

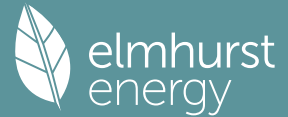
# Supporting SAP Worksheets for Energy Statement

Mr Vladimir Skiguine and Ms  
Irina Galikhanova

Oak Lawn  
Compton Avenue  
London  
N6 4LB  
London Borough of Haringey



# Full SAP Calculation Printout



|                                    |                                          |               |       |                |            |
|------------------------------------|------------------------------------------|---------------|-------|----------------|------------|
| Property Reference                 | New Design House                         |               |       | Issued on Date | 11/01/2024 |
| Assessment Reference               | Green                                    | Prop Type Ref |       |                |            |
| Property                           | Oak Lawn, Compton Avenue, London, N6 4LB |               |       |                |            |
|                                    |                                          |               |       |                |            |
| SAP Rating                         | 89 B                                     | DER           | 1.73  | TER            | 9.31       |
| Environmental                      | 98 A                                     | % DER < TER   |       |                | 81.42      |
| CO <sub>2</sub> Emissions (t/year) | 2.33                                     | DFEE          | 47.56 | TFEE           | 48.80      |
| Compliance Check                   | See BREL                                 | % DFEE < TFEE |       |                | 2.54       |
| % DPER < TPER                      | 64.69                                    | DPER          | 17.75 | TPER           | 50.27      |
|                                    |                                          |               |       |                |            |
| Assessor Details                   | Mr. Malcolm Maclean                      |               |       | Assessor ID    | V497-0002  |
| 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> ) |
|---------------------------------------------------------|---------------------------|------------------------------------|-----------------------------|
| Basement floor                                          | 460.0000 (1a)             | x 3.0500 (2a)                      | = 1403.0000 (1a) - (3a)     |
| Ground floor                                            | 384.6600 (1b)             | x 4.2000 (2b)                      | = 1615.5720 (1b) - (3b)     |
| First floor                                             | 332.1000 (1c)             | x 3.3300 (2c)                      | = 1105.8930 (1c) - (3c)     |
| Second floor                                            | 291.5200 (1d)             | x 2.7400 (2d)                      | = 798.7648 (1d) - (3d)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)... (1n) | 1468.2800                 |                                    | (4)                         |
| Dwelling volume                                         |                           | (3a)+(3b)+(3c)+(3d)+(3e)... (3n) = | 4923.2298 (5)               |

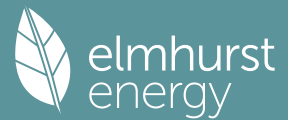
## 2. Ventilation rate

|                                                                                                         |        |        |        |        |        |        |        |        |        |        |                                         |              |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-----------------------------------------|--------------|
|                                                                                                         |        |        |        |        |        |        |        |        |        |        | m3 per hour                             |              |
| Number of open chimneys                                                                                 |        |        |        |        |        |        |        |        |        |        | 0 * 80 =                                | 0.0000 (6a)  |
| Number of open flues                                                                                    |        |        |        |        |        |        |        |        |        |        | 0 * 20 =                                | 0.0000 (6b)  |
| Number of chimneys / flues attached to closed fire                                                      |        |        |        |        |        |        |        |        |        |        | 0 * 10 =                                | 0.0000 (6c)  |
| Number of flues attached to solid fuel boiler                                                           |        |        |        |        |        |        |        |        |        |        | 0 * 20 =                                | 0.0000 (6d)  |
| Number of flues attached to other heater                                                                |        |        |        |        |        |        |        |        |        |        | 0 * 35 =                                | 0.0000 (6e)  |
| Number of blocked chimneys                                                                              |        |        |        |        |        |        |        |        |        |        | 0 * 20 =                                | 0.0000 (6f)  |
| Number of intermittent extract fans                                                                     |        |        |        |        |        |        |        |        |        |        | 0 * 10 =                                | 0.0000 (7a)  |
| Number of passive vents                                                                                 |        |        |        |        |        |        |        |        |        |        | 0 * 10 =                                | 0.0000 (7b)  |
| Number of flueless gas fires                                                                            |        |        |        |        |        |        |        |        |        |        | 0 * 40 =                                | 0.0000 (7c)  |
|                                                                                                         |        |        |        |        |        |        |        |        |        |        | Air changes per hour                    |              |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =      |        |        |        |        |        |        |        |        |        |        | 0.0000 / (5) =                          | 0.0000 (8)   |
| Pressure test                                                                                           |        |        |        |        |        |        |        |        |        |        | Yes                                     |              |
| Pressure Test Method                                                                                    |        |        |        |        |        |        |        |        |        |        | Blower Door                             |              |
| Measured/design AP50                                                                                    |        |        |        |        |        |        |        |        |        |        | 3.0000 (17)                             |              |
| Infiltration rate                                                                                       |        |        |        |        |        |        |        |        |        |        | 0.1500 (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) = 0.1275 (21)        |              |
|                                                                                                         |        |        |        |        |        |        |        |        |        |        |                                         |              |
| Wind speed                                                                                              | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov                                     | Dec          |
| Wind factor                                                                                             | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000                                  | 4.7000 (22)  |
| Wind factor                                                                                             | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250                                  | 1.1750 (22a) |
| Adj infilt rate                                                                                         |        |        |        |        |        |        |        |        |        |        |                                         |              |
|                                                                                                         | 0.1626 | 0.1594 | 0.1562 | 0.1403 | 0.1371 | 0.1211 | 0.1211 | 0.1179 | 0.1275 | 0.1371 | 0.1434                                  | 0.1498 (22b) |
| Balanced mechanical ventilation with heat recovery                                                      |        |        |        |        |        |        |        |        |        |        |                                         |              |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |                                         |              |
|                                                                                                         |        |        |        |        |        |        |        |        |        |        |                                         |              |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |                                         |              |
|                                                                                                         |        |        |        |        |        |        |        |        |        |        |                                         |              |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =            |        |        |        |        |        |        |        |        |        |        |                                         |              |
|                                                                                                         |        |        |        |        |        |        |        |        |        |        |                                         |              |
| Effective ac                                                                                            | 0.2846 | 0.2814 | 0.2782 | 0.2622 | 0.2591 | 0.2431 | 0.2431 | 0.2399 | 0.2495 | 0.2591 | 0.2654                                  | 0.2718 (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 |
|--------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|---------------|
| Window (Uw = 1.20) |                         |                            | 130.3600                  | 1.1450                        | 149.2672     |                                | (27)          |
| External Door      |                         |                            | 5.3400                    | 1.2000                        | 6.4080       |                                | (26)          |
| Basement Floor     |                         |                            | 396.1900                  | 0.1000                        | 39.6190      |                                | (28a)         |
| Basement Pool      |                         |                            | 64.0200                   | 0.2200                        | 14.0844      |                                | (28a)         |
| Ground Floor       |                         |                            | 59.7800                   | 0.1192                        | 7.1232       |                                | (28a)         |
| Basement Wall      | 312.6300                | 2.4600                     | 310.1700                  | 0.1800                        | 55.8306      |                                | (29a)         |
| Ground Floor       | 388.2100                | 77.1700                    | 311.0400                  | 0.1700                        | 52.8768      |                                | (29a)         |
| First Floor        | 264.7400                | 40.7800                    | 223.9600                  | 0.1700                        | 38.0732      |                                | (29a)         |
| Second Floor       | 35.0600                 |                            | 35.0600                   | 0.1700                        | 5.9602       |                                | (29a)         |
| Dormer Walls       | 27.9600                 | 15.2900                    | 12.6700                   | 0.2000                        | 2.5340       |                                | (29a)         |
| Loft Walls         | 0.1000                  |                            | 0.1000                    | 0.1600                        | 0.0160       |                                | (29a)         |
| Main Flat Roof     | 155.5800                |                            | 155.5800                  | 0.1200                        | 18.6696      |                                | (30)          |

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|                                                |          |                      |          |         |      |
|------------------------------------------------|----------|----------------------|----------|---------|------|
| Flat Roof GF                                   | 46.7600  | 46.7600              | 0.1200   | 5.6112  | (30) |
| Loft Insulation                                | 45.5900  | 45.5900              | 0.1221   | 5.5650  | (30) |
| Main Pitched Roof                              | 334.2000 | 334.2000             | 0.1200   | 40.1040 | (30) |
| Dormer Roofs                                   | 63.2200  | 63.2200              | 0.1500   | 9.4830  | (30) |
| Bridge over Basement                           | 129.7300 | 129.7300             | 0.1800   | 23.3514 | (30) |
| Total net area of external elements Aum(A, m2) |          | 2323.7700            |          |         | (31) |
| Fabric heat loss, W/K = Sum (A x U)            |          | (26)...(30) + (32) = | 474.5767 |         | (33) |

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)

|                                                                  |  |          |           |         |  |
|------------------------------------------------------------------|--|----------|-----------|---------|--|
| List of Thermal Bridges                                          |  |          |           |         |  |
| K1 Element                                                       |  | Length   | Psi-value | Total   |  |
| E5 Ground floor (normal)                                         |  | 21.3500  | 0.1600    | 3.4160  |  |
| E19 Ground floor (inverted)                                      |  | 14.1200  | 0.0700    | 0.9884  |  |
| E22 Basement floor                                               |  | 102.4700 | 0.2200    | 22.5434 |  |
| E6 Intermediate floor within a dwelling                          |  | 224.3800 | 0.0000    | 0.0000  |  |
| E11 Eaves (insulation at rafter level)                           |  | 76.9600  | 0.0400    | 3.0784  |  |
| E14 Flat roof                                                    |  | 53.8700  | 0.0800    | 4.3096  |  |
| E16 Corner (normal)                                              |  | 78.5400  | 0.0900    | 7.0686  |  |
| E17 Corner (inverted - internal area greater than external area) |  | 39.2700  | -0.0900   | -3.5343 |  |
| E2 Other lintels (including other steel lintels)                 |  | 60.3800  | 0.0500    | 3.0190  |  |
| E3 Sill                                                          |  | 58.2000  | 0.0500    | 2.9100  |  |
| E4 Jamb                                                          |  | 199.9800 | 0.0500    | 9.9990  |  |
| R4 Ridge (vaulted ceiling)                                       |  | 6.5600   | 0.0800    | 0.5248  |  |
| R5 Ridge (inverted)                                              |  | 0.0400   | 0.0400    | 0.0016  |  |

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 54.3245 (36)  
 Point Thermal bridges (36a) = 0.0000  
 Total fabric heat loss (33) + (36) + (36a) = 528.9012 (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                                                               | 462.3190 | 457.1403 | 451.9617 | 426.0686 | 420.8900 | 394.9969 | 394.9969 | 389.8183 | 405.3541 | 420.8900 | 431.2472 | 441.6045 |
| Heat transfer coeff                                                 | 991.2202 | 986.0416 | 980.8630 | 954.9699 | 949.7912 | 923.8981 | 923.8981 | 918.7195 | 934.2554 | 949.7912 | 960.1485 | 970.5057 |
| Average = Sum(39)m / 12 =                                           |          |          |          |          |          |          |          |          |          |          |          | 953.6752 |

|               |        |        |        |        |        |        |        |        |        |        |        |        |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|               | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |
| HLP           | 0.6751 | 0.6716 | 0.6680 | 0.6504 | 0.6469 | 0.6292 | 0.6292 | 0.6257 | 0.6363 | 0.6469 | 0.6539 | 0.6610 |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 0.6495 |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31     |

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

|                                          |          |          |          |          |          |          |          |          |          |          |          |          |
|------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| Assumed occupancy 4.6507 (42)            |          |          |          |          |          |          |          |          |          |          |          |          |
| Hot water usage for mixer showers        | 131.4310 | 129.4559 | 126.5777 | 121.0708 | 117.0068 | 112.4748 | 109.8987 | 112.7551 | 115.8863 | 120.7524 | 126.3775 | 130.9275 |
| Hot water usage for baths                | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   |
| Hot water usage for other uses           | 62.2578  | 59.9938  | 57.7299  | 55.4660  | 53.2021  | 50.9382  | 50.9382  | 53.2021  | 55.4660  | 57.7299  | 59.9938  | 62.2578  |
| Average daily hot water use (litres/day) |          |          |          |          |          |          |          |          |          |          |          | 177.7730 |

|                                        |          |          |          |          |          |          |          |          |          |                    |          |           |
|----------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------------------|----------|-----------|
|                                        | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct                | Nov      | Dec       |
| Daily hot water use                    | 193.6888 | 189.4497 | 184.3076 | 176.5368 | 170.2089 | 163.4129 | 160.8369 | 165.9572 | 171.3523 | 178.4823           | 186.3714 | 193.1852  |
| Energy conte                           | 306.7557 | 269.7739 | 283.2739 | 241.6700 | 229.1339 | 200.9353 | 194.5183 | 205.4897 | 211.2945 | 242.1988           | 265.5202 | 302.4813  |
| Energy content (annual)                |          |          |          |          |          |          |          |          |          | Total = Sum(45)m = |          | 2953.0455 |
| Distribution loss (46)m = 0.15 x (45)m | 46.0134  | 40.4661  | 42.4911  | 36.2505  | 34.3701  | 30.1403  | 29.1777  | 30.8235  | 31.6942  | 36.3298            | 39.8280  | 45.3722   |

Water storage loss:  
 Store volume 570.0000 (47)  
 a) If manufacturer declared loss factor is known (kWh/day): 2.4400 (48)  
 Temperature factor from Table 2b 0.5400 (49)  
 Enter (49) or (54) in (55) 1.3176 (55)  
 Total storage loss

|                                              |         |         |         |         |         |         |         |         |         |         |         |         |
|----------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
|                                              | 40.8456 | 36.8928 | 40.8456 | 39.5280 | 40.8456 | 39.5280 | 40.8456 | 40.8456 | 39.5280 | 40.8456 | 39.5280 | 40.8456 |
| If cylinder contains dedicated solar storage |         |         |         |         |         |         |         |         |         |         |         |         |
| 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 |
| Combi loss                                   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  |

