

# Full SAP Calculation Printout



|                                    |                                            |               |          |      |                |            |
|------------------------------------|--------------------------------------------|---------------|----------|------|----------------|------------|
| Property Reference                 | Plot 1 7HR                                 |               |          |      | Issued on Date | 28/03/2025 |
| Assessment Reference               | Plot 1-Gas Boiler                          | Prop Type Ref | LHS Plot |      |                |            |
| Property                           | Plot 1, 7 Hawthorne Road, READING, RG4 6LY |               |          |      |                |            |
|                                    |                                            |               |          |      |                |            |
| SAP Rating                         | 101 A                                      | DER           | 6.47     | TER  | 8.16           |            |
| Environmental                      | 93 A                                       | % DER < TER   |          |      |                | 20.71      |
| CO <sub>2</sub> Emissions (t/year) | 0.95                                       | DFEE          | 34.22    | TFEE | 37.09          |            |
| Compliance Check                   | See BREL                                   | % DFEE < TFEE |          |      |                | 7.75       |
| % DPER < TPER                      | 18.40                                      | DPER          | 34.88    | TPER | 42.75          |            |
|                                    |                                            |               |          |      |                |            |
| Assessor Details                   | Mr. Dhiraj Karsan                          |               |          |      | Assessor ID    | M078-0001  |
| Client                             |                                            |               |          |      |                |            |

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

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)            | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Main dwelling                                          |                           |                                 |                             |
| Ground floor                                           | 89.7000 (1b)              | x 2.4000 (2b)                   | = 215.2800 (1b) - (3b)      |
| First floor                                            | 61.8000 (1c)              | x 2.6000 (2c)                   | = 160.6800 (1c) - (3c)      |
| Second floor                                           | 34.1000 (1d)              | x 2.7000 (2d)                   | = 92.0700 (1d) - (3d)       |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 185.6000                  |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 468.0300 (5)              |

## 2. Ventilation rate

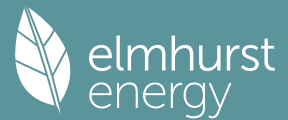
|                                                                                                  |                                         |
|--------------------------------------------------------------------------------------------------|-----------------------------------------|
|                                                                                                  | 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                                                              | 4 * 10 = 40.0000 (7a)                   |
| Number of passive vents                                                                          | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                                                     | 0 * 40 = 0.0000 (7c)                    |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) | 40.0000 / (5) = 0.0855 (8)              |
| Pressure test                                                                                    | Yes                                     |
| Pressure Test Method                                                                             | Blower Door                             |
| Measured/design AP50                                                                             | 5.0000 (17)                             |
| Infiltration rate                                                                                | 0.3355 (18)                             |
| Number of sides sheltered                                                                        | 1 (19)                                  |
| Shelter factor                                                                                   | (20) = 1 - [0.075 x (19)] = 0.9250 (20) |
| Infiltration rate adjusted to include shelter factor                                             | (21) = (18) x (20) = 0.3103 (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 | 0.3956 | 0.3879 | 0.3801 | 0.3413 | 0.3336 | 0.2948 | 0.2948 | 0.2870 | 0.3103 | 0.3336 | 0.3491 | 0.3646 (22b) |
| Effective ac    | 0.5783 | 0.5752 | 0.5722 | 0.5583 | 0.5556 | 0.5435 | 0.5435 | 0.5412 | 0.5481 | 0.5556 | 0.5609 | 0.5665 (25)  |

## 3. Heat losses and heat loss parameter

| Element                                                     | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K       | A x K<br>kJ/K   |
|-------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------------|-----------------|
| Main dwelling                                               |                         |                            |                           |                               |              |                                      |                 |
| Windows                                                     |                         |                            | 20.6100                   | 1.1450                        | 23.5992      |                                      | (27)            |
| Roof Windows                                                |                         |                            | 8.8800                    | 1.1450                        | 10.1679      |                                      | (27a)           |
| Door                                                        |                         |                            | 1.8900                    | 1.2000                        | 2.2680       |                                      | (26)            |
| Heat Loss Floor                                             |                         |                            | 89.7000                   | 0.1100                        | 9.8670       | 110.0000                             | 9867.0000 (28a) |
| Cavity Wall                                                 | 139.7000                | 22.5000                    | 117.2000                  | 0.1800                        | 21.0960      | 60.0000                              | 7032.0000 (29a) |
| Stud Wall                                                   | 28.1000                 |                            | 28.1000                   | 0.1100                        | 3.0910       | 9.0000                               | 252.9000 (29a)  |
| Flat Roof                                                   | 23.5000                 | 6.0000                     | 17.5000                   | 0.1400                        | 2.4500       | 9.0000                               | 157.5000 (30)   |
| Plane Roof                                                  | 55.2000                 |                            | 55.2000                   | 0.1132                        | 6.2491       | 9.0000                               | 496.8000 (30)   |
| Slope Roof                                                  | 13.4000                 | 2.8800                     | 10.5200                   | 0.1300                        | 1.3676       | 9.0000                               | 94.6800 (30)    |
| Total net area of external elements Aum(A, m <sup>2</sup> ) |                         |                            | 349.6000                  |                               |              |                                      | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                         |                         |                            |                           | (26)...(30) + (32) =          | 80.1558      |                                      | (33)            |
| Main dwelling                                               |                         |                            |                           |                               |              |                                      |                 |
| Party Wall                                                  |                         |                            | 72.7000                   | 0.0000                        | 0.0000       | 0.0000                               | 0.0000 (32)     |
| Internal Wall                                               |                         |                            | 216.2000                  |                               |              | 9.0000                               | 1945.8000 (32c) |
| Internal Ceiling                                            |                         |                            | 61.8000                   |                               |              | 9.0000                               | 556.2000 (32e)  |
| Internal Ceiling 2                                          |                         |                            | 34.1000                   |                               |              | 9.0000                               | 306.9000 (32e)  |
| Heat capacity Cm = Sum(A x k)                               |                         |                            |                           |                               |              | (28)...(30) + (32) + (32a)...(32e) = | 20709.7800 (34) |

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

111.5829 (35)

List of Thermal Bridges

|                                                            | Length  | Psi-value             | Total        |
|------------------------------------------------------------|---------|-----------------------|--------------|
| K1 Element                                                 | 16.8000 | 0.0400                | 0.6720       |
| E2 Other lintels (including other steel lintels)           | 15.9000 | 0.0300                | 0.4770       |
| E3 Sill                                                    | 31.6000 | 0.0300                | 0.9480       |
| E4 Jamb                                                    | 28.1000 | 0.0600                | 1.6860       |
| E5 Ground floor (normal)                                   | 41.1000 | 0.0700                | 2.8770       |
| E6 Intermediate floor within a dwelling                    | 15.4000 | 0.0900                | 1.3860       |
| E16 Corner (normal)                                        | 15.4000 | 0.0600                | 0.9240       |
| E18 Party wall between dwellings                           | 6.2000  | 0.0800                | 0.4960       |
| R1 Head of roof window                                     | 6.2000  | 0.0600                | 0.3720       |
| R2 Sill of roof window                                     | 11.2000 | 0.0800                | 0.8960       |
| R3 Jamb of roof window                                     |         |                       |              |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |         |                       | 10.7340 (36) |
| Point Thermal bridges                                      |         |                       | 0.0000       |
| Total fabric heat loss                                     |         | (33) + (36) + (36a) = | 90.8898 (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                     | 89.3130  | 88.8436  | 88.3835  | 86.2224  | 85.8181  | 83.9359  | 83.9359  | 83.5873  | 84.6609  | 85.8181  | 86.6360  | 87.4912 (38)  |
| Heat transfer coeff       | 180.2028 | 179.7334 | 179.2733 | 177.1122 | 176.7079 | 174.8257 | 174.8257 | 174.4771 | 175.5507 | 176.7079 | 177.5259 | 178.3810 (39) |
| Average = Sum(39)m / 12 = |          |          |          |          |          |          |          |          |          |          |          | 177.1103      |
| HLP                       | 0.9709   | 0.9684   | 0.9659   | 0.9543   | 0.9521   | 0.9419   | 0.9419   | 0.9401   | 0.9459   | 0.9521   | 0.9565   | 0.9611 (40)   |
| HLP (average)             |          |          |          |          |          |          |          |          |          |          |          | 0.9543        |
| Days in mont              | 31       | 28       | 31       | 30       | 31       | 30       | 31       | 31       | 30       | 31       | 30       | 31            |

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

|                                                                                |          |          |          |          |          |          |          |          |          |                                        |          |                |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------------------------------|----------|----------------|
| Assumed occupancy                                                              |          |          |          |          |          |          |          |          |          |                                        |          | 2.9832 (42)    |
| Hot water usage for mixer showers                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000 (42a)   |
| Hot water usage for baths                                                      | 85.6425  | 84.3706  | 82.5794  | 79.2769  | 76.8041  | 74.0621  | 72.5809  | 74.3595  | 76.2961  | 79.2302                                | 82.6007  | 85.3529 (42b)  |
| Hot water usage for other uses                                                 | 45.1804  | 43.5375  | 41.8946  | 40.2517  | 38.6087  | 36.9658  | 36.9658  | 38.6087  | 40.2517  | 41.8946                                | 43.5375  | 45.1804 (42c)  |
| Average daily hot water use (litres/day)                                       |          |          |          |          |          |          |          |          |          |                                        |          | 120.4772 (43)  |
| Daily hot water use                                                            | 130.8229 | 127.9081 | 124.4740 | 119.5286 | 115.4128 | 111.0279 | 109.5468 | 112.9683 | 116.5478 | 121.1247                               | 126.1382 | 130.5334 (44)  |
| Energy conte                                                                   | 207.1915 | 182.1394 | 191.3120 | 163.6287 | 155.3678 | 136.5217 | 132.4873 | 139.8783 | 143.7150 | 164.3651                               | 179.7070 | 204.3837 (45)  |
| Energy content (annual)                                                        |          |          |          |          |          |          |          |          |          | Total = Sum(45)m =                     |          | 2000.6976      |
| Distribution loss (46)m = 0.15 x (45)m                                         | 31.0787  | 27.3209  | 28.6968  | 24.5443  | 23.3052  | 20.4783  | 19.8731  | 20.9817  | 21.5573  | 24.6548                                | 26.9560  | 30.6576 (46)   |
| Water storage loss:                                                            |          |          |          |          |          |          |          |          |          |                                        |          |                |
| Store volume                                                                   |          |          |          |          |          |          |          |          |          |                                        |          | 300.0000 (47)  |
| a) If manufacturer declared loss factor is known (kWh/day):                    |          |          |          |          |          |          |          |          |          |                                        |          | 1.5900 (48)    |
| Temperature factor from Table 2b                                               |          |          |          |          |          |          |          |          |          |                                        |          | 0.5400 (49)    |
| Enter (49) or (54) in (55)                                                     |          |          |          |          |          |          |          |          |          |                                        |          | 0.8586 (55)    |
| Total storage loss                                                             | 26.6166  | 24.0408  | 26.6166  | 25.7580  | 26.6166  | 25.7580  | 26.6166  | 26.6166  | 25.7580  | 26.6166                                | 25.7580  | 26.6166 (56)   |
| If cylinder contains dedicated solar storage                                   | 26.6166  | 24.0408  | 26.6166  | 25.7580  | 26.6166  | 25.7580  | 26.6166  | 26.6166  | 25.7580  | 26.6166                                | 25.7580  | 26.6166 (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                | 257.0705 | 227.1914 | 241.1910 | 211.8987 | 205.2468 | 184.7917 | 182.3663 | 189.7573 | 191.9850 | 214.2441                               | 227.9770 | 254.2627 (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                                                                | 257.0705 | 227.1914 | 241.1910 | 211.8987 | 205.2468 | 184.7917 | 182.3663 | 189.7573 | 191.9850 | 214.2441                               | 227.9770 | 254.2627 (64)  |
| 12Total per year (kWh/year)                                                    |          |          |          |          |          |          |          |          |          | Total per year (kWh/year) = Sum(64)m = |          | 2587.9826 (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                                       | 108.7944 | 96.6029  | 103.5144 | 93.0225  | 91.5630  | 84.0095  | 83.9552  | 86.4127  | 86.4013  | 94.5546                                | 98.3686  | 107.8608 (65)  |

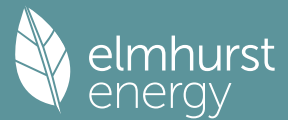
## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |           |           |           |           |           |           |           |           |           |           |           |                |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
| Metabolic gains (Table 5), Watts                                                    |           |           |           |           |           |           |           |           |           |           |           |                |
| (66)m                                                                               | 149.1575  | 149.1575  | 149.1575  | 149.1575  | 149.1575  | 149.1575  | 149.1575  | 149.1575  | 149.1575  | 149.1575  | 149.1575  | 149.1575 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 186.0508  | 205.9848  | 186.0508  | 192.2525  | 186.0508  | 192.2525  | 186.0508  | 186.0508  | 192.2525  | 186.0508  | 192.2525  | 186.0508 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 357.1453  | 360.8514  | 351.5123  | 331.6304  | 306.5330  | 282.9451  | 267.1869  | 263.4808  | 272.8200  | 292.7019  | 317.7992  | 341.3871 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 37.9158   | 37.9158   | 37.9158   | 37.9158   | 37.9158   | 37.9158   | 37.9158   | 37.9158   | 37.9158   | 37.9158   | 37.9158   | 37.9158 (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)                                 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 (71) |
| Water heating gains (Table 5)                                                       | 146.2290  | 143.7544  | 139.1323  | 129.1980  | 123.0686  | 116.6798  | 112.8431  | 116.1462  | 120.0017  | 127.0895  | 136.6230  | 144.9742 (72)  |
| Total internal gains                                                                | 760.1724  | 781.3378  | 747.4426  | 723.8281  | 686.3996  | 659.6246  | 633.8280  | 633.4250  | 652.8214  | 676.5894  | 717.4219  | 743.1594 (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   |
|-----------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|--------------|
| Northeast | 10.6800    | 11.2829                        | 0.7600                            | 0.7000                             | 0.7700                       | 44.4261 (75) |
| Southwest | 7.2900     | 36.7938                        | 0.7600                            | 0.7000                             | 0.7700                       | 98.8889 (79) |

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|            |  |  |        |  |         |  |        |  |        |  |        |  |              |
|------------|--|--|--------|--|---------|--|--------|--|--------|--|--------|--|--------------|
| Northwest  |  |  | 2.6400 |  | 11.2829 |  | 0.7600 |  | 0.7000 |  | 0.7700 |  | 10.9817 (81) |
| Northeast  |  |  | 2.1600 |  | 17.4137 |  | 0.7600 |  | 0.7000 |  | 1.0000 |  | 18.0094 (82) |
| Southwest  |  |  | 0.7200 |  | 38.2331 |  | 0.7600 |  | 0.7000 |  | 1.0000 |  | 13.1803 (82) |
| Horizontal |  |  | 6.0000 |  | 26.0000 |  | 0.7600 |  | 0.7000 |  | 1.0000 |  | 74.6928 (82) |

|             |           |           |           |           |           |           |           |           |           |           |           |          |      |
|-------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|------|
| Solar gains | 260.1792  | 498.7084  | 818.4381  | 1223.5480 | 1548.1778 | 1611.5461 | 1522.9377 | 1271.7321 | 958.5595  | 588.9725  | 322.0232  | 215.7874 | (83) |
| Total gains | 1020.3516 | 1280.0463 | 1565.8807 | 1947.3761 | 2234.5775 | 2271.1707 | 2156.7657 | 1905.1571 | 1611.3809 | 1265.5619 | 1039.4452 | 958.9468 | (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                                                                         | 31.9236 | 32.0069 | 32.0891 | 32.4806 | 32.5549 | 32.9054 | 32.9054 | 32.9712 | 32.7695 | 32.5549                   | 32.4049 | 32.2496 |              |
| alpha                                                                       | 3.1282  | 3.1338  | 3.1393  | 3.1654  | 3.1703  | 3.1937  | 3.1937  | 3.1981  | 3.1846  | 3.1703                    | 3.1603  | 3.1500  |              |
| util living area                                                            | 0.9773  | 0.9552  | 0.9077  | 0.7950  | 0.6338  | 0.4652  | 0.3480  | 0.4055  | 0.6438  | 0.8791                    | 0.9613  | 0.9811  | (86)         |
| MIT                                                                         | 19.2562 | 19.5342 | 19.9369 | 20.4135 | 20.7160 | 20.8522 | 20.8883 | 20.8790 | 20.7600 | 20.3060                   | 19.6959 | 19.2153 | (87)         |
| Th 2                                                                        | 20.1076 | 20.1098 | 20.1118 | 20.1216 | 20.1234 | 20.1320 | 20.1320 | 20.1336 | 20.1287 | 20.1234                   | 20.1197 | 20.1159 | (88)         |
| util rest of house                                                          | 0.9738  | 0.9484  | 0.8941  | 0.7676  | 0.5910  | 0.4094  | 0.2825  | 0.3346  | 0.5854  | 0.8555                    | 0.9543  | 0.9781  | (89)         |
| MIT 2                                                                       | 18.0349 | 18.3878 | 18.8928 | 19.4770 | 19.8217 | 19.9688 | 19.9998 | 19.9953 | 19.8831 | 19.3651                   | 18.6035 | 17.9888 | (90)         |
| Living area fraction                                                        |         |         |         |         |         |         |         |         |         | FLA = Living area / (4) = |         | 0.4014  | (91)         |
| MIT                                                                         | 18.5252 | 18.8480 | 19.3119 | 19.8529 | 20.1807 | 20.3234 | 20.3565 | 20.3500 | 20.2351 | 19.7428                   | 19.0420 | 18.4811 | (92)         |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |                           |         | -0.1500 |              |
| adjusted MIT                                                                | 18.3752 | 18.6980 | 19.1619 | 19.7029 | 20.0307 | 20.1734 | 20.2065 | 20.2000 | 20.0851 | 19.5928                   | 18.8920 | 18.3311 | (93)         |

## 8. Space heating requirement

|                                                                                |           |           |           |           |           |          |          |          |           |               |           |           |       |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|----------|----------|----------|-----------|---------------|-----------|-----------|-------|
|                                                                                | Jan       | Feb       | Mar       | Apr       | May       | Jun      | Jul      | Aug      | Sep       | Oct           | Nov       | Dec       |       |
| Utilisation                                                                    | 0.9645    | 0.9349    | 0.8768    | 0.7532    | 0.5862    | 0.4121   | 0.2882   | 0.3402   | 0.5823    | 0.8386        | 0.9417    | 0.9699    | (94)  |
| Useful gains                                                                   | 984.1794  | 1196.6741 | 1373.0044 | 1466.7296 | 1309.8802 | 935.9819 | 621.6667 | 648.0604 | 938.2483  | 1061.3222     | 978.8913  | 930.1272  | (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                                                               | 2536.3823 | 2479.9533 | 2269.9436 | 1913.3333 | 1472.0929 | 974.3757 | 630.5018 | 663.0213 | 1050.6842 | 1589.0983     | 2093.3805 | 2520.7262 | (97)  |
| Space heating kWh                                                              | 1154.8390 | 862.3636  | 667.3228  | 321.5547  | 120.6862  | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 392.6654      | 802.4322  | 1183.4056 | (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |           |          |          |          |           |               |           | 5505.2695 |       |
| 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                                                              | 1154.8390 | 862.3636  | 667.3228  | 321.5547  | 120.6862  | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 392.6654      | 802.4322  | 1183.4056 | (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |           |          |          |          |           |               |           | 5505.2695 |       |
| Space heating per m2                                                           |           |           |           |           |           |          |          |          |           | (98c) / (4) = |           | 29.6620   | (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                                                                            | 1154.8390 | 862.3636  | 667.3228  | 321.5547  | 120.6862  | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 392.6654  | 802.4322  | 1183.4056 | (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)                                                             | 1300.4943 | 971.1302  | 751.4896  | 362.1111  | 135.9079  | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 442.1908  | 903.6398  | 1332.6640 | (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                                                                            | 257.0705  | 227.1914  | 241.1910  | 211.8987  | 205.2468  | 184.7917  | 182.3663  | 189.7573  | 191.9850  | 214.2441  | 227.9770  | 254.2627  | (64)          |
| Efficiency of water heater (217)m                                                                    | 87.0132   | 86.7597   | 86.2185   | 84.9924   | 82.9115   | 79.8000   | 79.8000   | 79.8000   | 79.8000   | 85.4000   | 86.6381   | 87.0634   | (216)         |
| Fuel for water heating, kWh/month                                                                    | 295.4384  | 261.8629  | 279.7438  | 249.3149  | 247.5492  | 231.5686  | 228.5292  | 237.7911  | 240.5828  | 250.8714  | 263.1370  | 292.0432  | (219)         |
| Space cooling fuel requirement                                                                       |           |           |           |           |           |           |           |           |           |           |           |           |               |
| (221)m                                                                                               | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | (221)         |
| Pumps and Fa                                                                                         | 7.3041    | 6.5973    | 7.3041    | 7.0685    | 7.3041    | 7.0685    | 7.3041    | 7.3041    | 7.0685    | 7.3041    | 7.0685    | 7.3041    | (231)         |
| Lighting                                                                                             | 45.4448   | 36.4575   | 32.8259   | 24.0497   | 18.5767   | 15.1773   | 16.9463   | 22.0274   | 28.6114   | 37.5397   | 42.4010   | 46.7079   | (232)         |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |           |           |           |           |           |           |           |           |           |           |           |           |               |
| (233a)m                                                                                              | -92.0670  | -124.4227 | -170.8547 | -180.6546 | -183.8788 | -167.4022 | -165.0567 | -161.0089 | -151.7796 | -137.1226 | -98.9876  | -79.9797  | (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                                                                                              | -77.6467  | -166.5178 | -341.8534 | -525.9843 | -702.0207 | -707.8638 | -696.9055 | -584.2645 | -418.8719 | -239.8092 | -103.9230 | -60.9143  | (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                                                                   |           |           |           |           |           |           |           |           |           |           |           | 6199.6278 | (211)         |
| Space heating fuel - main system 2                                                                   |           |           |           |           |           |           |           |           |           |           |           | 0.0000    | (213)         |
| Space heating fuel - secondary                                                                       |           |           |           |           |           |           |           |           |           |           |           | 0.0000    | (215)         |
| Efficiency of water heater                                                                           |           |           |           |           |           |           |           |           |           |           |           | 79.8000   |               |

# Full SAP Calculation Printout



|                                                               |                  |
|---------------------------------------------------------------|------------------|
| Water heating fuel used                                       | 3078.4325 (219)  |
| Space cooling fuel                                            | 0.0000 (221)     |
| Electricity for pumps and fans:                               |                  |
| central heating pump                                          | 41.0000 (230c)   |
| main heating flue fan                                         | 45.0000 (230e)   |
| Total electricity for the above, kWh/year                     | 86.0000 (231)    |
| Electricity for lighting (calculated in Appendix L)           | 366.7656 (232)   |
| Energy saving/generation technologies (Appendices M ,N and Q) |                  |
| PV generation                                                 | -6339.7902 (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                           | 3391.0357 (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                   | 6199.6278          | 0.2100                        | 1301.9218 (261)          |
| Total CO2 associated with community systems     |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                      | 3078.4325          | 0.2100                        | 646.4708 (264)           |
| Space and water heating                         |                    |                               | 1948.3927 (265)          |
| Pumps, fans and electric keep-hot               | 86.0000            | 0.1387                        | 11.9293 (267)            |
| Energy for lighting                             | 366.7656           | 0.1443                        | 52.9356 (268)            |
| Energy saving/generation technologies           |                    |                               |                          |
| PV Unit electricity used in dwelling            | -1713.2150         | 0.1359                        | -232.7531                |
| PV Unit electricity exported                    | -4626.5751         | 0.1253                        | -579.9359                |
| Total                                           |                    |                               | -812.6890 (269)          |
| Total CO2, kg/year                              |                    |                               | 1200.5686 (272)          |
| EPC Dwelling Carbon Dioxide Emission Rate (DER) |                    |                               | 6.4700 (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               | 6199.6278          | 1.1300                              | 7005.5794 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 3078.4325          | 1.1300                              | 3478.6288 (278)            |
| Space and water heating                     |                    |                                     | 10484.2082 (279)           |
| Pumps, fans and electric keep-hot           | 86.0000            | 1.5128                              | 130.1008 (281)             |
| Energy for lighting                         | 366.7656           | 1.5338                              | 562.5573 (282)             |
| Energy saving/generation technologies       |                    |                                     |                            |
| PV Unit electricity used in dwelling        | -1713.2150         | 1.5022                              | -2573.5593                 |
| PV Unit electricity exported                | -4626.5751         | 0.4601                              | -2128.6712                 |
| Total                                       |                    |                                     | -4702.2305 (283)           |
| Total Primary energy kWh/year               |                    |                                     | 6474.6358 (286)            |
| Dwelling Primary energy Rate (DPER)         |                    |                                     | 34.8800 (287)              |

