |           |           |           |           |          |          |          |          |          |               |           |                |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|---------------|-----------|----------------|
|                                                                                | Jan       | Feb       | Mar       | Apr       | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov       | Dec            |
| Utilisation                                                                    | 0.9267    | 0.8855    | 0.8556    | 0.7961    | 0.7040   | 0.5767   | 0.4358   | 0.4707   | 0.6551   | 0.8010        | 0.8797    | 0.9203 (94)    |
| Useful gains                                                                   | 636.7053  | 671.1896  | 675.4239  | 660.9553  | 598.0017 | 462.5962 | 334.4238 | 344.2590 | 460.8563 | 554.9330      | 588.2680  | 610.5161 (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                                                               | 1549.0990 | 1348.0199 | 1228.2729 | 1036.4988 | 808.8995 | 548.5233 | 363.4585 | 380.6737 | 587.6072 | 877.7547      | 1148.9319 | 1423.3575 (97) |
| Space heating kWh                                                              | 678.8209  | 454.8300  | 411.3197  | 270.3913  | 156.9080 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 240.1793      | 403.6780  | 604.7540 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |          |          |          |          |          |               |           | 3220.8812      |
| 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                                                              | 678.8209  | 454.8300  | 411.3197  | 270.3913  | 156.9080 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 240.1793      | 403.6780  | 604.7540 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |          |          |          |          |          |               |           | 3220.8812      |
| Space heating per m2                                                           |           |           |           |           |          |          |          |          |          | (98c) / (4) = |           | 36.2916 (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 %)                                                             |          |          |          |          |          |          |          |          |          |          |          | 250.4344 (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                                                                                    | 678.8209 | 454.8300 | 411.3197 | 270.3913 | 156.9080 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 240.1793 | 403.6780 | 604.7540 (98)   |
| Space heating efficiency (main heating system 1)                                                             | 250.4344 | 250.4344 | 250.4344 | 250.4344 | 250.4344 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 250.4344 | 250.4344 | 250.4344 (210)  |
| Space heating fuel (main heating system)                                                                     | 271.0573 | 181.6164 | 164.2424 | 107.9689 | 62.6543  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 95.9051  | 161.1911 | 241.4820 (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                                                                                    | 364.1962 | 322.9541 | 344.4776 | 305.2461 | 297.7079 | 239.5739 | 235.9931 | 245.2898 | 247.9562 | 308.4020 | 325.3886 | 360.4516 (64)   |
| Efficiency of water heater (217)m                                                                            | 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                                                                            | 135.1779 | 119.8701 | 127.8590 | 113.2975 | 110.4996 | 88.9221  | 87.5930  | 91.0436  | 92.0333  | 114.4689 | 120.7738 | 133.7880 (219)  |
| Space cooling fuel requirement (221)m                                                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)    |
| Pumps and Fa                                                                                                 | 32.5137  | 29.3672  | 32.5137  | 31.4648  | 32.5137  | 31.4648  | 32.5137  | 32.5137  | 31.4648  | 32.5137  | 31.4648  | 32.5137 (231)   |
| Lighting                                                                                                     | 27.3666  | 21.9545  | 19.7676  | 14.4826  | 11.1868  | 9.1397   | 10.2049  | 13.2648  | 17.2296  | 22.6062  | 25.5336  | 28.1272 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity) (233a)m                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (233a)   |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)   |
| Electricity generated by PVs (Appendix M) (negative quantity) (233b)m                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (233b)   |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234b)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235d)   |
| Annual totals kWh/year                                                                                       |          |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating fuel - main system 1                                                                           |          |          |          |          |          |          |          |          |          |          |          | 1286.1175 (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                                                                                      |          |          |          |          |          |          |          |          |          |          |          | 1335.3267 (219) |

# Full SAP Calculation Printout



|                                                                                                               |                 |
|---------------------------------------------------------------------------------------------------------------|-----------------|
| Space cooling fuel                                                                                            | 0.0000 (221)    |
| Electricity for pumps and fans:<br>(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.4840) |                 |
| mechanical ventilation fans (SFP = 1.4840)                                                                    | 382.8220 (230a) |
| Total electricity for the above, kWh/year                                                                     | 382.8220 (231)  |
| Electricity for lighting (calculated in Appendix L)                                                           | 220.8639 (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                                                                           | 3225.1301 (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                   | 1286.1175          | 0.1546                        | 198.8245 (261)           |
| Total CO2 associated with community systems     |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                      | 1335.3267          | 0.1415                        | 188.9936 (264)           |
| Space and water heating                         |                    |                               | 387.8181 (265)           |
| Pumps, fans and electric keep-hot               | 382.8220           | 0.1387                        | 53.1021 (267)            |
| Energy for lighting                             | 220.8639           | 0.1443                        | 31.8775 (268)            |
| Total CO2, kg/year                              |                    |                               | 472.7977 (272)           |
| EPC Dwelling Carbon Dioxide Emission Rate (DER) |                    |                               | 5.3300 (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               | 1286.1175          | 1.5723                              | 2022.1543 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 1335.3267          | 1.5234                              | 2034.2153 (278)            |
| Space and water heating                     |                    |                                     | 4056.3696 (279)            |
| Pumps, fans and electric keep-hot           | 382.8220           | 1.5128                              | 579.1331 (281)             |
| Energy for lighting                         | 220.8639           | 1.5338                              | 338.7685 (282)             |
| Total Primary energy kWh/year               |                    |                                     | 4974.2712 (286)            |
| Dwelling Primary energy Rate (DPER)         |                    |                                     | 56.0500 (287)              |

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

### 1. Overall dwelling characteristics

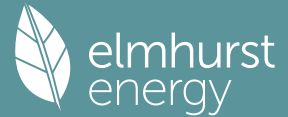
|                                                        | Area<br>(m2) | Storey height<br>(m)              | Volume<br>(m3)         |
|--------------------------------------------------------|--------------|-----------------------------------|------------------------|
| Ground floor                                           | 14.2700 (1b) | x 2.5000 (2b)                     | = 35.6750 (1b) - (3b)  |
| First floor                                            | 74.4800 (1c) | x 2.3600 (2c)                     | = 175.7728 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 88.7500      |                                   | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 211.4478 (5)           |

### 2. Ventilation rate

|                                                                                                    | m3 per hour                             |
|----------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                    |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                    |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                    |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                    |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                    |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                    |
| Number of intermittent extract fans                                                                | 3 * 10 = 30.0000 (7a)                   |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)                    |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 30.0000 / (5) = 0.1419 (8)              |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 5.0000 (17)                             |
| Infiltration rate                                                                                  | 0.3919 (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) = 0.3331 (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 | 0.4247 | 0.4164 | 0.4080 | 0.3664 | 0.3581 | 0.3164 | 0.3164 | 0.3081 | 0.3331 | 0.3581 | 0.3747 | 0.3914 (22b) |
| Effective ac    | 0.5902 | 0.5867 | 0.5832 | 0.5671 | 0.5641 | 0.5501 | 0.5501 | 0.5475 | 0.5555 | 0.5641 | 0.5702 | 0.5766 (25)  |

# Full SAP Calculation Printout



## 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                                |             |                | 6.4200        | 1.0000           | 6.4200       |                   |               | (26)  |
| TER Opening Type (Uw = 1.20)                   |             |                | 10.9600       | 1.1450           | 12.5496      |                   |               | (27)  |
| Ground Floor                                   |             |                | 14.2700       | 0.1300           | 1.8551       |                   |               | (28a) |
| Exposed Floor                                  |             |                | 60.2100       | 0.1300           | 7.8273       |                   |               | (28b) |
| External Wall                                  | 104.5100    | 15.2400        | 89.2700       | 0.1800           | 16.0686      |                   |               | (29a) |
| Semi Exposed                                   | 30.7900     | 2.1400         | 28.6500       | 0.1800           | 5.1570       |                   |               | (29a) |
| Roof - ceiling                                 | 74.4800     |                | 74.4800       | 0.1100           | 8.1928       |                   |               | (30)  |
| Total net area of external elements Aum(A, m2) |             |                | 284.2600      |                  |              |                   |               | (31)  |
| Fabric heat loss, W/K = Sum (A x U)            |             |                |               |                  | 58.0704      |                   |               | (33)  |
| (26)...(30) + (32) =                           |             |                |               |                  |              |                   |               |       |

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

100.0000 (35)

List of Thermal Bridges

|                                                                  | Length  | Psi-value | Total   |  |
|------------------------------------------------------------------|---------|-----------|---------|--|
| K1 Element                                                       | 12.3700 | 0.0500    | 0.6185  |  |
| E2 Other lintels (including other steel lintels)                 | 9.3100  | 0.0500    | 0.4655  |  |
| E3 Sill                                                          | 28.8000 | 0.0500    | 1.4400  |  |
| E4 Jamb                                                          | 18.3200 | 0.1600    | 2.9312  |  |
| E5 Ground floor (normal)                                         | 6.0200  | 0.0000    | 0.0000  |  |
| E6 Intermediate floor within a dwelling                          | 23.6100 | 0.0600    | 1.4166  |  |
| E10 Eaves (insulation at ceiling level)                          | 14.2900 | 0.0600    | 0.8574  |  |
| E12 Gable (insulation at ceiling level)                          | 24.1700 | 0.0900    | 2.1753  |  |
| E16 Corner (normal)                                              | 31.8800 | 0.3200    | 10.2016 |  |
| E20 Exposed floor (normal)                                       | 12.3000 | 0.3200    | 3.9360  |  |
| E21 Exposed floor (inverted)                                     | 4.7200  | -0.0900   | -0.4248 |  |
| E17 Corner (inverted - internal area greater than external area) |         |           |         |  |

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

23.6173 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 81.6877 (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                     | 41.1818  | 40.9374  | 40.6979  | 39.5729  | 39.3624  | 38.3825  | 38.3825  | 38.2011  | 38.7599  | 39.3624  | 39.7882  | 40.2334  | (38) |
| Heat transfer coeff       | 122.8695 | 122.6251 | 122.3856 | 121.2606 | 121.0501 | 120.0702 | 120.0702 | 119.8888 | 120.4477 | 121.0501 | 121.4759 | 121.9211 | (39) |
| Average = Sum(39)m / 12 = |          |          |          |          |          |          |          |          |          |          |          | 121.2596 |      |

|               | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |      |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| HLP           | 1.3844 | 1.3817 | 1.3790 | 1.3663 | 1.3639 | 1.3529 | 1.3529 | 1.3509 | 1.3572 | 1.3639 | 1.3687 | 1.3738 | (40) |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 1.3663 |      |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31     |      |

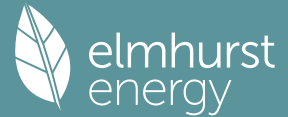
## 4. Water heating energy requirements (kWh/year)

|                                                                 |          |          |          |          |          |          |          |          |          |                                        |          |           |             |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------------------------------|----------|-----------|-------------|
| Assumed occupancy                                               |          |          |          |          |          |          |          |          |          |                                        |          |           | 2.6082 (42) |
| Hot water usage for mixer showers                               | 67.9510  | 66.9299  | 65.4418  | 62.5947  | 60.4936  | 58.1505  | 56.8187  | 58.2954  | 59.9143  | 62.4301                                | 65.3384  | 67.6907   | (42a)       |
| Hot water usage for baths                                       | 29.3444  | 28.9086  | 28.2949  | 27.1633  | 26.3160  | 25.3765  | 24.8690  | 25.4784  | 26.1420  | 27.1473                                | 28.3022  | 29.2452   | (42b)       |
| Hot water usage for other uses                                  | 41.3408  | 39.8375  | 38.3342  | 36.8309  | 35.3276  | 33.8243  | 33.8243  | 35.3276  | 36.8309  | 38.3342                                | 39.8375  | 41.3408   | (42c)       |
| Average daily hot water use (litres/day)                        |          |          |          |          |          |          |          |          |          |                                        |          | 127.4380  | (43)        |
| Daily hot water use                                             | 138.6362 | 135.6760 | 132.0709 | 126.5889 | 122.1372 | 117.3513 | 115.5120 | 119.1015 | 122.8871 | 127.9116                               | 133.4780 | 138.2767  | (44)        |
| Energy conte                                                    | 219.5659 | 193.2008 | 202.9881 | 173.2939 | 164.4202 | 144.2971 | 139.7017 | 147.4725 | 151.5321 | 173.5748                               | 190.1639 | 216.5079  | (45)        |
| Energy content (annual)                                         |          |          |          |          |          |          |          |          |          | Total = Sum(45)m =                     |          | 2116.7188 |             |
| Distribution loss (46)m = 0.15 x (45)m                          | 32.9349  | 28.9801  | 30.4482  | 25.9941  | 24.6630  | 21.6446  | 20.9553  | 22.1209  | 22.7298  | 26.0362                                | 28.5246  | 32.4762   | (46)        |
| Water storage loss:                                             |          |          |          |          |          |          |          |          |          |                                        |          |           |             |
| Store volume                                                    |          |          |          |          |          |          |          |          |          |                                        |          | 230.0000  | (47)        |
| a) If manufacturer declared loss factor is known (kWh/day):     |          |          |          |          |          |          |          |          |          |                                        |          | 1.7973    | (48)        |
| Temperature factor from Table 2b                                |          |          |          |          |          |          |          |          |          |                                        |          | 0.5400    | (49)        |
| Enter (49) or (54) in (55)                                      |          |          |          |          |          |          |          |          |          |                                        |          | 0.9706    | (55)        |
| Total storage loss                                              | 30.0872  | 27.1756  | 30.0872  | 29.1167  | 30.0872  | 29.1167  | 30.0872  | 30.0872  | 29.1167  | 30.0872                                | 29.1167  | 30.0872   | (56)        |
| If cylinder contains dedicated solar storage                    | 30.0872  | 27.1756  | 30.0872  | 29.1167  | 30.0872  | 29.1167  | 30.0872  | 30.0872  | 29.1167  | 30.0872                                | 29.1167  | 30.0872   | (57)        |
| Primary loss                                                    | 23.2624  | 21.0112  | 23.2624  | 22.5120  | 23.2624  | 22.5120  | 23.2624  | 23.2624  | 22.5120  | 23.2624                                | 22.5120  | 23.2624   | (59)        |
| Combi loss                                                      | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000    | (61)        |
| Total heat required for water heating calculated for each month | 272.9155 | 241.3875 | 256.3377 | 224.9226 | 217.7698 | 195.9258 | 193.0513 | 200.8221 | 203.1608 | 226.9244                               | 241.7925 | 269.8575  | (62)        |
| WWHRS                                                           | -31.0644 | -27.4736 | -28.7688 | -23.8217 | -22.2009 | -18.9975 | -17.8071 | -18.9361 | -19.6556 | -23.1717                               | -26.2508 | -30.4891  | (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                                                 | 241.8512 | 213.9139 | 227.5689 | 201.1009 | 195.5689 | 176.9283 | 175.2442 | 181.8860 | 183.5052 | 203.7527                               | 215.5418 | 239.3684  | (64)        |
| 12Total per year (kWh/year)                                     |          |          |          |          |          |          |          |          |          | Total per year (kWh/year) = Sum(64)m = |          | 2456.2304 | (64)        |
| Electric shower(s)                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000    | (64a)       |
|                                                                 |          |          |          |          |          |          |          |          |          |                                        |          | 0.0000    | (64a)       |
| Heat gains from water heating, kWh/month                        | 115.6854 | 102.7887 | 110.1732 | 98.9232  | 97.3494  | 89.2817  | 89.1305  | 91.7143  | 91.6874  | 100.3933                               | 104.5324 | 114.6686  | (65)        |