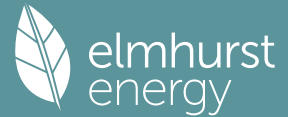
|                                                                                |          |          |          |          |          |          |          |          |          |                                        |          |           |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------------------------------|----------|-----------|
| Total heat required for water heating calculated for each month                |          |          |          |          |          |          |          |          |          |                                        |          |           |
|                                                                                | 370.8637 | 327.6779 | 347.3819 | 303.7100 | 293.2419 | 262.9753 | 258.6263 | 269.5977 | 273.3345 | 306.3068                               | 327.5602 | 366.5893  |
| 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    |
| 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                                                                | 370.8637 | 327.6779 | 347.3819 | 303.7100 | 293.2419 | 262.9753 | 258.6263 | 269.5977 | 273.3345 | 306.3068                               | 327.5602 | 366.5893  |
| 12Total per year (kWh/year)                                                    |          |          |          |          |          |          |          |          |          | Total per year (kWh/year) = Sum(64)m = |          | 3707.8655 |
| 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    |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |          |          |          |          |          |          |                                        |          | 0.0000    |

|                                          |          |          |          |          |          |          |          |          |          |          |          |          |
|------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| Heat gains from water heating, kWh/month | 153.2827 | 136.0230 | 145.4750 | 129.9873 | 127.4734 | 116.4430 | 115.9637 | 119.6117 | 119.8874 | 131.8175 | 137.9175 | 151.8614 |
|------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|

## 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                                                                               | 232.5347  | 232.5347  | 232.5347  | 232.5347  | 232.5347  | 232.5347  | 232.5347  | 232.5347  | 232.5347  | 232.5347  | 232.5347  | 232.5347  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 696.5973  | 771.2327  | 696.5973  | 719.8172  | 696.5973  | 719.8172  | 696.5973  | 696.5973  | 719.8172  | 696.5973  | 719.8172  | 696.5973  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 1167.2854 | 1179.3982 | 1148.8744 | 1083.8928 | 1001.8653 | 924.7710  | 873.2673  | 861.1545  | 891.6783  | 956.6599  | 1038.6874 | 1115.7817 |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 46.2535   | 46.2535   | 46.2535   | 46.2535   | 46.2535   | 46.2535   | 46.2535   | 46.2535   | 46.2535   | 46.2535   | 46.2535   | 46.2535   |
| 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    |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -186.0278 | -186.0278 | -186.0278 | -186.0278 | -186.0278 | -186.0278 | -186.0278 | -186.0278 | -186.0278 | -186.0278 | -186.0278 | -186.0278 |
| Water heating gains (Table 5)                                                       | 206.0251  | 202.4152  | 195.5309  | 180.5379  | 171.3353  | 161.7264  | 155.8652  | 160.7685  | 166.5103  | 177.1740  | 191.5520  | 204.1149  |
| Total internal gains                                                                | 2162.6682 | 2245.8065 | 2133.7630 | 2077.0084 | 1962.5583 | 1899.0750 | 1818.4903 | 1811.2807 | 1870.7663 | 1923.1916 | 2042.8170 | 2109.2542 |

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## 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       |           |           |           | 19.9700    | 10.6334                        | 0.7000                            | 0.7000                             | 0.7700                       | 72.1073    | (74)      |           |           |      |
| East        |           |           |           | 60.1300    | 19.6403                        | 0.7000                            | 0.7000                             | 0.7700                       | 401.0217   | (76)      |           |           |      |
| South       |           |           |           | 12.6700    | 46.7521                        | 0.7000                            | 0.7000                             | 0.7700                       | 201.1438   | (78)      |           |           |      |
| West        |           |           |           | 37.5900    | 19.6403                        | 0.7000                            | 0.7000                             | 0.7700                       | 250.6969   | (80)      |           |           |      |
|             |           |           |           |            |                                |                                   |                                    |                              |            |           |           |           |      |
| Solar gains | 924.9697  | 1742.1223 | 2753.3603 | 3912.4934  | 4753.6095                      | 4859.6009                         | 4628.4509                          | 3994.6630                    | 3161.7769  | 2032.1220 | 1139.9941 | 769.8606  | (83) |
| Total gains | 3087.6379 | 3987.9288 | 4887.1233 | 5989.5018  | 6716.1678                      | 6758.6759                         | 6446.9412                          | 5805.9437                    | 5032.5432  | 3955.3137 | 3182.8111 | 2879.1149 | (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                                                                         | 102.8670 | 103.4073 | 103.9532 | 106.7718 | 107.3540 | 110.3627 | 110.3627 | 110.9848 | 109.1392 | 107.3540 | 106.1960 | 105.0626 |      |
| alpha                                                                       | 7.8578   | 7.8938   | 7.9302   | 8.1181   | 8.1569   | 8.3575   | 8.3575   | 8.3990   | 8.2759   | 8.1569   | 8.0797   | 8.0042   |      |
| util living area                                                            | 1.0000   | 1.0000   | 0.9999   | 0.9977   | 0.9721   | 0.8247   | 0.6256   | 0.7134   | 0.9686   | 0.9997   | 1.0000   | 1.0000   | (86) |
| Living                                                                      | 20.1532  | 20.2475  | 20.4003  | 20.6255  | 20.8229  | 20.9422  | 20.9608  | 20.9578  | 20.8674  | 20.6047  | 20.3497  | 20.1541  |      |
| Non living                                                                  | 19.3249  | 19.4486  | 19.6473  | 19.9493  | 20.1990  | 20.3419  | 20.3552  | 20.3570  | 20.2630  | 19.9257  | 19.5931  | 19.3367  |      |
| 24 / 16                                                                     | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        |      |
| 24 / 9                                                                      | 31       | 28       | 22       | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 31       |      |
| 16 / 9                                                                      | 0        | 0        | 9        | 25       | 0        | 0        | 0        | 0        | 0        | 0        | 30       | 0        |      |
| MIT                                                                         | 21.0000  | 21.0000  | 20.9014  | 20.7609  | 20.8229  | 20.9422  | 20.9608  | 20.9578  | 20.8674  | 20.6047  | 20.6317  | 21.0000  | (87) |
| Th 2                                                                        | 20.3629  | 20.3660  | 20.3692  | 20.3849  | 20.3880  | 20.4038  | 20.4038  | 20.4069  | 20.3974  | 20.3880  | 20.3817  | 20.3754  | (88) |
| util rest of house                                                          | 1.0000   | 1.0000   | 0.9998   | 0.9966   | 0.9591   | 0.7666   | 0.5435   | 0.6289   | 0.9481   | 0.9995   | 1.0000   | 1.0000   | (89) |
| MIT 2                                                                       | 20.3629  | 20.3660  | 20.2767  | 20.1521  | 20.1990  | 20.3419  | 20.3552  | 20.3570  | 20.2630  | 19.9257  | 20.0336  | 20.3754  | (90) |
| Living area fraction                                                        |          |          |          |          |          |          |          |          |          |          |          |          |      |
| MIT                                                                         | 20.3878  | 20.3908  | 20.3011  | 20.1758  | 20.2234  | 20.3654  | 20.3788  | 20.3805  | 20.2866  | 19.9522  | 20.0570  | 20.3998  | (92) |
| Temperature adjustment                                                      |          |          |          |          |          |          |          |          |          |          |          | 0.0000   |      |
| adjusted MIT                                                                | 20.3878  | 20.3908  | 20.3011  | 20.1758  | 20.2234  | 20.3654  | 20.3788  | 20.3805  | 20.2866  | 19.9522  | 20.0570  | 20.3998  | (93) |

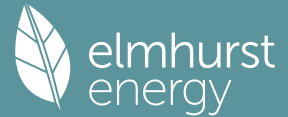
## 8. Space heating requirement

|                                                                                |            |            |            |            |           |           |           |           |           |               |            |            |       |
|--------------------------------------------------------------------------------|------------|------------|------------|------------|-----------|-----------|-----------|-----------|-----------|---------------|------------|------------|-------|
|                                                                                | Jan        | Feb        | Mar        | Apr        | May       | Jun       | Jul       | Aug       | Sep       | Oct           | Nov        | Dec        |       |
| Utilisation                                                                    | 1.0000     | 1.0000     | 0.9998     | 0.9962     | 0.9547    | 0.7625    | 0.5401    | 0.6250    | 0.9432    | 0.9992        | 1.0000     | 1.0000     | (94)  |
| Useful gains                                                                   | 3087.6317  | 3987.8554  | 4886.1557  | 5966.6695  | 6411.7522 | 5153.7048 | 3481.7088 | 3628.7094 | 4746.4438 | 3952.3250     | 3182.7721  | 2879.1119  | (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                                                               | 15946.5316 | 15274.5610 | 13536.9517 | 10768.0830 | 8095.4146 | 5326.6054 | 3491.2471 | 3656.9604 | 5779.8506 | 8882.6660     | 12440.6355 | 15722.0242 | (97)  |
| Space heating kWh                                                              | 9567.0215  | 7584.6662  | 6436.1923  | 3457.0177  | 1252.6448 | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 3668.1737     | 6665.6616  | 9555.1267  | (98a) |
| Space heating requirement - total per year (kWh/year)                          |            |            |            |            |           |           |           |           |           |               |            | 48186.5046 |       |
| 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                                                              | 9567.0215  | 7584.6662  | 6436.1923  | 3457.0177  | 1252.6448 | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 3668.1737     | 6665.6616  | 9555.1267  | (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |            |            |            |            |           |           |           |           |           |               |            | 48186.5046 |       |
| Space heating per m2                                                           |            |            |            |            |           |           |           |           |           | (98c) / (4) = |            | 32.8183    | (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 %)                                                     |           |           |           |           |           |           |           |           |           |           |           | 420.7410  | (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                                                                            | 9567.0215 | 7584.6662 | 6436.1923 | 3457.0177 | 1252.6448 | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 3668.1737 | 6665.6616 | 9555.1267 | (98)   |
| Space heating efficiency (main heating system 1)                                                     | 420.7410  | 420.7410  | 420.7410  | 420.7410  | 420.7410  | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 420.7410  | 420.7410  | 420.7410  | (210)  |
| Space heating fuel (main heating system)                                                             | 2273.8506 | 1802.6924 | 1529.7279 | 821.6498  | 297.7235  | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 871.8365  | 1584.2672 | 2271.0235 | (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                                                                            | 370.8637  | 327.6779  | 347.3819  | 303.7100  | 293.2419  | 262.9753  | 258.6263  | 269.5977  | 273.3345  | 306.3068  | 327.5602  | 366.5893  | (64)   |
| Efficiency of water heater (217)m                                                                    | 169.6940  | 169.6940  | 169.6940  | 169.6940  | 169.6940  | 169.6940  | 169.6940  | 169.6940  | 169.6940  | 169.6940  | 169.6940  | 169.6940  | (216)  |
| Fuel for water heating, kWh/month                                                                    | 218.5485  | 193.0993  | 204.7108  | 178.9751  | 172.8063  | 154.9703  | 152.4075  | 158.8729  | 161.0750  | 180.5054  | 193.0299  | 216.0297  | (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                                                                                         | 599.3999  | 541.3934  | 599.3999  | 580.0644  | 599.3999  | 580.0644  | 599.3999  | 599.3999  | 580.0644  | 599.3999  | 580.0644  | 599.3999  | (231)  |
| Lighting                                                                                             | 158.3534  | 127.0370  | 114.3827  | 83.8017   | 64.7308   | 52.8856   | 59.0496   | 76.7549   | 99.6971   | 130.8080  | 147.7473  | 162.7545  | (232)  |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | -232.7231 | -349.2937 | -527.1649 | -600.9569 | -631.2620 | -565.6852 | -561.5645 | -522.0602 | -451.4363 | -397.5880 | -260.6128 | -198.8252 | (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | (234a) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | (235a) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |           |           |           |           |           |           |           |           |           |           |           |           |        |