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

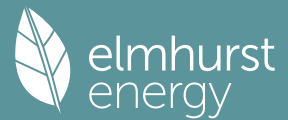
### 1. Overall dwelling characteristics

|                                                        | Area<br>(m2) | Storey height<br>(m)            | Volume<br>(m3)         |
|--------------------------------------------------------|--------------|---------------------------------|------------------------|
| Main dwelling                                          |              |                                 |                        |
| Ground floor                                           | 89.7000 (1b) | x 2.4000 (2b)                   | = 215.2800 (1b) - (3b) |
| First floor                                            | 61.8000 (1c) | x 2.6000 (2c)                   | = 160.6800 (1c) - (3c) |
| Second floor                                           | 34.1000 (1d) | x 2.7000 (2d)                   | = 92.0700 (1d) - (3d)  |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 185.6000     |                                 | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 468.0300 (5)         |

### 2. Ventilation rate

|                                                    | m3 per hour                |
|----------------------------------------------------|----------------------------|
| Number of open chimneys                            | 0 * 80 = 0.0000 (6a)       |
| Number of open flues                               | 0 * 20 = 0.0000 (6b)       |
| Number of chimneys / flues attached to closed fire | 0 * 10 = 0.0000 (6c)       |
| Number of flues attached to solid fuel boiler      | 0 * 20 = 0.0000 (6d)       |
| Number of flues attached to other heater           | 0 * 35 = 0.0000 (6e)       |
| Number of blocked chimneys                         | 0 * 20 = 0.0000 (6f)       |
| Number of intermittent extract fans                | 4 * 10 = 40.0000 (7a)      |
| Number of passive vents                            | 0 * 10 = 0.0000 (7b)       |
| Number of flueless gas fires                       | 0 * 40 = 0.0000 (7c)       |
| Infiltration due to chimneys, flues and fans       | Air changes per hour       |
| Pressure test                                      | 40.0000 / (5) = 0.0855 (8) |
| Pressure Test Method                               | Yes                        |
| Measured/design AP50                               | Blower Door                |
| Infiltration rate                                  | 5.0000 (17)                |
| Number of sides sheltered                          | 0.3355 (18)                |
|                                                    | 1 (19)                     |

# Full SAP Calculation Printout



Shelter factor  
Infiltration rate adjusted to include shelter factor

$$(20) = 1 - [0.075 \times (19)] = 0.9250 \quad (20)$$

$$(21) = (18) \times (20) = 0.3103 \quad (21)$$

|                 | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |       |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|
| Wind speed      | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 | (22)  |
| Wind factor     | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 | (22a) |
| Adj infilt rate |        |        |        |        |        |        |        |        |        |        |        |        |       |
| Effective ac    | 0.3956 | 0.3879 | 0.3801 | 0.3413 | 0.3336 | 0.2948 | 0.2948 | 0.2870 | 0.3103 | 0.3336 | 0.3491 | 0.3646 | (22b) |
|                 | 0.5783 | 0.5752 | 0.5722 | 0.5583 | 0.5556 | 0.5435 | 0.5435 | 0.5412 | 0.5481 | 0.5556 | 0.5609 | 0.5665 | (25)  |

## 3. Heat losses and heat loss parameter

| Element                                        | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K     | A x U<br>W/K | K-value<br>kJ/m2K | A x K<br>kJ/K |       |
|------------------------------------------------|-------------|----------------|---------------|----------------------|--------------|-------------------|---------------|-------|
| Main dwelling                                  |             |                |               |                      |              |                   |               |       |
| TER Opaque door                                |             |                | 1.8900        | 1.0000               | 1.8900       |                   |               | (26)  |
| TER Opening Type                               |             |                | 20.6100       | 1.1450               | 23.5992      |                   |               | (27)  |
| TER Roof Window                                |             |                | 8.8800        | 1.1450               | 13.8814      |                   |               | (27a) |
| Heat Loss Floor                                |             |                | 89.7000       | 0.1300               | 11.6610      |                   |               | (28a) |
| Cavity Wall                                    | 139.7000    | 22.5000        | 117.2000      | 0.1800               | 21.0960      |                   |               | (29a) |
| Stud Wall                                      | 28.1000     |                | 28.1000       | 0.1800               | 5.0580       |                   |               | (29a) |
| Flat Roof                                      | 23.5000     | 6.0000         | 17.5000       | 0.1100               | 1.9250       |                   |               | (30)  |
| Plane Roof                                     | 55.2000     |                | 55.2000       | 0.1100               | 6.0720       |                   |               | (30)  |
| Slope Roof                                     | 13.4000     | 2.8800         | 10.5200       | 0.1100               | 1.1572       |                   |               | (30)  |
| Total net area of external elements Aum(A, m2) |             |                | 349.6000      |                      |              |                   |               | (31)  |
| Fabric heat loss, W/K = Sum (A x U)            |             |                |               | (26)...(30) + (32) = | 86.3398      |                   |               | (33)  |
| Main dwelling                                  |             |                |               |                      |              |                   |               |       |
| Party Wall                                     |             |                | 72.7000       | 0.0000               | 0.0000       |                   |               | (32)  |

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

111.5829 (35)

## List of Thermal Bridges

|                                                            | Length  | Psi-value             | Total  |              |
|------------------------------------------------------------|---------|-----------------------|--------|--------------|
| K1 Element                                                 | 16.8000 | 0.0500                | 0.8400 |              |
| E2 Other lintels (including other steel lintels)           | 15.9000 | 0.0500                | 0.7950 |              |
| E3 Sill                                                    | 31.6000 | 0.0500                | 1.5800 |              |
| E4 Jamb                                                    | 28.1000 | 0.1600                | 4.4960 |              |
| E5 Ground floor (normal)                                   | 41.1000 | 0.0000                | 0.0000 |              |
| E6 Intermediate floor within a dwelling                    | 15.4000 | 0.0900                | 1.3860 |              |
| E16 Corner (normal)                                        | 15.4000 | 0.0600                | 0.9240 |              |
| E18 Party wall between dwellings                           | 6.2000  | 0.0800                | 0.4960 |              |
| R1 Head of roof window                                     | 6.2000  | 0.0600                | 0.3720 |              |
| R2 Sill of roof window                                     | 11.2000 | 0.0800                | 0.8960 |              |
| R3 Jamb of roof window                                     |         |                       |        |              |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |         |                       |        | 11.7850 (36) |
| Point Thermal bridges                                      |         |                       |        | 0.0000       |
| Total fabric heat loss                                     |         | (36a) =               |        | 98.1248 (37) |
|                                                            |         | (33) + (36) + (36a) = |        |              |

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

|                           | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |      |
|---------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| (38)m                     | 89.3130  | 88.8436  | 88.3835  | 86.2224  | 85.8181  | 83.9359  | 83.9359  | 83.5873  | 84.6609  | 85.8181  | 86.6360  | 87.4912  | (38) |
| Heat transfer coeff       | 187.4378 | 186.9684 | 186.5083 | 184.3472 | 183.9429 | 182.0607 | 182.0607 | 181.7121 | 182.7857 | 183.9429 | 184.7609 | 185.6160 | (39) |
| Average = Sum(39)m / 12 = |          |          |          |          |          |          |          |          |          |          |          | 184.3453 |      |

|               | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |      |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| HLP           | 1.0099 | 1.0074 | 1.0049 | 0.9933 | 0.9911 | 0.9809 | 0.9809 | 0.9791 | 0.9848 | 0.9911 | 0.9955 | 1.0001 | (40) |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 0.9932 |      |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31     |      |

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

|                                                                                |          |          |          |          |          |          |          |          |          |                                        |          |           |             |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------------------------------|----------|-----------|-------------|
| Assumed occupancy                                                              |          |          |          |          |          |          |          |          |          |                                        |          |           | 2.9832 (42) |
| Hot water usage for mixer showers                                              |          |          |          |          |          |          |          |          |          |                                        |          |           |             |
| 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000    | (42a)       |
| Hot water usage for baths                                                      |          |          |          |          |          |          |          |          |          |                                        |          |           |             |
| 85.6425                                                                        | 84.3706  | 82.5794  | 79.2769  | 76.8041  | 74.0621  | 72.5809  | 74.3595  | 76.2961  | 79.2302  | 82.6007                                | 85.3529  |           | (42b)       |
| Hot water usage for other uses                                                 |          |          |          |          |          |          |          |          |          |                                        |          |           |             |
| 45.1804                                                                        | 43.5375  | 41.8946  | 40.2517  | 38.6087  | 36.9658  | 36.9658  | 38.6087  | 40.2517  | 41.8946  | 43.5375                                | 45.1804  |           | (42c)       |
| Average daily hot water use (litres/day)                                       |          |          |          |          |          |          |          |          |          |                                        |          | 120.4772  | (43)        |
|                                                                                | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct                                    | Nov      | Dec       |             |
| Daily hot water use                                                            | 130.8229 | 127.9081 | 124.4740 | 119.5286 | 115.4128 | 111.0279 | 109.5468 | 112.9683 | 116.5478 | 121.1247                               | 126.1382 | 130.5334  | (44)        |
| Energy conte                                                                   | 207.1915 | 182.1394 | 191.3120 | 163.6287 | 155.3678 | 136.5217 | 132.4873 | 139.8783 | 143.7150 | 164.3651                               | 179.7070 | 204.3837  | (45)        |
| Energy content (annual)                                                        |          |          |          |          |          |          |          |          |          | Total = Sum(45)m =                     |          | 2000.6976 |             |
| Distribution loss (46)m = 0.15 x (45)m                                         | 31.0787  | 27.3209  | 28.6968  | 24.5443  | 23.3052  | 20.4783  | 19.8731  | 20.9817  | 21.5573  | 24.6548                                | 26.9560  | 30.6576   | (46)        |
| Water storage loss:                                                            |          |          |          |          |          |          |          |          |          |                                        |          |           |             |
| Store volume                                                                   |          |          |          |          |          |          |          |          |          |                                        |          | 300.0000  | (47)        |
| a) If manufacturer declared loss factor is known (kWh/day):                    |          |          |          |          |          |          |          |          |          |                                        |          | 2.1127    | (48)        |
| Temperature factor from Table 2b                                               |          |          |          |          |          |          |          |          |          |                                        |          | 0.5400    | (49)        |
| Enter (49) or (54) in (55)                                                     |          |          |          |          |          |          |          |          |          |                                        |          | 1.1409    | (55)        |
| Total storage loss                                                             | 35.3664  | 31.9439  | 35.3664  | 34.2256  | 35.3664  | 34.2256  | 35.3664  | 35.3664  | 34.2256  | 35.3664                                | 34.2256  | 35.3664   | (56)        |
| If cylinder contains dedicated solar storage                                   | 35.3664  | 31.9439  | 35.3664  | 34.2256  | 35.3664  | 34.2256  | 35.3664  | 35.3664  | 34.2256  | 35.3664                                | 34.2256  | 35.3664   | (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                | 265.8203 | 235.0945 | 249.9408 | 220.3663 | 213.9966 | 193.2593 | 191.1161 | 198.5071 | 200.4526 | 222.9939                               | 236.4445 | 263.0125  | (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                                                                | 265.8203 | 235.0945 | 249.9408 | 220.3663 | 213.9966 | 193.2593 | 191.1161 | 198.5071 | 200.4526 | 222.9939                               | 236.4445 | 263.0125  | (64)        |
| 12Total per year (kWh/year)                                                    |          |          |          |          |          |          |          |          |          | Total per year (kWh/year) = Sum(64)m = |          | 2691.0046 | (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                                       | 115.7942 | 102.9254 | 110.5143 | 99.7966  | 98.5629  | 90.7835  | 90.9551  | 93.4126  | 93.1753  | 101.5545                               | 105.1426 | 114.8606  | (65)        |

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

Metabolic gains (Table 5), Watts

|                                                                                     | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec       |      |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------|
| (66)m                                                                               | 149.1575  | 149.1575  | 149.1575  | 149.1575  | 149.1575  | 149.1575  | 149.1575  | 149.1575  | 149.1575  | 149.1575  | 149.1575  | 149.1575  | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 186.0508  | 205.9848  | 186.0508  | 192.2525  | 186.0508  | 192.2525  | 186.0508  | 186.0508  | 192.2525  | 186.0508  | 192.2525  | 186.0508  | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 357.1453  | 360.8514  | 351.5123  | 331.6304  | 306.5330  | 282.9451  | 267.1869  | 263.4808  | 272.8200  | 292.7019  | 317.7992  | 341.3871  | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 37.9158   | 37.9158   | 37.9158   | 37.9158   | 37.9158   | 37.9158   | 37.9158   | 37.9158   | 37.9158   | 37.9158   | 37.9158   | 37.9158   | (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)                                 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | (71) |
| Water heating gains (Table 5)                                                       | 155.6374  | 153.1628  | 148.5407  | 138.6064  | 132.4770  | 126.0882  | 122.2515  | 125.5546  | 129.4101  | 136.4979  | 146.0314  | 154.3826  | (72) |
| Total internal gains                                                                | 769.5808  | 790.7462  | 756.8510  | 733.2365  | 695.8080  | 669.0330  | 643.2364  | 642.8334  | 662.2298  | 685.9978  | 726.8303  | 752.5678  | (73) |

## 6. Solar gains

| [Jan]       |          |           |           |           | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c |           |           |          | Access<br>factor<br>Table 6d | Gains<br>W   |
|-------------|----------|-----------|-----------|-----------|------------|--------------------------------|-----------------------------------|------------------------------------|-----------|-----------|----------|------------------------------|--------------|
| <hr/>       |          |           |           |           |            |                                |                                   |                                    |           |           |          |                              |              |
| Northeast   |          |           |           |           | 10.6800    | 11.2829                        | 0.6300                            | 0.7000                             |           |           |          | 0.7700                       | 36.8269 (75) |
| Southwest   |          |           |           |           | 7.2900     | 36.7938                        | 0.6300                            | 0.7000                             |           |           |          | 0.7700                       | 81.9737 (79) |
| Northwest   |          |           |           |           | 2.6400     | 11.2829                        | 0.6300                            | 0.7000                             |           |           |          | 0.7700                       | 9.1033 (81)  |
| Northeast   |          |           |           |           | 2.1600     | 17.4137                        | 0.6300                            | 0.7000                             |           |           |          | 1.0000                       | 14.9288 (82) |
| Southwest   |          |           |           |           | 0.7200     | 38.2331                        | 0.6300                            | 0.7000                             |           |           |          | 1.0000                       | 10.9258 (82) |
| Horizontal  |          |           |           |           | 6.0000     | 26.0000                        | 0.6300                            | 0.7000                             |           |           |          | 1.0000                       | 61.9164 (82) |
| <hr/>       |          |           |           |           |            |                                |                                   |                                    |           |           |          |                              |              |
| Solar gains | 215.6749 | 413.4030  | 678.4421  | 1014.2569 | 1283.3579  | 1335.8869                      | 1262.4352                         | 1054.1990                          | 794.5953  | 488.2272  | 266.9403 | 178.8764                     | (83)         |
| Total gains | 985.2557 | 1204.1493 | 1435.2931 | 1747.4934 | 1979.1660  | 2004.9199                      | 1905.6716                         | 1697.0324                          | 1456.8252 | 1174.2250 | 993.7707 | 931.4442                     | (84)         |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)

|                                                                    |         |         |         |         |         |         |         |         |         |         |         |         |              |
|--------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Utilisation factor for gains for living area, nil,m (see Table 9a) |         |         |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
|                                                                    | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |              |
| tau                                                                | 30.6913 | 30.7684 | 30.8443 | 31.2059 | 31.2745 | 31.5978 | 31.5978 | 31.6584 | 31.4725 | 31.2745 | 31.1360 | 30.9926 |              |
| alpha                                                              | 3.0461  | 3.0512  | 3.0563  | 3.0804  | 3.0850  | 3.1065  | 3.1065  | 3.1106  | 3.0982  | 3.0850  | 3.0757  | 3.0662  |              |
| util living area                                                   | 0.9796  | 0.9624  | 0.9267  | 0.8381  | 0.6977  | 0.5306  | 0.4034  | 0.4633  | 0.6991  | 0.9008  | 0.9662  | 0.9826  | (86)         |
| MIT                                                                | 18.6704 | 19.0064 | 19.5188 | 20.1710 | 20.6428 | 20.8899 | 20.9648 | 20.9461 | 20.7365 | 20.0738 | 19.2614 | 18.6216 | (87)         |
| Th 2                                                               | 20.0751 | 20.0772 | 20.0793 | 20.0890 | 20.0908 | 20.0993 | 20.0993 | 20.1008 | 20.0960 | 20.0908 | 20.0871 | 20.0833 | (88)         |
| util rest of house                                                 | 0.9763  | 0.9566  | 0.9151  | 0.8135  | 0.6549  | 0.4687  | 0.3268  | 0.3825  | 0.6402  | 0.8799  | 0.9600  | 0.9798  | (89)         |
| MIT 2                                                              | 17.3207 | 17.7476 | 18.3931 | 19.1989 | 19.7471 | 20.0135 | 20.0794 | 20.0683 | 19.8687 | 19.1007 | 18.0815 | 17.2634 | (90)         |
| Living area fraction                                               | 17.8625 | 18.2529 | 18.8450 | 19.5891 | 20.1066 | 20.3653 | 20.4348 | 20.4206 | 20.2170 | 19.4913 | 18.5551 | 17.8086 | (92)         |
| MIT                                                                | 17.8625 | 18.2529 | 18.8450 | 19.5891 | 20.1066 | 20.3653 | 20.4348 | 20.4206 | 20.2170 | 19.4913 | 18.5551 | 17.8086 | (93)         |
| Temperature adjustment                                             |         |         |         |         |         |         |         |         |         |         |         | 0.0000  |              |
| adjusted MIT                                                       | 17.8625 | 18.2529 | 18.8450 | 19.5891 | 20.1066 | 20.3653 | 20.4348 | 20.4206 | 20.2170 | 19.4913 | 18.5551 | 17.8086 | (93)         |

## 8. Space heating requirement

|                                                                                | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul      | Aug      | Sep       | Oct           | Nov       | Dec       |       |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|----------|----------|-----------|---------------|-----------|-----------|-------|
| Utilisation                                                                    | 0.9651    | 0.9410    | 0.8958    | 0.7982    | 0.6557    | 0.4876    | 0.3559   | 0.4121   | 0.6487    | 0.8632        | 0.9456    | 0.9698    | (94)  |
| Useful gains                                                                   | 950.8861  | 1133.0633 | 1285.7988 | 1394.8816 | 1297.6471 | 977.5974  | 678.2968 | 699.3762 | 945.0995  | 1013.5563     | 939.7562  | 903.3604  | (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                                                               | 2542.1159 | 2496.5657 | 2302.4387 | 1970.5067 | 1546.3388 | 1049.6290 | 698.1653 | 730.5989 | 1118.1011 | 1635.4909     | 2116.4524 | 2525.9753 | (97)  |
| Space heating kWh                                                              | 1183.8750 | 916.2736  | 756.3801  | 414.4500  | 185.0267  | 0.0000    | 0.0000   | 0.0000   | 0.0000    | 462.7194      | 847.2212  | 1207.2255 | (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |           |           |          |          |           |               |           | 5973.1714 |       |
| 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                                                              | 1183.8750 | 916.2736  | 756.3801  | 414.4500  | 185.0267  | 0.0000    | 0.0000   | 0.0000   | 0.0000    | 462.7194      | 847.2212  | 1207.2255 | (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |           |           |          |          |           |               |           | 5973.1714 |       |
| Space heating per m2                                                           |           |           |           |           |           |           |          |          |           | (98c) / (4) = |           | 32.1830   | (99)  |

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

Fraction of space heat from secondary/supplementary system (Table 11)

|                                                         |           |          |          |          |          |        |        |        |        |          |          |           |               |
|---------------------------------------------------------|-----------|----------|----------|----------|----------|--------|--------|--------|--------|----------|----------|-----------|---------------|
| Fraction of space heat from main system(s)              |           |          |          |          |          |        |        |        |        |          |          |           | 0.0000 (201)  |
| Efficiency of main space heating system 1 (in %)        |           |          |          |          |          |        |        |        |        |          |          |           | 1.0000 (202)  |
| Efficiency of main space heating system 2 (in %)        |           |          |          |          |          |        |        |        |        |          |          |           | 92.3000 (206) |
| Efficiency of secondary/supplementary heating system, % |           |          |          |          |          |        |        |        |        |          |          |           | 0.0000 (207)  |
|                                                         |           |          |          |          |          |        |        |        |        |          |          |           | 0.0000 (208)  |
|                                                         | Jan       | Feb      | Mar      | Apr      | May      | Jun    | Jul    | Aug    | Sep    | Oct      | Nov      | Dec       |               |
| Space heating requirement                               | 1183.8750 | 916.2736 | 756.3801 | 414.4500 | 185.0267 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 462.7194 | 847.2212 | 1207.2255 | (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)                | 1282.6382 | 992.7125 | 819.4800 | 449.0249 | 200.4623 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 501.3211 | 917.8995 | 1307.9366 | (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)         |

# Full SAP Calculation Printout



|                                                                                                      |          |           |           |           |           |           |           |           |           |           |          |            |        |
|------------------------------------------------------------------------------------------------------|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|------------|--------|
| Water heating                                                                                        |          |           |           |           |           |           |           |           |           |           |          |            |        |
| Water heating requirement                                                                            | 265.8203 | 235.0945  | 249.9408  | 220.3663  | 213.9966  | 193.2593  | 191.1161  | 198.5071  | 200.4526  | 222.9939  | 236.4445 | 263.0125   | (64)   |
| Efficiency of water heater                                                                           |          |           |           |           |           |           |           |           |           |           |          | 79.8000    | (216)  |
| (217)m                                                                                               | 87.0008  | 86.8011   | 86.3803   | 85.4544   | 83.7353   | 79.8000   | 79.8000   | 79.8000   | 79.8000   | 85.6583   | 86.6673  | 87.0438    | (217)  |
| Fuel for water heating, kWh/month                                                                    | 305.5377 | 270.8427  | 289.3492  | 257.8758  | 255.5633  | 242.1795  | 239.4939  | 248.7558  | 251.1937  | 260.3295  | 272.8186 | 302.1610   | (219)  |
| Space cooling fuel requirement                                                                       |          |           |           |           |           |           |           |           |           |           |          |            |        |
| (221)m                                                                                               | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000     | (221)  |
| Pumps and Fa                                                                                         | 7.3041   | 6.5973    | 7.3041    | 7.0685    | 7.3041    | 7.0685    | 7.3041    | 7.3041    | 7.0685    | 7.3041    | 7.0685   | 7.3041     | (231)  |
| Lighting                                                                                             | 38.6577  | 31.0126   | 27.9234   | 20.4579   | 15.8023   | 12.9106   | 14.4154   | 18.7376   | 24.3383   | 31.9332   | 36.0685  | 39.7321    | (232)  |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |           |           |           |           |           |           |           |           |           |          |            |        |
| (233a)m                                                                                              | -76.4968 | -104.2556 | -144.8584 | -157.1540 | -164.6362 | -151.7767 | -149.6777 | -143.4858 | -132.1025 | -116.2300 | -82.7179 | -66.5455   | (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                                                                                              | -54.8416 | -113.8092 | -223.4848 | -331.8930 | -435.3980 | -436.4160 | -431.4785 | -367.0670 | -271.2412 | -161.7213 | -72.8539 | -43.5057   | (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                                                                   |          |           |           |           |           |           |           |           |           |           |          | 6471.4750  | (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                                                                              |          |           |           |           |           |           |           |           |           |           |          | 3196.1009  | (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)                                                  |          |           |           |           |           |           |           |           |           |           |          | 311.9896   | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |           |           |           |           |           |           |           |           |           |          |            |        |
| PV generation                                                                                        |          |           |           |           |           |           |           |           |           |           |          | -4433.6472 | (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                                                                  |          |           |           |           |           |           |           |           |           |           |          | 5631.9183  | (238)  |