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

|                                                                                     |          |          |          |          |          |          |          |          |          |          |          |          |      |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| Metabolic gains (Table 5), Watts                                                    |          |          |          |          |          |          |          |          |          |          |          |          |      |
| (66)m                                                                               | 130.4111 | 130.4111 | 130.4111 | 130.4111 | 130.4111 | 130.4111 | 130.4111 | 130.4111 | 130.4111 | 130.4111 | 130.4111 | 130.4111 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 131.7092 | 145.8209 | 131.7092 | 136.0995 | 131.7092 | 136.0995 | 131.7092 | 131.7092 | 136.0995 | 131.7092 | 136.0995 | 131.7092 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 236.7592 | 239.2160 | 233.0249 | 219.8448 | 203.2072 | 187.5703 | 177.1238 | 174.6670 | 180.8581 | 194.0382 | 210.6758 | 226.3127 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 36.0411  | 36.0411  | 36.0411  | 36.0411  | 36.0411  | 36.0411  | 36.0411  | 36.0411  | 36.0411  | 36.0411  | 36.0411  | 36.0411  | (69) |
| Pumps, fans                                                                         | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 3.0000   | 3.0000   | 3.0000   | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 |          |          |          |          |          |          |          |          |          |          |          |          |      |

# Full SAP Calculation Printout



|                               |           |           |           |           |           |           |           |           |           |           |           |                |
|-------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
| Water heating gains (Table 5) | -104.3289 | -104.3289 | -104.3289 | -104.3289 | -104.3289 | -104.3289 | -104.3289 | -104.3289 | -104.3289 | -104.3289 | -104.3289 | -104.3289 (71) |
| Total internal gains          | 155.4911  | 152.9593  | 148.0823  | 137.3933  | 130.8460  | 124.0024  | 119.7991  | 123.2719  | 127.3436  | 134.9373  | 145.1839  | 154.1244 (72)  |
|                               | 589.0828  | 603.1195  | 577.9397  | 558.4609  | 530.8857  | 509.7955  | 490.7554  | 491.7714  | 506.4245  | 525.8080  | 557.0825  | 577.2697 (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       |          |          |          | 6.5200     | 10.6334                        |          | 0.6300                            |          | 0.7000                             |          | 0.7700                       |          | 21.1881 (74) |
| South       |          |          |          | 3.7200     | 46.7521                        |          | 0.6300                            |          | 0.7000                             |          | 0.7700                       |          | 53.1515 (78) |
| West        |          |          |          | 0.7200     | 19.6403                        |          | 0.6300                            |          | 0.7000                             |          | 0.7700                       |          | 4.3217 (80)  |
| Solar gains | 78.6612  | 135.9940 | 193.6119 | 256.1471   | 304.3580                       | 310.5325 | 295.8495                          | 258.1392 | 214.7502                           | 152.1213 | 94.5295                      | 67.1451  | (83)         |
| Total gains | 667.7440 | 739.1136 | 771.5516 | 814.6080   | 835.2438                       | 820.3280 | 786.6049                          | 749.9106 | 721.1747                           | 677.9293 | 651.6120                     | 644.4148 | (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                                                                         | 20.0642 | 20.1042 | 20.1435 | 20.3304 | 20.3658 | 20.5320 | 20.5320 | 20.5630 | 20.4676                   | 20.3658 | 20.2944 | 20.2203      |
| alpha                                                                       | 2.3376  | 2.3403  | 2.3429  | 2.3554  | 2.3577  | 2.3688  | 2.3688  | 2.3709  | 2.3645                    | 2.3577  | 2.3530  | 2.3480       |
| util living area                                                            | 0.9499  | 0.9348  | 0.9144  | 0.8708  | 0.7983  | 0.6799  | 0.5553  | 0.5899  | 0.7508                    | 0.8774  | 0.9319  | 0.9537 (86)  |
| MIT                                                                         | 17.9874 | 18.2704 | 18.7241 | 19.3801 | 20.0181 | 20.5476 | 20.8035 | 20.7655 | 20.3791                   | 19.5794 | 18.6905 | 17.9428 (87) |
| Th 2                                                                        | 19.7753 | 19.7774 | 19.7795 | 19.7893 | 19.7911 | 19.7996 | 19.7996 | 19.8012 | 19.7963                   | 19.7911 | 19.7874 | 19.7835 (88) |
| util rest of house                                                          | 0.9420  | 0.9245  | 0.9000  | 0.8469  | 0.7558  | 0.6027  | 0.4381  | 0.4766  | 0.6851                    | 0.8501  | 0.9194  | 0.9464 (89)  |
| MIT 2                                                                       | 16.3056 | 16.6632 | 17.2368 | 18.0598 | 18.8355 | 19.4418 | 19.6907 | 19.6624 | 19.2680                   | 18.3191 | 17.2053 | 16.2535 (90) |
| Living area fraction                                                        |         |         |         |         |         |         |         |         | fLA = Living area / (4) = |         |         | 0.2851 (91)  |
| MIT                                                                         | 16.7850 | 17.1214 | 17.6608 | 18.4362 | 19.1726 | 19.7570 | 20.0080 | 19.9769 | 19.5848                   | 18.6783 | 17.6287 | 16.7350 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |                           |         |         | 0.0000       |
| adjusted MIT                                                                | 16.7850 | 17.1214 | 17.6608 | 18.4362 | 19.1726 | 19.7570 | 20.0080 | 19.9769 | 19.5848                   | 18.6783 | 17.6287 | 16.7350 (93) |

## 8. Space heating requirement

|                                                                                | Jan       | Feb       | Mar       | Apr       | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov           | Dec       |       |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|---------------|-----------|-------|
| Utilisation                                                                    | 0.9138    | 0.8930    | 0.8660    | 0.8127    | 0.7296   | 0.5996   | 0.4605   | 0.4951   | 0.6714   | 0.8173   | 0.8880        | 0.9194    | (94)  |
| Useful gains                                                                   | 610.2047  | 660.0196  | 668.1663  | 662.0177  | 609.4195 | 491.8580 | 362.2514 | 371.2837 | 484.1959 | 554.0605 | 578.6106      | 592.4687  | (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                                                               | 1534.0298 | 1498.6461 | 1365.9246 | 1156.3642 | 904.5608 | 619.2030 | 409.1946 | 428.8305 | 660.6263 | 977.8846 | 1278.9790     | 1528.2865 | (97)  |
| Space heating kWh                                                              | 687.3259  | 563.5570  | 519.1322  | 355.9295  | 219.5852 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 315.3252 | 504.2652      | 696.2484  | (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |          |          |          |          |          |          |               | 3861.3685 |       |
| 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                                                              | 687.3259  | 563.5570  | 519.1322  | 355.9295  | 219.5852 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 315.3252 | 504.2652      | 696.2484  | (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |          |          |          |          |          |          |               | 3861.3685 |       |
| Space heating per m2                                                           |           |           |           |           |          |          |          |          |          |          | (98c) / (4) = | 43.5084   | (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                                                           | 687.3259 | 563.5570 | 519.1322  | 355.9295  | 219.5852  | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 315.3252 | 504.2652 | 696.2484 (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)                                            | 744.6651 | 610.5709 | 562.4400  | 385.6224  | 237.9037  | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 341.6308 | 546.3329 | 754.3320 (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                                                           | 241.8512 | 213.9139 | 227.5689  | 201.1009  | 195.5689  | 176.9283  | 175.2442  | 181.8860  | 183.5052 | 203.7527 | 215.5418 | 239.3684 (64)   |
| Efficiency of water heater (217)m                                                   | 86.2676  | 86.1274  | 85.8492   | 85.3258   | 84.3202   | 79.8000   | 79.8000   | 79.8000   | 79.8000  | 85.0355  | 85.8990  | 79.8000 (216)   |
| Fuel for water heating, kWh/month                                                   | 280.3500 | 248.3692 | 265.0799  | 235.6859  | 231.9360  | 221.7146  | 219.6043  | 227.9273  | 229.9565 | 239.6090 | 250.9246 | 277.3369 (219)  |
| Space cooling fuel requirement                                                      |          |          |           |           |           |           |           |           |          |          |          |                 |
| (221)m                                                                              | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)    |
| Pumps and Fa                                                                        | 7.3041   | 6.5973   | 7.3041    | 7.0685    | 7.3041    | 7.0685    | 7.3041    | 7.3041    | 7.0685   | 7.3041   | 7.0685   | 7.3041 (231)    |
| Lighting                                                                            | 27.3666  | 21.9545  | 19.7676   | 14.4826   | 11.1868   | 9.1397    | 10.2049   | 13.2648   | 17.2296  | 22.6062  | 25.5336  | 28.1272 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                       |          |          |           |           |           |           |           |           |          |          |          |                 |
| (233a)m                                                                             | -60.0364 | -80.1350 | -109.1027 | -115.9672 | -119.6656 | -109.8086 | -108.4274 | -104.9195 | -98.0506 | -88.3427 | -64.3756 | -52.4500 (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)             |          |          |           |           |           |           |           |           |          |          |          |                 |
| (234a)m                                                                             | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) |          |          |           |           |           |           |           |           |          |          |          |                 |
| (235a)m                                                                             | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)   |

# Full SAP Calculation Printout



|                                                                                                      |          |           |           |           |           |           |           |           |           |          |          |        |            |        |
|------------------------------------------------------------------------------------------------------|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|----------|--------|------------|--------|
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |           |           |           |           |           |           |           |           |          |          |        |            |        |
| (235c)m                                                                                              | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000 | 0.0000     | (235c) |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |           |           |           |           |           |           |           |           |          |          |        |            |        |
| (233b)m                                                                                              | -49.0170 | -100.9293 | -196.7412 | -290.1000 | -378.5568 | -374.1202 | -319.0044 | -236.8551 | -142.4468 | -64.7992 | -38.9281 |        |            | (233b) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |           |           |           |           |           |           |           |           |          |          |        |            |        |
| (234b)m                                                                                              | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000 | 0.0000     | (234b) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |           |           |           |           |           |           |           |           |          |          |        |            |        |
| (235b)m                                                                                              | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000 | 0.0000     | (235b) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |           |           |           |           |           |           |           |           |          |          |        |            |        |
| (235d)m                                                                                              | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000 | 0.0000     | (235d) |
| Annual totals kWh/year                                                                               |          |           |           |           |           |           |           |           |           |          |          |        |            |        |
| Space heating fuel - main system 1                                                                   |          |           |           |           |           |           |           |           |           |          |          |        | 4183.4978  | (211)  |
| Space heating fuel - main system 2                                                                   |          |           |           |           |           |           |           |           |           |          |          |        | 0.0000     | (213)  |
| Space heating fuel - secondary                                                                       |          |           |           |           |           |           |           |           |           |          |          |        | 0.0000     | (215)  |
| Efficiency of water heater                                                                           |          |           |           |           |           |           |           |           |           |          |          |        | 79.8000    |        |
| Water heating fuel used                                                                              |          |           |           |           |           |           |           |           |           |          |          |        | 2928.4943  | (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)                                                  |          |           |           |           |           |           |           |           |           |          |          |        | 220.8639   | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |           |           |           |           |           |           |           |           |          |          |        |            |        |
| PV generation                                                                                        |          |           |           |           |           |           |           |           |           |          |          |        | -3681.3606 | (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                                                                  |          |           |           |           |           |           |           |           |           |          |          |        | 3737.4954  | (238)  |