# Full SAP Calculation Printout



|                                                                                                      |        |        |        |        |        |        |        |        |        |        |        |            |        |
|------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------------|--------|
| (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                                                                   |        |        |        |        |        |        |        |        |        |        |        | 11452.7714 | (211)  |
| Space heating fuel - main system 2                                                                   |        |        |        |        |        |        |        |        |        |        |        | 0.0000     | (213)  |
| Space heating fuel - secondary                                                                       |        |        |        |        |        |        |        |        |        |        |        | 0.0000     | (215)  |
| Efficiency of water heater                                                                           |        |        |        |        |        |        |        |        |        |        |        | 169.6940   |        |
| Water heating fuel used                                                                              |        |        |        |        |        |        |        |        |        |        |        | 2185.0307  | (219)  |
| Space cooling fuel                                                                                   |        |        |        |        |        |        |        |        |        |        |        | 0.0000     | (221)  |
| Electricity for pumps and fans:                                                                      |        |        |        |        |        |        |        |        |        |        |        |            |        |
| (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.1750)                           |        |        |        |        |        |        |        |        |        |        |        |            |        |
| mechanical ventilation fans (SFP = 1.1750)                                                           |        |        |        |        |        |        |        |        |        |        |        | 7057.4499  | (230a) |
| Total electricity for the above, kWh/year                                                            |        |        |        |        |        |        |        |        |        |        |        | 7057.4499  | (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |        |        |        |        |        |        |        |        |        |        |        | 1278.0028  | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |        |        |        |        |        |        |        |        |        |        |        |            |        |
| PV generation                                                                                        |        |        |        |        |        |        |        |        |        |        |        | -5299.1730 | (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                                                                  |        |        |        |        |        |        |        |        |        |        |        | 16674.0818 | (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                   | 11452.7714         | 0.1552                        | 1777.8832                | (261) |
| Total CO2 associated with community systems     |                    |                               | 0.0000                   | (373) |
| Water heating (other fuel)                      | 2185.0307          | 0.1410                        | 308.1116                 | (264) |
| Space and water heating                         |                    |                               | 2085.9948                | (265) |
| Pumps, fans and electric keep-hot               | 7057.4499          | 0.1387                        | 978.9553                 | (267) |
| Energy for lighting                             | 1278.0028          | 0.1443                        | 184.4553                 | (268) |
| Energy saving/generation technologies           |                    |                               |                          |       |
| PV Unit electricity used in dwelling            | -5299.1730         | 0.1346                        | -713.3354                |       |
| PV Unit electricity exported                    | 0.0000             | 0.0000                        | 0.0000                   |       |
| Total                                           |                    |                               | -713.3354                | (269) |
| Total CO2, kg/year                              |                    |                               | 2536.0700                | (272) |
| EPC Dwelling Carbon Dioxide Emission Rate (DER) |                    |                               | 1.7300                   | (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               | 11452.7714         | 1.5747                              | 18035.1021                 | (275) |
| Total CO2 associated with community systems |                    |                                     | 0.0000                     | (473) |
| Water heating (other fuel)                  | 2185.0307          | 1.5214                              | 3324.3275                  | (278) |
| Space and water heating                     |                    |                                     | 21359.4296                 | (279) |
| Pumps, fans and electric keep-hot           | 7057.4499          | 1.5128                              | 10676.5102                 | (281) |
| Energy for lighting                         | 1278.0028          | 1.5338                              | 1960.2434                  | (282) |
| Energy saving/generation technologies       |                    |                                     |                            |       |
| PV Unit electricity used in dwelling        | -5299.1730         | 1.4975                              | -7935.6761                 |       |
| PV Unit electricity exported                | 0.0000             | 0.0000                              | 0.0000                     |       |
| Total                                       |                    |                                     | -7935.6761                 | (283) |
| Total Primary energy kWh/year               |                    |                                     | 26060.5071                 | (286) |
| Dwelling Primary energy Rate (DPER)         |                    |                                     | 17.7500                    | (287) |

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

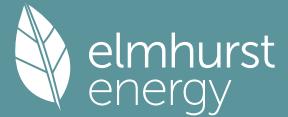
### 1. Overall dwelling characteristics

|                                                          | Area<br>(m <sup>2</sup> ) |   | Storey height<br>(m)              |   | Volume<br>(m <sup>3</sup> ) |     |
|----------------------------------------------------------|---------------------------|---|-----------------------------------|---|-----------------------------|-----|
| Basement floor                                           | 460.0000 (1a)             | x | 3.0500 (2a)                       | = | 1403.0000 (1a) - (3a)       |     |
| Ground floor                                             | 384.6600 (1b)             | x | 4.2000 (2b)                       | = | 1615.5720 (1b) - (3b)       |     |
| First floor                                              | 332.1000 (1c)             | x | 3.3300 (2c)                       | = | 1105.8930 (1c) - (3c)       |     |
| Second floor                                             | 291.5200 (1d)             | x | 2.7400 (2d)                       | = | 798.7648 (1d) - (3d)        |     |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e) ... (1n) | 1468.2800                 |   |                                   |   |                             | (4) |
| Dwelling volume                                          |                           |   | (3a)+(3b)+(3c)+(3d)+(3e) ... (3n) | = | 4923.2298 (5)               |     |

### 2. Ventilation rate

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

# Full SAP Calculation Printout



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

0 \* 20 = 0.0000 (6d)  
0 \* 35 = 0.0000 (6e)  
0 \* 20 = 0.0000 (6f)  
4 \* 10 = 40.0000 (7a)  
0 \* 10 = 0.0000 (7b)  
0 \* 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 40.0000 / (5) = 0.0081 (8)  
Pressure test Yes  
Pressure Test Method Blower Door  
Measured/design AP50 5.0000 (17)  
Infiltration rate 0.2581 (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) = 0.2194 (21)

|                 |        |        |        |        |        |        |        |        |        |        |        |        |       |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|
| Wind speed      | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |       |
|                 | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 | (22)  |
| Wind factor     | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 | (22a) |
| Adj infilt rate |        |        |        |        |        |        |        |        |        |        |        |        |       |
|                 | 0.2797 | 0.2743 | 0.2688 | 0.2413 | 0.2359 | 0.2084 | 0.2084 | 0.2030 | 0.2194 | 0.2359 | 0.2468 | 0.2578 | (22b) |
| Effective ac    | 0.5391 | 0.5376 | 0.5361 | 0.5291 | 0.5278 | 0.5217 | 0.5217 | 0.5206 | 0.5241 | 0.5278 | 0.5305 | 0.5332 | (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 |
|-------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|----------------------|--------------------------------|---------------|
| TER Opaque door                                             |                         |                            | 5.3400                    | 1.0000                        | 5.3400               |                                | (26)          |
| TER Opening Type (Uw = 1.20)                                |                         |                            | 130.3600                  | 1.1450                        | 149.2672             |                                | (27)          |
| Basement Floor                                              |                         |                            | 396.1900                  | 0.1300                        | 51.5047              |                                | (28a)         |
| Basement Pool                                               |                         |                            | 64.0200                   | 0.1300                        | 8.3226               |                                | (28a)         |
| Ground Floor                                                |                         |                            | 59.7800                   | 0.1300                        | 7.7714               |                                | (28a)         |
| Basement Wall                                               | 312.6300                | 2.4600                     | 310.1700                  | 0.1800                        | 55.8306              |                                | (29a)         |
| Ground Floor                                                | 388.2100                | 77.1700                    | 311.0400                  | 0.1800                        | 55.9872              |                                | (29a)         |
| First Floor                                                 | 264.7400                | 40.7800                    | 223.9600                  | 0.1800                        | 40.3128              |                                | (29a)         |
| Second Floor                                                | 35.0600                 |                            | 35.0600                   | 0.1800                        | 6.3108               |                                | (29a)         |
| Dormer Walls                                                | 27.9600                 | 15.2900                    | 12.6700                   | 0.1800                        | 2.2806               |                                | (29a)         |
| Loft Walls                                                  | 0.1000                  |                            | 0.1000                    | 0.1800                        | 0.0180               |                                | (29a)         |
| Main Flat Roof                                              | 155.5800                |                            | 155.5800                  | 0.1100                        | 17.1138              |                                | (30)          |
| Flat Roof GF                                                | 46.7600                 |                            | 46.7600                   | 0.1100                        | 5.1436               |                                | (30)          |
| Loft Insulation                                             | 45.5900                 |                            | 45.5900                   | 0.1100                        | 5.0149               |                                | (30)          |
| Main Pitched Roof                                           | 334.2000                |                            | 334.2000                  | 0.1100                        | 36.7620              |                                | (30)          |
| Dormer Roofs                                                | 63.2200                 |                            | 63.2200                   | 0.1100                        | 6.9542               |                                | (30)          |
| Bridge over Basement                                        | 129.7300                |                            | 129.7300                  | 0.1100                        | 14.2703              |                                | (30)          |
| Total net area of external elements Aum(A, m <sup>2</sup> ) |                         |                            | 2323.7700                 |                               |                      |                                | (31)          |
| Fabric heat loss, W/K = Sum (A x U)                         |                         |                            |                           |                               | 468.2047             |                                | (33)          |
|                                                             |                         |                            |                           |                               | (26)...(30) + (32) = |                                |               |

Thermal mass parameter (TMP = Cm / TFA) in kJ/m<sup>2</sup>K 250.0000 (35)

#### List of Thermal Bridges

| K1 Element                                                       | Length   | Psi-value | Total   |
|------------------------------------------------------------------|----------|-----------|---------|
| E5 Ground floor (normal)                                         | 21.3500  | 0.1600    | 3.4160  |
| E19 Ground floor (inverted)                                      | 14.1200  | 0.0700    | 0.9884  |
| E22 Basement floor                                               | 102.4700 | 0.0700    | 7.1729  |
| E6 Intermediate floor within a dwelling                          | 224.3800 | 0.0000    | 0.0000  |
| E11 Eaves (insulation at rafter level)                           | 76.9600  | 0.0400    | 3.0784  |
| E14 Flat roof                                                    | 53.8700  | 0.0800    | 4.3096  |
| E16 Corner (normal)                                              | 78.5400  | 0.0900    | 7.0686  |
| E17 Corner (inverted - internal area greater than external area) | 39.2700  | -0.0900   | -3.5343 |
| E2 Other lintels (including other steel lintels)                 | 60.3800  | 0.0500    | 3.0190  |
| E3 Sill                                                          | 58.2000  | 0.0500    | 2.9100  |
| E4 Jamb                                                          | 199.9800 | 0.0500    | 9.9990  |
| R4 Ridge (vaulted ceiling)                                       | 6.5600   | 0.0800    | 0.5248  |
| R5 Ridge (inverted)                                              | 0.0400   | 0.0400    | 0.0016  |

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 38.9540 (36)

#### Point Thermal Bridges

Total fabric heat loss (33) + (36) + (36a) = 507.1587 (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       |      |
|                           | 875.9028  | 873.4343  | 871.0147  | 859.6498  | 857.5235  | 847.6251  | 847.6251  | 845.7920  | 851.4378  | 857.5235  | 861.8251  | 866.3221  | (38) |
| Heat transfer coeff       | 1383.0615 | 1380.5930 | 1378.1734 | 1366.8085 | 1364.6822 | 1354.7838 | 1354.7838 | 1352.9507 | 1358.5965 | 1364.6822 | 1368.9837 | 1373.4808 | (39) |
| Average = Sum(39)m / 12 = |           |           |           |           |           |           |           |           |           |           |           | 1366.7983 |      |

|               |        |        |        |        |        |        |        |        |        |        |        |        |      |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| HLP           | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |      |
|               | 0.9420 | 0.9403 | 0.9386 | 0.9309 | 0.9294 | 0.9227 | 0.9227 | 0.9215 | 0.9253 | 0.9294 | 0.9324 | 0.9354 | (40) |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 0.9309 |      |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31     |      |

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

Assumed occupancy 4.6507 (42)

Hot water usage for mixer showers 131.4310 129.4559 126.5777 121.0708 117.0068 112.4748 109.8987 112.7551 115.8863 120.7524 126.3775 130.9275 (42a)

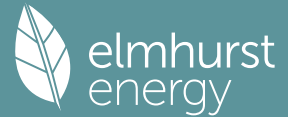
Hot water usage for baths 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (42b)

Hot water usage for other uses 62.2578 59.9938 57.7299 55.4660 53.2021 50.9382 50.9382 53.2021 55.4660 57.7299 59.9938 62.2578 (42c)

Average daily hot water use (litres/day) 177.7730 (43)

|                                                             |          |          |          |          |          |          |          |          |          |                    |          |           |      |
|-------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------------------|----------|-----------|------|
| Daily hot water use                                         | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct                | Nov      | Dec       |      |
|                                                             | 193.6888 | 189.4497 | 184.3076 | 176.5368 | 170.2089 | 163.4129 | 160.8369 | 165.9572 | 171.3523 | 178.4823           | 186.3714 | 193.1852  | (44) |
| Energy conte                                                | 306.7557 | 269.7739 | 283.2739 | 241.6700 | 229.1339 | 200.9353 | 194.5183 | 205.4897 | 211.2945 | 242.1988           | 265.5202 | 302.4813  | (45) |
| Energy content (annual)                                     |          |          |          |          |          |          |          |          |          | Total = Sum(45)m = |          | 2953.0455 |      |
| Distribution loss (46)m = 0.15 x (45)m                      |          |          |          |          |          |          |          |          |          |                    |          |           |      |
|                                                             | 46.0134  | 40.4661  | 42.4911  | 36.2505  | 34.3701  | 30.1403  | 29.1777  | 30.8235  | 31.6942  | 36.3298            | 39.8280  | 45.3722   | (46) |
| Water storage loss:                                         |          |          |          |          |          |          |          |          |          |                    |          |           |      |
| Store volume                                                |          |          |          |          |          |          |          |          |          |                    |          | 570.0000  | (47) |
| a) If manufacturer declared loss factor is known (kWh/day): |          |          |          |          |          |          |          |          |          |                    |          | 3.1502    | (48) |
| Temperature factor from Table 2b                            |          |          |          |          |          |          |          |          |          |                    |          | 0.5400    | (49) |

# Full SAP Calculation Printout



|                                                                 |          |          |          |          |          |          |          |          |          |          |                                                                                |                |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------------------------------------------------------------------------------|----------------|
| Enter (49) or (54) in (55)                                      |          |          |          |          |          |          |          |          |          |          |                                                                                | 1.7011 (55)    |
| Total storage loss                                              | 52.7336  | 47.6304  | 52.7336  | 51.0325  | 52.7336  | 51.0325  | 52.7336  | 52.7336  | 51.0325  | 52.7336  | 51.0325                                                                        | 52.7336 (56)   |
| If cylinder contains dedicated solar storage                    | 52.7336  | 47.6304  | 52.7336  | 51.0325  | 52.7336  | 51.0325  | 52.7336  | 52.7336  | 51.0325  | 52.7336  | 51.0325                                                                        | 52.7336 (57)   |
| Primary loss                                                    | 23.2624  | 21.0112  | 23.2624  | 22.5120  | 23.2624  | 22.5120  | 23.2624  | 23.2624  | 22.5120  | 23.2624  | 22.5120                                                                        | 23.2624 (59)   |
| Combi loss                                                      | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                                                         | 0.0000 (61)    |
| Total heat required for water heating calculated for each month |          |          |          |          |          |          |          |          |          |          |                                                                                |                |
| WWHRS                                                           | 382.7517 | 338.4154 | 359.2699 | 315.2146 | 305.1299 | 274.4798 | 270.5143 | 281.4857 | 284.8390 | 318.1948 | 339.0647                                                                       | 378.4774 (62)  |
| PV diverter                                                     | -60.0848 | -53.1395 | -55.6446 | -46.0759 | -42.9411 | -36.7450 | -34.4426 | -36.6262 | -38.0178 | -44.8188 | -50.7742                                                                       | -58.9721 (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                                                 | 322.6669 | 285.2759 | 303.6253 | 269.1387 | 262.1888 | 237.7348 | 236.0717 | 244.8595 | 246.8212 | 273.3760 | 288.2905                                                                       | 319.5053 (64)  |
|                                                                 |          |          |          |          |          |          |          |          |          |          | Total per year (kWh/year) = Sum(64)m =                                         | 3289.5547 (64) |
| 12Total per year (kWh/year)                                     |          |          |          |          |          |          |          |          |          |          |                                                                                | 3290 (64)      |
| Electric shower(s)                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                                                         | 0.0000 (64a)   |
|                                                                 |          |          |          |          |          |          |          |          |          |          | Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = | 0.0000 (64a)   |
| Heat gains from water heating, kWh/month                        | 162.7931 | 144.6131 | 154.9854 | 139.1909 | 136.9838 | 125.6466 | 125.4741 | 129.1221 | 129.0910 | 141.3279 | 147.1211                                                                       | 161.3719 (65)  |