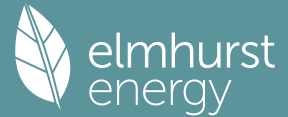
## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                               | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |       |
|-----------------------------------------------|--------------------|-------------------------------|--------------------------|-------|
| Space heating - main system 1                 | 6471.4750          | 0.2100                        | 1359.0098                | (261) |
| Total CO2 associated with community systems   |                    |                               | 0.0000                   | (373) |
| Water heating (other fuel)                    | 3196.1009          | 0.2100                        | 671.1812                 | (264) |
| Space and water heating                       |                    |                               | 2030.1909                | (265) |
| Pumps, fans and electric keep-hot             | 86.0000            | 0.1387                        | 11.9293                  | (267) |
| Energy for lighting                           | 311.9896           | 0.1443                        | 45.0297                  | (268) |
| Energy saving/generation technologies         |                    |                               |                          |       |
| PV Unit electricity used in dwelling          | -1489.9370         | 0.1354                        | -201.6771                |       |
| PV Unit electricity exported                  | -2943.7102         | 0.1262                        | -371.5589                |       |
| Total                                         |                    |                               | -573.2360                | (269) |
| Total CO2, kg/year                            |                    |                               | 1513.9139                | (272) |
| EPC Target Carbon Dioxide Emission Rate (TER) |                    |                               | 8.1600                   | (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               | 6471.4750          | 1.1300                              | 7312.7668                  | (275) |
| Total CO2 associated with community systems |                    |                                     | 0.0000                     | (473) |
| Water heating (other fuel)                  | 3196.1009          | 1.1300                              | 3611.5940                  | (278) |
| Space and water heating                     |                    |                                     | 10924.3608                 | (279) |
| Pumps, fans and electric keep-hot           | 86.0000            | 1.5128                              | 130.1008                   | (281) |
| Energy for lighting                         | 311.9896           | 1.5338                              | 478.5401                   | (282) |
| Energy saving/generation technologies       |                    |                                     |                            |       |
| PV Unit electricity used in dwelling        | -1489.9370         | 1.5003                              | -2235.3657                 |       |
| PV Unit electricity exported                | -2943.7102         | 0.4633                              | -1363.9171                 |       |
| Total                                       |                    |                                     | -3599.2827                 | (283) |
| Total Primary energy kWh/year               |                    |                                     | 7933.7190                  | (286) |
| Target Primary Energy Rate (TPER)           |                    |                                     | 42.7500                    | (287) |

# Full SAP Calculation Printout



|                                    |                                            |               |          |                |            |
|------------------------------------|--------------------------------------------|---------------|----------|----------------|------------|
| Property Reference                 | Plot 1 7HR                                 |               |          | Issued on Date | 28/03/2025 |
| Assessment Reference               | Plot 1-Gas Boiler                          | Prop Type Ref | LHS Plot |                |            |
| Property                           | Plot 1, 7 Hawthorne Road, READING, RG4 6LY |               |          |                |            |
|                                    |                                            |               |          |                |            |
| SAP Rating                         | 101 A                                      | DER           | 6.47     | TER            | 8.16       |
| Environmental                      | 93 A                                       | % DER < TER   |          |                | 20.71      |
| CO <sub>2</sub> Emissions (t/year) | 0.95                                       | DFEE          | 34.22    | TFEE           | 37.09      |
| Compliance Check                   | See BREL                                   | % DFEE < TFEE |          |                | 7.75       |
| % DPER < TPER                      | 18.40                                      | DPER          | 34.88    | TPER           | 42.75      |
|                                    |                                            |               |          |                |            |
| Assessor Details                   | Mr. Dhiraj Karsan                          |               |          | Assessor ID    | M078-0001  |
| Client                             |                                            |               |          |                |            |

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

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)            | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Main dwelling                                          |                           |                                 |                             |
| Ground floor                                           | 89.7000 (1b)              | x 2.4000 (2b)                   | = 215.2800 (1b) - (3b)      |
| First floor                                            | 61.8000 (1c)              | x 2.6000 (2c)                   | = 160.6800 (1c) - (3c)      |
| Second floor                                           | 34.1000 (1d)              | x 2.7000 (2d)                   | = 92.0700 (1d) - (3d)       |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 185.6000                  |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 468.0300 (5)              |

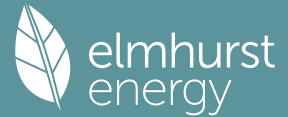
## 2. Ventilation rate

|                                                                                                         |        |        |        |        |        |        |        |        |        |        |             |              |                             |              |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------------|--------------|-----------------------------|--------------|
|                                                                                                         |        |        |        |        |        |        |        |        |        |        | 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) =      | 0.0855 (8)                  |              |
| Pressure test                                                                                           |        |        |        |        |        |        |        |        |        |        |             |              | Yes                         |              |
| Pressure Test Method                                                                                    |        |        |        |        |        |        |        |        |        |        |             |              | Blower Door                 |              |
| Measured/design AP50                                                                                    |        |        |        |        |        |        |        |        |        |        |             |              | 5.0000 (17)                 |              |
| Infiltration rate                                                                                       |        |        |        |        |        |        |        |        |        |        |             |              | 0.3355 (18)                 |              |
| Number of sides sheltered                                                                               |        |        |        |        |        |        |        |        |        |        |             |              | 1 (19)                      |              |
| Shelter factor                                                                                          |        |        |        |        |        |        |        |        |        |        |             |              | (20) = 1 - [0.075 x (19)] = | 0.9250 (20)  |
| Infiltration rate adjusted to include shelter factor                                                    |        |        |        |        |        |        |        |        |        |        |             |              | (21) = (18) x (20) =        | 0.3103 (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                                                                                         | 0.3956 | 0.3879 | 0.3801 | 0.3413 | 0.3336 | 0.2948 | 0.2948 | 0.2870 | 0.3103 | 0.3336 | 0.3491      | 0.3646 (22b) |                             |              |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |             |              | 0.0000 (23b)                |              |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =            |        |        |        |        |        |        |        |        |        |        |             |              | 0.0000 (23c)                |              |
| Effective ac                                                                                            | 0.5783 | 0.5752 | 0.5722 | 0.5583 | 0.5556 | 0.5435 | 0.5435 | 0.5412 | 0.5481 | 0.5556 | 0.5609      | 0.5665 (25)  |                             |              |

## 3. Heat losses and heat loss parameter

| Element                                                      | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K   |
|--------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|-----------------|
| Main dwelling                                                |                         |                            |                           |                               |              |                                |                 |
| Windows                                                      |                         |                            | 20.6100                   | 1.1450                        | 23.5992      |                                | (27)            |
| Roof Windows                                                 |                         |                            | 8.8800                    | 1.1450                        | 10.1679      |                                | (27a)           |
| Door                                                         |                         |                            | 1.8900                    | 1.2000                        | 2.2680       |                                | (26)            |
| Heat Loss Floor                                              |                         |                            | 89.7000                   | 0.1100                        | 9.8670       | 110.0000                       | 9867.0000 (28a) |
| Cavity Wall                                                  | 139.7000                | 22.5000                    | 117.2000                  | 0.1800                        | 21.0960      | 60.0000                        | 7032.0000 (29a) |
| Stud Wall                                                    | 28.1000                 |                            | 28.1000                   | 0.1100                        | 3.0910       | 9.0000                         | 252.9000 (29a)  |
| Flat Roof                                                    | 23.5000                 | 6.0000                     | 17.5000                   | 0.1400                        | 2.4500       | 9.0000                         | 157.5000 (30)   |
| Plane Roof                                                   | 55.2000                 |                            | 55.2000                   | 0.1132                        | 6.2491       | 9.0000                         | 496.8000 (30)   |
| Slope Roof                                                   | 13.4000                 | 2.8800                     | 10.5200                   | 0.1300                        | 1.3676       | 9.0000                         | 94.6800 (30)    |
| Total net area of external elements Aum (A, m <sup>2</sup> ) |                         |                            | 349.6000                  |                               |              |                                | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                          |                         |                            |                           | (26)...(30) + (32) =          | 80.1558      |                                | (33)            |
| Main dwelling                                                |                         |                            |                           |                               |              |                                |                 |
| Party Wall                                                   |                         |                            | 72.7000                   | 0.0000                        | 0.0000       | 0.0000                         | 0.0000 (32)     |
| Internal Wall                                                |                         |                            | 216.2000                  |                               |              | 9.0000                         | 1945.8000 (32c) |
| Internal Ceiling                                             |                         |                            | 61.8000                   |                               |              | 9.0000                         | 556.2000 (32e)  |
| Internal Ceiling 2                                           |                         |                            | 34.1000                   |                               |              | 9.0000                         | 306.9000 (32e)  |

# Full SAP Calculation Printout



|                                                            |  |  |  |  |  |  |  |  |  |  |  |  |
|------------------------------------------------------------|--|--|--|--|--|--|--|--|--|--|--|--|
| Heat capacity Cm = Sum(A x k)                              |  |  |  |  |  |  |  |  |  |  |  |  |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K          |  |  |  |  |  |  |  |  |  |  |  |  |
| List of Thermal Bridges                                    |  |  |  |  |  |  |  |  |  |  |  |  |
| K1 Element                                                 |  |  |  |  |  |  |  |  |  |  |  |  |
| E2 Other lintels (including other steel lintels)           |  |  |  |  |  |  |  |  |  |  |  |  |
| E3 Sill                                                    |  |  |  |  |  |  |  |  |  |  |  |  |
| E4 Jamb                                                    |  |  |  |  |  |  |  |  |  |  |  |  |
| E5 Ground floor (normal)                                   |  |  |  |  |  |  |  |  |  |  |  |  |
| E6 Intermediate floor within a dwelling                    |  |  |  |  |  |  |  |  |  |  |  |  |
| E16 Corner (normal)                                        |  |  |  |  |  |  |  |  |  |  |  |  |
| E18 Party wall between dwellings                           |  |  |  |  |  |  |  |  |  |  |  |  |
| R1 Head of roof window                                     |  |  |  |  |  |  |  |  |  |  |  |  |
| R2 Sill of roof window                                     |  |  |  |  |  |  |  |  |  |  |  |  |
| R3 Jamb of roof window                                     |  |  |  |  |  |  |  |  |  |  |  |  |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |  |  |  |  |  |  |  |  |  |  |  |  |
| Point Thermal bridges                                      |  |  |  |  |  |  |  |  |  |  |  |  |
| Total fabric heat loss                                     |  |  |  |  |  |  |  |  |  |  |  |  |
| (28)...(30) + (32) + (32a)...(32e) = 20709.7800 (34)       |  |  |  |  |  |  |  |  |  |  |  |  |
| 111.5829 (35)                                              |  |  |  |  |  |  |  |  |  |  |  |  |
| Length                                                     |  |  |  |  |  |  |  |  |  |  |  |  |
| Psi-value                                                  |  |  |  |  |  |  |  |  |  |  |  |  |
| Total                                                      |  |  |  |  |  |  |  |  |  |  |  |  |
| 16.8000 0.0400 0.6720                                      |  |  |  |  |  |  |  |  |  |  |  |  |
| 15.9000 0.0300 0.4770                                      |  |  |  |  |  |  |  |  |  |  |  |  |
| 31.6000 0.0300 0.9480                                      |  |  |  |  |  |  |  |  |  |  |  |  |
| 28.1000 0.0600 1.6860                                      |  |  |  |  |  |  |  |  |  |  |  |  |
| 41.1000 0.0700 2.8770                                      |  |  |  |  |  |  |  |  |  |  |  |  |
| 15.4000 0.0900 1.3860                                      |  |  |  |  |  |  |  |  |  |  |  |  |
| 15.4000 0.0600 0.9240                                      |  |  |  |  |  |  |  |  |  |  |  |  |
| 6.2000 0.0800 0.4960                                       |  |  |  |  |  |  |  |  |  |  |  |  |
| 6.2000 0.0600 0.3720                                       |  |  |  |  |  |  |  |  |  |  |  |  |
| 11.2000 0.0800 0.8960                                      |  |  |  |  |  |  |  |  |  |  |  |  |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |  |  |  |  |  |  |  |  |  |  |  |  |
| Point Thermal bridges                                      |  |  |  |  |  |  |  |  |  |  |  |  |
| Total fabric heat loss                                     |  |  |  |  |  |  |  |  |  |  |  |  |
| (36a) = 10.7340 (36)                                       |  |  |  |  |  |  |  |  |  |  |  |  |
| (33) + (36) + (36a) = 90.8898 (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                                                               | 89.3130  | 88.8436  | 88.3835  | 86.2224  | 85.8181  | 83.9359  | 83.9359  | 83.5873  | 84.6609  | 85.8181  | 86.6360  | 87.4912 (38)  |
| Heat transfer coeff                                                 |          |          |          |          |          |          |          |          |          |          |          |               |
| Average = Sum(39)m / 12 =                                           | 180.2028 | 179.7334 | 179.2733 | 177.1122 | 176.7079 | 174.8257 | 174.8257 | 174.4771 | 175.5507 | 176.7079 | 177.5259 | 178.3810 (39) |
| 177.1103                                                            |          |          |          |          |          |          |          |          |          |          |          |               |
| Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec                     |          |          |          |          |          |          |          |          |          |          |          |               |
| HLP                                                                 | 0.9709   | 0.9684   | 0.9659   | 0.9543   | 0.9521   | 0.9419   | 0.9419   | 0.9401   | 0.9459   | 0.9521   | 0.9565   | Dec           |
| HLP (average)                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.9611 (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                                                                           |  |  |  |  |  |  |  |  |  |  |  |                                                      |
| Hot water usage for mixer showers                                                           |  |  |  |  |  |  |  |  |  |  |  | 2.9832 (42)                                          |
| 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000                |  |  |  |  |  |  |  |  |  |  |  | 0.0000 (42a)                                         |
| Hot water usage for baths                                                                   |  |  |  |  |  |  |  |  |  |  |  |                                                      |
| 32.0478 31.5718 30.9016 29.6658 28.7404 27.7143 27.1601 27.8256 28.5503 29.6482 30.9095     |  |  |  |  |  |  |  |  |  |  |  | 31.9394 (42b)                                        |
| Hot water usage for other uses                                                              |  |  |  |  |  |  |  |  |  |  |  |                                                      |
| 45.1804 43.5375 41.8946 40.2517 38.6087 36.9658 36.9658 38.6087 40.2517 41.8946 43.5375     |  |  |  |  |  |  |  |  |  |  |  | 45.1804 (42c)                                        |
| Average daily hot water use (litres/day)                                                    |  |  |  |  |  |  |  |  |  |  |  | 70.7865 (43)                                         |
| Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec                                             |  |  |  |  |  |  |  |  |  |  |  |                                                      |
| Daily hot water use                                                                         |  |  |  |  |  |  |  |  |  |  |  |                                                      |
| 77.2282 75.1093 72.7962 69.9174 67.3491 64.6801 64.1259 66.4344 68.8020 71.5428 74.4470     |  |  |  |  |  |  |  |  |  |  |  | 77.1199 (44)                                         |
| Energy content (annual)                                                                     |  |  |  |  |  |  |  |  |  |  |  |                                                      |
| 122.3106 106.9547 111.8850 95.7135 90.6649 79.5318 77.5547 82.2596 84.8397 97.0830 106.0634 |  |  |  |  |  |  |  |  |  |  |  | 120.7511 (45)                                        |
| Distribution loss (46)m = 0.15 x (45)m                                                      |  |  |  |  |  |  |  |  |  |  |  | Total = Sum(45)m = 1175.6119                         |
| 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000                |  |  |  |  |  |  |  |  |  |  |  | 0.0000 (46)                                          |
| Water storage loss:                                                                         |  |  |  |  |  |  |  |  |  |  |  |                                                      |
| Total storage loss                                                                          |  |  |  |  |  |  |  |  |  |  |  |                                                      |
| 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000                |  |  |  |  |  |  |  |  |  |  |  | 0.0000 (56)                                          |
| If cylinder contains dedicated solar storage                                                |  |  |  |  |  |  |  |  |  |  |  |                                                      |
| 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000                |  |  |  |  |  |  |  |  |  |  |  | 0.0000 (57)                                          |
| Primary loss                                                                                |  |  |  |  |  |  |  |  |  |  |  | 0.0000 (59)                                          |
| Combi loss                                                                                  |  |  |  |  |  |  |  |  |  |  |  | 0.0000 (61)                                          |
| Total heat required for water heating calculated for each month                             |  |  |  |  |  |  |  |  |  |  |  |                                                      |
| 103.9640 90.9115 95.1022 81.3564 77.0652 67.6020 65.9215 69.9207 72.1138 82.5205 90.1539    |  |  |  |  |  |  |  |  |  |  |  | 102.6384 (62)                                        |
| WWHRS                                                                                       |  |  |  |  |  |  |  |  |  |  |  | 0.0000 (63a)                                         |
| PV diverter                                                                                 |  |  |  |  |  |  |  |  |  |  |  | 0.0000 (63b)                                         |
| Solar input                                                                                 |  |  |  |  |  |  |  |  |  |  |  | 0.0000 (63c)                                         |
| FGHRS                                                                                       |  |  |  |  |  |  |  |  |  |  |  | 0.0000 (63d)                                         |
| Output from w/h                                                                             |  |  |  |  |  |  |  |  |  |  |  |                                                      |
| 103.9640 90.9115 95.1022 81.3564 77.0652 67.6020 65.9215 69.9207 72.1138 82.5205 90.1539    |  |  |  |  |  |  |  |  |  |  |  | 102.6384 (64)                                        |
| Total per year (kWh/year)                                                                   |  |  |  |  |  |  |  |  |  |  |  | Total per year (kWh/year) = Sum(64)m = 999.2701 (64) |
| Electric shower(s)                                                                          |  |  |  |  |  |  |  |  |  |  |  | 999 (64)                                             |
| 59.4518 52.9721 57.8435 55.1993 56.2351 53.6429 55.4309 56.2351 55.1993 57.8435 56.7558     |  |  |  |  |  |  |  |  |  |  |  | 59.4518 (64a)                                        |
| Total Energy used by instantaneous electric shower(s) = Sum(64a)m =                         |  |  |  |  |  |  |  |  |  |  |  | 676.2613 (64a)                                       |
| Heat gains from water heating, kWh/month                                                    |  |  |  |  |  |  |  |  |  |  |  |                                                      |
| 40.8540 35.9709 38.2364 34.1389 33.3251 30.3112 30.3381 31.5390 31.8283 35.0910 36.7274     |  |  |  |  |  |  |  |  |  |  |  | 40.5226 (65)                                         |

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|            |        |         |        |        |        |              |
|------------|--------|---------|--------|--------|--------|--------------|
| Southwest  | 0.7200 | 38.2331 | 0.7600 | 0.7000 | 1.0000 | 13.1803 (82) |
| Horizontal | 6.0000 | 26.0000 | 0.7600 | 0.7000 | 1.0000 | 74.6928 (82) |

|             |          |           |           |           |           |           |           |           |           |           |          |               |
|-------------|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|---------------|
| Solar gains | 260.1792 | 498.7084  | 818.4381  | 1223.5480 | 1548.1778 | 1611.5461 | 1522.9377 | 1271.7321 | 958.5595  | 588.9725  | 322.0232 | 215.7874 (83) |
| Total gains | 926.0339 | 1186.8200 | 1475.1415 | 1862.5933 | 2153.3007 | 2196.5898 | 2084.6997 | 1831.4020 | 1535.5851 | 1182.6377 | 950.8325 | 865.4384 (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                                                                         | 31.9236 | 32.0069 | 32.0891 | 32.4806 | 32.5549 | 32.9054 | 32.9054 | 32.9712 | 32.7695                   | 32.5549 | 32.4049 | 32.2496      |
| alpha                                                                       | 3.1282  | 3.1338  | 3.1393  | 3.1654  | 3.1703  | 3.1937  | 3.1937  | 3.1981  | 3.1846                    | 3.1703  | 3.1603  | 3.1500       |
| util living area                                                            | 0.9825  | 0.9629  | 0.9192  | 0.8103  | 0.6497  | 0.4786  | 0.3592  | 0.4201  | 0.6645                    | 0.8952  | 0.9692  | 0.9857 (86)  |
| MIT                                                                         | 18.7107 | 19.0892 | 19.6418 | 20.3049 | 20.7318 | 20.9255 | 20.9775 | 20.9633 | 20.7900                   | 20.1450 | 19.3058 | 18.6545 (87) |
| Th 2                                                                        | 20.1076 | 20.1098 | 20.1118 | 20.1216 | 20.1234 | 20.1320 | 20.1320 | 20.1336 | 20.1287                   | 20.1234 | 20.1197 | 20.1159 (88) |
| util rest of house                                                          | 0.9797  | 0.9572  | 0.9070  | 0.7840  | 0.6070  | 0.4218  | 0.2919  | 0.3472  | 0.6063                    | 0.8739  | 0.9636  | 0.9834 (89)  |
| MIT 2                                                                       | 17.9908 | 18.3662 | 18.9078 | 19.5434 | 19.9243 | 20.0871 | 20.1221 | 20.1164 | 19.9886                   | 19.4108 | 18.5909 | 17.9408 (90) |
| Living area fraction                                                        |         |         |         |         |         |         |         |         | fLA = Living area / (4) = |         |         | 0.4014 (91)  |
| MIT                                                                         | 18.2798 | 18.6564 | 19.2024 | 19.8491 | 20.2484 | 20.4237 | 20.4655 | 20.4564 | 20.3103                   | 19.7055 | 18.8778 | 18.2273 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |                           |         |         | 0.0000       |
| adjusted MIT                                                                | 18.2798 | 18.6564 | 19.2024 | 19.8491 | 20.2484 | 20.4237 | 20.4655 | 20.4564 | 20.3103                   | 19.7055 | 18.8778 | 18.2273 (93) |

## 8. Space heating requirement

|                                                                                |           |           |           |           |           |           |          |          |           |               |           |                 |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|----------|----------|-----------|---------------|-----------|-----------------|
|                                                                                | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul      | Aug      | Sep       | Oct           | Nov       | Dec             |
| Utilisation                                                                    | 0.9719    | 0.9452    | 0.8920    | 0.7750    | 0.6134    | 0.4413    | 0.3181   | 0.3749   | 0.6191    | 0.8619        | 0.9530    | 0.9766 (94)     |
| Useful gains                                                                   | 900.0314  | 1121.8212 | 1315.7811 | 1443.5344 | 1320.7589 | 969.3191  | 663.1631 | 686.5909 | 950.7307  | 1019.3259     | 906.1803  | 845.2165 (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                                                               | 2519.1927 | 2472.4833 | 2277.2002 | 1939.2110 | 1510.5741 | 1018.1239 | 675.7829 | 707.7408 | 1090.2211 | 1609.0084     | 2090.8729 | 2502.2031 (97)  |
| Space heating kWh                                                              | 1204.6561 | 907.6449  | 715.2958  | 356.8871  | 141.2225  | 0.0000    | 0.0000   | 0.0000   | 0.0000    | 438.7238      | 852.9786  | 1232.7981 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |           |           |          |          |           |               |           | 5850.2070       |
| 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                                                              | 1204.6561 | 907.6449  | 715.2958  | 356.8871  | 141.2225  | 0.0000    | 0.0000   | 0.0000   | 0.0000    | 438.7238      | 852.9786  | 1232.7981 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |           |           |          |          |           |               |           | 5850.2070       |
| Space heating per m2                                                           |           |           |           |           |           |           |          |          |           | (98c) / (4) = |           | 31.5205 (99)    |

## 8c. Space cooling requirement

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

|                                  |        |        |        |        |         |           |           |           |                          |         |        |                |
|----------------------------------|--------|--------|--------|--------|---------|-----------|-----------|-----------|--------------------------|---------|--------|----------------|
|                                  | Jan    | Feb    | Mar    | Apr    | May     | Jun       | Jul       | Aug       | Sep                      | Oct     | Nov    | Dec            |
| Ext. temp.                       | 4.3000 | 4.9000 | 6.5000 | 8.9000 | 11.7000 | 14.6000   | 16.6000   | 16.4000   | 14.1000                  | 10.6000 | 7.1000 | 4.2000         |
| Heat loss rate W                 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 1643.3616 | 1293.7102 | 1326.0263 | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (100)   |
| Utilisation                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 0.8756    | 0.9172    | 0.8842    | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (101)   |
| Useful loss                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 1438.9788 | 1186.6532 | 1172.4368 | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (102)   |
| Total gains                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 2342.1270 | 2222.8544 | 1953.3693 | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (103)   |
| Space cooling kWh                | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 650.2667  | 770.9337  | 581.0138  | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (104)   |
| Cooled fraction                  |        |        |        |        |         |           |           |           | fC = cooled area / (4) = |         |        | 1.0000 (105)   |
| Intermittency factor (Table 10b) | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500  | 0.2500    | 0.2500    | 0.2500    | 0.2500                   | 0.2500  | 0.2500 | 0.2500 (106)   |
| Space cooling kWh                | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 162.5667  | 192.7334  | 145.2534  | 0.0000                   | 0.0000  | 0.0000 | 0.0000 (107)   |
| Space cooling requirement        |        |        |        |        |         |           |           |           |                          |         |        | 500.5536 (107) |
| Energy for space heating         |        |        |        |        |         |           |           |           |                          |         |        | 31.5205 (99)   |
| Energy for space cooling         |        |        |        |        |         |           |           |           |                          |         |        | 2.6969 (108)   |
| Total                            |        |        |        |        |         |           |           |           |                          |         |        | 34.2175 (109)  |
| Fabric Energy Efficiency (DFEE)  |        |        |        |        |         |           |           |           |                          |         |        | 34.2 (109)     |