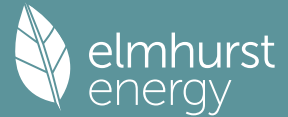
## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                               | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|-----------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1                 | 4183.4978          | 0.2100                        | 878.5345 (261)           |
| Total CO2 associated with community systems   |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                    | 2928.4943          | 0.2100                        | 614.9838 (264)           |
| Space and water heating                       |                    |                               | 1493.5183 (265)          |
| Pumps, fans and electric keep-hot             | 86.0000            | 0.1387                        | 11.9293 (267)            |
| Energy for lighting                           | 220.8639           | 0.1443                        | 31.8775 (268)            |
| Energy saving/generation technologies         |                    |                               |                          |
| PV Unit electricity used in dwelling          | -1111.2811         | 0.1358                        | -150.8897                |
| PV Unit electricity exported                  | -2570.0795         | 0.1264                        | -324.9804                |
| Total                                         |                    |                               | -475.8701 (269)          |
| Total CO2, kg/year                            |                    |                               | 1061.4549 (272)          |
| EPC Target Carbon Dioxide Emission Rate (TER) |                    |                               | 11.9600 (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               | 4183.4978          | 1.1300                              | 4727.3525 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 2928.4943          | 1.1300                              | 3309.1986 (278)            |
| Space and water heating                     |                    |                                     | 8036.5511 (279)            |
| Pumps, fans and electric keep-hot           | 86.0000            | 1.5128                              | 130.1008 (281)             |
| Energy for lighting                         | 220.8639           | 1.5338                              | 338.7685 (282)             |
| Energy saving/generation technologies       |                    |                                     |                            |
| PV Unit electricity used in dwelling        | -1111.2811         | 1.5019                              | -1669.0165                 |
| PV Unit electricity exported                | -2570.0795         | 0.4642                              | -1192.9649                 |
| Total                                       |                    |                                     | -2861.9814 (283)           |
| Total Primary energy kWh/year               |                    |                                     | 5643.4389 (286)            |
| Target Primary Energy Rate (TPER)           |                    |                                     | 63.5900 (287)              |

# Full SAP Calculation Printout



|                                    |                      |               |               |        |                |            |  |
|------------------------------------|----------------------|---------------|---------------|--------|----------------|------------|--|
| Property Reference                 | OP-D320 F2BULL       |               |               |        | Issued on Date | 29/11/2024 |  |
| Assessment Reference               | F2BULL               |               | Prop Type Ref | F2BULL |                |            |  |
| Property                           | F2BULL               |               |               |        |                |            |  |
|                                    |                      |               |               |        |                |            |  |
| SAP Rating                         | 77 C                 | DER           | 5.33          | TER    | 11.96          |            |  |
| Environmental                      | 95 A                 | % DER < TER   |               |        |                | 55.43      |  |
| CO <sub>2</sub> Emissions (t/year) | 0.44                 | DFEE          | 49.79         | TFEE   | 50.66          |            |  |
| Compliance Check                   | See BREL             | % DFEE < TFEE |               |        |                | 1.71       |  |
| % DPER < TPER                      | 11.86                | DPER          | 56.05         | TPER   | 63.59          |            |  |
|                                    |                      |               |               |        |                |            |  |
| 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                                           | 14.2700 (1b)              | x 2.5000 (2b)                   | = 35.6750 (1b) - (3b)       |
| First floor                                            | 74.4800 (1c)              | x 2.3600 (2c)                   | = 175.7728 (1c) - (3c)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 88.7500                   |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 211.4478 (5)              |

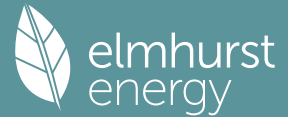
## 2. Ventilation rate

|                                                                                                         |                                                                                                                                     |              |
|---------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|--------------|
| 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                                                                     | 3 * 10 =                                                                                                                            | 30.0000 (7a) |
| Number of passive vents                                                                                 | 0 * 10 =                                                                                                                            | 0.0000 (7b)  |
| Number of flueless gas fires                                                                            | 0 * 40 =                                                                                                                            | 0.0000 (7c)  |
| Air changes per hour                                                                                    |                                                                                                                                     |              |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =      | 30.0000 / (5) =                                                                                                                     | 0.1419 (8)   |
| Pressure test                                                                                           | Yes                                                                                                                                 |              |
| Pressure Test Method                                                                                    | Blower Door                                                                                                                         |              |
| Measured/design AP50                                                                                    | 3.5000                                                                                                                              | (17)         |
| Infiltration rate                                                                                       | 0.3169                                                                                                                              | (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) =                                                                                                                | 0.2693 (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                                                                                         | 0.3434 0.3367 0.3300 0.2963 0.2895 0.2559 0.2559 0.2491 0.2693 0.2895 0.3030 0.3165                                                 | (22b)        |
| 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                                                                                            | 0.5590 0.5567 0.5544 0.5439 0.5419 0.5327 0.5327 0.5310 0.5363 0.5419 0.5459 0.5501                                                 | (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                                                     |                         |                            | 6.4200                    | 1.0000                        | 6.4200       |                                | (26)          |
| Windows (Uw = 1.30)                                            |                         |                            | 10.9600                   | 1.2357                        | 13.5437      |                                | (27)          |
| Ground Floor                                                   |                         |                            | 14.2700                   | 0.1100                        | 1.5697       |                                | (28a)         |
| Exposed Floor                                                  |                         |                            | 60.2100                   | 0.1400                        | 8.4294       |                                | (28b)         |
| External Wall                                                  | 104.5100                | 15.2400                    | 89.2700                   | 0.1700                        | 15.1759      |                                | (29a)         |
| Semi Exposed                                                   | 30.7900                 | 2.1400                     | 28.6500                   | 0.1700                        | 4.8705       |                                | (29a)         |
| Roof - ceiling                                                 | 74.4800                 |                            | 74.4800                   | 0.1100                        | 8.1928       |                                | (30)          |
| Total net area of external elements Aum(A, m <sup>2</sup> )    |                         |                            | 284.2600                  |                               |              |                                | (31)          |
| Fabric heat loss, W/K = Sum (A x U)                            |                         |                            | (26)...(30) + (32) =      |                               | 58.2020      |                                | (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)               |                         |                            |                           | 12.3700                       | 0.0500       | 0.6185                         |               |
| E3 Sill                                                        |                         |                            |                           | 9.3100                        | 0.0500       | 0.4655                         |               |
| E4 Jamb                                                        |                         |                            |                           | 28.8000                       | 0.0500       | 1.4400                         |               |
| E5 Ground floor (normal)                                       |                         |                            |                           | 18.3200                       | 0.1600       | 2.9312                         |               |

# Full SAP Calculation Printout



|                                                                  |         |                       |              |
|------------------------------------------------------------------|---------|-----------------------|--------------|
| E6 Intermediate floor within a dwelling                          | 6.0200  | 0.0000                | 0.0000       |
| E10 Eaves (insulation at ceiling level)                          | 23.6100 | 0.0600                | 1.4166       |
| E12 Gable (insulation at ceiling level)                          | 14.2900 | 0.0600                | 0.8574       |
| E16 Corner (normal)                                              | 24.1700 | 0.0900                | 2.1753       |
| E20 Exposed floor (normal)                                       | 31.8800 | 0.3200                | 10.2016      |
| E21 Exposed floor (inverted)                                     | 12.3000 | 0.3200                | 3.9360       |
| E17 Corner (inverted - internal area greater than external area) | 4.7200  | -0.0900               | -0.4248      |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)       |         |                       | 23.6173 (36) |
| Point Thermal bridges                                            |         |                       | 0.0000       |
| Total fabric heat loss                                           |         | (33) + (36) + (36a) = | 81.8193 (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                                                 | 39.0035  | 38.8438  | 38.6871  | 37.9515  | 37.8139  | 37.1732  | 37.1732  | 37.0546  | 37.4200  | 37.8139  | 38.0923  | 38.3834 (38)  |
| Average = Sum(39)m / 12 =                                           | 120.8229 | 120.6631 | 120.5065 | 119.7709 | 119.6332 | 118.9925 | 118.9925 | 118.8739 | 119.2393 | 119.6332 | 119.9117 | 120.2027 (39) |
|                                                                     |          |          |          |          |          |          |          |          |          |          |          | 119.7702      |
| HLP                                                                 | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
| HLP (average)                                                       | 1.3614   | 1.3596   | 1.3578   | 1.3495   | 1.3480   | 1.3408   | 1.3408   | 1.3394   | 1.3435   | 1.3480   | 1.3511   | 1.3544 (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                                                              |          |         |          |         |         |         |         |         |         |         |         | 2.6082 (42)    |
| Hot water usage for mixer showers                                              | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (42a)   |
| Hot water usage for baths                                                      | 29.3444  | 28.9086 | 28.2949  | 27.1633 | 26.3160 | 25.3765 | 24.8690 | 25.4784 | 26.1420 | 27.1473 | 28.3022 | 29.2452 (42b)  |
| Hot water usage for other uses                                                 | 41.3408  | 39.8375 | 38.3342  | 36.8309 | 35.3276 | 33.8243 | 33.8243 | 35.3276 | 36.8309 | 38.3342 | 39.8375 | 41.3408 (42c)  |
| Average daily hot water use (litres/day)                                       |          |         |          |         |         |         |         |         |         |         |         | 64.7894 (43)   |
| Daily hot water use                                                            | Jan      | Feb     | Mar      | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec            |
| Energy conte                                                                   | 70.6852  | 68.7461 | 66.6291  | 63.9942 | 61.6436 | 59.2008 | 58.6933 | 60.8060 | 62.9729 | 65.4815 | 68.1396 | 70.5860 (44)   |
| Energy content (annual)                                                        | 111.9481 | 97.8935 | 102.4064 | 87.6049 | 82.9841 | 72.7943 | 70.9845 | 75.2906 | 77.6518 | 88.8578 | 97.0774 | 110.5206 (45)  |
| Distribution loss (46)m = 0.15 x (45)m                                         | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (46)    |
| Water storage loss:                                                            |          |         |          |         |         |         |         |         |         |         |         |                |
| Total storage loss                                                             | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (56)    |
| If cylinder contains dedicated solar storage                                   | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (57)    |
| Primary loss                                                                   | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (59)    |
| Combi loss                                                                     | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (61)    |
| Total heat required for water heating calculated for each month                | 95.1559  | 83.2095 | 87.0455  | 74.4641 | 70.5365 | 61.8751 | 60.3368 | 63.9970 | 66.0041 | 75.5291 | 82.5158 | 93.9425 (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                                                                | 95.1559  | 83.2095 | 87.0455  | 74.4641 | 70.5365 | 61.8751 | 60.3368 | 63.9970 | 66.0041 | 75.5291 | 82.5158 | 93.9425 (64)   |
| 12Total per year (kWh/year)                                                    |          |         |          |         |         |         |         |         |         |         |         | 914.6118 (64)  |
| Electric shower(s)                                                             | 54.4175  | 48.4864 | 52.9453  | 50.5251 | 51.4731 | 49.1004 | 50.7371 | 51.4731 | 50.5251 | 52.9453 | 51.9497 | 54.4175 (64a)  |
| Heat gains from water heating, kWh/month                                       | 37.3933  | 32.9240 | 34.9977  | 31.2473 | 30.5024 | 27.7439 | 27.7685 | 28.8675 | 29.1323 | 32.1186 | 33.6164 | 37.0900 (65)   |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |         |          |         |         |         |         |         |         |         |         | 618.9955 (64a) |

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

|                                                                                     |           |           |           |           |           |           |           |           |           |           |           |                |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
| Metabolic gains (Table 5), Watts                                                    | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec            |
| (66)m                                                                               | 130.4111  | 130.4111  | 130.4111  | 130.4111  | 130.4111  | 130.4111  | 130.4111  | 130.4111  | 130.4111  | 130.4111  | 130.4111  | 130.4111 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 131.7092  | 145.8209  | 131.7092  | 136.0995  | 131.7092  | 136.0995  | 131.7092  | 131.7092  | 136.0995  | 131.7092  | 136.0995  | 131.7092 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 236.7592  | 239.2160  | 233.0249  | 219.8448  | 203.2072  | 187.5703  | 177.1238  | 174.6670  | 180.8581  | 194.0382  | 210.6758  | 226.3127 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 36.0411   | 36.0411   | 36.0411   | 36.0411   | 36.0411   | 36.0411   | 36.0411   | 36.0411   | 36.0411   | 36.0411   | 36.0411   | 36.0411 (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)                                 | -104.3289 | -104.3289 | -104.3289 | -104.3289 | -104.3289 | -104.3289 | -104.3289 | -104.3289 | -104.3289 | -104.3289 | -104.3289 | -104.3289 (71) |
| Water heating gains (Table 5)                                                       | 50.2599   | 48.9940   | 47.0399   | 43.3990   | 40.9979   | 38.5332   | 37.3232   | 38.8004   | 40.4615   | 43.1702   | 46.6894   | 49.8521 (72)   |
| Total internal gains                                                                | 480.8516  | 496.1542  | 473.8973  | 461.4666  | 438.0376  | 424.3263  | 408.2796  | 407.3000  | 419.5424  | 431.0409  | 455.5880  | 469.9974 (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       |          |          |          | 6.5200     | 10.6334                        | 0.6300                            | 0.7000                             | 0.7700                       | 21.1881 (74) |          |          |               |
| South       |          |          |          | 3.7200     | 46.7521                        | 0.6300                            | 0.7000                             | 0.7700                       | 53.1515 (78) |          |          |               |
| West        |          |          |          | 0.7200     | 19.6403                        | 0.6300                            | 0.7000                             | 0.7700                       | 4.3217 (80)  |          |          |               |
| Solar gains | 78.6612  | 135.9940 | 193.6119 | 256.1471   | 304.3580                       | 310.5325                          | 295.8495                           | 258.1392                     | 214.7502     | 152.1213 | 94.5295  | 67.1451 (83)  |
| Total gains | 559.5128 | 632.1483 | 667.5092 | 717.6137   | 742.3957                       | 734.8588                          | 704.1291                           | 665.4392                     | 634.2927     | 583.1622 | 550.1175 | 537.1425 (84) |