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

|                                                                                     |           |           |           |           |           |           |           |           |           |           |           |                |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
| Metabolic gains (Table 5), Watts                                                    | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec            |
| (66)m                                                                               | 232.5347  | 232.5347  | 232.5347  | 232.5347  | 232.5347  | 232.5347  | 232.5347  | 232.5347  | 232.5347  | 232.5347  | 232.5347  | 232.5347 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 696.5973  | 771.2327  | 696.5973  | 719.8172  | 696.5973  | 719.8172  | 696.5973  | 696.5973  | 719.8172  | 696.5973  | 719.8172  | 696.5973 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 1167.2854 | 1179.3982 | 1148.8744 | 1083.8928 | 1001.8653 | 924.7710  | 873.2673  | 861.1545  | 891.6783  | 956.6599  | 1038.6874 | 1115.7817 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 46.2535   | 46.2535   | 46.2535   | 46.2535   | 46.2535   | 46.2535   | 46.2535   | 46.2535   | 46.2535   | 46.2535   | 46.2535   | 46.2535 (69)   |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000 (70)    |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -186.0278 | -186.0278 | -186.0278 | -186.0278 | -186.0278 | -186.0278 | -186.0278 | -186.0278 | -186.0278 | -186.0278 | -186.0278 | -186.0278 (71) |
| Water heating gains (Table 5)                                                       | 218.8079  | 215.1980  | 208.3137  | 193.3207  | 184.1181  | 174.5092  | 168.6480  | 173.5513  | 179.2931  | 189.9569  | 204.3348  | 216.8977 (72)  |
| Total internal gains                                                                | 2178.4510 | 2261.5893 | 2149.5458 | 2092.7912 | 1978.3411 | 1911.8578 | 1831.2731 | 1824.0635 | 1883.5491 | 1938.9744 | 2058.5998 | 2125.0371 (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       |           |           |           | 19.9700    | 10.6334                        |           | 0.6300                            |           | 0.7000                             |           | 0.7700                       |  | 64.8966 (74)   |
| East        |           |           |           | 60.1300    | 19.6403                        |           | 0.6300                            |           | 0.7000                             |           | 0.7700                       |  | 360.9195 (76)  |
| South       |           |           |           | 12.6700    | 46.7521                        |           | 0.6300                            |           | 0.7000                             |           | 0.7700                       |  | 181.0295 (78)  |
| West        |           |           |           | 37.5900    | 19.6403                        |           | 0.6300                            |           | 0.7000                             |           | 0.7700                       |  | 225.6272 (80)  |
|             |           |           |           |            |                                |           |                                   |           |                                    |           |                              |  |                |
| Solar gains | 832.4727  | 1567.9100 | 2478.0243 | 3521.2441  | 4278.2485                      | 4373.6408 | 4165.6058                         | 3595.1967 | 2845.5992                          | 1828.9098 | 1025.9947                    |  | 692.8746 (83)  |
| Total gains | 3010.9237 | 3829.4993 | 4627.5701 | 5614.0353  | 6256.5997                      | 6285.4986 | 5996.8789                         | 5419.2602 | 4729.1483                          | 3767.8843 | 3084.5945                    |  | 2817.9116 (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                                                                         | 73.7233 | 73.8551 | 73.9848 | 74.6000 | 74.7162 | 75.2621 | 75.2621 | 75.3641 | 75.0509 | 74.7162 | 74.4814 | 74.2376      |
| alpha                                                                       | 5.9149  | 5.9237  | 5.9323  | 5.9733  | 5.9811  | 6.0175  | 6.0175  | 6.0243  | 6.0034  | 5.9811  | 5.9654  | 5.9492       |
| util living area                                                            | 1.0000  | 1.0000  | 0.9999  | 0.9990  | 0.9926  | 0.9557  | 0.8549  | 0.9097  | 0.9918  | 0.9997  | 1.0000  | 1.0000 (86)  |
| MIT                                                                         | 19.4758 | 19.6034 | 19.8339 | 20.1688 | 20.5070 | 20.7971 | 20.9365 | 20.9014 | 20.6434 | 20.2070 | 19.7879 | 19.4609 (87) |
| Th 2                                                                        | 20.1320 | 20.1334 | 20.1348 | 20.1413 | 20.1425 | 20.1482 | 20.1482 | 20.1493 | 20.1461 | 20.1425 | 20.1401 | 20.1375 (88) |
| util rest of house                                                          | 1.0000  | 1.0000  | 0.9998  | 0.9984  | 0.9880  | 0.9219  | 0.7483  | 0.8278  | 0.9842  | 0.9996  | 1.0000  | 1.0000 (89)  |
| MIT 2                                                                       | 18.2930 | 18.4579 | 18.7547 | 19.1890 | 19.6213 | 19.9800 | 20.1170 | 20.0920 | 19.7984 | 19.2391 | 18.6995 | 18.2781 (90) |
| Living area fraction                                                        | 18.3392 | 18.5026 | 18.7968 | 19.2273 | 19.6559 | 20.0119 | 20.1490 | 20.1236 | 19.8314 | 19.2769 | 18.7421 | 18.3243 (91) |
| MIT                                                                         | 18.3392 | 18.5026 | 18.7968 | 19.2273 | 19.6559 | 20.0119 | 20.1490 | 20.1236 | 19.8314 | 19.2769 | 18.7421 | 18.3243 (92) |
| Temperature adjustment                                                      | 18.3392 | 18.5026 | 18.7968 | 19.2273 | 19.6559 | 20.0119 | 20.1490 | 20.1236 | 19.8314 | 19.2769 | 18.7421 | 18.3243 (93) |

## 8. Space heating requirement

|                                                                                |            |            |            |            |            |           |           |           |           |            |            |                            |
|--------------------------------------------------------------------------------|------------|------------|------------|------------|------------|-----------|-----------|-----------|-----------|------------|------------|----------------------------|
| Utilisation                                                                    | 1.0000     | 0.9999     | 0.9997     | 0.9976     | 0.9840     | 0.9145    | 0.7484    | 0.8245    | 0.9797    | 0.9993     | 1.0000     | 1.0000 (94)                |
| Useful gains                                                                   | 3010.8823  | 3829.2519  | 4626.0475  | 5600.2969  | 6156.3543  | 5747.9272 | 4487.9965 | 4468.2951 | 4633.1890 | 3765.1583  | 3084.4562  | 2817.8867 (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                                                               | 19417.1091 | 18779.6896 | 16947.1879 | 14115.4381 | 10857.3208 | 7331.9376 | 4808.1356 | 5037.8264 | 7786.6166 | 11841.2148 | 15937.7771 | 19399.4556 (97)            |
| Space heating kWh                                                              | 12206.2328 | 10046.6942 | 9166.9285  | 6130.9017  | 3497.5191  | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 6008.5860  | 9254.3911  | 12336.6873 (98a)           |
| Space heating requirement - total per year (kWh/year)                          |            |            |            |            |            |           |           |           |           |            |            | 68647.9406                 |
| 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                                                              | 12206.2328 | 10046.6942 | 9166.9285  | 6130.9017  | 3497.5191  | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 6008.5860  | 9254.3911  | 12336.6873 (98c)           |
| Space heating requirement after solar contribution - total per year (kWh/year) |            |            |            |            |            |           |           |           |           |            |            | 68647.9406                 |
| Space heating per m <sup>2</sup>                                               |            |            |            |            |            |           |           |           |           |            |            | (98c) / (4) = 46.7540 (99) |

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

|                                                                                                              |            |            |            |            |            |            |            |            |            |           |            |             |               |
|--------------------------------------------------------------------------------------------------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|-----------|------------|-------------|---------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                        |            |            |            |            |            |            |            |            |            |           |            |             | 0.0000 (201)  |
| Fraction of space heat from main system(s)                                                                   |            |            |            |            |            |            |            |            |            |           |            |             | 1.0000 (202)  |
| Efficiency of main space heating system 1 (in %)                                                             |            |            |            |            |            |            |            |            |            |           |            |             | 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                                                                                    | 12206.2328 | 10046.6942 | 9166.9285  | 6130.9017  | 3497.5191  | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 6008.5860 | 9254.3911  | 12336.6873  | (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)                                                                     | 13224.5209 | 10884.8258 | 9931.6668  | 6642.3637  | 3789.2948  | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 6509.8440 | 10026.4259 | 13365.8584  | (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                                                                                    | 322.6669   | 285.2759   | 303.6253   | 269.1387   | 262.1888   | 237.7348   | 236.0717   | 244.8595   | 246.8212   | 273.3760  | 288.2905   | 319.5053    | (64)          |
| Efficiency of water heater (217)m                                                                            | 88.5428    | 88.5243    | 88.4801    | 88.3808    | 88.1070    | 79.8000    | 79.8000    | 79.8000    | 79.8000    | 88.3663   | 88.4985    | 79.8000     | (216)         |
| Fuel for water heating, kWh/month                                                                            | 364.4191   | 322.2571   | 343.1567   | 304.5215   | 297.5799   | 297.9133   | 295.8292   | 306.8415   | 309.2998   | 309.3668  | 325.7576   | 360.8277    | (217)         |
| Space cooling fuel requirement (221)m                                                                        | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000    | 0.0000     | 0.0000      | (219)         |
| 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      | (221)         |
| Lighting                                                                                                     | 144.7392   | 116.1151   | 104.5488   | 76.5969    | 59.1657    | 48.3389    | 53.9729    | 70.1560    | 91.1257    | 119.5619  | 135.0449   | 148.7619    | (222)         |
| Electricity generated by PVs (Appendix M) (negative quantity) (233a)m                                        | -338.1301  | -436.1927  | -573.1832  | -585.9284  | -584.6469  | -527.6447  | -519.2909  | -511.3260  | -493.6223  | -466.9635 | -356.1100  | -297.1332   | (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                                        | -335.4005  | -682.0880  | -1315.7565 | -1922.0053 | -2492.4516 | -2488.7281 | -2460.9977 | -2106.8931 | -1574.8067 | -958.4277 | -441.6939  | -267.2316   | (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                                                                           |            |            |            |            |            |            |            |            |            |           |            | 74374.8003  | (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                                                                                      |            |            |            |            |            |            |            |            |            |           |            | 3837.7702   | (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)                                                          |            |            |            |            |            |            |            |            |            |           |            | 1168.1279   | (232)         |
| Energy saving/generation technologies (Appendices M ,N and Q)                                                |            |            |            |            |            |            |            |            |            |           |            |             |               |
| PV generation                                                                                                |            |            |            |            |            |            |            |            |            |           |            | -22736.6525 | (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                                                                          |            |            |            |            |            |            |            |            |            |           |            | 56730.0459  | (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                 | 74374.8003         | 0.2100                        | 15618.7081               | (261) |
| Total CO2 associated with community systems   |                    |                               | 0.0000                   | (373) |
| Water heating (other fuel)                    | 3837.7702          | 0.2100                        | 805.9317                 | (264) |
| Space and water heating                       |                    |                               | 16424.6398               | (265) |
| Pumps, fans and electric keep-hot             | 86.0000            | 0.1387                        | 11.9293                  | (267) |
| Energy for lighting                           | 1168.1279          | 0.1443                        | 168.5970                 | (268) |
| Energy saving/generation technologies         |                    |                               |                          |       |
| PV Unit electricity used in dwelling          | -5690.1718         | 0.1367                        | -777.7257                |       |
| PV Unit electricity exported                  | -17046.4807        | 0.1267                        | -2160.1263               |       |
| Total                                         |                    |                               | -2937.8520               | (269) |
| Total CO2, kg/year                            |                    |                               | 13667.3140               | (272) |
| EPC Target Carbon Dioxide Emission Rate (TER) |                    |                               | 9.3100                   | (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               | 74374.8003         | 1.1300                              | 84043.5243                 | (275) |
| Total CO2 associated with community systems |                    |                                     | 0.0000                     | (473) |
| Water heating (other fuel)                  | 3837.7702          | 1.1300                              | 4336.6803                  | (278) |
| Space and water heating                     |                    |                                     | 88380.2046                 | (279) |
| Pumps, fans and electric keep-hot           | 86.0000            | 1.5128                              | 130.1008                   | (281) |
| Energy for lighting                         | 1168.1279          | 1.5338                              | 1791.7136                  | (282) |
| Energy saving/generation technologies       |                    |                                     |                            |       |
| PV Unit electricity used in dwelling        | -5690.1718         | 1.5053                              | -8565.1636                 |       |
| PV Unit electricity exported                | -17046.4807        | 0.4652                              | -7929.7368                 |       |
| Total                                       |                    |                                     | -16494.9003                | (283) |
| Total Primary energy kWh/year               |                    |                                     | 73807.1187                 | (286) |