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

### 1. Overall dwelling characteristics

|                                                        |              |                                   |                        |
|--------------------------------------------------------|--------------|-----------------------------------|------------------------|
| Main dwelling                                          | Area (m2)    | Storey height (m)                 | Volume (m3)            |
| Ground floor                                           | 89.7000 (1b) | x 2.4000 (2b)                     | = 215.2800 (1b) - (3b) |
| First floor                                            | 61.8000 (1c) | x 2.6000 (2c)                     | = 160.6800 (1c) - (3c) |
| Second floor                                           | 34.1000 (1d) | x 2.7000 (2d)                     | = 92.0700 (1d) - (3d)  |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 185.6000     |                                   | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 468.0300 (5)           |

### 2. Ventilation rate

m3 per hour

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|                                                    |          |              |
|----------------------------------------------------|----------|--------------|
| Number of open chimneys                            | 0 * 80 = | 0.0000 (6a)  |
| Number of open flues                               | 0 * 20 = | 0.0000 (6b)  |
| Number of chimneys / flues attached to closed fire | 0 * 10 = | 0.0000 (6c)  |
| Number of flues attached to solid fuel boiler      | 0 * 20 = | 0.0000 (6d)  |
| Number of flues attached to other heater           | 0 * 35 = | 0.0000 (6e)  |
| Number of blocked chimneys                         | 0 * 20 = | 0.0000 (6f)  |
| Number of intermittent extract fans                | 4 * 10 = | 40.0000 (7a) |
| Number of passive vents                            | 0 * 10 = | 0.0000 (7b)  |
| Number of flueless gas fires                       | 0 * 40 = | 0.0000 (7c)  |

|                                                      |                                                       |         |                      |             |
|------------------------------------------------------|-------------------------------------------------------|---------|----------------------|-------------|
| Infiltration due to chimneys, flues and fans         | = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 40.0000 | Air changes per hour | 0.0855 (8)  |
| Pressure test                                        |                                                       |         | Yes                  |             |
| Pressure Test Method                                 |                                                       |         | Blower Door          |             |
| Measured/design AP50                                 |                                                       |         |                      | 5.0000 (17) |
| Infiltration rate                                    |                                                       |         |                      | 0.3355 (18) |
| Number of sides sheltered                            |                                                       |         | 1                    | (19)        |
| Shelter factor                                       | (20) = 1 - [0.075 x (19)] =                           |         |                      | 0.9250 (20) |
| Infiltration rate adjusted to include shelter factor | (21) = (18) x (20) =                                  |         |                      | 0.3103 (21) |

|                                                                                                         |        |        |        |        |        |        |        |        |        |        |        |        |       |
|---------------------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|
| Wind speed                                                                                              | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |       |
| Wind factor                                                                                             | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 | (22)  |
| Adj infilt rate                                                                                         | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 | (22a) |
|                                                                                                         | 0.3956 | 0.3879 | 0.3801 | 0.3413 | 0.3336 | 0.2948 | 0.2948 | 0.2870 | 0.3103 | 0.3336 | 0.3491 | 0.3646 | (22b) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.0000 | (23b) |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =            |        |        |        |        |        |        |        |        |        |        |        | 0.0000 | (23c) |
| Effective ac                                                                                            | 0.5783 | 0.5752 | 0.5722 | 0.5583 | 0.5556 | 0.5435 | 0.5435 | 0.5412 | 0.5481 | 0.5556 | 0.5609 | 0.5665 | (25)  |

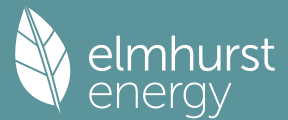
### 3. Heat losses and heat loss parameter

| Element                                                    | Gross    | Openings | NetArea  | U-value               | A x U     | K-value               | A x K         |
|------------------------------------------------------------|----------|----------|----------|-----------------------|-----------|-----------------------|---------------|
| Main dwelling                                              | m2       | m2       | m2       | W/m2K                 | W/K       | kJ/m2K                | kJ/K          |
| TER Opaque door                                            |          |          | 1.8900   | 1.0000                | 1.8900    |                       | (26)          |
| TER Opening Type                                           |          |          | 20.6100  | 1.1450                | 23.5992   |                       | (27)          |
| TER Roof Window                                            |          |          | 8.8800   | 1.1450                | 13.8814   |                       | (27a)         |
| Heat Loss Floor                                            |          |          | 89.7000  | 0.1300                | 11.6610   |                       | (28a)         |
| Cavity Wall                                                | 139.7000 | 22.5000  | 117.2000 | 0.1800                | 21.0960   |                       | (29a)         |
| Stud Wall                                                  | 28.1000  |          | 28.1000  | 0.1800                | 5.0580    |                       | (29a)         |
| Flat Roof                                                  | 23.5000  | 6.0000   | 17.5000  | 0.1100                | 1.9250    |                       | (30)          |
| Plane Roof                                                 | 55.2000  |          | 55.2000  | 0.1100                | 6.0720    |                       | (30)          |
| Slope Roof                                                 | 13.4000  | 2.8800   | 10.5200  | 0.1100                | 1.1572    |                       | (30)          |
| Total net area of external elements Aum(A, m2)             |          |          | 349.6000 |                       |           |                       | (31)          |
| Fabric heat loss, W/K = Sum (A x U)                        |          |          |          | (26)... (30) + (32) = | 86.3398   |                       | (33)          |
| Main dwelling                                              |          |          |          |                       |           |                       |               |
| Party Wall                                                 |          |          | 72.7000  | 0.0000                | 0.0000    |                       | (32)          |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K          |          |          |          |                       |           |                       | 111.5829 (35) |
| List of Thermal Bridges                                    |          |          |          |                       |           |                       |               |
| K1 Element                                                 |          |          |          | Length                | Psi-value | Total                 |               |
| E2 Other lintels (including other steel lintels)           |          |          |          | 16.8000               | 0.0500    | 0.8400                |               |
| E3 Sill                                                    |          |          |          | 15.9000               | 0.0500    | 0.7950                |               |
| E4 Jamb                                                    |          |          |          | 31.6000               | 0.0500    | 1.5800                |               |
| E5 Ground floor (normal)                                   |          |          |          | 28.1000               | 0.1600    | 4.4960                |               |
| E6 Intermediate floor within a dwelling                    |          |          |          | 41.1000               | 0.0000    | 0.0000                |               |
| E16 Corner (normal)                                        |          |          |          | 15.4000               | 0.0900    | 1.3860                |               |
| E18 Party wall between dwellings                           |          |          |          | 15.4000               | 0.0600    | 0.9240                |               |
| R1 Head of roof window                                     |          |          |          | 6.2000                | 0.0800    | 0.4960                |               |
| R2 Sill of roof window                                     |          |          |          | 6.2000                | 0.0600    | 0.3720                |               |
| R3 Jamb of roof window                                     |          |          |          | 11.2000               | 0.0800    | 0.8960                |               |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |          |          |          |                       |           |                       | 11.7850 (36)  |
| Point Thermal bridges                                      |          |          |          |                       |           | (36a) =               | 0.0000        |
| Total fabric heat loss                                     |          |          |          |                       |           | (33) + (36) + (36a) = | 98.1248 (37)  |

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

|                                                                 |          |          |          |         |         |         |         |         |         |         |          |          |             |
|-----------------------------------------------------------------|----------|----------|----------|---------|---------|---------|---------|---------|---------|---------|----------|----------|-------------|
| Assumed occupancy                                               |          |          |          |         |         |         |         |         |         |         |          |          | 2.9832 (42) |
| Hot water usage for mixer showers                               |          |          |          |         |         |         |         |         |         |         |          |          | (42a)       |
| Hot water usage for baths                                       |          |          |          |         |         |         |         |         |         |         |          |          | (42b)       |
| Hot water usage for other uses                                  |          |          |          |         |         |         |         |         |         |         |          |          | (42c)       |
| Average daily hot water use (litres/day)                        |          |          |          |         |         |         |         |         |         |         |          |          | (43)        |
| Daily hot water use                                             | Jan      | Feb      | Mar      | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov      | Dec      |             |
| Energy conte                                                    | 77.2282  | 75.1093  | 72.7962  | 69.9174 | 67.3491 | 64.6801 | 64.1259 | 66.4344 | 68.8020 | 71.5428 | 74.4470  | 77.1199  | (44)        |
| Energy content (annual)                                         | 122.3106 | 106.9547 | 111.8850 | 95.7135 | 90.6649 | 79.5318 | 77.5547 | 82.2596 | 84.8397 | 97.0830 | 106.0634 | 120.7511 | (45)        |
| Distribution loss (46)m = 0.15 x (45)m                          |          |          |          |         |         |         |         |         |         |         |          |          |             |
| Water storage loss:                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000   | 0.0000   | (46)        |
| Total storage loss                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000   | 0.0000   | (56)        |
| If cylinder contains dedicated solar storage                    | 0.0000   | 0.0000   | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000   | 0.0000   | (57)        |
| Primary loss                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000   | 0.0000   | (59)        |
| Combi loss                                                      | 0.0000   | 0.0000   | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000   | 0.0000   | (61)        |
| Total heat required for water heating calculated for each month |          |          |          |         |         |         |         |         |         |         |          |          |             |

# Full SAP Calculation Printout



|                                          |          |         |         |         |         |         |         |         |         |         |         |                |
|------------------------------------------|----------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|----------------|
| WWHRS                                    | 103.9640 | 90.9115 | 95.1022 | 81.3564 | 77.0652 | 67.6020 | 65.9215 | 69.9207 | 72.1138 | 82.5205 | 90.1539 | 102.6384 (62)  |
| PV diverter                              | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (63a)   |
| Solar input                              | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (63b)   |
| FGHRS                                    | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (63c)   |
| Output from w/h                          | 0.0000   | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (63d)   |
| 12Total per year (kWh/year)              | 103.9640 | 90.9115 | 95.1022 | 81.3564 | 77.0652 | 67.6020 | 65.9215 | 69.9207 | 72.1138 | 82.5205 | 90.1539 | 102.6384 (64)  |
| Electric shower(s)                       |          |         |         |         |         |         |         |         |         |         |         | 999.2701 (64)  |
|                                          | 59.4518  | 52.9721 | 57.8435 | 55.1993 | 56.2351 | 53.6429 | 55.4309 | 56.2351 | 55.1993 | 57.8435 | 56.7558 | 59.4518 (64a)  |
| Heat gains from water heating, kWh/month |          |         |         |         |         |         |         |         |         |         |         | 676.2613 (64a) |
|                                          | 40.8540  | 35.9709 | 38.2364 | 34.1389 | 33.3251 | 30.3112 | 30.3381 | 31.5390 | 31.8283 | 35.0910 | 36.7274 | 40.5226 (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     | 149.1575  | 149.1575  | 149.1575  | 149.1575  | 149.1575  | 149.1575  | 149.1575  | 149.1575  | 149.1575  | 149.1575  | 149.1575  | 149.1575 (66)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 186.0508  | 205.9848  | 186.0508  | 192.2525  | 186.0508  | 192.2525  | 186.0508  | 186.0508  | 192.2525  | 186.0508  | 192.2525  | 186.0508 (67)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 357.1453  | 360.8514  | 351.5123  | 331.6304  | 306.5330  | 282.9451  | 267.1869  | 263.4808  | 272.8200  | 292.7019  | 317.7992  | 341.3871 (68)  |
| Pumps, fans                                                                         | 37.9158   | 37.9158   | 37.9158   | 37.9158   | 37.9158   | 37.9158   | 37.9158   | 37.9158   | 37.9158   | 37.9158   | 37.9158   | 37.9158 (69)   |
| Losses e.g. evaporation (negative values) (Table 5)                                 | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000 (70)    |
| Water heating gains (Table 5)                                                       | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 (71) |
| Total internal gains                                                                | 54.9112   | 53.5281   | 51.3931   | 47.4152   | 44.7918   | 42.0989   | 40.7770   | 42.3911   | 44.2059   | 47.1653   | 51.0103   | 54.4658 (72)   |
|                                                                                     | 665.8546  | 688.1116  | 656.7034  | 639.0453  | 605.1228  | 585.0437  | 561.7620  | 559.6700  | 577.0256  | 593.6652  | 628.8093  | 649.6510 (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   |          |               |
|-------------|----------|-----------|-----------|-----------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|--------------|----------|---------------|
| Northeast   |          |           |           |           | 10.6800    | 11.2829                        | 0.6300                            | 0.7000                             | 0.7700                       | 36.8269 (75) |          |               |
| Southwest   |          |           |           |           | 7.2900     | 36.7938                        | 0.6300                            | 0.7000                             | 0.7700                       | 81.9737 (79) |          |               |
| Northwest   |          |           |           |           | 2.6400     | 11.2829                        | 0.6300                            | 0.7000                             | 0.7700                       | 9.1033 (81)  |          |               |
| Northeast   |          |           |           |           | 2.1600     | 17.4137                        | 0.6300                            | 0.7000                             | 1.0000                       | 14.9288 (82) |          |               |
| Southwest   |          |           |           |           | 0.7200     | 38.2331                        | 0.6300                            | 0.7000                             | 1.0000                       | 10.9258 (82) |          |               |
| Horizontal  |          |           |           |           | 6.0000     | 26.0000                        | 0.6300                            | 0.7000                             | 1.0000                       | 61.9164 (82) |          |               |
| Solar gains | 215.6749 | 413.4030  | 678.4421  | 1014.2569 | 1283.3579  | 1335.8869                      | 1262.4352                         | 1054.1990                          | 794.5953                     | 488.2272     | 266.9403 | 178.8764 (83) |
| Total gains | 881.5295 | 1101.5146 | 1335.1455 | 1653.3022 | 1888.4808  | 1920.9306                      | 1824.1972                         | 1613.8689                          | 1371.6210                    | 1081.8924    | 895.7496 | 828.5274 (84) |

## 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Th1 (C) |         |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |         |         |         |              |
| tau                                                                         | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| alpha                                                                       | 30.6913 | 30.7684 | 30.8443 | 31.2059 | 31.2745 | 31.5978 | 31.5978 | 31.6584 | 31.4725 | 31.2745 | 31.1360 | 30.9926      |
| util living area                                                            | 3.0461  | 3.0512  | 3.0563  | 3.0804  | 3.0850  | 3.1065  | 3.1065  | 3.1106  | 3.0982  | 3.0850  | 3.0757  | 3.0662       |
| MIT                                                                         | 0.9848  | 0.9700  | 0.9379  | 0.8542  | 0.7167  | 0.5486  | 0.4194  | 0.4834  | 0.7234  | 0.9170  | 0.9741  | 0.9873 (86)  |
| Th 2                                                                        | 18.5660 | 18.9089 | 19.4349 | 20.1144 | 20.6131 | 20.8791 | 20.9608 | 20.9393 | 20.7081 | 20.0028 | 19.1666 | 18.5166 (87) |
| util rest of house                                                          | 20.0751 | 20.0772 | 20.0793 | 20.0890 | 20.0908 | 20.0993 | 20.0993 | 20.1008 | 20.0960 | 20.0908 | 20.0871 | 20.0833 (88) |
| MIT 2                                                                       | 0.9823  | 0.9652  | 0.9278  | 0.8311  | 0.6745  | 0.4858  | 0.3405  | 0.4003  | 0.6658  | 0.8988  | 0.9692  | 0.9852 (89)  |
| Living area fraction                                                        | 17.8253 | 18.1662 | 18.6847 | 19.3439 | 19.7989 | 20.0254 | 20.0819 | 20.0720 | 19.8976 | 19.2533 | 18.4313 | 17.7817 (90) |
| MIT                                                                         | 18.1226 | 18.4643 | 18.9858 | 19.6532 | 20.1257 | 20.3680 | 20.4347 | 20.4202 | 20.2229 | 19.5541 | 18.7264 | 18.0767 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT                                                                | 18.1226 | 18.4643 | 18.9858 | 19.6532 | 20.1257 | 20.3680 | 20.4347 | 20.4202 | 20.2229 | 19.5541 | 18.7264 | 18.0767 (93) |

## 8. Space heating requirement

|                                                                                |           |           |           |           |           |           |          |          |           |           |           |                 |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|----------|----------|-----------|-----------|-----------|-----------------|
| Utilisation                                                                    | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul      | Aug      | Sep       | Oct       | Nov       | Dec             |
| Useful gains                                                                   | 0.9750    | 0.9540    | 0.9130    | 0.8186    | 0.6763    | 0.5052    | 0.3705   | 0.4308   | 0.6745    | 0.8856    | 0.9593    | 0.9788 (94)     |
| Ext temp.                                                                      | 859.4503  | 1050.8697 | 1218.9214 | 1353.4081 | 1277.1427 | 970.5358  | 675.9037 | 695.1824 | 925.2181  | 958.1363  | 859.2787  | 811.0006 (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                                                              | 2590.8807 | 2536.1017 | 2328.7072 | 1982.3162 | 1549.8527 | 1050.1331 | 698.1424 | 730.5126 | 1119.1840 | 1647.0483 | 2148.1117 | 2575.7413 (97)  |
| Space heating requirement - total per year (kWh/year)                          | 1288.1842 | 998.0759  | 825.6806  | 452.8138  | 202.8962  | 0.0000    | 0.0000   | 0.0000   | 0.0000    | 512.5506  | 927.9598  | 1312.9671 (98a) |
| Solar heating kWh                                                              |           |           |           |           |           |           |          |          |           |           |           | 6521.1282       |
| Solar heating contribution - total per year (kWh/year)                         | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000 (98b)    |
| Space heating requirement after solar contribution - total per year (kWh/year) | 1288.1842 | 998.0759  | 825.6806  | 452.8138  | 202.8962  | 0.0000    | 0.0000   | 0.0000   | 0.0000    | 512.5506  | 927.9598  | 1312.9671 (98c) |
| Space heating requirement per m <sup>2</sup>                                   |           |           |           |           |           |           |          |          |           |           |           | 35.1354 (99)    |

## 8c. Space cooling requirement

|                                                     |        |        |        |        |         |         |         |         |         |         |        |        |
|-----------------------------------------------------|--------|--------|--------|--------|---------|---------|---------|---------|---------|---------|--------|--------|
| Calculated for June, July and August. See Table 10b |        |        |        |        |         |         |         |         |         |         |        |        |
| Ext. temp.                                          | Jan    | Feb    | Mar    | Apr    | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov    | Dec    |
|                                                     | 4.3000 | 4.9000 | 6.5000 | 8.9000 | 11.7000 | 14.6000 | 16.6000 | 16.4000 | 14.1000 | 10.6000 | 7.1000 | 4.2000 |

# Full SAP Calculation Printout



|                                  |        |        |        |        |        |           |           |           |                          |        |        |                |
|----------------------------------|--------|--------|--------|--------|--------|-----------|-----------|-----------|--------------------------|--------|--------|----------------|
| Heat loss rate W                 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1711.3705 | 1347.2491 | 1381.0122 | 0.0000                   | 0.0000 | 0.0000 | 0.0000 (100)   |
| Utilisation                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.8189    | 0.8733    | 0.8320    | 0.0000                   | 0.0000 | 0.0000 | 0.0000 (101)   |
| Useful loss                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 1401.4589 | 1176.5201 | 1149.0262 | 0.0000                   | 0.0000 | 0.0000 | 0.0000 (102)   |
| Total gains                      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 2043.4865 | 1940.5908 | 1717.4340 | 0.0000                   | 0.0000 | 0.0000 | 0.0000 (103)   |
| Space cooling kWh                | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 462.2598  | 568.4686  | 422.8953  | 0.0000                   | 0.0000 | 0.0000 | 0.0000 (104)   |
| Cooled fraction                  |        |        |        |        |        |           |           |           | FC = cooled area / (4) = |        |        | 1.0000 (105)   |
| Intermittency factor (Table 10b) | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500    | 0.2500    | 0.2500    | 0.2500                   | 0.2500 | 0.2500 | 0.2500 (106)   |
| Space cooling kWh                | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 115.5650  | 142.1172  | 105.7238  | 0.0000                   | 0.0000 | 0.0000 | 0.0000 (107)   |
| Space cooling requirement        |        |        |        |        |        |           |           |           |                          |        |        | 363.4060 (107) |
| Energy for space heating         |        |        |        |        |        |           |           |           |                          |        |        | 35.1354 (99)   |
| Energy for space cooling         |        |        |        |        |        |           |           |           |                          |        |        | 1.9580 (108)   |
| Total                            |        |        |        |        |        |           |           |           |                          |        |        | 37.0934 (109)  |
| Fabric Energy Efficiency (TFEE)  |        |        |        |        |        |           |           |           |                          |        |        | 37.1 (109)     |

# Full SAP Calculation Printout



|                                    |                                            |               |          |      |                |            |
|------------------------------------|--------------------------------------------|---------------|----------|------|----------------|------------|
| Property Reference                 | Plot 1 7HR                                 |               |          |      | Issued on Date | 28/03/2025 |
| Assessment Reference               | Plot 1-Gas Boiler                          | Prop Type Ref | LHS Plot |      |                |            |
| Property                           | Plot 1, 7 Hawthorne Road, READING, RG4 6LY |               |          |      |                |            |
|                                    |                                            |               |          |      |                |            |
| SAP Rating                         | 101 A                                      | DER           | 6.47     | TER  | 8.16           |            |
| Environmental                      | 93 A                                       | % DER < TER   |          |      |                | 20.71      |
| CO <sub>2</sub> Emissions (t/year) | 0.95                                       | DFEE          | 34.22    | TFEE | 37.09          |            |
| Compliance Check                   | See BREL                                   | % DFEE < TFEE |          |      |                | 7.75       |
| % DPER < TPER                      | 18.40                                      | DPER          | 34.88    | TPER | 42.75          |            |
|                                    |                                            |               |          |      |                |            |
| Assessor Details                   | Mr. Dhiraj Karsan                          |               |          |      | Assessor ID    | M078-0001  |
| Client                             |                                            |               |          |      |                |            |

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

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)            | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Main dwelling                                          |                           |                                 |                             |
| Ground floor                                           | 89.7000 (1b)              | x 2.4000 (2b)                   | = 215.2800 (1b) - (3b)      |
| First floor                                            | 61.8000 (1c)              | x 2.6000 (2c)                   | = 160.6800 (1c) - (3c)      |
| Second floor                                           | 34.1000 (1d)              | x 2.7000 (2d)                   | = 92.0700 (1d) - (3d)       |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 185.6000                  |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 468.0300 (5)              |

## 2. Ventilation rate

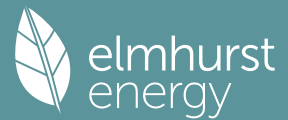
|                                                                                                  |                                         |
|--------------------------------------------------------------------------------------------------|-----------------------------------------|
|                                                                                                  | 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                                                              | 4 * 10 = 40.0000 (7a)                   |
| Number of passive vents                                                                          | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                                                     | 0 * 40 = 0.0000 (7c)                    |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) | 40.0000 / (5) = 0.0855 (8)              |
| Pressure test                                                                                    | Yes                                     |
| Pressure Test Method                                                                             | Blower Door                             |
| Measured/design AP50                                                                             | 5.0000 (17)                             |
| Infiltration rate                                                                                | 0.3355 (18)                             |
| Number of sides sheltered                                                                        | 1 (19)                                  |
| Shelter factor                                                                                   | (20) = 1 - [0.075 x (19)] = 0.9250 (20) |
| Infiltration rate adjusted to include shelter factor                                             | (21) = (18) x (20) = 0.3103 (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 | 0.3956 | 0.3879 | 0.3801 | 0.3413 | 0.3336 | 0.2948 | 0.2948 | 0.2870 | 0.3103 | 0.3336 | 0.3491 | 0.3646 (22b) |
| Effective ac    | 0.5783 | 0.5752 | 0.5722 | 0.5583 | 0.5556 | 0.5435 | 0.5435 | 0.5412 | 0.5481 | 0.5556 | 0.5609 | 0.5665 (25)  |