## 7. Mean internal temperature (heating season)

# Full SAP Calculation Printout



|                                                                             |                           |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |                           |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |                           |         |         |         |         |         |         |         |         |         |         |              |
|                                                                             | Jan                       | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| tau                                                                         | 20.4041                   | 20.4311 | 20.4576 | 20.5833 | 20.6070 | 20.7179 | 20.7179 | 20.7386 | 20.6750 | 20.6070 | 20.5591 | 20.5093      |
| alpha                                                                       | 2.3603                    | 2.3621  | 2.3638  | 2.3722  | 2.3738  | 2.3812  | 2.3812  | 2.3826  | 2.3783  | 2.3738  | 2.3706  | 2.3673       |
| util living area                                                            | 0.9645                    | 0.9513  | 0.9339  | 0.8949  | 0.8290  | 0.7167  | 0.5948  | 0.6327  | 0.7890  | 0.9047  | 0.9504  | 0.9677 (86)  |
| MIT                                                                         | 17.8356                   | 18.1267 | 18.5909 | 19.2656 | 19.9310 | 20.4938 | 20.7742 | 20.7287 | 20.3060 | 19.4591 | 18.5428 | 17.7822 (87) |
| Th 2                                                                        | 19.7931                   | 19.7945 | 19.7958 | 19.8022 | 19.8034 | 19.8090 | 19.8090 | 19.8101 | 19.8069 | 19.8034 | 19.8010 | 17.7985 (88) |
| util rest of house                                                          | 0.9587                    | 0.9434  | 0.9223  | 0.8745  | 0.7906  | 0.6423  | 0.4761  | 0.5193  | 0.7283  | 0.8821  | 0.9409  | 0.9624 (89)  |
| MIT 2                                                                       | 16.9339                   | 17.2220 | 17.6812 | 18.3446 | 18.9809 | 19.4904 | 19.7086 | 19.6811 | 19.3363 | 18.5421 | 17.6415 | 16.8845 (90) |
| Living area fraction                                                        | fLA = Living area / (4) = |         |         |         |         |         |         |         |         |         |         |              |
| MIT                                                                         | 17.1909                   | 17.4799 | 17.9405 | 18.6071 | 19.2517 | 19.7765 | 20.0124 | 19.9797 | 19.6128 | 18.8035 | 17.8984 | 17.1404 (92) |
| Temperature adjustment                                                      | 0.0000                    |         |         |         |         |         |         |         |         |         |         |              |
| adjusted MIT                                                                | 17.1909                   | 17.4799 | 17.9405 | 18.6071 | 19.2517 | 19.7765 | 20.0124 | 19.9797 | 19.6128 | 18.8035 | 17.8984 | 17.1404 (93) |

## 8. Space heating requirement

|                                                                                |                            |           |           |           |          |          |          |          |          |          |           |                |
|--------------------------------------------------------------------------------|----------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|-----------|----------------|
|                                                                                | Jan                        | Feb       | Mar       | Apr       | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov       | Dec            |
| Utilisation                                                                    | 0.9409                     | 0.9222    | 0.8983    | 0.8483    | 0.7691   | 0.6400   | 0.4987   | 0.5376   | 0.7165   | 0.8574   | 0.9199    | 0.9457 (94)    |
| Useful gains                                                                   | 526.4585                   | 582.9729  | 599.5940  | 608.7872  | 570.9590 | 470.2941 | 351.1751 | 357.7159 | 454.4405 | 500.0227 | 506.0742  | 507.9522 (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                                                               | 1557.5209                  | 1517.9329 | 1378.6538 | 1162.6312 | 903.4402 | 615.9613 | 406.0483 | 425.5363 | 657.3383 | 981.4151 | 1294.8544 | 1555.4743 (97) |
| Space heating kWh                                                              | 767.1104                   | 628.2931  | 579.6205  | 398.7677  | 247.3660 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 358.1559 | 567.9218  | 779.3564 (98a) |
| Space heating requirement - total per year (kWh/year)                          | 4326.5918                  |           |           |           |          |          |          |          |          |          |           |                |
| 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                                                              | 767.1104                   | 628.2931  | 579.6205  | 398.7677  | 247.3660 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 358.1559 | 567.9218  | 779.3564 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) | 4326.5918                  |           |           |           |          |          |          |          |          |          |           |                |
| Space heating per m2                                                           | (98c) / (4) = 48.7503 (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  | 1118.5299 | 880.5448 | 903.4416 | 0.0000  | 0.0000  | 0.0000 | 0.0000 (100) |
| Utilisation                      | 0.0000                   | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 0.5792    | 0.6535   | 0.6226   | 0.0000  | 0.0000  | 0.0000 | 0.0000 (101) |
| Useful loss                      | 0.0000                   | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 647.8746  | 575.4259 | 562.4872 | 0.0000  | 0.0000  | 0.0000 | 0.0000 (102) |
| Total gains                      | 0.0000                   | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 798.3949  | 765.3594 | 722.8263 | 0.0000  | 0.0000  | 0.0000 | 0.0000 (103) |
| Space cooling kWh                | 0.0000                   | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 108.3746  | 141.3105 | 119.2923 | 0.0000  | 0.0000  | 0.0000 | 0.0000 (104) |
| Cooled fraction                  | fc = cooled area / (4) = |        |        |        |         |           |          |          |         |         |        |              |
| 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  | 27.0937   | 35.3276  | 29.8231  | 0.0000  | 0.0000  | 0.0000 | 0.0000 (107) |
| Space cooling requirement        | 92.2444 (107)            |        |        |        |         |           |          |          |         |         |        |              |
| Energy for space heating         | 48.7503 (99)             |        |        |        |         |           |          |          |         |         |        |              |
| Energy for space cooling         | 1.0394 (108)             |        |        |        |         |           |          |          |         |         |        |              |
| Total                            | 49.7897 (109)            |        |        |        |         |           |          |          |         |         |        |              |
| Fabric Energy Efficiency (DFEE)  | 49.8 (109)               |        |        |        |         |           |          |          |         |         |        |              |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

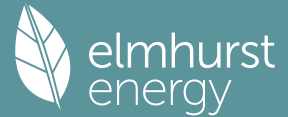
## 1. Overall dwelling characteristics

|                                                        |              |                                 |                        |
|--------------------------------------------------------|--------------|---------------------------------|------------------------|
|                                                        | Area (m2)    | Storey height (m)               | Volume (m3)            |
| Ground floor                                           | 14.2700 (1b) | x 2.5000 (2b)                   | = 35.6750 (1b) - (3b)  |
| First floor                                            | 74.4800 (1c) | x 2.3600 (2c)                   | = 175.7728 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 88.7500      |                                 | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 211.4478 (5)         |

## 2. Ventilation rate

|                                                                                                    |                            |
|----------------------------------------------------------------------------------------------------|----------------------------|
|                                                                                                    | m3 per hour                |
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)       |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)       |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)       |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)       |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)       |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)       |
| Number of intermittent extract fans                                                                | 3 * 10 = 30.0000 (7a)      |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)       |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)       |
| Air changes per hour                                                                               |                            |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 30.0000 / (5) = 0.1419 (8) |

# Full SAP Calculation Printout



|                                                                                                         |        |        |        |        |        |        |        |        |        |        |        |                                         |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-----------------------------------------|
| Pressure test                                                                                           |        |        |        |        |        |        |        |        |        |        |        | Yes                                     |
| Pressure Test Method                                                                                    |        |        |        |        |        |        |        |        |        |        |        | Blower Door                             |
| Measured/design AP50                                                                                    |        |        |        |        |        |        |        |        |        |        |        | 5.0000 (17)                             |
| Infiltration rate                                                                                       |        |        |        |        |        |        |        |        |        |        |        | 0.3919 (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) = 0.3331 (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)                            |
|                                                                                                         | 0.4247 | 0.4164 | 0.4080 | 0.3664 | 0.3581 | 0.3164 | 0.3164 | 0.3081 | 0.3331 | 0.3581 | 0.3747 | 0.3914 (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                                                                                            | 0.5902 | 0.5867 | 0.5832 | 0.5671 | 0.5641 | 0.5501 | 0.5501 | 0.5475 | 0.5555 | 0.5641 | 0.5702 | 0.5766 (25)                             |

## 3. Heat losses and heat loss parameter

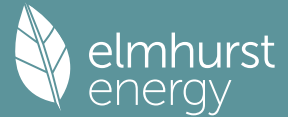
| Element                                                          | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K | A x U<br>W/K                 | K-value<br>kJ/m2K             | A x K<br>kJ/K |
|------------------------------------------------------------------|-------------|----------------|---------------|------------------|------------------------------|-------------------------------|---------------|
| TER Opaque door                                                  |             |                | 6.4200        | 1.0000           | 6.4200                       |                               | (26)          |
| TER Opening Type (Uw = 1.20)                                     |             |                | 10.9600       | 1.1450           | 12.5496                      |                               | (27)          |
| Ground Floor                                                     |             |                | 14.2700       | 0.1300           | 1.8551                       |                               | (28a)         |
| Exposed Floor                                                    |             |                | 60.2100       | 0.1300           | 7.8273                       |                               | (28b)         |
| External Wall                                                    | 104.5100    | 15.2400        | 89.2700       | 0.1800           | 16.0686                      |                               | (29a)         |
| Semi Exposed                                                     | 30.7900     | 2.1400         | 28.6500       | 0.1800           | 5.1570                       |                               | (29a)         |
| Roof - ceiling                                                   | 74.4800     |                | 74.4800       | 0.1100           | 8.1928                       |                               | (30)          |
| Total net area of external elements Aum(A, m2)                   |             |                | 284.2600      |                  |                              |                               | (31)          |
| Fabric heat loss, W/K = Sum (A x U)                              |             |                |               |                  | (26)...(30) + (32) = 58.0704 |                               | (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)                 |             |                |               | 12.3700          | 0.0500                       | 0.6185                        |               |
| E3 Sill                                                          |             |                |               | 9.3100           | 0.0500                       | 0.4655                        |               |
| E4 Jamb                                                          |             |                |               | 28.8000          | 0.0500                       | 1.4400                        |               |
| E5 Ground floor (normal)                                         |             |                |               | 18.3200          | 0.1600                       | 2.9312                        |               |
| E6 Intermediate floor within a dwelling                          |             |                |               | 6.0200           | 0.0000                       | 0.0000                        |               |
| E10 Eaves (insulation at ceiling level)                          |             |                |               | 23.6100          | 0.0600                       | 1.4166                        |               |
| E12 Gable (insulation at ceiling level)                          |             |                |               | 14.2900          | 0.0600                       | 0.8574                        |               |
| E16 Corner (normal)                                              |             |                |               | 24.1700          | 0.0900                       | 2.1753                        |               |
| E20 Exposed floor (normal)                                       |             |                |               | 31.8800          | 0.3200                       | 10.2016                       |               |
| E21 Exposed floor (inverted)                                     |             |                |               | 12.3000          | 0.3200                       | 3.9360                        |               |
| E17 Corner (inverted - internal area greater than external area) |             |                |               | 4.7200           | -0.0900                      | -0.4248                       |               |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)       |             |                |               |                  |                              | 23.6173                       | (36)          |
| Point Thermal bridges                                            |             |                |               |                  |                              | (36a) = 0.0000                |               |
| Total fabric heat loss                                           |             |                |               |                  |                              | (33) + (36) + (36a) = 81.6877 | (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                                                 | 41.1818  | 40.9374  | 40.6979  | 39.5729  | 39.3624  | 38.3825  | 38.3825  | 38.2011  | 38.7599  | 39.3624  | 39.7882  | 40.2334 (38)  |
| Average = Sum(39)m / 12 =                                           | 122.8695 | 122.6251 | 122.3856 | 121.2606 | 121.0501 | 120.0702 | 120.0702 | 119.8888 | 120.4477 | 121.0501 | 121.4759 | 121.9211 (39) |
|                                                                     |          |          |          |          |          |          |          |          |          |          |          | 121.2596      |
| HLP                                                                 | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
| HLP (average)                                                       | 1.3844   | 1.3817   | 1.3790   | 1.3663   | 1.3639   | 1.3529   | 1.3529   | 1.3509   | 1.3572   | 1.3639   | 1.3687   | 1.3738 (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                                               |          |         |          |         |         |         |         |         |         |         |         | 2.6082 (42)                                          |
| Hot water usage for mixer showers                               |          |         |          |         |         |         |         |         |         |         |         | 0.0000 (42a)                                         |
| Hot water usage for baths                                       |          |         |          |         |         |         |         |         |         |         |         | 29.3444 (42b)                                        |
| Hot water usage for other uses                                  |          |         |          |         |         |         |         |         |         |         |         | 41.3408 (42c)                                        |
| Average daily hot water use (litres/day)                        |          |         |          |         |         |         |         |         |         |         |         | 64.7894 (43)                                         |
| Daily hot water use                                             | Jan      | Feb     | Mar      | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec                                                  |
| Energy conte                                                    | 70.6852  | 68.7461 | 66.6291  | 63.9942 | 61.6436 | 59.2008 | 58.6933 | 60.8060 | 62.9729 | 65.4815 | 68.1396 | 70.5860 (44)                                         |
| Energy content (annual)                                         | 111.9481 | 97.8935 | 102.4064 | 87.6049 | 82.9841 | 72.7943 | 70.9845 | 75.2906 | 77.6518 | 88.8578 | 97.0774 | 110.5206 (45)                                        |
| Distribution loss (46)m = 0.15 x (45)m                          |          |         |          |         |         |         |         |         |         |         |         | Total = Sum(45)m = 1076.0139                         |
| 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 (46)                                          |
| If cylinder contains dedicated solar storage                    |          |         |          |         |         |         |         |         |         |         |         |                                                      |
| Primary loss                                                    | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (57)                                          |
| Combi loss                                                      | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (59)                                          |
| Total heat required for water heating calculated for each month |          |         |          |         |         |         |         |         |         |         |         |                                                      |
| WWHRS                                                           | 95.1559  | 83.2095 | 87.0455  | 74.4641 | 70.5365 | 61.8751 | 60.3368 | 63.9970 | 66.0041 | 75.5291 | 82.5158 | 93.9425 (62)                                         |
| PV diverter                                                     | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (63a)                                         |
| Solar input                                                     | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (63b)                                         |
| FGHRS                                                           | 0.0000   | 0.0000  | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (63c)                                         |
| Output from w/h                                                 | 95.1559  | 83.2095 | 87.0455  | 74.4641 | 70.5365 | 61.8751 | 60.3368 | 63.9970 | 66.0041 | 75.5291 | 82.5158 | 93.9425 (64)                                         |
| 12Total per year (kWh/year)                                     |          |         |          |         |         |         |         |         |         |         |         | Total per year (kWh/year) = Sum(64)m = 914.6118 (64) |
| Electric shower(s)                                              | 54.4175  | 48.4864 | 52.9453  | 50.5251 | 51.4731 | 49.1004 | 50.7371 | 51.4731 | 50.5251 | 52.9453 | 51.9497 | 54.4175 (64a)                                        |
| Heat gains from water heating, kWh/month                        | 37.3933  | 32.9240 | 34.9977  | 31.2473 | 30.5024 | 27.7439 | 27.7685 | 28.8675 | 29.1323 | 32.1186 | 33.6164 | 37.0900 (65)                                         |