Target Primary Energy Rate (TPER)

50.2700 (287)

# Full SAP Calculation Printout



|                                    |                                          |               |       |                |            |
|------------------------------------|------------------------------------------|---------------|-------|----------------|------------|
| Property Reference                 | New Design House                         |               |       | Issued on Date | 11/01/2024 |
| Assessment Reference               | Lean                                     | Prop Type Ref |       |                |            |
| Property                           | Oak Lawn, Compton Avenue, London, N6 4LB |               |       |                |            |
|                                    |                                          |               |       |                |            |
| SAP Rating                         | 87 B                                     | DER           | 8.56  | TER            | 9.31       |
| Environmental                      | 89 B                                     | % DER < TER   |       |                | 8.06       |
| CO <sub>2</sub> Emissions (t/year) | 11.36                                    | DFEE          | 47.56 | TFEE           | 48.80      |
| Compliance Check                   | See BREL                                 | % DFEE < TFEE |       |                | 2.54       |
| % DPER < TPER                      | -0.39                                    | DPER          | 50.47 | TPER           | 50.27      |
|                                    |                                          |               |       |                |            |
| Assessor Details                   | Mr. Malcolm Maclean                      |               |       | Assessor ID    | V497-0002  |
| 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> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Basement floor                                         | 460.0000 (1a)             | x 3.0500 (2a)                   | = 1403.0000 (1a) - (3a)     |
| Ground floor                                           | 384.6600 (1b)             | x 4.2000 (2b)                   | = 1615.5720 (1b) - (3b)     |
| First floor                                            | 332.1000 (1c)             | x 3.3300 (2c)                   | = 1105.8930 (1c) - (3c)     |
| Second floor                                           | 291.5200 (1d)             | x 2.7400 (2d)                   | = 798.7648 (1d) - (3d)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 1468.2800                 |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 4923.2298 (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)    |

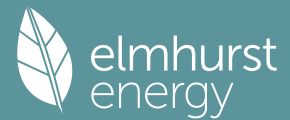
|                                                      |                                                       |                |            |
|------------------------------------------------------|-------------------------------------------------------|----------------|------------|
| Infiltration 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                                 |                                                       | 3.0000 (17)    |            |
| Infiltration rate                                    |                                                       | 0.1500 (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) =                                  | 0.1275 (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                                                                                         | 0.1626 | 0.1594 | 0.1562 | 0.1403 | 0.1371 | 0.1211 | 0.1211 | 0.1179 | 0.1275 | 0.1371 | 0.1434 | 0.1498 (22b)  |
| Balanced mechanical ventilation with heat recovery                                                      |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a)  |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b)  |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 75.6000 (23c) |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =            |        |        |        |        |        |        |        |        |        |        |        |               |
| Effective ac                                                                                            | 0.2846 | 0.2814 | 0.2782 | 0.2622 | 0.2591 | 0.2431 | 0.2431 | 0.2399 | 0.2495 | 0.2591 | 0.2654 | 0.2718 (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 |
|--------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|---------------|
| Window (Uw = 1.20) |                         |                            | 130.3600                  | 1.1450                        | 149.2672     |                                | (27)          |
| External Door      |                         |                            | 5.3400                    | 1.2000                        | 6.4080       |                                | (26)          |
| Basement Floor     |                         |                            | 396.1900                  | 0.1000                        | 39.6190      |                                | (28a)         |
| Basement Pool      |                         |                            | 64.0200                   | 0.2200                        | 14.0844      |                                | (28a)         |
| Ground Floor       |                         |                            | 59.7800                   | 0.1192                        | 7.1232       |                                | (28a)         |
| Basement Wall      | 312.6300                | 2.4600                     | 310.1700                  | 0.1800                        | 55.8306      |                                | (29a)         |
| Ground Floor       | 388.2100                | 77.1700                    | 311.0400                  | 0.1700                        | 52.8768      |                                | (29a)         |
| First Floor        | 264.7400                | 40.7800                    | 223.9600                  | 0.1700                        | 38.0732      |                                | (29a)         |
| Second Floor       | 35.0600                 |                            | 35.0600                   | 0.1700                        | 5.9602       |                                | (29a)         |
| Dormer Walls       | 27.9600                 | 15.2900                    | 12.6700                   | 0.2000                        | 2.5340       |                                | (29a)         |
| Loft Walls         | 0.1000                  |                            | 0.1000                    | 0.1600                        | 0.0160       |                                | (29a)         |
| Main Flat Roof     | 155.5800                |                            | 155.5800                  | 0.1200                        | 18.6696      |                                | (30)          |

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|                                                |          |                      |          |         |      |
|------------------------------------------------|----------|----------------------|----------|---------|------|
| Flat Roof GF                                   | 46.7600  | 46.7600              | 0.1200   | 5.6112  | (30) |
| Loft Insulation                                | 45.5900  | 45.5900              | 0.1221   | 5.5650  | (30) |
| Main Pitched Roof                              | 334.2000 | 334.2000             | 0.1200   | 40.1040 | (30) |
| Dormer Roofs                                   | 63.2200  | 63.2200              | 0.1500   | 9.4830  | (30) |
| Bridge over Basement                           | 129.7300 | 129.7300             | 0.1800   | 23.3514 | (30) |
| Total net area of external elements Aum(A, m2) |          | 2323.7700            |          |         | (31) |
| Fabric heat loss, W/K = Sum (A x U)            |          | (26)...(30) + (32) = | 474.5767 |         | (33) |

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)

|                                                                  |  |          |           |         |  |
|------------------------------------------------------------------|--|----------|-----------|---------|--|
| List of Thermal Bridges                                          |  |          |           |         |  |
| K1 Element                                                       |  | Length   | Psi-value | Total   |  |
| E5 Ground floor (normal)                                         |  | 21.3500  | 0.1600    | 3.4160  |  |
| E19 Ground floor (inverted)                                      |  | 14.1200  | 0.0700    | 0.9884  |  |
| E22 Basement floor                                               |  | 102.4700 | 0.2200    | 22.5434 |  |
| E6 Intermediate floor within a dwelling                          |  | 224.3800 | 0.0000    | 0.0000  |  |
| E11 Eaves (insulation at rafter level)                           |  | 76.9600  | 0.0400    | 3.0784  |  |
| E14 Flat roof                                                    |  | 53.8700  | 0.0800    | 4.3096  |  |
| E16 Corner (normal)                                              |  | 78.5400  | 0.0900    | 7.0686  |  |
| E17 Corner (inverted - internal area greater than external area) |  | 39.2700  | -0.0900   | -3.5343 |  |
| E2 Other lintels (including other steel lintels)                 |  | 60.3800  | 0.0500    | 3.0190  |  |
| E3 Sill                                                          |  | 58.2000  | 0.0500    | 2.9100  |  |
| E4 Jamb                                                          |  | 199.9800 | 0.0500    | 9.9990  |  |
| R4 Ridge (vaulted ceiling)                                       |  | 6.5600   | 0.0800    | 0.5248  |  |
| R5 Ridge (inverted)                                              |  | 0.0400   | 0.0400    | 0.0016  |  |

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 54.3245 (36)  
Point Thermal bridges (36a) = 0.0000  
Total fabric heat loss (33) + (36) + (36a) = 528.9012 (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                                                 | 462.3190 | 457.1403 | 451.9617 | 426.0686 | 420.8900 | 394.9969 | 394.9969 | 389.8183 | 405.3541 | 420.8900 | 431.2472 | 441.6045 | (38) |
| Average = Sum(39)m / 12 =                                           | 991.2202 | 986.0416 | 980.8630 | 954.9699 | 949.7912 | 923.8981 | 923.8981 | 918.7195 | 934.2554 | 949.7912 | 960.1485 | 970.5057 | (39) |
|                                                                     |          |          |          |          |          |          |          |          |          |          |          | 953.6752 |      |

|               |        |        |        |        |        |        |        |        |        |        |        |        |      |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| HLP           | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |      |
| HLP (average) | 0.6751 | 0.6716 | 0.6680 | 0.6504 | 0.6469 | 0.6292 | 0.6292 | 0.6257 | 0.6363 | 0.6469 | 0.6539 | 0.6610 | (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                        |          |          |          |          |          |          |          |          |          |          |          |          | 4.6507 (42)   |
| Hot water usage for mixer showers        |          |          |          |          |          |          |          |          |          |          |          |          |               |
|                                          | 131.4310 | 129.4559 | 126.5777 | 121.0708 | 117.0068 | 112.4748 | 109.8987 | 112.7551 | 115.8863 | 120.7524 | 126.3775 | 130.9275 | (42a)         |
| Hot water usage for baths                |          |          |          |          |          |          |          |          |          |          |          |          |               |
|                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (42b)         |
| Hot water usage for other uses           |          |          |          |          |          |          |          |          |          |          |          |          |               |
|                                          | 62.2578  | 59.9938  | 57.7299  | 55.4660  | 53.2021  | 50.9382  | 50.9382  | 53.2021  | 55.4660  | 57.7299  | 59.9938  | 62.2578  | (42c)         |
| Average daily hot water use (litres/day) |          |          |          |          |          |          |          |          |          |          |          |          | 177.7730 (43) |

|                                        |          |          |          |          |          |          |          |          |          |          |          |          |                              |
|----------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------------------------------|
| Daily hot water use                    | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |                              |
|                                        | 193.6888 | 189.4497 | 184.3076 | 176.5368 | 170.2089 | 163.4129 | 160.8369 | 165.9572 | 171.3523 | 178.4823 | 186.3714 | 193.1852 | (44)                         |
| Energy conte                           | 306.7557 | 269.7739 | 283.2739 | 241.6700 | 229.1339 | 200.9353 | 194.5183 | 205.4897 | 211.2945 | 242.1988 | 265.5202 | 302.4813 | (45)                         |
| Energy content (annual)                |          |          |          |          |          |          |          |          |          |          |          |          |                              |
|                                        |          |          |          |          |          |          |          |          |          |          |          |          | Total = Sum(45)m = 2953.0455 |
| Distribution loss (46)m = 0.15 x (45)m |          |          |          |          |          |          |          |          |          |          |          |          |                              |
|                                        | 46.0134  | 40.4661  | 42.4911  | 36.2505  | 34.3701  | 30.1403  | 29.1777  | 30.8235  | 31.6942  | 36.3298  | 39.8280  | 45.3722  | (46)                         |

Water storage loss:  
Store volume 570.0000 (47)  
a) If manufacturer declared loss factor is known (kWh/day): 2.4400 (48)  
Temperature factor from Table 2b 0.5400 (49)  
Enter (49) or (54) in (55) 1.3176 (55)  
Total storage loss

|                                              |         |         |         |         |         |         |         |         |         |         |         |         |      |
|----------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| 40.8456                                      | 36.8928 | 40.8456 | 39.5280 | 40.8456 | 39.5280 | 40.8456 | 40.8456 | 39.5280 | 40.8456 | 39.5280 | 40.8456 | 40.8456 | (56) |
| If cylinder contains dedicated solar storage |         |         |         |         |         |         |         |         |         |         |         |         |      |
| 40.8456                                      | 36.8928 | 40.8456 | 39.5280 | 40.8456 | 39.5280 | 40.8456 | 40.8456 | 39.5280 | 40.8456 | 39.5280 | 40.8456 | 40.8456 | (57) |
| Primary loss                                 | 23.2624 | 21.0112 | 23.2624 | 22.5120 | 23.2624 | 22.5120 | 23.2624 | 22.5120 | 23.2624 | 22.5120 | 23.2624 | 23.2624 | (59) |
| Combi loss                                   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | (61) |

|                                                                 |          |          |          |          |          |          |          |          |          |          |          |          |       |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-------|
| Total heat required for water heating calculated for each month |          |          |          |          |          |          |          |          |          |          |          |          |       |
|                                                                 | 370.8637 | 327.6779 | 347.3819 | 303.7100 | 293.2419 | 262.9753 | 258.6263 | 269.5977 | 273.3345 | 306.3068 | 327.5602 | 366.5893 | (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) |

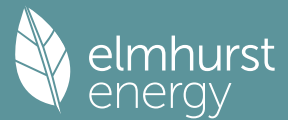
Output from w/h 370.8637 327.6779 347.3819 303.7100 293.2419 262.9753 258.6263 269.5977 273.3345 306.3068 327.5602 366.5893 (64)  
Total per year (kWh/year) = Sum(64)m = 3707.8655 (64)  
3708 (64)

|                                                                                |          |          |          |          |          |          |          |          |          |          |          |          |              |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------------|
| 12Total per year (kWh/year)                                                    |          |          |          |          |          |          |          |          |          |          |          |          |              |
| Electric shower(s)                                                             |          |          |          |          |          |          |          |          |          |          |          |          |              |
|                                                                                | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (64a)        |
|                                                                                |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (64a) |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |          |          |          |          |          |          |          |          |          |              |
| Heat gains from water heating, kWh/month                                       |          |          |          |          |          |          |          |          |          |          |          |          |              |
|                                                                                | 153.2827 | 136.0230 | 145.4750 | 129.9873 | 127.4734 | 116.4430 | 115.9637 | 119.6117 | 119.8874 | 131.8175 | 137.9175 | 151.8614 | (65)         |