## 3. Heat losses and heat loss parameter

| Element                                                     | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K       | A x K<br>kJ/K   |
|-------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------------|-----------------|
| Main dwelling                                               |                         |                            |                           |                               |              |                                      |                 |
| Windows                                                     |                         |                            | 20.6100                   | 1.1450                        | 23.5992      |                                      | (27)            |
| Roof Windows                                                |                         |                            | 8.8800                    | 1.1450                        | 10.1679      |                                      | (27a)           |
| Door                                                        |                         |                            | 1.8900                    | 1.2000                        | 2.2680       |                                      | (26)            |
| Heat Loss Floor                                             |                         |                            | 89.7000                   | 0.1100                        | 9.8670       | 110.0000                             | 9867.0000 (28a) |
| Cavity Wall                                                 | 139.7000                | 22.5000                    | 117.2000                  | 0.1800                        | 21.0960      | 60.0000                              | 7032.0000 (29a) |
| Stud Wall                                                   | 28.1000                 |                            | 28.1000                   | 0.1100                        | 3.0910       | 9.0000                               | 252.9000 (29a)  |
| Flat Roof                                                   | 23.5000                 | 6.0000                     | 17.5000                   | 0.1400                        | 2.4500       | 9.0000                               | 157.5000 (30)   |
| Plane Roof                                                  | 55.2000                 |                            | 55.2000                   | 0.1132                        | 6.2491       | 9.0000                               | 496.8000 (30)   |
| Slope Roof                                                  | 13.4000                 | 2.8800                     | 10.5200                   | 0.1300                        | 1.3676       | 9.0000                               | 94.6800 (30)    |
| Total net area of external elements Aum(A, m <sup>2</sup> ) |                         |                            | 349.6000                  |                               |              |                                      | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                         |                         |                            |                           | (26)...(30) + (32) =          | 80.1558      |                                      | (33)            |
| Main dwelling                                               |                         |                            |                           |                               |              |                                      |                 |
| Party Wall                                                  |                         |                            | 72.7000                   | 0.0000                        | 0.0000       | 0.0000                               | 0.0000 (32)     |
| Internal Wall                                               |                         |                            | 216.2000                  |                               |              | 9.0000                               | 1945.8000 (32c) |
| Internal Ceiling                                            |                         |                            | 61.8000                   |                               |              | 9.0000                               | 556.2000 (32e)  |
| Internal Ceiling 2                                          |                         |                            | 34.1000                   |                               |              | 9.0000                               | 306.9000 (32e)  |
| Heat capacity Cm = Sum(A x k)                               |                         |                            |                           |                               |              | (28)...(30) + (32) + (32a)...(32e) = | 20709.7800 (34) |

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

111.5829 (35)

List of Thermal Bridges

|                                                            | Length  | Psi-value             | Total        |
|------------------------------------------------------------|---------|-----------------------|--------------|
| K1 Element                                                 | 16.8000 | 0.0400                | 0.6720       |
| E2 Other lintels (including other steel lintels)           | 15.9000 | 0.0300                | 0.4770       |
| E3 Sill                                                    | 31.6000 | 0.0300                | 0.9480       |
| E4 Jamb                                                    | 28.1000 | 0.0600                | 1.6860       |
| E5 Ground floor (normal)                                   | 41.1000 | 0.0700                | 2.8770       |
| E6 Intermediate floor within a dwelling                    | 15.4000 | 0.0900                | 1.3860       |
| E16 Corner (normal)                                        | 15.4000 | 0.0600                | 0.9240       |
| E18 Party wall between dwellings                           | 6.2000  | 0.0800                | 0.4960       |
| R1 Head of roof window                                     | 6.2000  | 0.0600                | 0.3720       |
| R2 Sill of roof window                                     | 11.2000 | 0.0800                | 0.8960       |
| R3 Jamb of roof window                                     |         |                       |              |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |         |                       | 10.7340 (36) |
| Point Thermal bridges                                      |         |                       | 0.0000       |
| Total fabric heat loss                                     |         | (33) + (36) + (36a) = | 90.8898 (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                     | 89.3130  | 88.8436  | 88.3835  | 86.2224  | 85.8181  | 83.9359  | 83.9359  | 83.5873  | 84.6609  | 85.8181  | 86.6360  | 87.4912 (38)  |
| Heat transfer coeff       | 180.2028 | 179.7334 | 179.2733 | 177.1122 | 176.7079 | 174.8257 | 174.8257 | 174.4771 | 175.5507 | 176.7079 | 177.5259 | 178.3810 (39) |
| Average = Sum(39)m / 12 = |          |          |          |          |          |          |          |          |          |          |          | 177.1103      |
| HLP                       | 0.9709   | 0.9684   | 0.9659   | 0.9543   | 0.9521   | 0.9419   | 0.9419   | 0.9401   | 0.9459   | 0.9521   | 0.9565   | 0.9611 (40)   |
| HLP (average)             |          |          |          |          |          |          |          |          |          |          |          | 0.9543        |
| Days in mont              | 31       | 28       | 31       | 30       | 31       | 30       | 31       | 31       | 30       | 31       | 30       | 31            |

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

|                                                                                |          |          |          |          |          |          |          |          |          |                                        |          |                |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------------------------------|----------|----------------|
| Assumed occupancy                                                              |          |          |          |          |          |          |          |          |          |                                        |          | 2.9832 (42)    |
| Hot water usage for mixer showers                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000 (42a)   |
| Hot water usage for baths                                                      | 85.6425  | 84.3706  | 82.5794  | 79.2769  | 76.8041  | 74.0621  | 72.5809  | 74.3595  | 76.2961  | 79.2302                                | 82.6007  | 85.3529 (42b)  |
| Hot water usage for other uses                                                 | 45.1804  | 43.5375  | 41.8946  | 40.2517  | 38.6087  | 36.9658  | 36.9658  | 38.6087  | 40.2517  | 41.8946                                | 43.5375  | 45.1804 (42c)  |
| Average daily hot water use (litres/day)                                       |          |          |          |          |          |          |          |          |          |                                        |          | 120.4772 (43)  |
| Daily hot water use                                                            | 130.8229 | 127.9081 | 124.4740 | 119.5286 | 115.4128 | 111.0279 | 109.5468 | 112.9683 | 116.5478 | 121.1247                               | 126.1382 | 130.5334 (44)  |
| Energy conte                                                                   | 207.1915 | 182.1394 | 191.3120 | 163.6287 | 155.3678 | 136.5217 | 132.4873 | 139.8783 | 143.7150 | 164.3651                               | 179.7070 | 204.3837 (45)  |
| Energy content (annual)                                                        |          |          |          |          |          |          |          |          |          | Total = Sum(45)m =                     |          | 2000.6976      |
| Distribution loss (46)m = 0.15 x (45)m                                         | 31.0787  | 27.3209  | 28.6968  | 24.5443  | 23.3052  | 20.4783  | 19.8731  | 20.9817  | 21.5573  | 24.6548                                | 26.9560  | 30.6576 (46)   |
| Water storage loss:                                                            |          |          |          |          |          |          |          |          |          |                                        |          |                |
| Store volume                                                                   |          |          |          |          |          |          |          |          |          |                                        |          | 300.0000 (47)  |
| a) If manufacturer declared loss factor is known (kWh/day):                    |          |          |          |          |          |          |          |          |          |                                        |          | 1.5900 (48)    |
| Temperature factor from Table 2b                                               |          |          |          |          |          |          |          |          |          |                                        |          | 0.5400 (49)    |
| Enter (49) or (54) in (55)                                                     |          |          |          |          |          |          |          |          |          |                                        |          | 0.8586 (55)    |
| Total storage loss                                                             | 26.6166  | 24.0408  | 26.6166  | 25.7580  | 26.6166  | 25.7580  | 26.6166  | 26.6166  | 25.7580  | 26.6166                                | 25.7580  | 26.6166 (56)   |
| If cylinder contains dedicated solar storage                                   | 26.6166  | 24.0408  | 26.6166  | 25.7580  | 26.6166  | 25.7580  | 26.6166  | 26.6166  | 25.7580  | 26.6166                                | 25.7580  | 26.6166 (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                | 257.0705 | 227.1914 | 241.1910 | 211.8987 | 205.2468 | 184.7917 | 182.3663 | 189.7573 | 191.9850 | 214.2441                               | 227.9770 | 254.2627 (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                                                                | 257.0705 | 227.1914 | 241.1910 | 211.8987 | 205.2468 | 184.7917 | 182.3663 | 189.7573 | 191.9850 | 214.2441                               | 227.9770 | 254.2627 (64)  |
| 12Total per year (kWh/year)                                                    |          |          |          |          |          |          |          |          |          | Total per year (kWh/year) = Sum(64)m = |          | 2587.9826 (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                                       | 108.7944 | 96.6029  | 103.5144 | 93.0225  | 91.5630  | 84.0095  | 83.9552  | 86.4127  | 86.4013  | 94.5546                                | 98.3686  | 107.8608 (65)  |

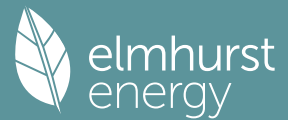
## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |           |           |           |           |           |           |           |           |           |           |           |                |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
| Metabolic gains (Table 5), Watts                                                    |           |           |           |           |           |           |           |           |           |           |           |                |
| (66)m                                                                               | 149.1575  | 149.1575  | 149.1575  | 149.1575  | 149.1575  | 149.1575  | 149.1575  | 149.1575  | 149.1575  | 149.1575  | 149.1575  | 149.1575 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 186.0508  | 205.9848  | 186.0508  | 192.2525  | 186.0508  | 192.2525  | 186.0508  | 186.0508  | 192.2525  | 186.0508  | 192.2525  | 186.0508 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 357.1453  | 360.8514  | 351.5123  | 331.6304  | 306.5330  | 282.9451  | 267.1869  | 263.4808  | 272.8200  | 292.7019  | 317.7992  | 341.3871 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 37.9158   | 37.9158   | 37.9158   | 37.9158   | 37.9158   | 37.9158   | 37.9158   | 37.9158   | 37.9158   | 37.9158   | 37.9158   | 37.9158 (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)                                 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 (71) |
| Water heating gains (Table 5)                                                       | 146.2290  | 143.7544  | 139.1323  | 129.1980  | 123.0686  | 116.6798  | 112.8431  | 116.1462  | 120.0017  | 127.0895  | 136.6230  | 144.9742 (72)  |
| Total internal gains                                                                | 760.1724  | 781.3378  | 747.4426  | 723.8281  | 686.3996  | 659.6246  | 633.8280  | 633.4250  | 652.8214  | 676.5894  | 717.4219  | 743.1594 (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   |
|-----------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|--------------|
| Northeast | 10.6800    | 11.2829                        | 0.7600                            | 0.7000                             | 0.7700                       | 44.4261 (75) |
| Southwest | 7.2900     | 36.7938                        | 0.7600                            | 0.7000                             | 0.7700                       | 98.8889 (79) |

# Full SAP Calculation Printout



|            |  |  |        |  |         |  |        |  |        |  |        |  |              |
|------------|--|--|--------|--|---------|--|--------|--|--------|--|--------|--|--------------|
| Northwest  |  |  | 2.6400 |  | 11.2829 |  | 0.7600 |  | 0.7000 |  | 0.7700 |  | 10.9817 (81) |
| Northeast  |  |  | 2.1600 |  | 17.4137 |  | 0.7600 |  | 0.7000 |  | 1.0000 |  | 18.0094 (82) |
| Southwest  |  |  | 0.7200 |  | 38.2331 |  | 0.7600 |  | 0.7000 |  | 1.0000 |  | 13.1803 (82) |
| Horizontal |  |  | 6.0000 |  | 26.0000 |  | 0.7600 |  | 0.7000 |  | 1.0000 |  | 74.6928 (82) |

|             |           |           |           |           |           |           |           |           |           |           |           |          |      |
|-------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|------|
| Solar gains | 260.1792  | 498.7084  | 818.4381  | 1223.5480 | 1548.1778 | 1611.5461 | 1522.9377 | 1271.7321 | 958.5595  | 588.9725  | 322.0232  | 215.7874 | (83) |
| Total gains | 1020.3516 | 1280.0463 | 1565.8807 | 1947.3761 | 2234.5775 | 2271.1707 | 2156.7657 | 1905.1571 | 1611.3809 | 1265.5619 | 1039.4452 | 958.9468 | (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                                                                         | 31.9236 | 32.0069 | 32.0891 | 32.4806 | 32.5549 | 32.9054 | 32.9054 | 32.9712 | 32.7695 | 32.5549                   | 32.4049 | 32.2496 |              |
| alpha                                                                       | 3.1282  | 3.1338  | 3.1393  | 3.1654  | 3.1703  | 3.1937  | 3.1937  | 3.1981  | 3.1846  | 3.1703                    | 3.1603  | 3.1500  |              |
| util living area                                                            | 0.9773  | 0.9552  | 0.9077  | 0.7950  | 0.6338  | 0.4652  | 0.3480  | 0.4055  | 0.6438  | 0.8791                    | 0.9613  | 0.9811  | (86)         |
| MIT                                                                         | 19.2562 | 19.5342 | 19.9369 | 20.4135 | 20.7160 | 20.8522 | 20.8883 | 20.8790 | 20.7600 | 20.3060                   | 19.6959 | 19.2153 | (87)         |
| Th 2                                                                        | 20.1076 | 20.1098 | 20.1118 | 20.1216 | 20.1234 | 20.1320 | 20.1320 | 20.1336 | 20.1287 | 20.1234                   | 20.1197 | 20.1159 | (88)         |
| util rest of house                                                          | 0.9738  | 0.9484  | 0.8941  | 0.7676  | 0.5910  | 0.4094  | 0.2825  | 0.3346  | 0.5854  | 0.8555                    | 0.9543  | 0.9781  | (89)         |
| MIT 2                                                                       | 18.0349 | 18.3878 | 18.8928 | 19.4770 | 19.8217 | 19.9688 | 19.9998 | 19.9953 | 19.8831 | 19.3651                   | 18.6035 | 17.9888 | (90)         |
| Living area fraction                                                        |         |         |         |         |         |         |         |         |         | FLA = Living area / (4) = |         | 0.4014  | (91)         |
| MIT                                                                         | 18.5252 | 18.8480 | 19.3119 | 19.8529 | 20.1807 | 20.3234 | 20.3565 | 20.3500 | 20.2351 | 19.7428                   | 19.0420 | 18.4811 | (92)         |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |                           |         | -0.1500 |              |
| adjusted MIT                                                                | 18.3752 | 18.6980 | 19.1619 | 19.7029 | 20.0307 | 20.1734 | 20.2065 | 20.2000 | 20.0851 | 19.5928                   | 18.8920 | 18.3311 | (93)         |

## 8. Space heating requirement

|                                                                                |           |           |           |           |           |          |          |          |           |               |           |           |       |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|----------|----------|----------|-----------|---------------|-----------|-----------|-------|
|                                                                                | Jan       | Feb       | Mar       | Apr       | May       | Jun      | Jul      | Aug      | Sep       | Oct           | Nov       | Dec       |       |
| Utilisation                                                                    | 0.9645    | 0.9349    | 0.8768    | 0.7532    | 0.5862    | 0.4121   | 0.2882   | 0.3402   | 0.5823    | 0.8386        | 0.9417    | 0.9699    | (94)  |
| Useful gains                                                                   | 984.1794  | 1196.6741 | 1373.0044 | 1466.7296 | 1309.8802 | 935.9819 | 621.6667 | 648.0604 | 938.2483  | 1061.3222     | 978.8913  | 930.1272  | (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                                                               | 2536.3823 | 2479.9533 | 2269.9436 | 1913.3333 | 1472.0929 | 974.3757 | 630.5018 | 663.0213 | 1050.6842 | 1589.0983     | 2093.3805 | 2520.7262 | (97)  |
| Space heating kWh                                                              | 1154.8390 | 862.3636  | 667.3228  | 321.5547  | 120.6862  | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 392.6654      | 802.4322  | 1183.4056 | (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |           |          |          |          |           |               |           | 5505.2695 |       |
| 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                                                              | 1154.8390 | 862.3636  | 667.3228  | 321.5547  | 120.6862  | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 392.6654      | 802.4322  | 1183.4056 | (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |           |          |          |          |           |               |           | 5505.2695 |       |
| Space heating per m2                                                           |           |           |           |           |           |          |          |          |           | (98c) / (4) = |           | 29.6620   | (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                                                                            | 1154.8390 | 862.3636  | 667.3228  | 321.5547  | 120.6862  | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 392.6654  | 802.4322  | 1183.4056 | (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)                                                             | 1300.4943 | 971.1302  | 751.4896  | 362.1111  | 135.9079  | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 442.1908  | 903.6398  | 1332.6640 | (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                                                                            | 257.0705  | 227.1914  | 241.1910  | 211.8987  | 205.2468  | 184.7917  | 182.3663  | 189.7573  | 191.9850  | 214.2441  | 227.9770  | 254.2627  | (64)          |
| Efficiency of water heater (217)m                                                                    | 87.0132   | 86.7597   | 86.2185   | 84.9924   | 82.9115   | 79.8000   | 79.8000   | 79.8000   | 79.8000   | 85.4000   | 86.6381   | 87.0634   | (216)         |
| Fuel for water heating, kWh/month                                                                    | 295.4384  | 261.8629  | 279.7438  | 249.3149  | 247.5492  | 231.5686  | 228.5292  | 237.7911  | 240.5828  | 250.8714  | 263.1370  | 292.0432  | (219)         |
| Space cooling fuel requirement                                                                       |           |           |           |           |           |           |           |           |           |           |           |           |               |
| (221)m                                                                                               | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | (221)         |
| Pumps and Fa                                                                                         | 7.3041    | 6.5973    | 7.3041    | 7.0685    | 7.3041    | 7.0685    | 7.3041    | 7.3041    | 7.0685    | 7.3041    | 7.0685    | 7.3041    | (231)         |
| Lighting                                                                                             | 45.4448   | 36.4575   | 32.8259   | 24.0497   | 18.5767   | 15.1773   | 16.9463   | 22.0274   | 28.6114   | 37.5397   | 42.4010   | 46.7079   | (232)         |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |           |           |           |           |           |           |           |           |           |           |           |           |               |
| (233a)m                                                                                              | -92.0670  | -124.4227 | -170.8547 | -180.6546 | -183.8788 | -167.4022 | -165.0567 | -161.0089 | -151.7796 | -137.1226 | -98.9876  | -79.9797  | (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                                                                                              | -77.6467  | -166.5178 | -341.8534 | -525.9843 | -702.0207 | -707.8638 | -696.9055 | -584.2645 | -418.8719 | -239.8092 | -103.9230 | -60.9143  | (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                                                                   |           |           |           |           |           |           |           |           |           |           |           | 6199.6278 | (211)         |
| Space heating fuel - main system 2                                                                   |           |           |           |           |           |           |           |           |           |           |           | 0.0000    | (213)         |
| Space heating fuel - secondary                                                                       |           |           |           |           |           |           |           |           |           |           |           | 0.0000    | (215)         |
| Efficiency of water heater                                                                           |           |           |           |           |           |           |           |           |           |           |           | 79.8000   |               |

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|                                                               |                  |
|---------------------------------------------------------------|------------------|
| Water heating fuel used                                       | 3078.4325 (219)  |
| Space cooling fuel                                            | 0.0000 (221)     |
| Electricity for pumps and fans:                               |                  |
| central heating pump                                          | 41.0000 (230c)   |
| main heating flue fan                                         | 45.0000 (230e)   |
| Total electricity for the above, kWh/year                     | 86.0000 (231)    |
| Electricity for lighting (calculated in Appendix L)           | 366.7656 (232)   |
| Energy saving/generation technologies (Appendices M ,N and Q) |                  |
| PV generation                                                 | -6339.7902 (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                           | 3391.0357 (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                   | 6199.6278          | 0.2100                        | 1301.9218 (261)          |
| Total CO2 associated with community systems     |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                      | 3078.4325          | 0.2100                        | 646.4708 (264)           |
| Space and water heating                         |                    |                               | 1948.3927 (265)          |
| Pumps, fans and electric keep-hot               | 86.0000            | 0.1387                        | 11.9293 (267)            |
| Energy for lighting                             | 366.7656           | 0.1443                        | 52.9356 (268)            |
| Energy saving/generation technologies           |                    |                               |                          |
| PV Unit electricity used in dwelling            | -1713.2150         | 0.1359                        | -232.7531                |
| PV Unit electricity exported                    | -4626.5751         | 0.1253                        | -579.9359                |
| Total                                           |                    |                               | -812.6890 (269)          |
| Total CO2, kg/year                              |                    |                               | 1200.5686 (272)          |
| EPC Dwelling Carbon Dioxide Emission Rate (DER) |                    |                               | 6.4700 (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               | 6199.6278          | 1.1300                              | 7005.5794 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 3078.4325          | 1.1300                              | 3478.6288 (278)            |
| Space and water heating                     |                    |                                     | 10484.2082 (279)           |
| Pumps, fans and electric keep-hot           | 86.0000            | 1.5128                              | 130.1008 (281)             |
| Energy for lighting                         | 366.7656           | 1.5338                              | 562.5573 (282)             |
| Energy saving/generation technologies       |                    |                                     |                            |
| PV Unit electricity used in dwelling        | -1713.2150         | 1.5022                              | -2573.5593                 |
| PV Unit electricity exported                | -4626.5751         | 0.4601                              | -2128.6712                 |
| Total                                       |                    |                                     | -4702.2305 (283)           |
| Total Primary energy kWh/year               |                    |                                     | 6474.6358 (286)            |
| Dwelling Primary energy Rate (DPER)         |                    |                                     | 34.8800 (287)              |

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

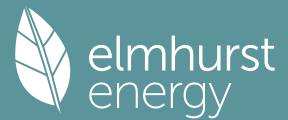
### 1. Overall dwelling characteristics

|                                                        | Area<br>(m2) | Storey height<br>(m)            | Volume<br>(m3)         |
|--------------------------------------------------------|--------------|---------------------------------|------------------------|
| Main dwelling                                          |              |                                 |                        |
| Ground floor                                           | 89.7000 (1b) | x 2.4000 (2b)                   | = 215.2800 (1b) - (3b) |
| First floor                                            | 61.8000 (1c) | x 2.6000 (2c)                   | = 160.6800 (1c) - (3c) |
| Second floor                                           | 34.1000 (1d) | x 2.7000 (2d)                   | = 92.0700 (1d) - (3d)  |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 185.6000     |                                 | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 468.0300 (5)         |

### 2. Ventilation rate

|                                                    | m3 per hour                |
|----------------------------------------------------|----------------------------|
| Number of open chimneys                            | 0 * 80 = 0.0000 (6a)       |
| Number of open flues                               | 0 * 20 = 0.0000 (6b)       |
| Number of chimneys / flues attached to closed fire | 0 * 10 = 0.0000 (6c)       |
| Number of flues attached to solid fuel boiler      | 0 * 20 = 0.0000 (6d)       |
| Number of flues attached to other heater           | 0 * 35 = 0.0000 (6e)       |
| Number of blocked chimneys                         | 0 * 20 = 0.0000 (6f)       |
| Number of intermittent extract fans                | 4 * 10 = 40.0000 (7a)      |
| Number of passive vents                            | 0 * 10 = 0.0000 (7b)       |
| Number of flueless gas fires                       | 0 * 40 = 0.0000 (7c)       |
| Infiltration due to chimneys, flues and fans       | Air changes per hour       |
| Pressure test                                      | 40.0000 / (5) = 0.0855 (8) |
| Pressure Test Method                               | Yes                        |
| Measured/design AP50                               | Blower Door                |
| Infiltration rate                                  | 5.0000 (17)                |
| Number of sides sheltered                          | 0.3355 (18)                |
|                                                    | 1 (19)                     |

# Full SAP Calculation Printout



Shelter factor  
Infiltration rate adjusted to include shelter factor

$$(20) = 1 - [0.075 \times (19)] = 0.9250 \quad (20)$$

$$(21) = (18) \times (20) = 0.3103 \quad (21)$$

|                 | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |       |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|
| Wind speed      | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 | (22)  |
| Wind factor     | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 | (22a) |
| Adj infilt rate |        |        |        |        |        |        |        |        |        |        |        |        |       |
| Effective ac    | 0.3956 | 0.3879 | 0.3801 | 0.3413 | 0.3336 | 0.2948 | 0.2948 | 0.2870 | 0.3103 | 0.3336 | 0.3491 | 0.3646 | (22b) |
|                 | 0.5783 | 0.5752 | 0.5722 | 0.5583 | 0.5556 | 0.5435 | 0.5435 | 0.5412 | 0.5481 | 0.5556 | 0.5609 | 0.5665 | (25)  |