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

| Metabolic gains (Table 5), Watts                                                    |           |           |           |           |           |           |           |           |           |           |           |                |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
|                                                                                     | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec            |
| (66)m                                                                               | 130.4111  | 130.4111  | 130.4111  | 130.4111  | 130.4111  | 130.4111  | 130.4111  | 130.4111  | 130.4111  | 130.4111  | 130.4111  | 130.4111 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 131.7092  | 145.8209  | 131.7092  | 136.0995  | 131.7092  | 136.0995  | 131.7092  | 131.7092  | 136.0995  | 131.7092  | 136.0995  | 131.7092 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 236.7592  | 239.2160  | 233.0249  | 219.8448  | 203.2072  | 187.5703  | 177.1238  | 174.6670  | 180.8581  | 194.0382  | 210.6758  | 226.3127 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 36.0411   | 36.0411   | 36.0411   | 36.0411   | 36.0411   | 36.0411   | 36.0411   | 36.0411   | 36.0411   | 36.0411   | 36.0411   | 36.0411 (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)                                 | -104.3289 | -104.3289 | -104.3289 | -104.3289 | -104.3289 | -104.3289 | -104.3289 | -104.3289 | -104.3289 | -104.3289 | -104.3289 | -104.3289 (71) |
| Water heating gains (Table 5)                                                       | 50.2599   | 48.9940   | 47.0399   | 43.3990   | 40.9979   | 38.5332   | 37.3232   | 38.8004   | 40.4615   | 43.1702   | 46.6894   | 49.8521 (72)   |
| Total internal gains                                                                | 480.8516  | 496.1542  | 473.8973  | 461.4666  | 438.0376  | 424.3263  | 408.2796  | 407.3000  | 419.5424  | 431.0409  | 455.5880  | 469.9974 (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       |          |          |          | 6.5200     | 10.6334                        | 0.6300                            | 0.7000                             | 0.7700                       | 21.1881 (74) |          |          |               |
| South       |          |          |          | 3.7200     | 46.7521                        | 0.6300                            | 0.7000                             | 0.7700                       | 53.1515 (78) |          |          |               |
| West        |          |          |          | 0.7200     | 19.6403                        | 0.6300                            | 0.7000                             | 0.7700                       | 4.3217 (80)  |          |          |               |
|             |          |          |          |            |                                |                                   |                                    |                              |              |          |          |               |
| Solar gains | 78.6612  | 135.9940 | 193.6119 | 256.1471   | 304.3580                       | 310.5325                          | 295.8495                           | 258.1392                     | 214.7502     | 152.1213 | 94.5295  | 67.1451 (83)  |
| Total gains | 559.5128 | 632.1483 | 667.5092 | 717.6137   | 742.3957                       | 734.8588                          | 704.1291                           | 665.4392                     | 634.2927     | 583.1622 | 550.1175 | 537.1425 (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                                                                         | 20.0642 | 20.1042 | 20.1435 | 20.3304 | 20.3658 | 20.5320 | 20.5320 | 20.5630 | 20.4676 | 20.3658 | 20.2944 | 20.2203      |
| alpha                                                                       | 2.3376  | 2.3403  | 2.3429  | 2.3554  | 2.3577  | 2.3688  | 2.3688  | 2.3709  | 2.3645  | 2.3577  | 2.3530  | 2.3480       |
| util living area                                                            | 0.9647  | 0.9516  | 0.9344  | 0.8958  | 0.8305  | 0.7187  | 0.5973  | 0.6349  | 0.7907  | 0.9054  | 0.9507  | 0.9678 (86)  |
| MIT                                                                         | 17.7865 | 18.0803 | 18.5500 | 19.2377 | 19.9108 | 20.4841 | 20.7687 | 20.7229 | 20.2935 | 19.4364 | 18.5106 | 17.7408 (87) |
| Th 2                                                                        | 19.7753 | 19.7774 | 19.7795 | 19.7893 | 19.7911 | 19.7996 | 19.7996 | 19.8012 | 19.7963 | 19.7911 | 19.7874 | 19.7835 (88) |
| util rest of house                                                          | 0.9589  | 0.9437  | 0.9228  | 0.8753  | 0.7921  | 0.6440  | 0.4778  | 0.5208  | 0.7298  | 0.8829  | 0.9412  | 0.9625 (89)  |
| MIT 2                                                                       | 16.8747 | 17.1659 | 17.6310 | 18.3095 | 18.9538 | 19.4754 | 19.6971 | 19.6698 | 19.3179 | 18.5124 | 17.6015 | 16.8345 (90) |
| Living area fraction                                                        | 17.1346 | 17.4266 | 17.8930 | 18.5741 | 19.2266 | 19.7629 | 20.0026 | 19.9700 | 19.5960 | 18.7758 | 17.8606 | 17.0929 (92) |
| MIT                                                                         | 17.1346 | 17.4266 | 17.8930 | 18.5741 | 19.2266 | 19.7629 | 20.0026 | 19.9700 | 19.5960 | 18.7758 | 17.8606 | 17.0929 (93) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT                                                                | 17.1346 | 17.4266 | 17.8930 | 18.5741 | 19.2266 | 19.7629 | 20.0026 | 19.9700 | 19.5960 | 18.7758 | 17.8606 | 17.0929 (93) |

## 8. Space heating requirement

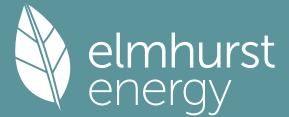
|                                                                                | Jan       | Feb       | Mar       | Apr       | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov       | Dec            |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|-----------|----------------|
| Utilisation                                                                    | 0.9409    | 0.9223    | 0.8986    | 0.8489    | 0.7702   | 0.6414   | 0.5004   | 0.5391   | 0.7176   | 0.8579   | 0.9200    | 0.9456 (94)    |
| Useful gains                                                                   | 526.4430  | 583.0440  | 599.7936  | 609.2179  | 571.7899 | 471.3340 | 352.3295 | 358.7102 | 455.1949 | 500.3001 | 506.1265  | 507.9263 (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                                                               | 1576.9807 | 1536.0714 | 1394.3353 | 1173.0852 | 911.0974 | 619.9136 | 408.5484 | 428.0032 | 661.9801 | 989.6871 | 1307.1583 | 1571.9129 (97) |
| Space heating kWh                                                              | 781.6000  | 640.4344  | 591.1391  | 405.9845  | 252.4448 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 364.1039 | 576.7429  | 791.6061 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |          |          |          |          |          |          |           | 4404.0557      |
| 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                                                              | 781.6000  | 640.4344  | 591.1391  | 405.9845  | 252.4448 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 364.1039 | 576.7429  | 791.6061 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |          |          |          |          |          |          |           | 4404.0557      |
| Space heating per m2                                                           |           |           |           |           |          |          |          |          |          |          |           | 49.6232 (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  | 1128.6602 | 888.5197 | 911.1547 | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (100)  |
| Utilisation                                         | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 0.5750    | 0.6492   | 0.6185   | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (101)  |
| Useful loss                                         | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 648.9428  | 576.7863 | 563.5730 | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (102)  |
| Total gains                                         | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 798.3949  | 765.3594 | 722.8263 | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (103)  |
| Space cooling kWh                                   | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 107.6055  | 140.2983 | 118.4845 | 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  | 26.9014   | 35.0746  | 29.6211  | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (107)  |
| Space cooling requirement                           |        |        |        |        |         |           |          |          |                          |         |        | 91.5971 (107) |
| Energy for space heating                            |        |        |        |        |         |           |          |          |                          |         |        | 49.6232 (99)  |
| Energy for space cooling                            |        |        |        |        |         |           |          |          |                          |         |        | 1.0321 (108)  |
| Total                                               |        |        |        |        |         |           |          |          |                          |         |        | 50.6552 (109) |
| Fabric Energy Efficiency (TFEE)                     |        |        |        |        |         |           |          |          |                          |         |        | 50.7 (109)    |



# Full SAP Calculation Printout



|                                    |                      |               |               |        |                |            |  |
|------------------------------------|----------------------|---------------|---------------|--------|----------------|------------|--|
| Property Reference                 | OP-D320 F2BULL       |               |               |        | Issued on Date | 29/11/2024 |  |
| Assessment Reference               | F2BULL               |               | Prop Type Ref | F2BULL |                |            |  |
| Property                           | F2BULL               |               |               |        |                |            |  |
|                                    |                      |               |               |        |                |            |  |
| SAP Rating                         | 77 C                 | DER           | 5.33          | TER    | 11.96          |            |  |
| Environmental                      | 95 A                 | % DER < TER   |               |        |                | 55.43      |  |
| CO <sub>2</sub> Emissions (t/year) | 0.44                 | DFEE          | 49.79         | TFEE   | 50.66          |            |  |
| Compliance Check                   | See BREL             | % DFEE < TFEE |               |        |                | 1.71       |  |
| % DPER < TPER                      | 11.86                | DPER          | 56.05         | TPER   | 63.59          |            |  |
|                                    |                      |               |               |        |                |            |  |
| 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                                           | 14.2700 (1b)              | x 2.5000 (2b)                     | = 35.6750 (1b) - (3b)       |
| First floor                                            | 74.4800 (1c)              | x 2.3600 (2c)                     | = 175.7728 (1c) - (3c)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 88.7500                   |                                   | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 211.4478 (5)                |

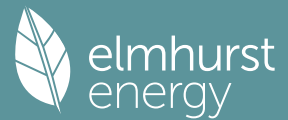
## 2. Ventilation rate

|                                                                                                         | 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) =            | 71.2000 (23c)                                                                                                                            |
| Effective ac                                                                                            | 0.3337 0.3299 0.3262 0.3076 0.3039 0.2853 0.2853 0.2816 0.2927 0.3039 0.3113 0.3188 (25)                                                 |

## 3. Heat losses and heat loss parameter

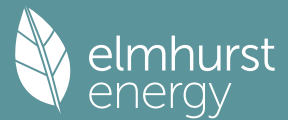
| Element                                                        | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K |
|----------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|---------------|
| Front Door                                                     |                         |                            | 6.4200                    | 1.0000                        | 6.4200       |                                | (26)          |
| Windows (Uw = 1.30)                                            |                         |                            | 10.9600                   | 1.2357                        | 13.5437      |                                | (27)          |
| Ground Floor                                                   |                         |                            | 14.2700                   | 0.1100                        | 1.5697       |                                | (28a)         |
| Exposed Floor                                                  |                         |                            | 60.2100                   | 0.1400                        | 8.4294       |                                | (28b)         |
| External Wall                                                  | 104.5100                | 15.2400                    | 89.2700                   | 0.1700                        | 15.1759      |                                | (29a)         |
| Semi Exposed                                                   | 30.7900                 | 2.1400                     | 28.6500                   | 0.1700                        | 4.8705       |                                | (29a)         |
| Roof - ceiling                                                 | 74.4800                 |                            | 74.4800                   | 0.1100                        | 8.1928       |                                | (30)          |
| Total net area of external elements Aum (A, m <sup>2</sup> )   |                         |                            | 284.2600                  |                               |              |                                | (31)          |
| Fabric heat loss, W/K = Sum (A x U)                            |                         |                            | (26)...(30) + (32) =      |                               | 58.2020      |                                | (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)               |                         |                            |                           | 12.3700                       | 0.0500       | 0.6185                         |               |