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

|                                                                                     |           |           |           |           |           |           |           |           |           |           |           |           |      |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------|
| Metabolic gains (Table 5), Watts                                                    |           |           |           |           |           |           |           |           |           |           |           |           |      |
| (66)m                                                                               | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec       |      |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 232.5347  | 232.5347  | 232.5347  | 232.5347  | 232.5347  | 232.5347  | 232.5347  | 232.5347  | 232.5347  | 232.5347  | 232.5347  | 232.5347  | (66) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 696.5973  | 771.2327  | 696.5973  | 719.8172  | 696.5973  | 719.8172  | 696.5973  | 696.5973  | 719.8172  | 696.5973  | 719.8172  | 696.5973  | (67) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 1167.2854 | 1179.3982 | 1148.8744 | 1083.8928 | 1001.8653 | 924.7710  | 873.2673  | 861.1545  | 891.6783  | 956.6599  | 1038.6874 | 1115.7817 | (68) |
| Pumps, fans                                                                         | 46.2535   | 46.2535   | 46.2535   | 46.2535   | 46.2535   | 46.2535   | 46.2535   | 46.2535   | 46.2535   | 46.2535   | 46.2535   | 46.2535   | (69) |
| Losses e.g. evaporation (negative values) (Table 5)                                 | 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) |
| -186.0278                                                                           | -186.0278 | -186.0278 | -186.0278 | -186.0278 | -186.0278 | -186.0278 | -186.0278 | -186.0278 | -186.0278 | -186.0278 | -186.0278 | -186.0278 | (71) |
| Water heating gains (Table 5)                                                       |           |           |           |           |           |           |           |           |           |           |           |           |      |
|                                                                                     | 206.0251  | 202.4152  | 195.5309  | 180.5379  | 171.3353  | 161.7264  | 155.8652  | 160.7685  | 166.5103  | 177.1740  | 191.5520  | 204.1149  | (72) |
| Total internal gains                                                                | 2165.6682 | 2248.8065 | 2136.7630 | 2080.0084 | 1965.5583 | 1899.0750 | 1818.4903 | 1811.2807 | 1870.7663 | 1926.1916 | 2045.8170 | 2112.2542 | (73) |

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## 6. Solar gains

| [Jan]       | Area<br>m2 |           | Solar flux<br>Table 6a<br>W/m2 |           | Specific data<br>or Table 6b |           | Specific data<br>or Table 6c |           | FF        |           | Access<br>factor<br>Table 6d |           | Gains<br>W    |  |
|-------------|------------|-----------|--------------------------------|-----------|------------------------------|-----------|------------------------------|-----------|-----------|-----------|------------------------------|-----------|---------------|--|
| North       | 19.9700    |           | 10.6334                        |           | 0.7000                       |           | 0.7000                       |           | 0.7700    |           | 0.7700                       |           | 72.1073 (74)  |  |
| East        | 60.1300    |           | 19.6403                        |           | 0.7000                       |           | 0.7000                       |           | 0.7700    |           | 0.7700                       |           | 401.0217 (76) |  |
| South       | 12.6700    |           | 46.7521                        |           | 0.7000                       |           | 0.7000                       |           | 0.7700    |           | 0.7700                       |           | 201.1438 (78) |  |
| West        | 37.5900    |           | 19.6403                        |           | 0.7000                       |           | 0.7000                       |           | 0.7700    |           | 0.7700                       |           | 250.6969 (80) |  |
| Solar gains | 924.9697   | 1742.1223 | 2753.3603                      | 3912.4934 | 4753.6095                    | 4859.6009 | 4628.4509                    | 3994.6630 | 3161.7769 | 2032.1220 | 1139.9941                    | 769.8606  | (83)          |  |
| Total gains | 3090.6379  | 3990.9288 | 4890.1233                      | 5992.5018 | 6719.1678                    | 6758.6759 | 6446.9412                    | 5805.9437 | 5032.5432 | 3958.3137 | 3185.8111                    | 2882.1149 | (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                                                                         | 102.8670 | 103.4073 | 103.9532 | 106.7718 | 107.3540 | 110.3627 | 110.3627 | 110.9848 | 109.1392 | 107.3540 | 106.1960 | 105.0626 |              |
| alpha                                                                       | 7.8578   | 7.8938   | 7.9302   | 8.1181   | 8.1569   | 8.3575   | 8.3575   | 8.3990   | 8.2759   | 8.1569   | 8.0797   | 8.0042   |              |
| util living area                                                            | 1.0000   | 1.0000   | 0.9999   | 0.9977   | 0.9720   | 0.8247   | 0.6256   | 0.7134   | 0.9686   | 0.9997   | 1.0000   | 1.0000   | (86)         |
| MIT                                                                         | 20.1534  | 20.2477  | 20.4005  | 20.6257  | 20.8231  | 20.9422  | 20.9608  | 20.9578  | 20.8674  | 20.6049  | 20.3499  | 20.1543  | (87)         |
| Th 2                                                                        | 20.3629  | 20.3660  | 20.3692  | 20.3849  | 20.3880  | 20.4038  | 20.4038  | 20.4069  | 20.3974  | 20.3880  | 20.3817  | 20.3754  | (88)         |
| util rest of house                                                          | 1.0000   | 1.0000   | 0.9998   | 0.9966   | 0.9590   | 0.7666   | 0.5435   | 0.6289   | 0.9481   | 0.9995   | 1.0000   | 1.0000   | (89)         |
| MIT 2                                                                       | 19.3251  | 19.4488  | 19.6476  | 19.9495  | 20.1992  | 20.3419  | 20.3552  | 20.3570  | 20.2630  | 19.9259  | 19.5933  | 19.3370  | (90)         |
| Living area fraction                                                        | 19.3575  | 19.4800  | 19.6770  | 19.9759  | 20.2235  | 20.3654  | 20.3788  | 20.3805  | 20.2866  | 19.9525  | 19.6229  | 19.3689  | (91)         |
| MIT                                                                         | 19.3575  | 19.4800  | 19.6770  | 19.9759  | 20.2235  | 20.3654  | 20.3788  | 20.3805  | 20.2866  | 19.9525  | 19.6229  | 19.3689  | (92)         |
| Temperature adjustment                                                      | 19.2075  | 19.3300  | 19.5270  | 19.8259  | 20.0735  | 20.2154  | 20.2288  | 20.2305  | 20.1366  | 19.8025  | 19.4729  | 19.2189  | (93)         |
| adjusted MIT                                                                | 19.2075  | 19.3300  | 19.5270  | 19.8259  | 20.0735  | 20.2154  | 20.2288  | 20.2305  | 20.1366  | 19.8025  | 19.4729  | 19.2189  | (93)         |

## 8. Space heating requirement

|                                                                                |            |            |            |            |           |           |           |           |           |               |            |            |       |
|--------------------------------------------------------------------------------|------------|------------|------------|------------|-----------|-----------|-----------|-----------|-----------|---------------|------------|------------|-------|
|                                                                                | Jan        | Feb        | Mar        | Apr        | May       | Jun       | Jul       | Aug       | Sep       | Oct           | Nov        | Dec        |       |
| Utilisation                                                                    | 1.0000     | 1.0000     | 0.9997     | 0.9953     | 0.9501    | 0.7462    | 0.5190    | 0.6025    | 0.9357    | 0.9991        | 1.0000     | 1.0000     | (94)  |
| Useful gains                                                                   | 3090.6267  | 3990.8029  | 4888.6376  | 5964.0383  | 6384.0910 | 5043.6542 | 3345.8339 | 3498.2833 | 4708.9917 | 3954.9272     | 3185.7550  | 2882.1095  | (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                                                               | 14776.6091 | 14228.5856 | 12777.6728 | 10433.9370 | 7953.1074 | 5188.0207 | 3352.6624 | 3519.1525 | 5639.7123 | 8740.4149     | 11879.7981 | 14575.9257 | (97)  |
| Space heating kWh                                                              | 8694.3709  | 6879.7900  | 5869.4422  | 3218.3271  | 1167.3482 | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 3560.4028     | 6259.7110  | 8700.1992  | (98a) |
| Space heating requirement - total per year (kWh/year)                          |            |            |            |            |           |           |           |           |           |               |            | 44349.5915 |       |
| 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                                                              | 8694.3709  | 6879.7900  | 5869.4422  | 3218.3271  | 1167.3482 | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 3560.4028     | 6259.7110  | 8700.1992  | (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |            |            |            |            |           |           |           |           |           |               |            | 44349.5915 |       |
| Space heating per m2                                                           |            |            |            |            |           |           |           |           |           | (98c) / (4) = |            | 30.2051    | (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 %)                                                     |           |           |           |           |           |          |          |          |          |           |           |           | 88.8000 (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                                                                            | 8694.3709 | 6879.7900 | 5869.4422 | 3218.3271 | 1167.3482 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 3560.4028 | 6259.7110 | 8700.1992 | (98)          |
| Space heating efficiency (main heating system 1)                                                     | 88.8000   | 88.8000   | 88.8000   | 88.8000   | 88.8000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 88.8000   | 88.8000   | 88.8000   | (210)         |
| Space heating fuel (main heating system)                                                             | 9790.9582 | 7747.5113 | 6609.7322 | 3624.2422 | 1314.5813 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 4009.4626 | 7049.2241 | 9797.5217 | (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                                                                            | 370.8637  | 327.6779  | 347.3819  | 303.7100  | 293.2419  | 262.9753 | 258.6263 | 269.5977 | 273.3345 | 306.3068  | 327.5602  | 366.5893  | (64)          |
| Efficiency of water heater                                                                           | 88.3922   | 88.3470   | 88.2439   | 87.9447   | 86.8338   | 79.8000  | 79.8000  | 79.8000  | 79.8000  | 88.0137   | 88.3048   | 88.3969   | (216)         |
| Fuel for water heating, kWh/month                                                                    | 419.5662  | 370.8987  | 393.6612  | 345.3420  | 337.7048  | 329.5430 | 324.0931 | 337.8417 | 342.5245 | 348.0218  | 370.9428  | 414.7083  | (219)         |
| Space cooling fuel requirement                                                                       | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | (221)         |
| Pumps and Fa                                                                                         | 606.7040  | 547.9907  | 606.7040  | 587.1329  | 606.7040  | 587.1329 | 606.7040 | 606.7040 | 587.1329 | 606.7040  | 587.1329  | 606.7040  | (231)         |
| Lighting                                                                                             | 158.3534  | 127.0370  | 114.3827  | 83.8017   | 64.7308   | 52.8856  | 59.0496  | 76.7549  | 99.6971  | 130.8080  | 147.7473  | 162.7545  | (232)         |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | (233a)        |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | (234a)        |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | (235a)        |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | (235c)        |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | (233b)        |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | (234b)        |

# Full SAP Calculation Printout



|                                                                                                      |        |        |        |        |        |        |        |        |        |        |        |            |        |
|------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------------|--------|
| 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                                                                   |        |        |        |        |        |        |        |        |        |        |        | 49943.2337 | (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                                                                              |        |        |        |        |        |        |        |        |        |        |        | 4334.8482  | (219)  |
| Space cooling fuel                                                                                   |        |        |        |        |        |        |        |        |        |        |        | 0.0000     | (221)  |
| Electricity for pumps and fans:                                                                      |        |        |        |        |        |        |        |        |        |        |        |            |        |
| (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.1750)                           |        |        |        |        |        |        |        |        |        |        |        |            |        |
| mechanical ventilation fans (SFP = 1.1750)                                                           |        |        |        |        |        |        |        |        |        |        |        | 7057.4499  | (230a) |
| central heating pump                                                                                 |        |        |        |        |        |        |        |        |        |        |        | 41.0000    | (230c) |
| main heating flue fan                                                                                |        |        |        |        |        |        |        |        |        |        |        | 45.0000    | (230e) |
| Total electricity for the above, kWh/year                                                            |        |        |        |        |        |        |        |        |        |        |        | 7143.4499  | (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |        |        |        |        |        |        |        |        |        |        |        | 1278.0028  | (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                                                                  |        |        |        |        |        |        |        |        |        |        |        | 62699.5345 | (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                   | 49943.2337         | 0.2100                        | 10488.0791 (261)         |
| Total CO2 associated with community systems     |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                      | 4334.8482          | 0.2100                        | 910.3181 (264)           |
| Space and water heating                         |                    |                               | 11398.3972 (265)         |
| Pumps, fans and electric keep-hot               | 7143.4499          | 0.1387                        | 990.8846 (267)           |
| Energy for lighting                             | 1278.0028          | 0.1443                        | 184.4553 (268)           |
| Total CO2, kg/year                              |                    |                               | 12573.7371 (272)         |
| EPC Dwelling Carbon Dioxide Emission Rate (DER) |                    |                               | 8.5600 (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               | 49943.2337         | 1.1300                              | 56435.8540 (275)           |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 4334.8482          | 1.1300                              | 4898.3784 (278)            |
| Space and water heating                     |                    |                                     | 61334.2325 (279)           |
| Pumps, fans and electric keep-hot           | 7143.4499          | 1.5128                              | 10806.6110 (281)           |
| Energy for lighting                         | 1278.0028          | 1.5338                              | 1960.2434 (282)            |
| Total Primary energy kWh/year               |                    |                                     | 74101.0869 (286)           |
| Dwelling Primary energy Rate (DPER)         |                    |                                     | 50.4700 (287)              |

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

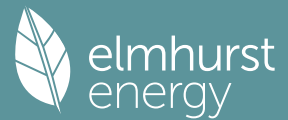
## 1. Overall dwelling characteristics

|                                                        | Area<br>(m2)  | Storey height<br>(m)              | Volume<br>(m3)          |
|--------------------------------------------------------|---------------|-----------------------------------|-------------------------|
| Basement floor                                         | 460.0000 (1a) | x 3.0500 (2a)                     | = 1403.0000 (1a) - (3a) |
| Ground floor                                           | 384.6600 (1b) | x 4.2000 (2b)                     | = 1615.5720 (1b) - (3b) |
| First floor                                            | 332.1000 (1c) | x 3.3300 (2c)                     | = 1105.8930 (1c) - (3c) |
| Second floor                                           | 291.5200 (1d) | x 2.7400 (2d)                     | = 798.7648 (1d) - (3d)  |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 1468.2800     |                                   | (4)                     |
| Dwelling volume                                        |               | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 4923.2298 (5)           |