## 3. Heat losses and heat loss parameter

| Element                                        | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K     | A x U<br>W/K | K-value<br>kJ/m2K | A x K<br>kJ/K |       |
|------------------------------------------------|-------------|----------------|---------------|----------------------|--------------|-------------------|---------------|-------|
| Main dwelling                                  |             |                |               |                      |              |                   |               |       |
| TER Opaque door                                |             |                | 1.8900        | 1.0000               | 1.8900       |                   |               | (26)  |
| TER Opening Type                               |             |                | 20.6100       | 1.1450               | 23.5992      |                   |               | (27)  |
| TER Roof Window                                |             |                | 8.8800        | 1.1450               | 13.8814      |                   |               | (27a) |
| Heat Loss Floor                                |             |                | 89.7000       | 0.1300               | 11.6610      |                   |               | (28a) |
| Cavity Wall                                    | 139.7000    | 22.5000        | 117.2000      | 0.1800               | 21.0960      |                   |               | (29a) |
| Stud Wall                                      | 28.1000     |                | 28.1000       | 0.1800               | 5.0580       |                   |               | (29a) |
| Flat Roof                                      | 23.5000     | 6.0000         | 17.5000       | 0.1100               | 1.9250       |                   |               | (30)  |
| Plane Roof                                     | 55.2000     |                | 55.2000       | 0.1100               | 6.0720       |                   |               | (30)  |
| Slope Roof                                     | 13.4000     | 2.8800         | 10.5200       | 0.1100               | 1.1572       |                   |               | (30)  |
| Total net area of external elements Aum(A, m2) |             |                | 349.6000      |                      |              |                   |               | (31)  |
| Fabric heat loss, W/K = Sum (A x U)            |             |                |               | (26)...(30) + (32) = | 86.3398      |                   |               | (33)  |
| Main dwelling                                  |             |                |               |                      |              |                   |               |       |
| Party Wall                                     |             |                | 72.7000       | 0.0000               | 0.0000       |                   |               | (32)  |

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

111.5829 (35)

## List of Thermal Bridges

|                                                            | Length  | Psi-value             | Total   |      |
|------------------------------------------------------------|---------|-----------------------|---------|------|
| K1 Element                                                 | 16.8000 | 0.0500                | 0.8400  |      |
| E2 Other lintels (including other steel lintels)           | 15.9000 | 0.0500                | 0.7950  |      |
| E3 Sill                                                    | 31.6000 | 0.0500                | 1.5800  |      |
| E4 Jamb                                                    | 28.1000 | 0.1600                | 4.4960  |      |
| E5 Ground floor (normal)                                   | 41.1000 | 0.0000                | 0.0000  |      |
| E6 Intermediate floor within a dwelling                    | 15.4000 | 0.0900                | 1.3860  |      |
| E16 Corner (normal)                                        | 15.4000 | 0.0600                | 0.9240  |      |
| E18 Party wall between dwellings                           | 6.2000  | 0.0800                | 0.4960  |      |
| R1 Head of roof window                                     | 6.2000  | 0.0600                | 0.3720  |      |
| R2 Sill of roof window                                     | 11.2000 | 0.0800                | 0.8960  |      |
| R3 Jamb of roof window                                     |         |                       |         |      |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |         |                       | 11.7850 | (36) |
| Point Thermal bridges                                      |         |                       | 0.0000  |      |
| Total fabric heat loss                                     |         | (36a) =               | 98.1248 | (37) |
|                                                            |         | (33) + (36) + (36a) = |         |      |

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

|                           | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |      |
|---------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| (38)m                     | 89.3130  | 88.8436  | 88.3835  | 86.2224  | 85.8181  | 83.9359  | 83.9359  | 83.5873  | 84.6609  | 85.8181  | 86.6360  | 87.4912  | (38) |
| Heat transfer coeff       | 187.4378 | 186.9684 | 186.5083 | 184.3472 | 183.9429 | 182.0607 | 182.0607 | 181.7121 | 182.7857 | 183.9429 | 184.7609 | 185.6160 | (39) |
| Average = Sum(39)m / 12 = |          |          |          |          |          |          |          |          |          |          |          | 184.3453 |      |

|               | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |      |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| HLP           | 1.0099 | 1.0074 | 1.0049 | 0.9933 | 0.9911 | 0.9809 | 0.9809 | 0.9791 | 0.9848 | 0.9911 | 0.9955 | 1.0001 | (40) |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 0.9932 |      |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31     |      |

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

|                                                                 |          |          |          |          |          |          |          |          |          |                                        |          |           |             |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------------------------------|----------|-----------|-------------|
| Assumed occupancy                                               |          |          |          |          |          |          |          |          |          |                                        |          |           | 2.9832 (42) |
| Hot water usage for mixer showers                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000    | (42a)       |
| Hot water usage for baths                                       | 85.6425  | 84.3706  | 82.5794  | 79.2769  | 76.8041  | 74.0621  | 72.5809  | 74.3595  | 76.2961  | 79.2302                                | 82.6007  | 85.3529   | (42b)       |
| Hot water usage for other uses                                  | 45.1804  | 43.5375  | 41.8946  | 40.2517  | 38.6087  | 36.9658  | 36.9658  | 38.6087  | 40.2517  | 41.8946                                | 43.5375  | 45.1804   | (42c)       |
| Average daily hot water use (litres/day)                        |          |          |          |          |          |          |          |          |          |                                        |          | 120.4772  | (43)        |
|                                                                 | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct                                    | Nov      | Dec       |             |
| Daily hot water use                                             | 130.8229 | 127.9081 | 124.4740 | 119.5286 | 115.4128 | 111.0279 | 109.5468 | 112.9683 | 116.5478 | 121.1247                               | 126.1382 | 130.5334  | (44)        |
| Energy content (annual)                                         | 207.1915 | 182.1394 | 191.3120 | 163.6287 | 155.3678 | 136.5217 | 132.4873 | 139.8783 | 143.7150 | 164.3651                               | 179.7070 | 204.3837  | (45)        |
| Distribution loss (46)m = 0.15 x (45)m                          | 31.0787  | 27.3209  | 28.6968  | 24.5443  | 23.3052  | 20.4783  | 19.8731  | 20.9817  | 21.5573  | 24.6548                                | 26.9560  | 30.6576   | (46)        |
| Water storage loss:                                             |          |          |          |          |          |          |          |          |          |                                        |          |           |             |
| Store volume                                                    |          |          |          |          |          |          |          |          |          |                                        |          | 300.0000  | (47)        |
| a) If manufacturer declared loss factor is known (kWh/day):     |          |          |          |          |          |          |          |          |          |                                        |          | 2.1127    | (48)        |
| Temperature factor from Table 2b                                |          |          |          |          |          |          |          |          |          |                                        |          | 0.5400    | (49)        |
| Enter (49) or (54) in (55)                                      |          |          |          |          |          |          |          |          |          |                                        |          | 1.1409    | (55)        |
| Total storage loss                                              | 35.3664  | 31.9439  | 35.3664  | 34.2256  | 35.3664  | 34.2256  | 35.3664  | 35.3664  | 34.2256  | 35.3664                                | 34.2256  | 35.3664   | (56)        |
| If cylinder contains dedicated solar storage                    | 35.3664  | 31.9439  | 35.3664  | 34.2256  | 35.3664  | 34.2256  | 35.3664  | 35.3664  | 34.2256  | 35.3664                                | 34.2256  | 35.3664   | (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 | 265.8203 | 235.0945 | 249.9408 | 220.3663 | 213.9966 | 193.2593 | 191.1161 | 198.5071 | 200.4526 | 222.9939                               | 236.4445 | 263.0125  | (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                                                 | 265.8203 | 235.0945 | 249.9408 | 220.3663 | 213.9966 | 193.2593 | 191.1161 | 198.5071 | 200.4526 | 222.9939                               | 236.4445 | 263.0125  | (64)        |
| 12Total per year (kWh/year)                                     |          |          |          |          |          |          |          |          |          | Total per year (kWh/year) = Sum(64)m = |          | 2691.0046 | (64)        |
| Electric shower(s)                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000                                 | 0.0000   | 0.0000    | (64a)       |
|                                                                 |          |          |          |          |          |          |          |          |          |                                        |          | 0.0000    | (64a)       |
| Heat gains from water heating, kWh/month                        | 115.7942 | 102.9254 | 110.5143 | 99.7966  | 98.5629  | 90.7835  | 90.9551  | 93.4126  | 93.1753  | 101.5545                               | 105.1426 | 114.8606  | (65)        |

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

Metabolic gains (Table 5), Watts

|                                                                                     | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec       |      |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------|
| (66)m                                                                               | 149.1575  | 149.1575  | 149.1575  | 149.1575  | 149.1575  | 149.1575  | 149.1575  | 149.1575  | 149.1575  | 149.1575  | 149.1575  | 149.1575  | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 186.0508  | 205.9848  | 186.0508  | 192.2525  | 186.0508  | 192.2525  | 186.0508  | 186.0508  | 192.2525  | 186.0508  | 192.2525  | 186.0508  | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 357.1453  | 360.8514  | 351.5123  | 331.6304  | 306.5330  | 282.9451  | 267.1869  | 263.4808  | 272.8200  | 292.7019  | 317.7992  | 341.3871  | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 37.9158   | 37.9158   | 37.9158   | 37.9158   | 37.9158   | 37.9158   | 37.9158   | 37.9158   | 37.9158   | 37.9158   | 37.9158   | 37.9158   | (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)                                 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | (71) |
| Water heating gains (Table 5)                                                       | 155.6374  | 153.1628  | 148.5407  | 138.6064  | 132.4770  | 126.0882  | 122.2515  | 125.5546  | 129.4101  | 136.4979  | 146.0314  | 154.3826  | (72) |
| Total internal gains                                                                | 769.5808  | 790.7462  | 756.8510  | 733.2365  | 695.8080  | 669.0330  | 643.2364  | 642.8334  | 662.2298  | 685.9978  | 726.8303  | 752.5678  | (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   |      |
|-------------|--|--|--|----------|------------|--------------------------------|-----------------------------------|------------------------------------|-----------|-----------|-----------|------------------------------|-----------|----------|--------------|------|
| -----       |  |  |  |          |            |                                |                                   |                                    |           |           |           |                              |           |          |              |      |
| Northeast   |  |  |  |          | 10.6800    | 11.2829                        | 0.6300                            | 0.7000                             |           |           |           | 0.7700                       |           |          | 36.8269 (75) |      |
| Southwest   |  |  |  |          | 7.2900     | 36.7938                        | 0.6300                            | 0.7000                             |           |           |           | 0.7700                       |           |          | 81.9737 (79) |      |
| Northwest   |  |  |  |          | 2.6400     | 11.2829                        | 0.6300                            | 0.7000                             |           |           |           | 0.7700                       |           |          | 9.1033 (81)  |      |
| Northeast   |  |  |  |          | 2.1600     | 17.4137                        | 0.6300                            | 0.7000                             |           |           |           | 1.0000                       |           |          | 14.9288 (82) |      |
| Southwest   |  |  |  |          | 0.7200     | 38.2331                        | 0.6300                            | 0.7000                             |           |           |           | 1.0000                       |           |          | 10.9258 (82) |      |
| Horizontal  |  |  |  |          | 6.0000     | 26.0000                        | 0.6300                            | 0.7000                             |           |           |           | 1.0000                       |           |          | 61.9164 (82) |      |
| -----       |  |  |  |          |            |                                |                                   |                                    |           |           |           |                              |           |          |              |      |
| Solar gains |  |  |  | 215.6749 | 413.4030   | 678.4421                       | 1014.2569                         | 1283.3579                          | 1335.8869 | 1262.4352 | 1054.1990 | 794.5953                     | 488.2272  | 266.9403 | 178.8764     | (83) |
| Total gains |  |  |  | 985.2557 | 1204.1493  | 1435.2931                      | 1747.4934                         | 1979.1660                          | 2004.9199 | 1905.6716 | 1697.0324 | 1456.8252                    | 1174.2250 | 993.7707 | 931.4442     | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)

|                                                                    |         |         |         |         |         |         |         |         |         |         |         |         |              |
|--------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Utilisation factor for gains for living area, nil,m (see Table 9a) |         |         |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
|                                                                    | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |              |
| tau                                                                | 30.6913 | 30.7684 | 30.8443 | 31.2059 | 31.2745 | 31.5978 | 31.5978 | 31.6584 | 31.4725 | 31.2745 | 31.1360 | 30.9926 |              |
| alpha                                                              | 3.0461  | 3.0512  | 3.0563  | 3.0804  | 3.0850  | 3.1065  | 3.1065  | 3.1106  | 3.0982  | 3.0850  | 3.0757  | 3.0662  |              |
| util living area                                                   | 0.9796  | 0.9624  | 0.9267  | 0.8381  | 0.6977  | 0.5306  | 0.4034  | 0.4633  | 0.6991  | 0.9008  | 0.9662  | 0.9826  | (86)         |
| MIT                                                                | 18.6704 | 19.0064 | 19.5188 | 20.1710 | 20.6428 | 20.8899 | 20.9648 | 20.9461 | 20.7365 | 20.0738 | 19.2614 | 18.6216 | (87)         |
| Th 2                                                               | 20.0751 | 20.0772 | 20.0793 | 20.0890 | 20.0908 | 20.0993 | 20.0993 | 20.1008 | 20.0960 | 20.0908 | 20.0871 | 20.0833 | (88)         |
| util rest of house                                                 | 0.9763  | 0.9566  | 0.9151  | 0.8135  | 0.6549  | 0.4687  | 0.3268  | 0.3825  | 0.6402  | 0.8799  | 0.9600  | 0.9798  | (89)         |
| MIT 2                                                              | 17.3207 | 17.7476 | 18.3931 | 19.1989 | 19.7471 | 20.0135 | 20.0794 | 20.0683 | 19.8687 | 19.1007 | 18.0815 | 17.2634 | (90)         |
| Living area fraction                                               | 17.8625 | 18.2529 | 18.8450 | 19.5891 | 20.1066 | 20.3653 | 20.4348 | 20.4206 | 20.2170 | 19.4913 | 18.5551 | 17.8086 | (92)         |
| MIT                                                                | 17.8625 | 18.2529 | 18.8450 | 19.5891 | 20.1066 | 20.3653 | 20.4348 | 20.4206 | 20.2170 | 19.4913 | 18.5551 | 17.8086 | (93)         |
| Temperature adjustment                                             |         |         |         |         |         |         |         |         |         |         |         | 0.0000  |              |
| adjusted MIT                                                       | 17.8625 | 18.2529 | 18.8450 | 19.5891 | 20.1066 | 20.3653 | 20.4348 | 20.4206 | 20.2170 | 19.4913 | 18.5551 | 17.8086 | (93)         |

## 8. Space heating requirement

|                                                                                | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul      | Aug      | Sep       | Oct           | Nov       | Dec       |       |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|----------|----------|-----------|---------------|-----------|-----------|-------|
| Utilisation                                                                    | 0.9651    | 0.9410    | 0.8958    | 0.7982    | 0.6557    | 0.4876    | 0.3559   | 0.4121   | 0.6487    | 0.8632        | 0.9456    | 0.9698    | (94)  |
| Useful gains                                                                   | 950.8861  | 1133.0633 | 1285.7988 | 1394.8816 | 1297.6471 | 977.5974  | 678.2968 | 699.3762 | 945.0995  | 1013.5563     | 939.7562  | 903.3604  | (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                                                               | 2542.1159 | 2496.5657 | 2302.4387 | 1970.5067 | 1546.3388 | 1049.6290 | 698.1653 | 730.5989 | 1118.1011 | 1635.4909     | 2116.4524 | 2525.9753 | (97)  |
| Space heating kWh                                                              | 1183.8750 | 916.2736  | 756.3801  | 414.4500  | 185.0267  | 0.0000    | 0.0000   | 0.0000   | 0.0000    | 462.7194      | 847.2212  | 1207.2255 | (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |           |           |          |          |           |               |           | 5973.1714 |       |
| 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                                                              | 1183.8750 | 916.2736  | 756.3801  | 414.4500  | 185.0267  | 0.0000    | 0.0000   | 0.0000   | 0.0000    | 462.7194      | 847.2212  | 1207.2255 | (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |           |           |          |          |           |               |           | 5973.1714 |       |
| Space heating per m2                                                           |           |           |           |           |           |           |          |          |           | (98c) / (4) = |           | 32.1830   | (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                                             | 1183.8750 | 916.2736 | 756.3801 | 414.4500 | 185.0267 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 462.7194 | 847.2212 | 1207.2255 | (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)                              | 1282.6382 | 992.7125 | 819.4800 | 449.0249 | 200.4623 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 501.3211 | 917.8995 | 1307.9366 | (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)         |

# Full SAP Calculation Printout



|                                                                                                      |          |           |           |           |           |           |           |           |           |           |          |            |        |
|------------------------------------------------------------------------------------------------------|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|------------|--------|
| Water heating                                                                                        |          |           |           |           |           |           |           |           |           |           |          |            |        |
| Water heating requirement                                                                            | 265.8203 | 235.0945  | 249.9408  | 220.3663  | 213.9966  | 193.2593  | 191.1161  | 198.5071  | 200.4526  | 222.9939  | 236.4445 | 263.0125   | (64)   |
| Efficiency of water heater                                                                           |          |           |           |           |           |           |           |           |           |           |          | 79.8000    | (216)  |
| (217)m                                                                                               | 87.0008  | 86.8011   | 86.3803   | 85.4544   | 83.7353   | 79.8000   | 79.8000   | 79.8000   | 79.8000   | 85.6583   | 86.6673  | 87.0438    | (217)  |
| Fuel for water heating, kWh/month                                                                    | 305.5377 | 270.8427  | 289.3492  | 257.8758  | 255.5633  | 242.1795  | 239.4939  | 248.7558  | 251.1937  | 260.3295  | 272.8186 | 302.1610   | (219)  |
| Space cooling fuel requirement                                                                       |          |           |           |           |           |           |           |           |           |           |          |            |        |
| (221)m                                                                                               | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000     | (221)  |
| Pumps and Fa                                                                                         | 7.3041   | 6.5973    | 7.3041    | 7.0685    | 7.3041    | 7.0685    | 7.3041    | 7.3041    | 7.0685    | 7.3041    | 7.0685   | 7.3041     | (231)  |
| Lighting                                                                                             | 38.6577  | 31.0126   | 27.9234   | 20.4579   | 15.8023   | 12.9106   | 14.4154   | 18.7376   | 24.3383   | 31.9332   | 36.0685  | 39.7321    | (232)  |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |           |           |           |           |           |           |           |           |           |          |            |        |
| (233a)m                                                                                              | -76.4968 | -104.2556 | -144.8584 | -157.1540 | -164.6362 | -151.7767 | -149.6777 | -143.4858 | -132.1025 | -116.2300 | -82.7179 | -66.5455   | (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                                                                                              | -54.8416 | -113.8092 | -223.4848 | -331.8930 | -435.3980 | -436.4160 | -431.4785 | -367.0670 | -271.2412 | -161.7213 | -72.8539 | -43.5057   | (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                                                                   |          |           |           |           |           |           |           |           |           |           |          | 6471.4750  | (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                                                                              |          |           |           |           |           |           |           |           |           |           |          | 3196.1009  | (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)                                                  |          |           |           |           |           |           |           |           |           |           |          | 311.9896   | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |           |           |           |           |           |           |           |           |           |          |            |        |
| PV generation                                                                                        |          |           |           |           |           |           |           |           |           |           |          | -4433.6472 | (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                                                                  |          |           |           |           |           |           |           |           |           |           |          | 5631.9183  | (238)  |

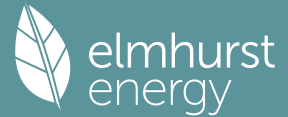
## 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

|                                               | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |       |
|-----------------------------------------------|--------------------|-------------------------------|--------------------------|-------|
| Space heating - main system 1                 | 6471.4750          | 0.2100                        | 1359.0098                | (261) |
| Total CO2 associated with community systems   |                    |                               | 0.0000                   | (373) |
| Water heating (other fuel)                    | 3196.1009          | 0.2100                        | 671.1812                 | (264) |
| Space and water heating                       |                    |                               | 2030.1909                | (265) |
| Pumps, fans and electric keep-hot             | 86.0000            | 0.1387                        | 11.9293                  | (267) |
| Energy for lighting                           | 311.9896           | 0.1443                        | 45.0297                  | (268) |
| Energy saving/generation technologies         |                    |                               |                          |       |
| PV Unit electricity used in dwelling          | -1489.9370         | 0.1354                        | -201.6771                |       |
| PV Unit electricity exported                  | -2943.7102         | 0.1262                        | -371.5589                |       |
| Total                                         |                    |                               | -573.2360                | (269) |
| Total CO2, kg/year                            |                    |                               | 1513.9139                | (272) |
| EPC Target Carbon Dioxide Emission Rate (TER) |                    |                               | 8.1600                   | (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               | 6471.4750          | 1.1300                              | 7312.7668                  | (275) |
| Total CO2 associated with community systems |                    |                                     | 0.0000                     | (473) |
| Water heating (other fuel)                  | 3196.1009          | 1.1300                              | 3611.5940                  | (278) |
| Space and water heating                     |                    |                                     | 10924.3608                 | (279) |
| Pumps, fans and electric keep-hot           | 86.0000            | 1.5128                              | 130.1008                   | (281) |
| Energy for lighting                         | 311.9896           | 1.5338                              | 478.5401                   | (282) |
| Energy saving/generation technologies       |                    |                                     |                            |       |
| PV Unit electricity used in dwelling        | -1489.9370         | 1.5003                              | -2235.3657                 |       |
| PV Unit electricity exported                | -2943.7102         | 0.4633                              | -1363.9171                 |       |
| Total                                       |                    |                                     | -3599.2827                 | (283) |
| Total Primary energy kWh/year               |                    |                                     | 7933.7190                  | (286) |
| Target Primary Energy Rate (TPER)           |                    |                                     | 42.7500                    | (287) |

# Full SAP Calculation Printout



|                                    |                                            |               |          |                |            |
|------------------------------------|--------------------------------------------|---------------|----------|----------------|------------|
| Property Reference                 | Plot 1 7HR                                 |               |          | Issued on Date | 28/03/2025 |
| Assessment Reference               | Plot 1-Gas Boiler                          | Prop Type Ref | LHS Plot |                |            |
| Property                           | Plot 1, 7 Hawthorne Road, READING, RG4 6LY |               |          |                |            |
|                                    |                                            |               |          |                |            |
| SAP Rating                         | 101 A                                      | DER           | 6.47     | TER            | 8.16       |
| Environmental                      | 93 A                                       | % DER < TER   |          |                | 20.71      |
| CO <sub>2</sub> Emissions (t/year) | 0.95                                       | DFEE          | 34.22    | TFEE           | 37.09      |
| Compliance Check                   | See BREL                                   | % DFEE < TFEE |          |                | 7.75       |
| % DPER < TPER                      | 18.40                                      | DPER          | 34.88    | TPER           | 42.75      |
|                                    |                                            |               |          |                |            |
| Assessor Details                   | Mr. Dhiraj Karsan                          |               |          | Assessor ID    | M078-0001  |
| Client                             |                                            |               |          |                |            |

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

## 1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)            | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Main dwelling                                          |                           |                                 |                             |
| Ground floor                                           | 89.7000 (1b)              | x 2.4000 (2b)                   | = 215.2800 (1b) - (3b)      |
| First floor                                            | 61.8000 (1c)              | x 2.6000 (2c)                   | = 160.6800 (1c) - (3c)      |
| Second floor                                           | 34.1000 (1d)              | x 2.7000 (2d)                   | = 92.0700 (1d) - (3d)       |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 185.6000                  |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 468.0300 (5)              |