# Full SAP Calculation Printout



|                                                                                     |          |          |          |          |          |          |          |          |                       |          |          |           |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------------|----------|----------|-----------|
| E3 Sill                                                                             |          |          |          |          |          | 9.3100   | 0.0500   | 0.4655   |                       |          |          |           |
| E4 Jamb                                                                             |          |          |          |          |          | 28.8000  | 0.0500   | 1.4400   |                       |          |          |           |
| E5 Ground floor (normal)                                                            |          |          |          |          |          | 18.3200  | 0.1600   | 2.9312   |                       |          |          |           |
| E6 Intermediate floor within a dwelling                                             |          |          |          |          |          | 6.0200   | 0.0000   | 0.0000   |                       |          |          |           |
| E10 Baves (insulation at ceiling level)                                             |          |          |          |          |          | 23.6100  | 0.0600   | 1.4166   |                       |          |          |           |
| E12 Gable (insulation at ceiling level)                                             |          |          |          |          |          | 14.2900  | 0.0600   | 0.8574   |                       |          |          |           |
| E16 Corner (normal)                                                                 |          |          |          |          |          | 24.1700  | 0.0900   | 2.1753   |                       |          |          |           |
| E20 Exposed floor (normal)                                                          |          |          |          |          |          | 31.8800  | 0.3200   | 10.2016  |                       |          |          |           |
| E21 Exposed floor (inverted)                                                        |          |          |          |          |          | 12.3000  | 0.3200   | 3.9360   |                       |          |          |           |
| E17 Corner (inverted - internal area greater than external area)                    |          |          |          |          |          | 4.7200   | -0.0900  | -0.4248  |                       |          |          |           |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)                          |          |          |          |          |          |          |          |          |                       |          | 23.6173  | (36)      |
| Point Thermal bridges                                                               |          |          |          |          |          |          |          |          |                       |          | 0.0000   |           |
| Total fabric heat loss                                                              |          |          |          |          |          |          |          |          | (33) + (36) + (36a) = |          | 81.8193  | (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                                                                 | 23.2818  | 23.0223  | 22.7628  | 21.4654  | 21.2059  | 19.9085  | 19.9085  | 19.6490  | 20.4274               | 21.2059  | 21.7249  | 22.2438   |
| Average = Sum(39)m / 12 =                                                           | 105.1011 | 104.8416 | 104.5821 | 103.2847 | 103.0252 | 101.7278 | 101.7278 | 101.4683 | 102.2468              | 103.0252 | 103.5442 | 104.0632  |
|                                                                                     |          |          |          |          |          |          |          |          |                       |          |          | 103.2198  |
| HLP                                                                                 | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep                   | Oct      | Nov      | Dec       |
| HLP (average)                                                                       | 1.1842   | 1.1813   | 1.1784   | 1.1638   | 1.1608   | 1.1462   | 1.1462   | 1.1433   | 1.1521                | 1.1608   | 1.1667   | 1.1725    |
| Days in mont                                                                        | 31       | 28       | 31       | 30       | 31       | 30       | 31       | 31       | 30                    | 31       | 30       | 31        |
|                                                                                     |          |          |          |          |          |          |          |          |                       |          |          | 1.1630    |
|                                                                                     |          |          |          |          |          |          |          |          |                       |          |          |           |
| 4. Water heating energy requirements (kWh/year)                                     |          |          |          |          |          |          |          |          |                       |          |          |           |
| Assumed occupancy                                                                   |          |          |          |          |          |          |          |          |                       |          |          | 2.6082    |
| Hot water usage for mixer showers                                                   |          |          |          |          |          |          |          |          |                       |          |          | 93.0747   |
| Hot water usage for baths                                                           |          |          |          |          |          |          |          |          |                       |          |          | 30.7844   |
| Hot water usage for other uses                                                      |          |          |          |          |          |          |          |          |                       |          |          | 43.5166   |
| Average daily hot water use (litres/day)                                            |          |          |          |          |          |          |          |          |                       |          |          | 154.3412  |
| Daily hot water use                                                                 | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep                   | Oct      | Nov      | Dec       |
| Energy conte                                                                        | 167.8382 | 164.3929 | 160.1184 | 153.4301 | 148.0667 | 142.2736 | 139.9081 | 144.1626 | 148.6694              | 154.7692 | 161.5662 | 167.3758  |
| Energy content (annual)                                                             | 265.8146 | 234.0933 | 246.0960 | 210.0381 | 199.3263 | 174.9419 | 169.2067 | 178.5034 | 183.3242              | 210.0204 | 230.1806 | 262.0700  |
| Distribution loss (46)m = 0.15 x (45)m                                              |          |          |          |          |          |          |          |          |                       |          |          | 2563.6155 |
| Water storage loss:                                                                 |          |          |          |          |          |          |          |          |                       |          |          |           |
| Store volume                                                                        |          |          |          |          |          |          |          |          |                       |          |          | 230.0000  |
| a) If manufacturer declared loss factor is known (kWh/day):                         |          |          |          |          |          |          |          |          |                       |          |          | 1.8000    |
| Temperature factor from Table 2b                                                    |          |          |          |          |          |          |          |          |                       |          |          | 0.7800    |
| Enter (49) or (54) in (55)                                                          |          |          |          |          |          |          |          |          |                       |          |          | 1.4040    |
| Total storage loss                                                                  |          |          |          |          |          |          |          |          |                       |          |          |           |
| If cylinder contains dedicated solar storage                                        |          |          |          |          |          |          |          |          |                       |          |          |           |
| Primary loss                                                                        |          |          |          |          |          |          |          |          |                       |          |          |           |
| Combi loss                                                                          |          |          |          |          |          |          |          |          |                       |          |          |           |
| Total heat required for water heating calculated for each month                     |          |          |          |          |          |          |          |          |                       |          |          |           |
| WWHRS                                                                               |          |          |          |          |          |          |          |          |                       |          |          |           |
| PV diverter                                                                         |          |          |          |          |          |          |          |          |                       |          |          |           |
| Solar input                                                                         |          |          |          |          |          |          |          |          |                       |          |          |           |
| FGHRS                                                                               |          |          |          |          |          |          |          |          |                       |          |          |           |
| Output from w/h                                                                     |          |          |          |          |          |          |          |          |                       |          |          |           |
| 12Total per year (kWh/year)                                                         |          |          |          |          |          |          |          |          |                       |          |          |           |
| Electric shower(s)                                                                  |          |          |          |          |          |          |          |          |                       |          |          |           |
| Heat gains from water heating, kWh/month                                            |          |          |          |          |          |          |          |          |                       |          |          |           |
| 5. Internal gains (see Table 5 and 5a)                                              |          |          |          |          |          |          |          |          |                       |          |          |           |
| Metabolic gains (Table 5), Watts                                                    |          |          |          |          |          |          |          |          |                       |          |          |           |
| (66)m                                                                               | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep                   | Oct      | Nov      | Dec       |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     |          |          |          |          |          |          |          |          |                       |          |          |           |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 |          |          |          |          |          |          |          |          |                       |          |          |           |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    |          |          |          |          |          |          |          |          |                       |          |          |           |
| Pumps, fans                                                                         |          |          |          |          |          |          |          |          |                       |          |          |           |
| Losses e.g. evaporation (negative values) (Table 5)                                 |          |          |          |          |          |          |          |          |                       |          |          |           |
| Water heating gains (Table 5)                                                       |          |          |          |          |          |          |          |          |                       |          |          |           |
| Total internal gains                                                                |          |          |          |          |          |          |          |          |                       |          |          |           |
| 6. Solar gains                                                                      |          |          |          |          |          |          |          |          |                       |          |          |           |
| [Jan]                                                                               |          |          |          |          |          |          |          |          |                       |          |          |           |
| Area                                                                                |          |          |          |          |          |          |          |          |                       |          |          |           |
| Solar flux                                                                          |          |          |          |          |          |          |          |          |                       |          |          |           |
| Specific data                                                                       |          |          |          |          |          |          |          |          |                       |          |          |           |
| Specific data                                                                       |          |          |          |          |          |          |          |          |                       |          |          |           |
| Access factor                                                                       |          |          |          |          |          |          |          |          |                       |          |          |           |
| Gains                                                                               |          |          |          |          |          |          |          |          |                       |          |          |           |
| North                                                                               |          |          |          |          |          |          |          |          |                       |          |          |           |
| South                                                                               |          |          |          |          |          |          |          |          |                       |          |          |           |
| West                                                                                |          |          |          |          |          |          |          |          |                       |          |          |           |

# Full SAP Calculation Printout



|             |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Solar gains | 78.6612  | 135.9940 | 193.6119 | 256.1471 | 304.3580 | 310.5325 | 295.8495 | 258.1392 | 214.7502 | 152.1213 | 94.5295  | 67.1451 (83)  |
| Total gains | 687.0344 | 757.9683 | 789.4384 | 830.1981 | 849.4651 | 802.1281 | 767.4391 | 731.4268 | 703.5046 | 692.8386 | 668.7135 | 663.3984 (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                                                                         | 23.4562 | 23.5143 | 23.5726 | 23.8688 | 23.9289 | 24.2341 | 24.2341 | 24.2960 | 24.1111 | 23.9289 | 23.8089 | 23.6902      |
| alpha                                                                       | 2.5637  | 2.5676  | 2.5715  | 2.5913  | 2.5953  | 2.6156  | 2.6156  | 2.6197  | 2.6074  | 2.5953  | 2.5873  | 2.5793       |
| util living area                                                            | 0.9430  | 0.9252  | 0.9009  | 0.8489  | 0.7638  | 0.6445  | 0.5141  | 0.5495  | 0.7238  | 0.8560  | 0.9213  | 0.9474 (86)  |
| Living                                                                      | 18.4856 | 18.7572 | 19.1678 | 19.7537 | 20.2919 | 20.6915 | 20.8779 | 20.8507 | 20.5493 | 19.9049 | 19.1194 | 18.4470      |
| Non living                                                                  | 17.0167 | 17.3591 | 17.8764 | 18.6090 | 19.2562 | 19.7132 | 19.8917 | 19.8729 | 19.5669 | 18.8068 | 17.8279 | 16.9735      |
| 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                                                                         | 19.7137 | 18.7572 | 19.1678 | 19.7537 | 20.2919 | 20.6915 | 20.8779 | 20.8507 | 20.5493 | 19.9049 | 19.1194 | 18.8042 (87) |
| Th 2                                                                        | 19.9326 | 19.9350 | 19.9373 | 19.9491 | 19.9514 | 19.9633 | 19.9633 | 19.9656 | 19.9585 | 19.9514 | 19.9467 | 19.9420 (88) |
| util rest of house                                                          | 0.9349  | 0.9145  | 0.8860  | 0.8245  | 0.7221  | 0.5746  | 0.4143  | 0.4518  | 0.6625  | 0.8281  | 0.9083  | 0.9398 (89)  |
| MIT 2                                                                       | 18.7701 | 17.3591 | 17.8764 | 18.6090 | 19.2562 | 19.7132 | 19.8917 | 19.8729 | 19.5669 | 18.8068 | 17.8279 | 17.5085 (90) |
| Living area fraction                                                        | 19.0391 | 17.7577 | 18.2446 | 18.9354 | 19.5515 | 19.9921 | 20.1729 | 20.1517 | 19.8470 | 19.1198 | 18.1961 | 0.2851 (91)  |
| MIT                                                                         | 19.0391 | 17.7577 | 18.2446 | 18.9354 | 19.5515 | 19.9921 | 20.1729 | 20.1517 | 19.8470 | 19.1198 | 18.1961 | 17.8778 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT                                                                | 19.0391 | 17.7577 | 18.2446 | 18.9354 | 19.5515 | 19.9921 | 20.1729 | 20.1517 | 19.8470 | 19.1198 | 18.1961 | 17.8778 (93) |

## 8. Space heating requirement

|                                                                                |           |           |           |           |          |          |          |          |          |               |           |                |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|---------------|-----------|----------------|
|                                                                                | Jan       | Feb       | Mar       | Apr       | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov       | Dec            |
| Utilisation                                                                    | 0.9267    | 0.8855    | 0.8556    | 0.7961    | 0.7040   | 0.5767   | 0.4358   | 0.4707   | 0.6551   | 0.8010        | 0.8797    | 0.9203 (94)    |
| Useful gains                                                                   | 636.7053  | 671.1896  | 675.4239  | 660.9553  | 598.0017 | 462.5962 | 334.4238 | 344.2590 | 460.8563 | 554.9330      | 588.2680  | 610.5161 (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                                                               | 1549.0990 | 1348.0199 | 1228.2729 | 1036.4988 | 808.8995 | 548.5233 | 363.4585 | 380.6737 | 587.6072 | 877.7547      | 1148.9319 | 1423.3575 (97) |
| Space heating kWh                                                              | 678.8209  | 454.8300  | 411.3197  | 270.3913  | 156.9080 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 240.1793      | 403.6780  | 604.7540 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |          |          |          |          |          |               |           | 3220.8812      |
| 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                                                              | 678.8209  | 454.8300  | 411.3197  | 270.3913  | 156.9080 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 240.1793      | 403.6780  | 604.7540 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |          |          |          |          |          |               |           | 3220.8812      |
| Space heating per m2                                                           |           |           |           |           |          |          |          |          |          | (98c) / (4) = |           | 36.2916 (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 %)                                                             |          |          |          |          |          |          |          |          |          |          |          | 250.4344 (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                                                                                    | 678.8209 | 454.8300 | 411.3197 | 270.3913 | 156.9080 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 240.1793 | 403.6780 | 604.7540 (98)   |
| Space heating efficiency (main heating system 1)                                                             | 250.4344 | 250.4344 | 250.4344 | 250.4344 | 250.4344 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 250.4344 | 250.4344 | 250.4344 (210)  |
| Space heating fuel (main heating system)                                                                     | 271.0573 | 181.6164 | 164.2424 | 107.9689 | 62.6543  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 95.9051  | 161.1911 | 241.4820 (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                                                                                    | 364.1962 | 322.9541 | 344.4776 | 305.2461 | 297.7079 | 239.5739 | 235.9931 | 245.2898 | 247.9562 | 308.4020 | 325.3886 | 360.4516 (64)   |
| Efficiency of water heater (217)m                                                                            | 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                                                                            | 135.1779 | 119.8701 | 127.8590 | 113.2975 | 110.4996 | 88.9221  | 87.5930  | 91.0436  | 92.0333  | 114.4689 | 120.7738 | 133.7880 (219)  |
| Space cooling fuel requirement (221)m                                                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)    |
| Pumps and Fa                                                                                                 | 32.5137  | 29.3672  | 32.5137  | 31.4648  | 32.5137  | 31.4648  | 32.5137  | 32.5137  | 31.4648  | 32.5137  | 31.4648  | 32.5137 (231)   |
| Lighting                                                                                                     | 27.3666  | 21.9545  | 19.7676  | 14.4826  | 11.1868  | 9.1397   | 10.2049  | 13.2648  | 17.2296  | 22.6062  | 25.5336  | 28.1272 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity) (233a)m                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (233a)   |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)   |
| Electricity generated by PVs (Appendix M) (negative quantity) (233b)m                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (233b)   |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234b)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235d)   |
| Annual totals kWh/year                                                                                       |          |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating fuel - main system 1                                                                           |          |          |          |          |          |          |          |          |          |          |          | 1286.1175 (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                                                                                      |          |          |          |          |          |          |          |          |          |          |          | 1335.3267 (219) |