## 2. Ventilation rate

|                                                                                                    | m3 per hour                |
|----------------------------------------------------------------------------------------------------|----------------------------|
| Number of open chimneys                                                                            | 0 * 80 = 0.0000 (6a)       |
| Number of open flues                                                                               | 0 * 20 = 0.0000 (6b)       |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 = 0.0000 (6c)       |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 = 0.0000 (6d)       |
| Number of flues attached to other heater                                                           | 0 * 35 = 0.0000 (6e)       |
| Number of blocked chimneys                                                                         | 0 * 20 = 0.0000 (6f)       |
| Number of intermittent extract fans                                                                | 4 * 10 = 40.0000 (7a)      |
| Number of passive vents                                                                            | 0 * 10 = 0.0000 (7b)       |
| Number of flueless gas fires                                                                       | 0 * 40 = 0.0000 (7c)       |
| Air changes per hour                                                                               |                            |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 40.0000 / (5) = 0.0081 (8) |
| Pressure test                                                                                      | Yes                        |
| Pressure Test Method                                                                               | Blower Door                |
| Measured/design AP50                                                                               | 5.0000 (17)                |
| Infiltration rate                                                                                  | 0.2581 (18)                |

# Full SAP Calculation Printout



Number of sides sheltered

2 (19)

Shelter factor

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

Infiltration rate adjusted to include shelter factor

$$(21) = (18) \times (20) = 0.2194 \quad (21)$$

|                 |               |               |               |               |               |               |               |               |               |               |               |               |       |
|-----------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|-------|
| Wind speed      | Jan<br>5.1000 | Feb<br>5.0000 | Mar<br>4.9000 | Apr<br>4.4000 | May<br>4.3000 | Jun<br>3.8000 | Jul<br>3.8000 | Aug<br>3.7000 | Sep<br>4.0000 | Oct<br>4.3000 | Nov<br>4.5000 | Dec<br>4.7000 | (22)  |
| Wind factor     | 1.2750        | 1.2500        | 1.2250        | 1.1000        | 1.0750        | 0.9500        | 0.9500        | 0.9250        | 1.0000        | 1.0750        | 1.1250        | 1.1750        | (22a) |
| Adj infilt rate | 0.2797        | 0.2743        | 0.2688        | 0.2413        | 0.2359        | 0.2084        | 0.2084        | 0.2030        | 0.2194        | 0.2359        | 0.2468        | 0.2578        | (22b) |
| Effective ac    | 0.5391        | 0.5376        | 0.5361        | 0.5291        | 0.5278        | 0.5217        | 0.5217        | 0.5206        | 0.5241        | 0.5278        | 0.5305        | 0.5332        | (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                                |             |                | 5.3400        | 1.0000           | 5.3400                        |                   | (26)          |
| TER Opening Type (Uw = 1.20)                   |             |                | 130.3600      | 1.1450           | 149.2672                      |                   | (27)          |
| Basement Floor                                 |             |                | 396.1900      | 0.1300           | 51.5047                       |                   | (28a)         |
| Basement Pool                                  |             |                | 64.0200       | 0.1300           | 8.3226                        |                   | (28a)         |
| Ground Floor                                   |             |                | 59.7800       | 0.1300           | 7.7714                        |                   | (28a)         |
| Basement Wall                                  | 312.6300    | 2.4600         | 310.1700      | 0.1800           | 55.8306                       |                   | (29a)         |
| Ground Floor                                   | 388.2100    | 77.1700        | 311.0400      | 0.1800           | 55.9872                       |                   | (29a)         |
| First Floor                                    | 264.7400    | 40.7800        | 223.9600      | 0.1800           | 40.3128                       |                   | (29a)         |
| Second Floor                                   | 35.0600     |                | 35.0600       | 0.1800           | 6.3108                        |                   | (29a)         |
| Dormer Walls                                   | 27.9600     | 15.2900        | 12.6700       | 0.1800           | 2.2806                        |                   | (29a)         |
| Loft Walls                                     | 0.1000      |                | 0.1000        | 0.1800           | 0.0180                        |                   | (29a)         |
| Main Flat Roof                                 | 155.5800    |                | 155.5800      | 0.1100           | 17.1138                       |                   | (30)          |
| Flat Roof GF                                   | 46.7600     |                | 46.7600       | 0.1100           | 5.1436                        |                   | (30)          |
| Loft Insulation                                | 45.5900     |                | 45.5900       | 0.1100           | 5.0149                        |                   | (30)          |
| Main Pitched Roof                              | 334.2000    |                | 334.2000      | 0.1100           | 36.7620                       |                   | (30)          |
| Dormer Roofs                                   | 63.2200     |                | 63.2200       | 0.1100           | 6.9542                        |                   | (30)          |
| Bridge over Basement                           | 129.7300    |                | 129.7300      | 0.1100           | 14.2703                       |                   | (30)          |
| Total net area of external elements Aum(A, m2) |             |                | 2323.7700     |                  |                               |                   | (31)          |
| Fabric heat loss, W/K = Sum (A x U)            |             |                |               |                  | (26)...(30) + (32) = 468.2047 |                   | (33)          |

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

250.0000 (35)

List of Thermal Bridges

| K1 Element                                                       | Length   | Psi-value | Total   |
|------------------------------------------------------------------|----------|-----------|---------|
| E5 Ground floor (normal)                                         | 21.3500  | 0.1600    | 3.4160  |
| E19 Ground floor (inverted)                                      | 14.1200  | 0.0700    | 0.9884  |
| E22 Basement floor                                               | 102.4700 | 0.0700    | 7.1729  |
| E6 Intermediate floor within a dwelling                          | 224.3800 | 0.0000    | 0.0000  |
| E11 Eaves (insulation at rafter level)                           | 76.9600  | 0.0400    | 3.0784  |
| E14 Flat roof                                                    | 53.8700  | 0.0800    | 4.3096  |
| E16 Corner (normal)                                              | 78.5400  | 0.0900    | 7.0686  |
| E17 Corner (inverted - internal area greater than external area) | 39.2700  | -0.0900   | -3.5343 |
| E2 Other lintels (including other steel lintels)                 | 60.3800  | 0.0500    | 3.0190  |
| E3 Sill                                                          | 58.2000  | 0.0500    | 2.9100  |
| E4 Jamb                                                          | 199.9800 | 0.0500    | 9.9990  |
| R4 Ridge (vaulted ceiling)                                       | 6.5600   | 0.0800    | 0.5248  |
| R5 Ridge (inverted)                                              | 0.0400   | 0.0400    | 0.0016  |

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

38.9540 (36)

Point Thermal bridges

$$(36a) = 0.0000$$

Total fabric heat loss

$$(33) + (36) + (36a) = 507.1587 \quad (37)$$

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

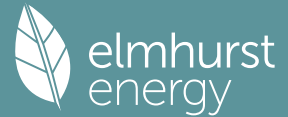
|                           |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |      |
|---------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|------|
| (38)m                     | Jan<br>875.9028 | Feb<br>873.4343 | Mar<br>871.0147 | Apr<br>859.6498 | May<br>857.5235 | Jun<br>847.6251 | Jul<br>847.6251 | Aug<br>845.7920 | Sep<br>851.4378 | Oct<br>857.5235 | Nov<br>861.8251 | Dec<br>866.3221 | (38) |
| Heat transfer coeff       | 1383.0615       | 1380.5930       | 1378.1734       | 1366.8085       | 1364.6822       | 1354.7838       | 1354.7838       | 1352.9507       | 1358.5965       | 1364.6822       | 1368.9837       | 1373.4808       | (39) |
| Average = Sum(39)m / 12 = |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 | 1366.7983       |      |

|               |               |               |               |               |               |               |               |               |               |               |               |               |      |
|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|------|
| HLP           | Jan<br>0.9420 | Feb<br>0.9403 | Mar<br>0.9386 | Apr<br>0.9309 | May<br>0.9294 | Jun<br>0.9227 | Jul<br>0.9227 | Aug<br>0.9215 | Sep<br>0.9253 | Oct<br>0.9294 | Nov<br>0.9324 | Dec<br>0.9354 | (40) |
| HLP (average) |               |               |               |               |               |               |               |               |               |               |               | 0.9309        |      |
| Days in mont  | 31            | 28            | 31            | 30            | 31            | 30            | 31            | 31            | 30            | 31            | 30            | 31            |      |

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

|                                                                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |             |
|-----------------------------------------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-------------|
| Assumed occupancy                                               |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 | 4.6507 (42) |
| Hot water usage for mixer showers                               |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |             |
| 131.4310                                                        | 129.4559        | 126.5777        | 121.0708        | 117.0068        | 112.4748        | 109.8987        | 112.7551        | 115.8863        | 120.7524        | 126.3775        | 130.9275        | 130.9275        | (42a)       |
| Hot water usage for baths                                       |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |             |
| 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          | (42b)       |
| Hot water usage for other uses                                  |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |             |
| 62.2578                                                         | 59.9938         | 57.7299         | 55.4660         | 53.2021         | 50.9382         | 50.9382         | 53.2021         | 55.4660         | 57.7299         | 59.9938         | 62.2578         | 62.2578         | (42c)       |
| Average daily hot water use (litres/day)                        |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 | 177.7730        | (43)        |
| Daily hot water use                                             | Jan<br>193.6888 | Feb<br>189.4497 | Mar<br>184.3076 | Apr<br>176.5368 | May<br>170.2089 | Jun<br>163.4129 | Jul<br>160.8369 | Aug<br>165.9572 | Sep<br>171.3523 | Oct<br>178.4823 | Nov<br>186.3714 | Dec<br>193.1852 | (44)        |
| Energy conte                                                    | 306.7557        | 269.7739        | 283.2739        | 241.6700        | 229.1339        | 200.9353        | 194.5183        | 205.4897        | 211.2945        | 242.1988        | 265.5202        | 302.4813        | (45)        |
| Energy content (annual)                                         |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 | 2953.0455       |             |
| Distribution loss (46)m = 0.15 x (45)m                          |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |             |
| 46.0134                                                         | 40.4661         | 42.4911         | 36.2505         | 34.3701         | 30.1403         | 29.1777         | 30.8235         | 31.6942         | 36.3298         | 39.8280         | 45.3722         | 45.3722         | (46)        |
| Water storage loss:                                             |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |             |
| Store volume                                                    |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 | 570.0000        | (47)        |
| a) If manufacturer declared loss factor is known (kWh/day):     |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 | 3.1502          | (48)        |
| Temperature factor from Table 2b                                |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 | 0.5400          | (49)        |
| Enter (49) or (54) in (55)                                      |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 | 1.7011          | (55)        |
| Total storage loss                                              |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |             |
| 52.7336                                                         | 47.6304         | 52.7336         | 51.0325         | 52.7336         | 51.0325         | 52.7336         | 52.7336         | 51.0325         | 52.7336         | 51.0325         | 52.7336         | 52.7336         | (56)        |
| If cylinder contains dedicated solar storage                    |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |             |
| 52.7336                                                         | 47.6304         | 52.7336         | 51.0325         | 52.7336         | 51.0325         | 52.7336         | 52.7336         | 51.0325         | 52.7336         | 51.0325         | 52.7336         | 52.7336         | (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 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |                 |             |
| 382.7517                                                        | 338.4154        | 359.2699        | 315.2146        | 305.1299        | 274.4798        | 270.5143        | 281.4857        | 284.8390        | 318.1948        | 339.0647        | 378.4774        | 378.4774        | (62)        |
| WWHRS                                                           | -60.0848        | -53.1395        | -55.6446        | -46.0759        | -42.9411        | -36.7450        | -34.4426        | -36.6262        | -38.0178        | -44.8188        | -50.7742        | -58.9721        | (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)       |

# Full SAP Calculation Printout



|                                          |                                                                                |          |          |          |          |          |          |          |          |          |          |                |
|------------------------------------------|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| Output from w/h                          | 322.6669                                                                       | 285.2759 | 303.6253 | 269.1387 | 262.1888 | 237.7348 | 236.0717 | 244.8595 | 246.8212 | 273.3760 | 288.2905 | 319.5053 (64)  |
| 12Total per year (kWh/year)              | Total per year (kWh/year) = Sum(64)m =                                         |          |          |          |          |          |          |          |          |          |          | 3289.5547 (64) |
| Electric shower(s)                       | 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (64a)   |
|                                          | Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |          |          |          |          |          |          |          | 0.0000 (64a)   |
| Heat gains from water heating, kWh/month | 162.7931                                                                       | 144.6131 | 154.9854 | 139.1909 | 136.9838 | 125.6466 | 125.4741 | 129.1221 | 129.0910 | 141.3279 | 147.1211 | 161.3719 (65)  |