## 2. Ventilation rate

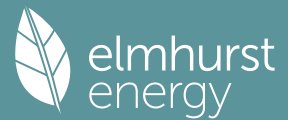
|                                                                                                  | m <sup>3</sup> per hour                 |
|--------------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open 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                                                              | 4 * 10 = 40.0000 (7a)                   |
| Number of passive vents                                                                          | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                                                     | 0 * 40 = 0.0000 (7c)                    |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) | 40.0000 / (5) = 0.0855 (8)              |
| Pressure test                                                                                    | Yes                                     |
| Pressure Test Method                                                                             | Blower Door                             |
| Measured/design AP50                                                                             | 5.0000 (17)                             |
| Infiltration rate                                                                                | 0.3355 (18)                             |
| Number of sides sheltered                                                                        | 1 (19)                                  |
| Shelter factor                                                                                   | (20) = 1 - [0.075 x (19)] = 0.9250 (20) |
| Infiltration rate adjusted to include shelter factor                                             | (21) = (18) x (20) = 0.3103 (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 | 0.3956 | 0.3879 | 0.3801 | 0.3413 | 0.3336 | 0.2948 | 0.2948 | 0.2870 | 0.3103 | 0.3336 | 0.3491 | 0.3646 (22b) |
| Effective ac    | 0.5783 | 0.5752 | 0.5722 | 0.5583 | 0.5556 | 0.5435 | 0.5435 | 0.5412 | 0.5481 | 0.5556 | 0.5609 | 0.5665 (25)  |

## 3. Heat losses and heat loss parameter

| Element                                                     | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K       | A x K<br>kJ/K   |
|-------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------------|-----------------|
| Main dwelling                                               |                         |                            |                           |                               |              |                                      |                 |
| Windows                                                     |                         |                            | 20.6100                   | 1.1450                        | 23.5992      |                                      | (27)            |
| Roof Windows                                                |                         |                            | 8.8800                    | 1.1450                        | 10.1679      |                                      | (27a)           |
| Door                                                        |                         |                            | 1.8900                    | 1.2000                        | 2.2680       |                                      | (26)            |
| Heat Loss Floor                                             |                         |                            | 89.7000                   | 0.1100                        | 9.8670       | 110.0000                             | 9867.0000 (28a) |
| Cavity Wall                                                 | 139.7000                | 22.5000                    | 117.2000                  | 0.1800                        | 21.0960      | 60.0000                              | 7032.0000 (29a) |
| Stud Wall                                                   | 28.1000                 |                            | 28.1000                   | 0.1100                        | 3.0910       | 9.0000                               | 252.9000 (29a)  |
| Flat Roof                                                   | 23.5000                 | 6.0000                     | 17.5000                   | 0.1400                        | 2.4500       | 9.0000                               | 157.5000 (30)   |
| Plane Roof                                                  | 55.2000                 |                            | 55.2000                   | 0.1132                        | 6.2491       | 9.0000                               | 496.8000 (30)   |
| Slope Roof                                                  | 13.4000                 | 2.8800                     | 10.5200                   | 0.1300                        | 1.3676       | 9.0000                               | 94.6800 (30)    |
| Total net area of external elements Aum(A, m <sup>2</sup> ) |                         |                            | 349.6000                  |                               |              |                                      | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                         |                         |                            |                           | (26)...(30) + (32) =          | 80.1558      |                                      | (33)            |
| Main dwelling                                               |                         |                            |                           |                               |              |                                      |                 |
| Party Wall                                                  |                         |                            | 72.7000                   | 0.0000                        | 0.0000       | 0.0000                               | 0.0000 (32)     |
| Internal Wall                                               |                         |                            | 216.2000                  |                               |              | 9.0000                               | 1945.8000 (32c) |
| Internal Ceiling                                            |                         |                            | 61.8000                   |                               |              | 9.0000                               | 556.2000 (32e)  |
| Internal Ceiling 2                                          |                         |                            | 34.1000                   |                               |              | 9.0000                               | 306.9000 (32e)  |
| Heat capacity Cm = Sum(A x k)                               |                         |                            |                           |                               |              | (28)...(30) + (32) + (32a)...(32e) = | 20709.7800 (34) |

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

111.5829 (35)

List of Thermal Bridges

|                                                            | Length  | Psi-value             | Total        |
|------------------------------------------------------------|---------|-----------------------|--------------|
| K1 Element                                                 | 16.8000 | 0.0400                | 0.6720       |
| E2 Other lintels (including other steel lintels)           | 15.9000 | 0.0300                | 0.4770       |
| E3 Sill                                                    | 31.6000 | 0.0300                | 0.9480       |
| E4 Jamb                                                    | 28.1000 | 0.0600                | 1.6860       |
| E5 Ground floor (normal)                                   | 41.1000 | 0.0700                | 2.8770       |
| E6 Intermediate floor within a dwelling                    | 15.4000 | 0.0900                | 1.3860       |
| E16 Corner (normal)                                        | 15.4000 | 0.0600                | 0.9240       |
| E18 Party wall between dwellings                           | 6.2000  | 0.0800                | 0.4960       |
| R1 Head of roof window                                     | 6.2000  | 0.0600                | 0.3720       |
| R2 Sill of roof window                                     | 11.2000 | 0.0800                | 0.8960       |
| R3 Jamb of roof window                                     |         |                       |              |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |         |                       | 10.7340 (36) |
| Point Thermal bridges                                      |         |                       | 0.0000       |
| Total fabric heat loss                                     |         | (33) + (36) + (36a) = | 90.8898 (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                     | 89.3130  | 88.8436  | 88.3835  | 86.2224  | 85.8181  | 83.9359  | 83.9359  | 83.5873  | 84.6609  | 85.8181  | 86.6360  | 87.4912 (38)  |
| Heat transfer coeff       | 180.2028 | 179.7334 | 179.2733 | 177.1122 | 176.7079 | 174.8257 | 174.8257 | 174.4771 | 175.5507 | 176.7079 | 177.5259 | 178.3810 (39) |
| Average = Sum(39)m / 12 = |          |          |          |          |          |          |          |          |          |          |          | 177.1103      |
| HLP                       | 0.9709   | 0.9684   | 0.9659   | 0.9543   | 0.9521   | 0.9419   | 0.9419   | 0.9401   | 0.9459   | 0.9521   | 0.9565   | 0.9611 (40)   |
| HLP (average)             |          |          |          |          |          |          |          |          |          |          |          | 0.9543        |
| Days in mont              | 31       | 28       | 31       | 30       | 31       | 30       | 31       | 31       | 30       | 31       | 30       | 31            |

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

Assumed occupancy

2.9832 (42)

|                                                                                |          |          |          |          |          |          |          |          |          |                    |          |               |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------------------|----------|---------------|
| Hot water usage for mixer showers                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | 0.0000 (42a)  |
| Hot water usage for baths                                                      | 85.6425  | 84.3706  | 82.5794  | 79.2769  | 76.8041  | 74.0621  | 72.5809  | 74.3595  | 76.2961  | 79.2302            | 82.6007  | 85.3529 (42b) |
| Hot water usage for other uses                                                 | 45.1804  | 43.5375  | 41.8946  | 40.2517  | 38.6087  | 36.9658  | 36.9658  | 38.6087  | 40.2517  | 41.8946            | 43.5375  | 45.1804 (42c) |
| Average daily hot water use (litres/day)                                       |          |          |          |          |          |          |          |          |          |                    |          | 120.4772 (43) |
| Daily hot water use                                                            | 130.8229 | 127.9081 | 124.4740 | 119.5286 | 115.4128 | 111.0279 | 109.5468 | 112.9683 | 116.5478 | 121.1247           | 126.1382 | 130.5334 (44) |
| Energy conte                                                                   | 207.1915 | 182.1394 | 191.3120 | 163.6287 | 155.3678 | 136.5217 | 132.4873 | 139.8783 | 143.7150 | 164.3651           | 179.7070 | 204.3837 (45) |
| Energy content (annual)                                                        |          |          |          |          |          |          |          |          |          | Total = Sum(45)m = |          | 2000.6976     |
| Distribution loss (46)m = 0.15 x (45)m                                         | 31.0787  | 27.3209  | 28.6968  | 24.5443  | 23.3052  | 20.4783  | 19.8731  | 20.9817  | 21.5573  | 24.6548            | 26.9560  | 30.6576 (46)  |
| Water storage loss:                                                            |          |          |          |          |          |          |          |          |          |                    |          |               |
| Store volume                                                                   |          |          |          |          |          |          |          |          |          |                    |          | 300.0000 (47) |
| a) If manufacturer declared loss factor is known (kWh/day):                    |          |          |          |          |          |          |          |          |          |                    |          | 1.5900 (48)   |
| Temperature factor from Table 2b                                               |          |          |          |          |          |          |          |          |          |                    |          | 0.5400 (49)   |
| Enter (49) or (54) in (55)                                                     |          |          |          |          |          |          |          |          |          |                    |          | 0.8586 (55)   |
| Total storage loss                                                             | 26.6166  | 24.0408  | 26.6166  | 25.7580  | 26.6166  | 25.7580  | 26.6166  | 26.6166  | 25.7580  | 26.6166            | 25.7580  | 26.6166 (56)  |
| If cylinder contains dedicated solar storage                                   | 26.6166  | 24.0408  | 26.6166  | 25.7580  | 26.6166  | 25.7580  | 26.6166  | 26.6166  | 25.7580  | 26.6166            | 25.7580  | 26.6166 (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                | 257.0705 | 227.1914 | 241.1910 | 211.8987 | 205.2468 | 184.7917 | 182.3663 | 189.7573 | 191.9850 | 214.2441           | 227.9770 | 254.2627 (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                                                                | 257.0705 | 227.1914 | 241.1910 | 211.8987 | 205.2468 | 184.7917 | 182.3663 | 189.7573 | 191.9850 | 214.2441           | 227.9770 | 254.2627 (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                                       | 108.7944 | 96.6029  | 103.5144 | 93.0225  | 91.5630  | 84.0095  | 83.9552  | 86.4127  | 86.4013  | 94.5546            | 98.3686  | 107.8608 (65) |

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

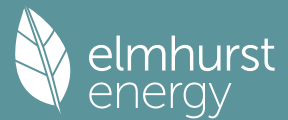
Metabolic gains (Table 5), Watts

|                                                                                     | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov       | Dec            |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
| (66)m                                                                               | 178.9890  | 178.9890  | 178.9890  | 178.9890  | 178.9890  | 178.9890  | 178.9890  | 178.9890  | 178.9890  | 178.9890  | 178.9890  | 178.9890 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 51.9195   | 46.1144   | 37.5028   | 28.3920   | 21.2234   | 17.9176   | 19.3607   | 25.1657   | 33.7774   | 42.8881   | 50.0568   | 53.3625 (67)   |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 533.0527  | 538.5841  | 524.6452  | 494.9707  | 457.5120  | 422.3061  | 398.7864  | 393.2550  | 407.1940  | 436.8684  | 474.3271  | 509.5330 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 55.8821   | 55.8821   | 55.8821   | 55.8821   | 55.8821   | 55.8821   | 55.8821   | 55.8821   | 55.8821   | 55.8821   | 55.8821   | 55.8821 (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)                                 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 (71) |
| Water heating gains (Table 5)                                                       | 146.2290  | 143.7544  | 139.1323  | 129.1980  | 123.0686  | 116.6798  | 112.8431  | 116.1462  | 120.0017  | 127.0895  | 136.6230  | 144.9742 (72)  |
| Total internal gains                                                                | 849.7463  | 846.9980  | 819.8253  | 771.1057  | 720.3489  | 672.4486  | 646.5351  | 650.1119  | 676.5181  | 725.3911  | 779.5520  | 826.4147 (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   |
|-----------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|--------------|
| Northeast | 10.6800    | 11.2829                        | 0.7600                            | 0.7000                             | 0.7700                       | 44.4261 (75) |
| Southwest | 7.2900     | 36.7938                        | 0.7600                            | 0.7000                             | 0.7700                       | 98.8889 (79) |
| Northwest | 2.6400     | 11.2829                        | 0.7600                            | 0.7000                             | 0.7700                       | 10.9817 (81) |

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|            |        |         |        |        |        |              |
|------------|--------|---------|--------|--------|--------|--------------|
| Northeast  | 2.1600 | 17.4137 | 0.7600 | 0.7000 | 1.0000 | 18.0094 (82) |
| Southwest  | 0.7200 | 38.2331 | 0.7600 | 0.7000 | 1.0000 | 13.1803 (82) |
| Horizontal | 6.0000 | 26.0000 | 0.7600 | 0.7000 | 1.0000 | 74.6928 (82) |

|             |           |           |           |           |           |           |           |           |           |           |           |                |
|-------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------|
| Solar gains | 260.1792  | 498.7084  | 818.4381  | 1223.5480 | 1548.1778 | 1611.5461 | 1522.9377 | 1271.7321 | 958.5595  | 588.9725  | 322.0232  | 215.7874 (83)  |
| Total gains | 1109.9255 | 1345.7064 | 1638.2634 | 1994.6537 | 2268.5268 | 2283.9947 | 2169.4729 | 1921.8440 | 1635.0776 | 1314.3636 | 1101.5752 | 1042.2022 (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                                                                         | 31.9236 | 32.0069 | 32.0891 | 32.4806 | 32.5549 | 32.9054 | 32.9054 | 32.9712 | 32.7695 | 32.5549 | 32.4049 | 32.2496      |
| alpha                                                                       | 3.1282  | 3.1338  | 3.1393  | 3.1654  | 3.1703  | 3.1937  | 3.1937  | 3.1981  | 3.1846  | 3.1703  | 3.1603  | 3.1500       |
| util living area                                                            | 0.9717  | 0.9493  | 0.8981  | 0.7865  | 0.6273  | 0.4629  | 0.3461  | 0.4023  | 0.6375  | 0.8693  | 0.9552  | 0.9763 (86)  |
| MIT                                                                         | 19.3227 | 19.5790 | 19.9780 | 20.4305 | 20.7216 | 20.8529 | 20.8886 | 20.8796 | 20.7641 | 20.3308 | 19.7394 | 19.2783 (87) |
| Th 2                                                                        | 20.1076 | 20.1098 | 20.1118 | 20.1216 | 20.1234 | 20.1320 | 20.1320 | 20.1336 | 20.1287 | 20.1234 | 20.1197 | 20.1159 (88) |
| util rest of house                                                          | 0.9673  | 0.9418  | 0.8835  | 0.7586  | 0.5845  | 0.4073  | 0.2809  | 0.3318  | 0.5791  | 0.8445  | 0.9473  | 0.9726 (89)  |
| MIT 2                                                                       | 18.1190 | 18.4438 | 18.9426 | 19.4963 | 19.8272 | 19.9694 | 19.9999 | 19.9957 | 19.8868 | 19.3939 | 18.6578 | 18.0686 (90) |
| Living area fraction                                                        | 18.6021 | 18.8995 | 19.3582 | 19.8713 | 20.1862 | 20.3240 | 20.3566 | 20.3505 | 20.2390 | 19.7700 | 19.0920 | 18.5542 (91) |
| MIT                                                                         | 18.6021 | 18.8995 | 19.3582 | 19.8713 | 20.1862 | 20.3240 | 20.3566 | 20.3505 | 20.2390 | 19.7700 | 19.0920 | 18.5542 (92) |
| Temperature adjustment                                                      | 18.4521 | 18.7495 | 19.2082 | 19.7213 | 20.0362 | 20.1740 | 20.2066 | 20.2005 | 20.0890 | 19.6200 | 18.9420 | -0.1500      |
| adjusted MIT                                                                | 18.4521 | 18.7495 | 19.2082 | 19.7213 | 20.0362 | 20.1740 | 20.2066 | 20.2005 | 20.0890 | 19.6200 | 18.9420 | 18.4042 (93) |

## 8. Space heating requirement

|                                                                                |           |           |           |           |           |          |          |          |           |           |           |                 |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|----------|----------|----------|-----------|-----------|-----------|-----------------|
|                                                                                | Jan       | Feb       | Mar       | Apr       | May       | Jun      | Jul      | Aug      | Sep       | Oct       | Nov       | Dec             |
| Utilisation                                                                    | 0.9568    | 0.9274    | 0.8660    | 0.7445    | 0.5800    | 0.4101   | 0.2866   | 0.3374   | 0.5762    | 0.8278    | 0.9338    | 0.9632 (94)     |
| Useful gains                                                                   | 1061.9293 | 1248.0644 | 1418.7698 | 1485.1028 | 1315.6754 | 936.6273 | 621.8413 | 648.4800 | 942.1952  | 1087.9896 | 1028.5994 | 1003.8714 (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                                                               | 2550.2566 | 2489.2174 | 2278.2402 | 1916.5768 | 1473.0784 | 974.4850 | 630.5337 | 663.0966 | 1051.3682 | 1593.9017 | 2102.2575 | 2533.7515 (97)  |
| Space heating kWh                                                              | 1107.3155 | 834.0548  | 639.4459  | 310.6613  | 117.1079  | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 376.3986  | 773.0338  | 1138.2308 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |           |          |          |          |           |           |           | 5296.2486       |
| 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                                                              | 1107.3155 | 834.0548  | 639.4459  | 310.6613  | 117.1079  | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 376.3986  | 773.0338  | 1138.2308 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |           |          |          |          |           |           |           | 5296.2486       |
| Space heating per m2                                                           |           |           |           |           |           |          |          |          |           |           |           | 28.5358 (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                                                                                    | 1107.3155 | 834.0548  | 639.4459  | 310.6613  | 117.1079  | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 376.3986  | 773.0338  | 1138.2308 (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)                                                                     | 1246.9769 | 939.2509  | 720.0968  | 349.8438  | 131.8782  | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 423.8723  | 870.5336  | 1281.7914 (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                                                                                    | 257.0705  | 227.1914  | 241.1910  | 211.8987  | 205.2468  | 184.7917  | 182.3663  | 189.7573  | 191.9850  | 214.2441  | 227.9770  | 254.2627 (64)   |
| Efficiency of water heater (217)m                                                                            | 86.9523   | 86.7065   | 86.1392   | 84.9165   | 82.8505   | 79.8000   | 79.8000   | 79.8000   | 79.8000   | 85.3100   | 86.5762   | 79.8000 (216)   |
| Fuel for water heating, kWh/month                                                                            | 295.6455  | 262.0234  | 280.0012  | 249.5377  | 247.7314  | 231.5686  | 228.5292  | 237.7911  | 240.5828  | 251.1360  | 263.3251  | 292.2285 (219)  |
| Space cooling fuel requirement (221)m                                                                        | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000 (221)    |
| Pumps and Fa                                                                                                 | 7.3041    | 6.5973    | 7.3041    | 7.0685    | 7.3041    | 7.0685    | 7.3041    | 7.3041    | 7.0685    | 7.3041    | 7.0685    | 7.3041 (231)    |
| Lighting                                                                                                     | 45.4448   | 36.4575   | 32.8259   | 24.0497   | 18.5767   | 15.1773   | 16.9463   | 22.0274   | 28.6114   | 37.5397   | 42.4010   | 46.7079 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity) (233a)m                                        | -92.0670  | -124.4227 | -170.8547 | -180.6546 | -183.8788 | -167.4022 | -165.0567 | -161.0089 | -151.7796 | -137.1226 | -98.9876  | -79.9797 (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                                        | -77.6467  | -166.5178 | -341.8534 | -525.9843 | -702.0207 | -707.8638 | -696.9055 | -584.2645 | -418.8719 | -239.8092 | -103.9230 | -60.9143 (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                                                                           |           |           |           |           |           |           |           |           |           |           |           | 5964.2439 (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                                                                                      |           |           |           |           |           |           |           |           |           |           |           | 3080.1006 (219) |

# Full SAP Calculation Printout



|                                                               |                  |
|---------------------------------------------------------------|------------------|
| Space cooling fuel                                            | 0.0000 (221)     |
| Electricity for pumps and fans:                               |                  |
| central heating pump                                          | 41.0000 (230c)   |
| main heating flue fan                                         | 45.0000 (230e)   |
| Total electricity for the above, kWh/year                     | 86.0000 (231)    |
| Electricity for lighting (calculated in Appendix L)           | 366.7656 (232)   |
| Energy saving/generation technologies (Appendices M ,N and Q) |                  |
| PV generation                                                 | -6339.7902 (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                           | 3157.3199 (238)  |

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

|                                             | Fuel<br>kWh/year | Fuel price<br>p/kWh | Fuel cost<br>£/year |
|---------------------------------------------|------------------|---------------------|---------------------|
| Space heating - main system 1               | 5964.2439        | 3.6400              | 217.0985 (240)      |
| Total CO2 associated with community systems |                  |                     | 0.0000 (473)        |
| Water heating (other fuel)                  | 3080.1006        | 3.6400              | 112.1157 (247)      |
| Energy for instantaneous electric shower(s) | 0.0000           | 16.4900             | 0.0000 (247a)       |
| Pumps, fans and electric keep-hot           | 86.0000          | 16.4900             | 14.1814 (249)       |
| Energy for lighting                         | 366.7656         | 16.4900             | 60.4796 (250)       |
| Additional standing charges                 |                  |                     | 92.0000 (251)       |
| Energy saving/generation technologies       |                  |                     |                     |
| PV Unit electricity used in dwelling        | -1713.2150       | 16.4900             | -282.5092           |
| PV Unit electricity exported                | -4626.5751       | 5.5900              | -258.6256           |
| Total                                       |                  |                     | -541.1347 (252)     |
| Total energy cost                           |                  |                     | -45.2595 (255)      |

## 11a. SAP rating - Individual heating systems

|                                  |                                         |               |
|----------------------------------|-----------------------------------------|---------------|
| Energy cost deflator (Table 12): |                                         | 0.3600 (256)  |
| Energy cost factor (ECF)         | $[(255) \times (256)] / [(4) + 45.0] =$ | -0.0707 (257) |
| SAP value                        |                                         | 101.1453      |
| SAP rating (Section 12)          |                                         | 101 (258)     |
| SAP band                         |                                         | A             |

## 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               | 5964.2439          | 0.2100                        | 1252.4912 (261)          |
| Total CO2 associated with community systems |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                  | 3080.1006          | 0.2100                        | 646.8211 (264)           |
| Space and water heating                     |                    |                               | 1899.3123 (265)          |
| Pumps, fans and electric keep-hot           | 86.0000            | 0.1387                        | 11.9293 (267)            |
| Energy for lighting                         | 366.7656           | 0.1443                        | 52.9356 (268)            |
| Energy saving/generation technologies       |                    |                               |                          |
| PV Unit electricity used in dwelling        | -1713.2150         | 0.1359                        | -232.7531                |
| PV Unit electricity exported                | -4626.5751         | 0.1253                        | -579.9359                |
| Total                                       |                    |                               | -812.6890 (269)          |
| Total CO2, kg/year                          |                    |                               | 1151.4882 (272)          |
| CO2 emissions per m2                        |                    |                               | 6.2000 (273)             |
| EI value                                    |                    |                               | 93.3088                  |
| EI rating                                   |                    |                               | 93 (274)                 |
| EI band                                     |                    |                               | A                        |

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

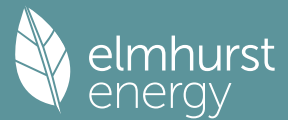
### 1. Overall dwelling characteristics

|                                                        | Area<br>(m2) | Storey height<br>(m)              | Volume<br>(m3)         |
|--------------------------------------------------------|--------------|-----------------------------------|------------------------|
| Main dwelling                                          |              |                                   |                        |
| Ground floor                                           | 89.7000 (1b) | x 2.4000 (2b)                     | = 215.2800 (1b) - (3b) |
| First floor                                            | 61.8000 (1c) | x 2.6000 (2c)                     | = 160.6800 (1c) - (3c) |
| Second floor                                           | 34.1000 (1d) | x 2.7000 (2d)                     | = 92.0700 (1d) - (3d)  |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 185.6000     |                                   | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 468.0300 (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) |

# Full SAP Calculation Printout



|                                                                                                    |                             |              |
|----------------------------------------------------------------------------------------------------|-----------------------------|--------------|
| 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) =             | 0.0855 (8)   |
| Pressure test                                                                                      | Yes                         |              |
| Pressure Test Method                                                                               | Blower Door                 |              |
| Measured/design AP50                                                                               |                             | 5.0000 (17)  |
| Infiltration rate                                                                                  |                             | 0.3355 (18)  |
| Number of sides sheltered                                                                          | 1                           | (19)         |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = | 0.9250 (20)  |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) =        | 0.3103 (21)  |

|                 |        |        |        |        |        |        |        |        |        |        |        |              |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed      | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
| Wind factor     | 4.6000 | 4.4000 | 4.4000 | 4.1000 | 4.1000 | 3.7000 | 3.7000 | 3.5000 | 3.8000 | 4.2000 | 4.0000 | 4.3000 (22)  |
| Adj infilt rate | 1.1500 | 1.1000 | 1.1000 | 1.0250 | 1.0250 | 0.9250 | 0.9250 | 0.8750 | 0.9500 | 1.0500 | 1.0000 | 1.0750 (22a) |
| Effective ac    | 0.3569 | 0.3413 | 0.3413 | 0.3181 | 0.3181 | 0.2870 | 0.2870 | 0.2715 | 0.2948 | 0.3258 | 0.3103 | 0.3336 (22b) |
|                 | 0.5637 | 0.5583 | 0.5583 | 0.5506 | 0.5506 | 0.5412 | 0.5412 | 0.5369 | 0.5435 | 0.5531 | 0.5481 | 0.5556 (25)  |