# Full SAP Calculation Printout



|                                                                                                               |                 |
|---------------------------------------------------------------------------------------------------------------|-----------------|
| Space cooling fuel                                                                                            | 0.0000 (221)    |
| Electricity for pumps and fans:<br>(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.4840) |                 |
| mechanical ventilation fans (SFP = 1.4840)                                                                    | 382.8220 (230a) |
| Total electricity for the above, kWh/year                                                                     | 382.8220 (231)  |
| Electricity for lighting (calculated in Appendix L)                                                           | 220.8639 (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                                                                           | 3225.1301 (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                   | 1286.1175          | 0.1546                        | 198.8245 (261)           |
| Total CO2 associated with community systems     |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                      | 1335.3267          | 0.1415                        | 188.9936 (264)           |
| Space and water heating                         |                    |                               | 387.8181 (265)           |
| Pumps, fans and electric keep-hot               | 382.8220           | 0.1387                        | 53.1021 (267)            |
| Energy for lighting                             | 220.8639           | 0.1443                        | 31.8775 (268)            |
| Total CO2, kg/year                              |                    |                               | 472.7977 (272)           |
| EPC Dwelling Carbon Dioxide Emission Rate (DER) |                    |                               | 5.3300 (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               | 1286.1175          | 1.5723                              | 2022.1543 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 1335.3267          | 1.5234                              | 2034.2153 (278)            |
| Space and water heating                     |                    |                                     | 4056.3696 (279)            |
| Pumps, fans and electric keep-hot           | 382.8220           | 1.5128                              | 579.1331 (281)             |
| Energy for lighting                         | 220.8639           | 1.5338                              | 338.7685 (282)             |
| Total Primary energy kWh/year               |                    |                                     | 4974.2712 (286)            |
| Dwelling Primary energy Rate (DPER)         |                    |                                     | 56.0500 (287)              |

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

### 1. Overall dwelling characteristics

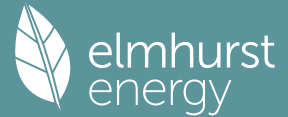
|                                                        | Area<br>(m2) | Storey height<br>(m)              | Volume<br>(m3)         |
|--------------------------------------------------------|--------------|-----------------------------------|------------------------|
| Ground floor                                           | 14.2700 (1b) | x 2.5000 (2b)                     | = 35.6750 (1b) - (3b)  |
| First floor                                            | 74.4800 (1c) | x 2.3600 (2c)                     | = 175.7728 (1c) - (3c) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 88.7500      |                                   | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 211.4478 (5)           |

### 2. Ventilation rate

|                                                                                                    | m3 per hour                             |
|----------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)                    |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)                    |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)                    |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)                    |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)                    |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)                    |
| Number of intermittent extract fans                                                                | 3 * 10 = 30.0000 (7a)                   |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)                    |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 30.0000 / (5) = 0.1419 (8)              |
| Pressure test                                                                                      | Yes                                     |
| Pressure Test Method                                                                               | Blower Door                             |
| Measured/design AP50                                                                               | 5.0000 (17)                             |
| Infiltration rate                                                                                  | 0.3919 (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) = 0.3331 (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 | 0.4247 | 0.4164 | 0.4080 | 0.3664 | 0.3581 | 0.3164 | 0.3164 | 0.3081 | 0.3331 | 0.3581 | 0.3747 | 0.3914 (22b) |
| Effective ac    | 0.5902 | 0.5867 | 0.5832 | 0.5671 | 0.5641 | 0.5501 | 0.5501 | 0.5475 | 0.5555 | 0.5641 | 0.5702 | 0.5766 (25)  |

# Full SAP Calculation Printout



## 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                                |             |                | 6.4200        | 1.0000           | 6.4200       |                   |               | (26)  |
| TER Opening Type (Uw = 1.20)                   |             |                | 10.9600       | 1.1450           | 12.5496      |                   |               | (27)  |
| Ground Floor                                   |             |                | 14.2700       | 0.1300           | 1.8551       |                   |               | (28a) |
| Exposed Floor                                  |             |                | 60.2100       | 0.1300           | 7.8273       |                   |               | (28b) |
| External Wall                                  | 104.5100    | 15.2400        | 89.2700       | 0.1800           | 16.0686      |                   |               | (29a) |
| Semi Exposed                                   | 30.7900     | 2.1400         | 28.6500       | 0.1800           | 5.1570       |                   |               | (29a) |
| Roof - ceiling                                 | 74.4800     |                | 74.4800       | 0.1100           | 8.1928       |                   |               | (30)  |
| Total net area of external elements Aum(A, m2) |             |                | 284.2600      |                  |              |                   |               | (31)  |
| Fabric heat loss, W/K = Sum (A x U)            |             |                |               |                  | 58.0704      |                   |               | (33)  |
| (26)...(30) + (32) =                           |             |                |               |                  |              |                   |               |       |

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)                 | 12.3700 | 0.0500    | 0.6185  |
| E3 Sill                                                          | 9.3100  | 0.0500    | 0.4655  |
| E4 Jamb                                                          | 28.8000 | 0.0500    | 1.4400  |
| E5 Ground floor (normal)                                         | 18.3200 | 0.1600    | 2.9312  |
| E6 Intermediate floor within a dwelling                          | 6.0200  | 0.0000    | 0.0000  |
| E10 Eaves (insulation at ceiling level)                          | 23.6100 | 0.0600    | 1.4166  |
| E12 Gable (insulation at ceiling level)                          | 14.2900 | 0.0600    | 0.8574  |
| E16 Corner (normal)                                              | 24.1700 | 0.0900    | 2.1753  |
| E20 Exposed floor (normal)                                       | 31.8800 | 0.3200    | 10.2016 |
| E21 Exposed floor (inverted)                                     | 12.3000 | 0.3200    | 3.9360  |
| E17 Corner (inverted - internal area greater than external area) | 4.7200  | -0.0900   | -0.4248 |

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

23.6173 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 81.6877 (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                     | 41.1818  | 40.9374  | 40.6979  | 39.5729  | 39.3624  | 38.3825  | 38.3825  | 38.2011  | 38.7599  | 39.3624  | 39.7882  | 40.2334  | (38) |
| Heat transfer coeff       | 122.8695 | 122.6251 | 122.3856 | 121.2606 | 121.0501 | 120.0702 | 120.0702 | 119.8888 | 120.4477 | 121.0501 | 121.4759 | 121.9211 | (39) |
| Average = Sum(39)m / 12 = |          |          |          |          |          |          |          |          |          |          |          | 121.2596 |      |

|               | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |      |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| HLP           | 1.3844 | 1.3817 | 1.3790 | 1.3663 | 1.3639 | 1.3529 | 1.3529 | 1.3509 | 1.3572 | 1.3639 | 1.3687 | 1.3738 | (40) |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 1.3663 |      |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31     |      |

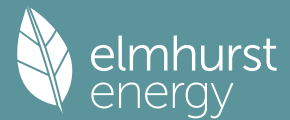
## 4. Water heating energy requirements (kWh/year)

|                                                                                |          |          |          |          |          |          |          |          |          |          |          |           |             |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-------------|
| Assumed occupancy                                                              |          |          |          |          |          |          |          |          |          |          |          |           | 2.6082 (42) |
| Hot water usage for mixer showers                                              |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 67.9510                                                                        | 66.9299  | 65.4418  | 62.5947  | 60.4936  | 58.1505  | 56.8187  | 58.2954  | 59.9143  | 62.4301  | 65.3384  | 67.6907  | 67.6907   | (42a)       |
| Hot water usage for baths                                                      |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 29.3444                                                                        | 28.9086  | 28.2949  | 27.1633  | 26.3160  | 25.3765  | 24.8690  | 25.4784  | 26.1420  | 27.1473  | 28.3022  | 29.2452  | 29.2452   | (42b)       |
| Hot water usage for other uses                                                 |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 41.3408                                                                        | 39.8375  | 38.3342  | 36.8309  | 35.3276  | 33.8243  | 33.8243  | 35.3276  | 36.8309  | 38.3342  | 39.8375  | 41.3408  | 41.3408   | (42c)       |
| Average daily hot water use (litres/day)                                       |          |          |          |          |          |          |          |          |          |          |          | 127.4380  | (43)        |
|                                                                                | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec       |             |
| Daily hot water use                                                            | 138.6362 | 135.6760 | 132.0709 | 126.5889 | 122.1372 | 117.3513 | 115.5120 | 119.1015 | 122.8871 | 127.9116 | 133.4780 | 138.2767  | (44)        |
| Energy conte                                                                   | 219.5659 | 193.2008 | 202.9881 | 173.2939 | 164.4202 | 144.2971 | 139.7017 | 147.4725 | 151.5321 | 173.5748 | 190.1639 | 216.5079  | (45)        |
| Energy content (annual)                                                        |          |          |          |          |          |          |          |          |          |          |          | 2116.7188 |             |
| Distribution loss (46)m = 0.15 x (45)m                                         |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 32.9349                                                                        | 28.9801  | 30.4482  | 25.9941  | 24.6630  | 21.6446  | 20.9553  | 22.1209  | 22.7298  | 26.0362  | 28.5246  | 32.4762  | 32.4762   | (46)        |
| Water storage loss:                                                            |          |          |          |          |          |          |          |          |          |          |          |           |             |
| Store volume                                                                   |          |          |          |          |          |          |          |          |          |          |          | 230.0000  | (47)        |
| a) If manufacturer declared loss factor is known (kWh/day):                    |          |          |          |          |          |          |          |          |          |          |          | 1.7973    | (48)        |
| Temperature factor from Table 2b                                               |          |          |          |          |          |          |          |          |          |          |          | 0.5400    | (49)        |
| Enter (49) or (54) in (55)                                                     |          |          |          |          |          |          |          |          |          |          |          | 0.9706    | (55)        |
| Total storage loss                                                             |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 30.0872                                                                        | 27.1756  | 30.0872  | 29.1167  | 30.0872  | 29.1167  | 30.0872  | 30.0872  | 29.1167  | 30.0872  | 29.1167  | 30.0872  | 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  | 30.0872   | (57)        |
| Primary loss                                                                   | 23.2624  | 21.0112  | 23.2624  | 22.5120  | 23.2624  | 22.5120  | 23.2624  | 23.2624  | 22.5120  | 23.2624  | 22.5120  | 23.2624   | (59)        |
| Combi loss                                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (61)        |
| Total heat required for water heating calculated for each month                |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 272.9155                                                                       | 241.3875 | 256.3377 | 224.9226 | 217.7698 | 195.9258 | 193.0513 | 200.8221 | 203.1608 | 226.9244 | 241.7925 | 269.8575 | 269.8575  | (62)        |
| WWHRS                                                                          | -31.0644 | -27.4736 | -28.7688 | -23.8217 | -22.2009 | -18.9975 | -17.8071 | -18.9361 | -19.6556 | -23.1717 | -26.2508 | -30.4891  | (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                                                                |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 241.8512                                                                       | 213.9139 | 227.5689 | 201.1009 | 195.5689 | 176.9283 | 175.2442 | 181.8860 | 183.5052 | 203.7527 | 215.5418 | 239.3684 | 239.3684  | (64)        |
| 12Total per year (kWh/year)                                                    |          |          |          |          |          |          |          |          |          |          |          | 2456.2304 | (64)        |
| Electric shower(s)                                                             |          |          |          |          |          |          |          |          |          |          |          | 2456      | (64)        |
| 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (64a)       |
|                                                                                |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (64a)       |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |          |          |          |          |          |          |          |          |           |             |
| Heat gains from water heating, kWh/month                                       |          |          |          |          |          |          |          |          |          |          |          |           |             |
| 115.6854                                                                       | 102.7887 | 110.1732 | 98.9232  | 97.3494  | 89.2817  | 89.1305  | 91.7143  | 91.6874  | 100.3933 | 104.5324 | 114.6686 | 114.6686  | (65)        |