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

|                                                                                     |           |           |           |           |           |           |           |           |           |           |           |           |      |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------|
| Metabolic gains (Table 5), Watts                                                    | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec       |      |
| (66)m                                                                               | 232.5347  | 232.5347  | 232.5347  | 232.5347  | 232.5347  | 232.5347  | 232.5347  | 232.5347  | 232.5347  | 232.5347  | 232.5347  | 232.5347  | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 696.5973  | 771.2327  | 696.5973  | 719.8172  | 696.5973  | 719.8172  | 696.5973  | 696.5973  | 719.8172  | 696.5973  | 719.8172  | 696.5973  | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 1167.2854 | 1179.3982 | 1148.8744 | 1083.8928 | 1001.8653 | 924.7710  | 873.2673  | 861.1545  | 891.6783  | 956.6599  | 1038.6874 | 1115.7817 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 46.2535   | 46.2535   | 46.2535   | 46.2535   | 46.2535   | 46.2535   | 46.2535   | 46.2535   | 46.2535   | 46.2535   | 46.2535   | 46.2535   | (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)                                 | -186.0278 | -186.0278 | -186.0278 | -186.0278 | -186.0278 | -186.0278 | -186.0278 | -186.0278 | -186.0278 | -186.0278 | -186.0278 | -186.0278 | (71) |
| Water heating gains (Table 5)                                                       | 218.8079  | 215.1980  | 208.3137  | 193.3207  | 184.1181  | 174.5092  | 168.6480  | 173.5513  | 179.2931  | 189.9569  | 204.3348  | 216.8977  | (72) |
| Total internal gains                                                                | 2178.4510 | 2261.5893 | 2149.5458 | 2092.7912 | 1978.3411 | 1911.8578 | 1831.2731 | 1824.0635 | 1883.5491 | 1938.9744 | 2058.5998 | 2125.0371 | (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       |           |           |           | 19.9700    | 10.6334                        |           | 0.6300                            |           | 0.7000                             |           | 0.7700                       |           | 64.8966 (74)  |
| East        |           |           |           | 60.1300    | 19.6403                        |           | 0.6300                            |           | 0.7000                             |           | 0.7700                       |           | 360.9195 (76) |
| South       |           |           |           | 12.6700    | 46.7521                        |           | 0.6300                            |           | 0.7000                             |           | 0.7700                       |           | 181.0295 (78) |
| West        |           |           |           | 37.5900    | 19.6403                        |           | 0.6300                            |           | 0.7000                             |           | 0.7700                       |           | 225.6272 (80) |
|             |           |           |           |            |                                |           |                                   |           |                                    |           |                              |           |               |
| Solar gains | 832.4727  | 1567.9100 | 2478.0243 | 3521.2441  | 4278.2485                      | 4373.6408 | 4165.6058                         | 3595.1967 | 2845.5992                          | 1828.9098 | 1025.9947                    | 692.8746  | (83)          |
| Total gains | 3010.9237 | 3829.4993 | 4627.5701 | 5614.0353  | 6256.5897                      | 6285.4986 | 5996.8789                         | 5419.2602 | 4729.1483                          | 3767.8843 | 3084.5945                    | 2817.9116 | (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                                                                         | 73.7233                               | 73.8551 | 73.9848 | 74.6000 | 74.7162 | 75.2621 | 75.2621 | 75.3641 | 75.0509 | 74.7162 | 74.4814 | 74.2376      |
| alpha                                                                       | 5.9149                                | 5.9237  | 5.9323  | 5.9733  | 5.9811  | 6.0175  | 6.0175  | 6.0243  | 6.0034  | 5.9811  | 5.9654  | 5.9492       |
| util living area                                                            | 1.0000                                | 1.0000  | 0.9999  | 0.9990  | 0.9926  | 0.9557  | 0.8549  | 0.9097  | 0.9918  | 0.9997  | 1.0000  | 1.0000 (86)  |
| MIT                                                                         | 19.4758                               | 19.6034 | 19.8339 | 20.1688 | 20.5070 | 20.7971 | 20.9365 | 20.9014 | 20.6434 | 20.2070 | 19.7879 | 19.4609 (87) |
| Th 2                                                                        | 20.1320                               | 20.1334 | 20.1348 | 20.1413 | 20.1425 | 20.1482 | 20.1482 | 20.1493 | 20.1461 | 20.1425 | 20.1401 | 20.1375 (88) |
| util rest of house                                                          | 1.0000                                | 1.0000  | 0.9998  | 0.9984  | 0.9880  | 0.9219  | 0.7483  | 0.8278  | 0.9842  | 0.9996  | 1.0000  | 1.0000 (89)  |
| MIT 2                                                                       | 18.2930                               | 18.4579 | 18.7547 | 19.1890 | 19.6213 | 19.9800 | 20.1170 | 20.0920 | 19.7984 | 19.2391 | 18.6995 | 18.2781 (90) |
| Living area fraction                                                        | fLA = Living area / (4) = 0.0391 (91) |         |         |         |         |         |         |         |         |         |         |              |
| MIT                                                                         | 18.3392                               | 18.5026 | 18.7968 | 19.2273 | 19.6559 | 20.0119 | 20.1490 | 20.1236 | 19.8314 | 19.2769 | 18.7421 | 18.3243 (92) |
| Temperature adjustment                                                      | 0.0000                                |         |         |         |         |         |         |         |         |         |         |              |
| adjusted MIT                                                                | 18.3392                               | 18.5026 | 18.7968 | 19.2273 | 19.6559 | 20.0119 | 20.1490 | 20.1236 | 19.8314 | 19.2769 | 18.7421 | 18.3243 (93) |

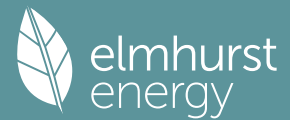
## 8. Space heating requirement

|                                                                                |               |            |            |            |            |           |           |           |           |            |            |            |       |
|--------------------------------------------------------------------------------|---------------|------------|------------|------------|------------|-----------|-----------|-----------|-----------|------------|------------|------------|-------|
| Utilisation                                                                    | Jan           | Feb        | Mar        | Apr        | May        | Jun       | Jul       | Aug       | Sep       | Oct        | Nov        | Dec        |       |
| Useful gains                                                                   | 1.0000        | 0.9999     | 0.9997     | 0.9976     | 0.9840     | 0.9145    | 0.7484    | 0.8245    | 0.9797    | 0.9993     | 1.0000     | 1.0000     | (94)  |
| Ext temp.                                                                      | 3010.8823     | 3829.2519  | 4626.0475  | 5600.2969  | 6156.3543  | 5747.9272 | 4487.9965 | 4468.2951 | 4633.1890 | 3765.1583  | 3084.4562  | 2817.8867  | (95)  |
| Heat loss rate W                                                               | 4.3000        | 4.9000     | 6.5000     | 8.9000     | 11.7000    | 14.6000   | 16.6000   | 16.4000   | 14.1000   | 10.6000    | 7.1000     | 4.2000     | (96)  |
| Space heating kWh                                                              | 19417.1091    | 18779.6896 | 16947.1879 | 14115.4381 | 10857.3208 | 7331.9376 | 4808.1356 | 5037.8264 | 7786.6166 | 11841.2148 | 15937.7771 | 19399.4556 | (97)  |
| Space heating requirement - total per year (kWh/year)                          | 12206.2328    | 10046.6942 | 9166.9285  | 6130.9017  | 3497.5191  | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 6008.5860  | 9254.3911  | 12336.6873 | (98a) |
| Solar heating kWh                                                              | 68647.9406    |            |            |            |            |           |           |           |           |            |            |            |       |
| Space heating contribution - total per year (kWh/year)                         | 0.0000        | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000     | 0.0000     | 0.0000     | (98b) |
| Space heating kWh                                                              | 0.0000        |            |            |            |            |           |           |           |           |            |            |            |       |
| Space heating requirement after solar contribution - total per year (kWh/year) | 12206.2328    | 10046.6942 | 9166.9285  | 6130.9017  | 3497.5191  | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 6008.5860  | 9254.3911  | 12336.6873 | (98c) |
| Space heating per m2                                                           | (98c) / (4) = |            |            |            |            |           |           |           |           |            |            | 46.7540    | (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                                             | 12206.2328 | 10046.6942 | 9166.9285 | 6130.9017 | 3497.5191 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 6008.5860 | 9254.3911 | 12336.6873    | (98) |
| Space heating efficiency (main heating system 1)                      |            |            |           |           |           |        |        |        |        |           |           |               |      |

# Full SAP Calculation Printout



|                                                                                                      |           |           |            |            |            |            |            |            |            |           |            |             |        |
|------------------------------------------------------------------------------------------------------|-----------|-----------|------------|------------|------------|------------|------------|------------|------------|-----------|------------|-------------|--------|
| Space heating fuel (main heating system)                                                             | 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)  |
| 13224.5209 10884.8258 9931.6668 6642.3637 3789.2948                                                  |           |           |            |            |            | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 6509.8440 | 10026.4259 | 13365.8584  | (211)  |
| Space heating efficiency (main heating system 2)                                                     | 0.0000    | 0.0000    | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000    | 0.0000     | 0.0000      | (212)  |
| Space heating fuel (main heating system 2)                                                           | 0.0000    | 0.0000    | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000    | 0.0000     | 0.0000      | (213)  |
| Space heating fuel (secondary)                                                                       | 0.0000    | 0.0000    | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000    | 0.0000     | 0.0000      | (215)  |
| Water heating requirement                                                                            | 322.6669  | 285.2759  | 303.6253   | 269.1387   | 262.1888   | 237.7348   | 236.0717   | 244.8595   | 246.8212   | 273.3760  | 288.2905   | 319.5053    | (64)   |
| Efficiency of water heater (217)m                                                                    | 88.5428   | 88.5243   | 88.4801    | 88.3808    | 88.1070    | 79.8000    | 79.8000    | 79.8000    | 79.8000    | 88.3663   | 88.4985    | 79.8000     | (216)  |
| Fuel for water heating, kWh/month                                                                    | 364.4191  | 322.2571  | 343.1567   | 304.5215   | 297.5799   | 297.9133   | 295.8292   | 306.8415   | 309.2998   | 309.3668  | 325.7576   | 360.8277    | (219)  |
| Space cooling fuel requirement (221)m                                                                | 0.0000    | 0.0000    | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000    | 0.0000     | 0.0000      | (221)  |
| Pumps and Fa                                                                                         | 7.3041    | 6.5973    | 7.3041     | 7.0685     | 7.3041     | 7.0685     | 7.3041     | 7.0685     | 7.3041     | 7.0685    | 7.3041     | 7.0685      | (231)  |
| Lighting                                                                                             | 144.7392  | 116.1151  | 104.5488   | 76.5969    | 59.1657    | 48.3389    | 53.9729    | 70.1560    | 91.1257    | 119.5619  | 135.0449   | 148.7619    | (232)  |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | -338.1301 | -436.1927 | -573.1832  | -585.9284  | -584.6469  | -527.6447  | -519.2909  | -511.3260  | -493.6223  | -466.9635 | -356.1100  | -297.1332   | (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000    | 0.0000    | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000    | 0.0000     | 0.0000      | (234a) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000    | 0.0000    | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000    | 0.0000     | 0.0000      | (235a) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000    | 0.0000    | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000    | 0.0000     | 0.0000      | (235c) |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | -335.4005 | -682.0880 | -1315.7565 | -1922.0053 | -2492.4516 | -2488.7281 | -2460.9977 | -2106.8931 | -1574.8067 | -958.4277 | -441.6939  | -267.2316   | (233b) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000    | 0.0000    | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000    | 0.0000     | 0.0000      | (234b) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000    | 0.0000    | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000    | 0.0000     | 0.0000      | (235b) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000    | 0.0000    | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000    | 0.0000     | 0.0000      | (235d) |
| Annual totals kWh/year                                                                               |           |           |            |            |            |            |            |            |            |           |            |             |        |
| Space heating fuel - main system 1                                                                   |           |           |            |            |            |            |            |            |            |           |            | 74374.8003  | (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                                                                              |           |           |            |            |            |            |            |            |            |           |            | 3837.7702   | (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)                                                  |           |           |            |            |            |            |            |            |            |           |            | 1168.1279   | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |           |           |            |            |            |            |            |            |            |           |            |             |        |
| PV generation                                                                                        |           |           |            |            |            |            |            |            |            |           |            | -22736.6525 | (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                                                                  |           |           |            |            |            |            |            |            |            |           |            | 56730.0459  | (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                 | 74374.8003         | 0.2100                        | 15618.7081               | (261) |
| Total CO2 associated with community systems   |                    |                               | 0.0000                   | (373) |
| Water heating (other fuel)                    | 3837.7702          | 0.2100                        | 805.9317                 | (264) |
| Space and water heating                       |                    |                               | 16424.6398               | (265) |
| Pumps, fans and electric keep-hot             | 86.0000            | 0.1387                        | 11.9293                  | (267) |
| Energy for lighting                           | 1168.1279          | 0.1443                        | 168.5970                 | (268) |
| Energy saving/generation technologies         |                    |                               |                          |       |
| PV Unit electricity used in dwelling          | -5690.1718         | 0.1367                        | -777.7257                |       |
| PV Unit electricity exported                  | -17046.4807        | 0.1267                        | -2160.1263               |       |
| Total                                         |                    |                               | -2937.8520               | (269) |
| Total CO2, kg/year                            |                    |                               | 13667.3140               | (272) |
| EPC Target Carbon Dioxide Emission Rate (TER) |                    |                               | 9.3100                   | (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               | 74374.8003         | 1.1300                              | 84043.5243                 | (275) |
| Total CO2 associated with community systems |                    |                                     | 0.0000                     | (473) |
| Water heating (other fuel)                  | 3837.7702          | 1.1300                              | 4336.6803                  | (278) |
| Space and water heating                     |                    |                                     | 88380.2046                 | (279) |
| Pumps, fans and electric keep-hot           | 86.0000            | 1.5128                              | 130.1008                   | (281) |
| Energy for lighting                         | 1168.1279          | 1.5338                              | 1791.7136                  | (282) |
| Energy saving/generation technologies       |                    |                                     |                            |       |
| PV Unit electricity used in dwelling        | -5690.1718         | 1.5053                              | -8565.1636                 |       |
| PV Unit electricity exported                | -17046.4807        | 0.4652                              | -7929.7368                 |       |
| Total                                       |                    |                                     | -16494.9003                | (283) |
| Total Primary energy kWh/year               |                    |                                     | 73807.1187                 | (286) |
| Target Primary Energy Rate (TPER)           |                    |                                     | 50.2700                    | (287) |



SRE Registered Office | Greenforde Farm

Stoner Hill Road | Froxfield

Petersfield | Hampshire | GU32 1DY

01730 710044

[info@sre.co.uk](mailto:info@sre.co.uk)

[www.sre.co.uk](http://www.sre.co.uk)