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

|                                                                                     |          |          |          |          |          |          |          |          |          |          |          |          |      |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| Metabolic gains (Table 5), Watts                                                    |          |          |          |          |          |          |          |          |          |          |          |          |      |
| (66)m                                                                               | 130.4111 | 130.4111 | 130.4111 | 130.4111 | 130.4111 | 130.4111 | 130.4111 | 130.4111 | 130.4111 | 130.4111 | 130.4111 | 130.4111 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     |          |          |          |          |          |          |          |          |          |          |          |          |      |
| 131.7092                                                                            | 145.8209 | 131.7092 | 136.0995 | 131.7092 | 136.0995 | 131.7092 | 131.7092 | 136.0995 | 131.7092 | 136.0995 | 131.7092 | 131.7092 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 |          |          |          |          |          |          |          |          |          |          |          |          |      |
| 236.7592                                                                            | 239.2160 | 233.0249 | 219.8448 | 203.2072 | 187.5703 | 177.1238 | 174.6670 | 180.8581 | 194.0382 | 210.6758 | 226.3127 | 226.3127 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    |          |          |          |          |          |          |          |          |          |          |          |          |      |
| 36.0411                                                                             | 36.0411  | 36.0411  | 36.0411  | 36.0411  | 36.0411  | 36.0411  | 36.0411  | 36.0411  | 36.0411  | 36.0411  | 36.0411  | 36.0411  | (69) |
| Pumps, fans                                                                         | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 3.0000   | 3.0000   | 3.0000   | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 |          |          |          |          |          |          |          |          |          |          |          |          |      |

# Full SAP Calculation Printout



|                               |           |           |           |           |           |           |           |           |           |           |           |                |
|-------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
| Water heating gains (Table 5) | -104.3289 | -104.3289 | -104.3289 | -104.3289 | -104.3289 | -104.3289 | -104.3289 | -104.3289 | -104.3289 | -104.3289 | -104.3289 | -104.3289 (71) |
| Total internal gains          | 155.4911  | 152.9593  | 148.0823  | 137.3933  | 130.8460  | 124.0024  | 119.7991  | 123.2719  | 127.3436  | 134.9373  | 145.1839  | 154.1244 (72)  |
|                               | 589.0828  | 603.1195  | 577.9397  | 558.4609  | 530.8857  | 509.7955  | 490.7554  | 491.7714  | 506.4245  | 525.8080  | 557.0825  | 577.2697 (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       |          |          |          | 6.5200     | 10.6334                        |          | 0.6300                            |          | 0.7000                             |          | 0.7700                       |  | 21.1881 (74)  |
| South       |          |          |          | 3.7200     | 46.7521                        |          | 0.6300                            |          | 0.7000                             |          | 0.7700                       |  | 53.1515 (78)  |
| West        |          |          |          | 0.7200     | 19.6403                        |          | 0.6300                            |          | 0.7000                             |          | 0.7700                       |  | 4.3217 (80)   |
|             |          |          |          |            |                                |          |                                   |          |                                    |          |                              |  |               |
| Solar gains | 78.6612  | 135.9940 | 193.6119 | 256.1471   | 304.3580                       | 310.5325 | 295.8495                          | 258.1392 | 214.7502                           | 152.1213 | 94.5295                      |  | 67.1451 (83)  |
| Total gains | 667.7440 | 739.1136 | 771.5516 | 814.6080   | 835.2438                       | 820.3280 | 786.6049                          | 749.9106 | 721.1747                           | 677.9293 | 651.6120                     |  | 644.4148 (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                                                                         | 20.0642 | 20.1042 | 20.1435 | 20.3304 | 20.3658 | 20.5320 | 20.5320 | 20.5630 | 20.4676                   | 20.3658 | 20.2944 | 20.2203      |
| alpha                                                                       | 2.3376  | 2.3403  | 2.3429  | 2.3554  | 2.3577  | 2.3688  | 2.3688  | 2.3709  | 2.3645                    | 2.3577  | 2.3530  | 2.3480       |
| util living area                                                            | 0.9499  | 0.9348  | 0.9144  | 0.8708  | 0.7983  | 0.6799  | 0.5553  | 0.5899  | 0.7508                    | 0.8774  | 0.9319  | 0.9537 (86)  |
| MIT                                                                         | 17.9874 | 18.2704 | 18.7241 | 19.3801 | 20.0181 | 20.5476 | 20.8035 | 20.7655 | 20.3791                   | 19.5794 | 18.6905 | 17.9428 (87) |
| Th 2                                                                        | 19.7753 | 19.7774 | 19.7795 | 19.7893 | 19.7911 | 19.7996 | 19.7996 | 19.8012 | 19.7963                   | 19.7911 | 19.7874 | 19.7835 (88) |
| util rest of house                                                          | 0.9420  | 0.9245  | 0.9000  | 0.8469  | 0.7558  | 0.6027  | 0.4381  | 0.4766  | 0.6851                    | 0.8501  | 0.9194  | 0.9464 (89)  |
| MIT 2                                                                       | 16.3056 | 16.6632 | 17.2368 | 18.0598 | 18.8355 | 19.4418 | 19.6907 | 19.6624 | 19.2680                   | 18.3191 | 17.2053 | 16.2535 (90) |
| Living area fraction                                                        |         |         |         |         |         |         |         |         | fLA = Living area / (4) = |         |         | 0.2851 (91)  |
| MIT                                                                         | 16.7850 | 17.1214 | 17.6608 | 18.4362 | 19.1726 | 19.7570 | 20.0080 | 19.9769 | 19.5848                   | 18.6783 | 17.6287 | 16.7350 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |                           |         |         | 0.0000       |
| adjusted MIT                                                                | 16.7850 | 17.1214 | 17.6608 | 18.4362 | 19.1726 | 19.7570 | 20.0080 | 19.9769 | 19.5848                   | 18.6783 | 17.6287 | 16.7350 (93) |

## 8. Space heating requirement

|                                                                                |           |           |           |           |          |          |          |          |          |               |           |                |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|---------------|-----------|----------------|
| Utilisation                                                                    | Jan       | Feb       | Mar       | Apr       | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov       | Dec            |
|                                                                                | 0.9138    | 0.8930    | 0.8660    | 0.8127    | 0.7296   | 0.5996   | 0.4605   | 0.4951   | 0.6714   | 0.8173        | 0.8880    | 0.9194 (94)    |
| Useful gains                                                                   | 610.2047  | 660.0196  | 668.1663  | 662.0177  | 609.4195 | 491.8580 | 362.2514 | 371.2837 | 484.1959 | 554.0605      | 578.6106  | 592.4687 (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                                                               | 1534.0298 | 1498.6461 | 1365.9246 | 1156.3642 | 904.5608 | 619.2030 | 409.1946 | 428.8305 | 660.6263 | 977.8846      | 1278.9790 | 1528.2865 (97) |
| Space heating kWh                                                              | 687.3259  | 563.5570  | 519.1322  | 355.9295  | 219.5852 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 315.3252      | 504.2652  | 696.2484 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |          |          |          |          |          |               |           | 3861.3685      |
| 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                                                              | 687.3259  | 563.5570  | 519.1322  | 355.9295  | 219.5852 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 315.3252      | 504.2652  | 696.2484 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |          |          |          |          |          |               |           | 3861.3685      |
| Space heating per m2                                                           |           |           |           |           |          |          |          |          |          | (98c) / (4) = |           | 43.5084 (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)    |
| Space heating requirement                                                           | Jan      | Feb      | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep      | Oct      | Nov      | Dec             |
|                                                                                     | 687.3259 | 563.5570 | 519.1322  | 355.9295  | 219.5852  | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 315.3252 | 504.2652 | 696.2484 (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)                                            | 744.6651 | 610.5709 | 562.4400  | 385.6224  | 237.9037  | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 341.6308 | 546.3329 | 754.3320 (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                                                           | 241.8512 | 213.9139 | 227.5689  | 201.1009  | 195.5689  | 176.9283  | 175.2442  | 181.8860  | 183.5052 | 203.7527 | 215.5418 | 239.3684 (64)   |
| Efficiency of water heater (217)m                                                   | 86.2676  | 86.1274  | 85.8492   | 85.3258   | 84.3202   | 79.8000   | 79.8000   | 79.8000   | 79.8000  | 85.0355  | 85.8990  | 79.8000 (216)   |
| Fuel for water heating, kWh/month                                                   | 280.3500 | 248.3692 | 265.0799  | 235.6859  | 231.9360  | 221.7146  | 219.6043  | 227.9273  | 229.9565 | 239.6090 | 250.9246 | 277.3369 (219)  |
| Space cooling fuel requirement                                                      |          |          |           |           |           |           |           |           |          |          |          |                 |
| (221)m                                                                              | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000 (221)    |
| Pumps and Fa                                                                        | 7.3041   | 6.5973   | 7.3041    | 7.0685    | 7.3041    | 7.0685    | 7.3041    | 7.3041    | 7.0685   | 7.3041   | 7.0685   | 7.3041 (231)    |
| Lighting                                                                            | 27.3666  | 21.9545  | 19.7676   | 14.4826   | 11.1868   | 9.1397    | 10.2049   | 13.2648   | 17.2296  | 22.6062  | 25.5336  | 28.1272 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity)                       |          |          |           |           |           |           |           |           |          |          |          |                 |
| (233a)m                                                                             | -60.0364 | -80.1350 | -109.1027 | -115.9672 | -119.6656 | -109.8086 | -108.4274 | -104.9195 | -98.0506 | -88.3427 | -64.3756 | -52.4500 (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)             |          |          |           |           |           |           |           |           |          |          |          |                 |
| (234a)m                                                                             | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) |          |          |           |           |           |           |           |           |          |          |          |                 |
| (235a)m                                                                             | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)   |

# Full SAP Calculation Printout



|                                                                                                      |          |           |           |           |           |           |           |           |           |          |          |        |            |        |
|------------------------------------------------------------------------------------------------------|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|----------|--------|------------|--------|
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |           |           |           |           |           |           |           |           |          |          |        |            |        |
| (235c)m                                                                                              | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000 | 0.0000     | (235c) |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |           |           |           |           |           |           |           |           |          |          |        |            |        |
| (233b)m                                                                                              | -49.0170 | -100.9293 | -196.7412 | -290.1000 | -378.5568 | -374.1202 | -319.0044 | -236.8551 | -142.4468 | -64.7992 | -38.9281 |        |            | (233b) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |           |           |           |           |           |           |           |           |          |          |        |            |        |
| (234b)m                                                                                              | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000 | 0.0000     | (234b) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |           |           |           |           |           |           |           |           |          |          |        |            |        |
| (235b)m                                                                                              | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000 | 0.0000     | (235b) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |           |           |           |           |           |           |           |           |          |          |        |            |        |
| (235d)m                                                                                              | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000 | 0.0000     | (235d) |
| Annual totals kWh/year                                                                               |          |           |           |           |           |           |           |           |           |          |          |        |            |        |
| Space heating fuel - main system 1                                                                   |          |           |           |           |           |           |           |           |           |          |          |        | 4183.4978  | (211)  |
| Space heating fuel - main system 2                                                                   |          |           |           |           |           |           |           |           |           |          |          |        | 0.0000     | (213)  |
| Space heating fuel - secondary                                                                       |          |           |           |           |           |           |           |           |           |          |          |        | 0.0000     | (215)  |
| Efficiency of water heater                                                                           |          |           |           |           |           |           |           |           |           |          |          |        | 79.8000    |        |
| Water heating fuel used                                                                              |          |           |           |           |           |           |           |           |           |          |          |        | 2928.4943  | (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)                                                  |          |           |           |           |           |           |           |           |           |          |          |        | 220.8639   | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |           |           |           |           |           |           |           |           |          |          |        |            |        |
| PV generation                                                                                        |          |           |           |           |           |           |           |           |           |          |          |        | -3681.3606 | (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                                                                  |          |           |           |           |           |           |           |           |           |          |          |        | 3737.4954  | (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                 | 4183.4978          | 0.2100                        | 878.5345 (261)           |
| Total CO2 associated with community systems   |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                    | 2928.4943          | 0.2100                        | 614.9838 (264)           |
| Space and water heating                       |                    |                               | 1493.5183 (265)          |
| Pumps, fans and electric keep-hot             | 86.0000            | 0.1387                        | 11.9293 (267)            |
| Energy for lighting                           | 220.8639           | 0.1443                        | 31.8775 (268)            |
| Energy saving/generation technologies         |                    |                               |                          |
| PV Unit electricity used in dwelling          | -1111.2811         | 0.1358                        | -150.8897                |
| PV Unit electricity exported                  | -2570.0795         | 0.1264                        | -324.9804                |
| Total                                         |                    |                               | -475.8701 (269)          |
| Total CO2, kg/year                            |                    |                               | 1061.4549 (272)          |
| EPC Target Carbon Dioxide Emission Rate (TER) |                    |                               | 11.9600 (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               | 4183.4978          | 1.1300                              | 4727.3525 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 2928.4943          | 1.1300                              | 3309.1986 (278)            |
| Space and water heating                     |                    |                                     | 8036.5511 (279)            |
| Pumps, fans and electric keep-hot           | 86.0000            | 1.5128                              | 130.1008 (281)             |
| Energy for lighting                         | 220.8639           | 1.5338                              | 338.7685 (282)             |
| Energy saving/generation technologies       |                    |                                     |                            |
| PV Unit electricity used in dwelling        | -1111.2811         | 1.5019                              | -1669.0165                 |
| PV Unit electricity exported                | -2570.0795         | 0.4642                              | -1192.9649                 |
| Total                                       |                    |                                     | -2861.9814 (283)           |
| Total Primary energy kWh/year               |                    |                                     | 5643.4389 (286)            |
| Target Primary Energy Rate (TPER)           |                    |                                     | 63.5900 (287)              |