## 3. Heat losses and heat loss parameter

| Element                                           | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K     | A x U<br>W/K | K-value<br>kJ/m2K                    | A x K<br>kJ/K   |
|---------------------------------------------------|-------------|----------------|---------------|----------------------|--------------|--------------------------------------|-----------------|
| Main dwelling                                     |             |                |               |                      |              |                                      |                 |
| Windows                                           |             |                | 20.6100       | 1.1450               | 23.5992      |                                      | (27)            |
| Roof Windows                                      |             |                | 8.8800        | 1.1450               | 10.1679      |                                      | (27a)           |
| Door                                              |             |                | 1.8900        | 1.2000               | 2.2680       |                                      | (26)            |
| Heat Loss Floor                                   |             |                | 89.7000       | 0.1100               | 9.8670       | 110.0000                             | 9867.0000 (28a) |
| Cavity Wall                                       | 139.7000    | 22.5000        | 117.2000      | 0.1800               | 21.0960      | 60.0000                              | 7032.0000 (29a) |
| Stud Wall                                         | 28.1000     |                | 28.1000       | 0.1100               | 3.0910       | 9.0000                               | 252.9000 (29a)  |
| Flat Roof                                         | 23.5000     | 6.0000         | 17.5000       | 0.1400               | 2.4500       | 9.0000                               | 157.5000 (30)   |
| Plane Roof                                        | 55.2000     |                | 55.2000       | 0.1132               | 6.2491       | 9.0000                               | 496.8000 (30)   |
| Slope Roof                                        | 13.4000     | 2.8800         | 10.5200       | 0.1300               | 1.3676       | 9.0000                               | 94.6800 (30)    |
| Total net area of external elements Aum(A, m2)    |             |                | 349.6000      |                      |              |                                      | (31)            |
| Fabric heat loss, W/K = Sum (A x U)               |             |                |               | (26)...(30) + (32) = | 80.1558      |                                      | (33)            |
| Main dwelling                                     |             |                |               |                      |              |                                      |                 |
| Party Wall                                        |             |                | 72.7000       | 0.0000               | 0.0000       | 0.0000                               | 0.0000 (32)     |
| Internal Wall                                     |             |                | 216.2000      |                      |              | 9.0000                               | 1945.8000 (32c) |
| Internal Ceiling                                  |             |                | 61.8000       |                      |              | 9.0000                               | 556.2000 (32e)  |
| Internal Ceiling 2                                |             |                | 34.1000       |                      |              | 9.0000                               | 306.9000 (32e)  |
| Heat capacity Cm = Sum(A x k)                     |             |                |               |                      |              | (28)...(30) + (32) + (32a)...(32e) = | 20709.7800 (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K |             |                |               |                      |              |                                      | 111.5829 (35)   |

|                                                            |         |           |                                    |
|------------------------------------------------------------|---------|-----------|------------------------------------|
| List of Thermal Bridges                                    | Length  | Psi-value | Total                              |
| K1 Element                                                 | 16.8000 | 0.0400    | 0.6720                             |
| E2 Other lintels (including other steel lintels)           | 15.9000 | 0.0300    | 0.4770                             |
| E3 Sill                                                    | 31.6000 | 0.0300    | 0.9480                             |
| E4 Jamb                                                    | 28.1000 | 0.0600    | 1.6860                             |
| E5 Ground floor (normal)                                   | 41.1000 | 0.0700    | 2.8770                             |
| E6 Intermediate floor within a dwelling                    | 15.4000 | 0.0900    | 1.3860                             |
| E16 Corner (normal)                                        | 15.4000 | 0.0600    | 0.9240                             |
| E18 Party wall between dwellings                           | 6.2000  | 0.0800    | 0.4960                             |
| R1 Head of roof window                                     | 6.2000  | 0.0600    | 0.3720                             |
| R2 Sill of roof window                                     | 11.2000 | 0.0800    | 0.8960                             |
| R3 Jamb of roof window                                     |         |           |                                    |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |         |           | 10.7340 (36)                       |
| Point Thermal bridges                                      |         |           | (36a) = 0.0000                     |
| Total fabric heat loss                                     |         |           | (33) + (36) + (36a) = 90.8898 (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                                                               | 87.0589  | 86.2224  | 86.2224  | 85.0373  | 85.0373  | 83.5873  | 83.5873  | 82.9181  | 83.9359  | 85.4230  | 84.6609  | 85.8181 (38)  |
| Heat transfer coeff                                                 | 177.9488 | 177.1122 | 177.1122 | 175.9271 | 175.9271 | 174.4771 | 174.4771 | 173.8079 | 174.8257 | 176.3129 | 175.5507 | 176.7079 (39) |
| Average = Sum(39)m / 12 =                                           |          |          |          |          |          |          |          |          |          |          |          | 175.8489      |
| HLP                                                                 | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
| HLP (average)                                                       | 0.9588   | 0.9543   | 0.9543   | 0.9479   | 0.9479   | 0.9401   | 0.9401   | 0.9365   | 0.9419   | 0.9500   | 0.9459   | 0.9521 (40)   |
| Days in mont                                                        | 31       | 28       | 31       | 30       | 31       | 30       | 31       | 31       | 30       | 31       | 30       | 31            |

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

|                                                             |          |          |          |          |          |          |          |          |          |                    |          |          |               |
|-------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------------------|----------|----------|---------------|
| Assumed occupancy                                           |          |          |          |          |          |          |          |          |          |                    |          |          | 2.9832 (42)   |
| Hot water usage for mixer showers                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | 0.0000   | (42a)         |
| Hot water usage for baths                                   | 85.6425  | 84.3706  | 82.5794  | 79.2769  | 76.8041  | 74.0621  | 72.5809  | 74.3595  | 76.2961  | 79.2302            | 82.6007  | 85.3529  | (42b)         |
| Hot water usage for other uses                              | 45.1804  | 43.5375  | 41.8946  | 40.2517  | 38.6087  | 36.9658  | 36.9658  | 38.6087  | 40.2517  | 41.8946            | 43.5375  | 45.1804  | (42c)         |
| Average daily hot water use (litres/day)                    |          |          |          |          |          |          |          |          |          |                    |          |          | 120.4772 (43) |
|                                                             | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct                | Nov      | Dec      |               |
| Daily hot water use                                         | 130.8229 | 127.9081 | 124.4740 | 119.5286 | 115.4128 | 111.0279 | 109.5468 | 112.9683 | 116.5478 | 121.1247           | 126.1382 | 130.5334 | (44)          |
| Energy conte                                                | 207.1915 | 182.1394 | 191.3120 | 163.6287 | 155.3678 | 136.5217 | 132.4873 | 139.8783 | 143.7150 | 164.3651           | 179.7070 | 204.3837 | (45)          |
| Energy content (annual)                                     |          |          |          |          |          |          |          |          |          | Total = Sum(45)m = |          |          | 2000.6976     |
| Distribution loss (46)m = 0.15 x (45)m                      | 31.0787  | 27.3209  | 28.6968  | 24.5443  | 23.3052  | 20.4783  | 19.8731  | 20.9817  | 21.5573  | 24.6548            | 26.9560  | 30.6576  | (46)          |
| Water storage loss:                                         |          |          |          |          |          |          |          |          |          |                    |          |          |               |
| Store volume                                                |          |          |          |          |          |          |          |          |          |                    |          |          | 300.0000 (47) |
| a) If manufacturer declared loss factor is known (kWh/day): |          |          |          |          |          |          |          |          |          |                    |          |          | 1.5900 (48)   |
| Temperature factor from Table 2b                            |          |          |          |          |          |          |          |          |          |                    |          |          | 0.5400 (49)   |
| Enter (49) or (54) in (55)                                  |          |          |          |          |          |          |          |          |          |                    |          |          | 0.8586 (55)   |
| Total storage loss                                          | 26.6166  | 24.0408  | 26.6166  | 25.7580  | 26.6166  | 25.7580  | 26.6166  | 26.6166  | 25.7580  | 26.6166            | 25.7580  | 26.6166  | (56)          |
| If cylinder contains dedicated solar storage                | 26.6166  | 24.0408  | 26.6166  | 25.7580  | 26.6166  | 25.7580  | 26.6166  | 26.6166  | 25.7580  | 26.6166            | 25.7580  | 26.6166  | (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)          |

# Full SAP Calculation Printout



|                                                                 |                                                                                |          |          |          |          |          |          |          |          |          |          |                |
|-----------------------------------------------------------------|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| 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 | 257.0705                                                                       | 227.1914 | 241.1910 | 211.8987 | 205.2468 | 184.7917 | 182.3663 | 189.7573 | 191.9850 | 214.2441 | 227.9770 | 254.2627 (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                                                 | 257.0705                                                                       | 227.1914 | 241.1910 | 211.8987 | 205.2468 | 184.7917 | 182.3663 | 189.7573 | 191.9850 | 214.2441 | 227.9770 | 254.2627 (64)  |
|                                                                 | Total per year (kWh/year) = Sum(64)m =                                         |          |          |          |          |          |          |          |          |          |          | 2587.9826 (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                        | 108.7944                                                                       | 96.6029  | 103.5144 | 93.0225  | 91.5630  | 84.0095  | 83.9552  | 86.4127  | 86.4013  | 94.5546  | 98.3686  | 107.8608 (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                                                                               | 178.9890  | 178.9890  | 178.9890  | 178.9890  | 178.9890  | 178.9890  | 178.9890  | 178.9890  | 178.9890  | 178.9890  | 178.9890  | 178.9890  | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 51.9195   | 46.1144   | 37.5028   | 28.3920   | 21.2234   | 17.9176   | 19.3607   | 25.1657   | 33.7774   | 42.8881   | 50.0568   | 53.3625   | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 533.0527  | 538.5841  | 524.6452  | 494.9707  | 457.5120  | 422.3061  | 398.7864  | 393.2550  | 407.1940  | 436.8684  | 474.3271  | 509.5330  | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 55.8821   | 55.8821   | 55.8821   | 55.8821   | 55.8821   | 55.8821   | 55.8821   | 55.8821   | 55.8821   | 55.8821   | 55.8821   | 55.8821   | (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)                                 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | (71) |
| Water heating gains (Table 5)                                                       | 146.2290  | 143.7544  | 139.1323  | 129.1980  | 123.0686  | 116.6798  | 112.8431  | 116.1462  | 120.0017  | 127.0895  | 136.6230  | 144.9742  | (72) |
| Total internal gains                                                                | 849.7463  | 846.9980  | 819.8253  | 771.1057  | 720.3489  | 672.4486  | 646.5351  | 650.1119  | 676.5181  | 725.3911  | 779.5520  | 826.4147  | (73) |

## 6. Solar gains

| [Jan]       |  |  |  |  | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 |           | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d |           | Gains<br>W    |           |           |           |                |
|-------------|--|--|--|--|------------|--------------------------------|-----------|-----------------------------------|------------------------------------|------------------------------|-----------|---------------|-----------|-----------|-----------|----------------|
| <hr/>       |  |  |  |  |            |                                |           |                                   |                                    |                              |           |               |           |           |           |                |
| Northeast   |  |  |  |  | 10.6800    | 13.7804                        |           | 0.7600                            | 0.7000                             | 0.7700                       |           | 54.2598 (75)  |           |           |           |                |
| Southwest   |  |  |  |  | 7.2900     | 43.0593                        |           | 0.7600                            | 0.7000                             | 0.7700                       |           | 115.7282 (79) |           |           |           |                |
| Northwest   |  |  |  |  | 2.6400     | 13.7804                        |           | 0.7600                            | 0.7000                             | 0.7700                       |           | 13.4125 (81)  |           |           |           |                |
| Northeast   |  |  |  |  | 2.1600     | 21.4042                        |           | 0.7600                            | 0.7000                             | 1.0000                       |           | 22.1364 (82)  |           |           |           |                |
| Southwest   |  |  |  |  | 0.7200     | 45.8318                        |           | 0.7600                            | 0.7000                             | 1.0000                       |           | 15.7999 (82)  |           |           |           |                |
| Horizontal  |  |  |  |  | 6.0000     | 32.0000                        |           | 0.7600                            | 0.7000                             | 1.0000                       |           | 91.9296 (82)  |           |           |           |                |
| <hr/>       |  |  |  |  |            |                                |           |                                   |                                    |                              |           |               |           |           |           |                |
| Solar gains |  |  |  |  | 313.2664   | 526.4122                       | 852.1393  | 1308.0253                         | 1603.6127                          | 1765.3541                    | 1651.8521 | 1414.2183     | 1067.1087 | 659.4501  | 372.7717  | 261.0608 (83)  |
| Total gains |  |  |  |  | 1163.0127  | 1373.4102                      | 1671.9645 | 2079.1310                         | 2323.9616                          | 2437.8027                    | 2298.3872 | 2064.3301     | 1743.6268 | 1384.8413 | 1152.3237 | 1087.4755 (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                                                                         | 32.3279 | 32.4806 | 32.4806 | 32.6994 | 32.6994 | 32.9712 | 32.9712 | 33.0981 | 32.9054 | 32.6279 | 32.7695 | 32.5549      |
| alpha                                                                       | 3.1552  | 3.1654  | 3.1654  | 3.1800  | 3.1800  | 3.1981  | 3.1981  | 3.2065  | 3.1937  | 3.1752  | 3.1846  | 3.1703       |
| util living area                                                            | 0.9657  | 0.9427  | 0.8840  | 0.7503  | 0.5814  | 0.3876  | 0.2774  | 0.3143  | 0.5757  | 0.8401  | 0.9446  | 0.9711 (86)  |
| MIT                                                                         | 19.4429 | 19.6807 | 20.0791 | 20.5215 | 20.7700 | 20.8773 | 20.8972 | 20.8944 | 20.8086 | 20.4236 | 19.8609 | 19.4014 (87) |
| Th 2                                                                        | 20.1178 | 20.1216 | 20.1216 | 20.1270 | 20.1270 | 20.1336 | 20.1336 | 20.1366 | 20.1320 | 20.1252 | 20.1287 | 20.1234 (88) |
| util rest of house                                                          | 0.9605  | 0.9342  | 0.8674  | 0.7189  | 0.5356  | 0.3317  | 0.2139  | 0.2451  | 0.5136  | 0.8104  | 0.9349  | 0.9666 (89)  |
| MIT 2                                                                       | 18.2788 | 18.5806 | 19.0749 | 19.6064 | 19.8816 | 19.9918 | 20.0072 | 20.0089 | 19.9325 | 19.5053 | 18.8170 | 18.2306 (90) |
| Living area fraction                                                        | 18.7461 | 19.0222 | 19.4780 | 19.9737 | 20.2382 | 20.3473 | 20.3644 | 20.3644 | 20.2842 | 19.8739 | 19.2360 | 18.7006 (91) |
| MIT                                                                         | 18.7461 | 19.0222 | 19.4780 | 19.9737 | 20.2382 | 20.3473 | 20.3644 | 20.3644 | 20.2842 | 19.8739 | 19.2360 | 18.7006 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | -0.1500      |
| adjusted MIT                                                                | 18.5961 | 18.8722 | 19.3280 | 19.8237 | 20.0882 | 20.1973 | 20.2144 | 20.2144 | 20.1342 | 19.7239 | 19.0860 | 18.5506 (93) |

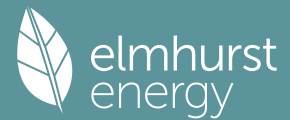
## 8. Space heating requirement

|                                                                                |           |           |           |           |           |          |          |          |          |           |           |           |       |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|-----------|-----------|-----------|-------|
| Utilisation                                                                    | Jan       | Feb       | Mar       | Apr       | May       | Jun      | Jul      | Aug      | Sep      | Oct       | Nov       | Dec       |       |
| Useful gains                                                                   | 0.9488    | 0.9193    | 0.8500    | 0.7071    | 0.5334    | 0.3359   | 0.2199   | 0.2515   | 0.5138   | 0.7947    | 0.9202    | 0.9561    | (94)  |
| Ext temp.                                                                      | 1103.4092 | 1262.5467 | 1421.1986 | 1470.1147 | 1239.6990 | 818.8049 | 505.3161 | 519.0894 | 895.8108 | 1100.5975 | 1060.3618 | 1039.6872 | (95)  |
| Heat loss rate W                                                               | 4.7000    | 5.3000    | 7.0000    | 9.5000    | 12.4000   | 15.4000  | 17.3000  | 17.2000  | 14.6000  | 11.1000   | 7.6000    | 4.7000    | (96)  |
| Space heating kWh                                                              | 2472.7869 | 2403.7964 | 2183.4318 | 1816.2236 | 1352.5588 | 837.0110 | 508.5025 | 523.9193 | 967.5215 | 1520.5085 | 2016.3813 | 2447.5069 | (97)  |
| Space heating requirement - total per year (kWh/year)                          | 1018.8170 | 766.9198  | 567.1015  | 249.1984  | 83.9677   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 312.4138  | 688.3340  | 1047.4178 | (98a) |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | (98b) |
| Solar heating contribution - total per year (kWh/year)                         | 1018.8170 | 766.9198  | 567.1015  | 249.1984  | 83.9677   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 312.4138  | 688.3340  | 1047.4178 | (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |           |          |          |          |          |           |           | 4734.1701 |       |
| Space heating per m2                                                           |           |           |           |           |           |          |          |          |          |           |           | 25.5074   | (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) |

# Full SAP Calculation Printout



|                                                                                                      |           |           |           |           |           |           |           |           |           |           |           |           |                  |
|------------------------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------------------|
| 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                                                                            | 1018.8170 | 766.9198  | 567.1015  | 249.1984  | 83.9677   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 312.4138  | 688.3340  | 1047.4178 | (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)                                                             | 1147.3165 | 863.6485  | 638.6278  | 280.6288  | 94.5582   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 351.8174  | 775.1509  | 1179.5246 | (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                                                                            | 257.0705  | 227.1914  | 241.1910  | 211.8987  | 205.2468  | 184.7917  | 182.3663  | 189.7573  | 191.9850  | 214.2441  | 227.9770  | 254.2627  | (64)             |
| Efficiency of water heater                                                                           | 86.8270   | 86.5687   | 85.9089   | 84.4243   | 82.2193   | 79.8000   | 79.8000   | 79.8000   | 79.8000   | 84.9046   | 86.3763   | 86.8859   | (216)            |
| Fuel for water heating, kWh/month                                                                    | 296.0722  | 262.4406  | 280.7522  | 250.9924  | 249.6333  | 231.5686  | 228.5292  | 237.7911  | 240.5828  | 252.3351  | 263.9347  | 292.6398  | (217)            |
| Space cooling fuel requirement                                                                       | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | (219)            |
| (217)m                                                                                               | 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)            |
| Pumps and Fa                                                                                         | 45.4448   | 36.4575   | 32.8259   | 24.0497   | 18.5767   | 15.1773   | 16.9463   | 22.0274   | 28.6114   | 37.5397   | 42.4010   | 46.7079   | (221)            |
| Lighting                                                                                             | -104.2013 | -127.9525 | -173.3124 | -183.7198 | -184.7961 | -169.3012 | -166.7320 | -164.1137 | -156.4386 | -144.2145 | -108.2265 | -91.2688  | (221)            |
| 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    | (221)            |
| (233a)m                                                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | (221)            |
| 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    | (221)            |
| (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    | (221)            |
| 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    | (221)            |
| (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    | (221)            |
| 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    | (221)            |
| (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    | (221)            |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | -99.8293  | -177.8810 | -356.5605 | -564.7293 | -724.4677 | -781.2785 | -759.9244 | -656.9105 | -473.5016 | -275.5209 | -126.1271 | -79.0494  | (221)            |
| (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    | (221)            |
| 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    | (221)            |
| (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    | (221)            |
| 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    | (221)            |
| (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    | (221)            |
| 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    | (221)            |
| (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    | (221)            |
| Annual totals kWh/year                                                                               |           |           |           |           |           |           |           |           |           |           |           |           |                  |
| Space heating fuel - main system 1                                                                   |           |           |           |           |           |           |           |           |           |           |           |           | 5331.2726 (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                                                                              |           |           |           |           |           |           |           |           |           |           |           |           | 3087.2719 (219)  |
| Space cooling fuel                                                                                   |           |           |           |           |           |           |           |           |           |           |           |           | 0.0000 (221)     |
| Electricity for pumps and fans:                                                                      |           |           |           |           |           |           |           |           |           |           |           |           |                  |
| central heating pump                                                                                 |           |           |           |           |           |           |           |           |           |           |           |           | 41.0000 (230c)   |
| main heating flue fan                                                                                |           |           |           |           |           |           |           |           |           |           |           |           | 45.0000 (230e)   |
| Total electricity for the above, kWh/year                                                            |           |           |           |           |           |           |           |           |           |           |           |           | 86.0000 (231)    |
| Electricity for lighting (calculated in Appendix L)                                                  |           |           |           |           |           |           |           |           |           |           |           |           | 366.7656 (232)   |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |           |           |           |           |           |           |           |           |           |           |           |           |                  |
| PV generation                                                                                        |           |           |           |           |           |           |           |           |           |           |           |           | -6850.0579 (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                                                                  |           |           |           |           |           |           |           |           |           |           |           |           | 2021.2522 (238)  |

## 10a. Fuel costs - using BEDF prices (567)

|                                             | Fuel<br>kWh/year | Fuel price<br>p/kWh | Fuel cost<br>£/year |        |
|---------------------------------------------|------------------|---------------------|---------------------|--------|
| Space heating - main system 1               | 5331.2726        | 5.6000              | 298.5513            | (240)  |
| Total CO2 associated with community systems |                  |                     | 0.0000              | (473)  |
| Water heating (other fuel)                  | 3087.2719        | 5.6000              | 172.8872            | (247)  |
| Energy for instantaneous electric shower(s) | 0.0000           | 26.0600             | 0.0000              | (247a) |
| Pumps, fans and electric keep-hot           | 86.0000          | 26.0600             | 22.4116             | (249)  |
| Energy for lighting                         | 366.7656         | 26.0600             | 95.5791             | (250)  |
| Additional standing charges                 |                  |                     | 99.0000             | (251)  |
| Energy saving/generation technologies       |                  |                     |                     |        |
| PV Unit electricity used in dwelling        | -1774.2776       | 26.0600             | -462.3767           |        |
| PV Unit electricity exported                | -5075.7803       | 5.8100              | -294.9028           |        |
| Total                                       |                  |                     | -757.2796           | (252)  |
| Total energy cost                           |                  |                     | -68.8504            | (255)  |

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

|                                             | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |       |
|---------------------------------------------|--------------------|-------------------------------|--------------------------|-------|
| Space heating - main system 1               | 5331.2726          | 0.2100                        | 1119.5673                | (261) |
| Total CO2 associated with community systems |                    |                               | 0.0000                   | (373) |
| Water heating (other fuel)                  | 3087.2719          | 0.2100                        | 648.3271                 | (264) |
| Space and water heating                     |                    |                               | 1767.8944                | (265) |
| Pumps, fans and electric keep-hot           | 86.0000            | 0.1387                        | 11.9293                  | (267) |
| Energy for lighting                         | 366.7656           | 0.1443                        | 52.9356                  | (268) |
| Energy saving/generation technologies       |                    |                               |                          |       |
| PV Unit electricity used in dwelling        | -1774.2776         | 0.1363                        | -241.7609                |       |
| PV Unit electricity exported                | -5075.7803         | 0.1254                        | -636.4385                |       |
| Total                                       |                    |                               | -878.1993                | (269) |
| Total CO2, kg/year                          |                    |                               | 954.5599                 | (272) |

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## 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               | 5331.2726          | 1.1300                              | 6024.3381 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 3087.2719          | 1.1300                              | 3488.6173 (278)            |
| Space and water heating                     |                    |                                     | 9512.9554 (279)            |
| Pumps, fans and electric keep-hot           | 86.0000            | 1.5128                              | 130.1008 (281)             |
| Energy for lighting                         | 366.7656           | 1.5338                              | 562.5573 (282)             |
| Energy saving/generation technologies       |                    |                                     |                            |
| PV Unit electricity used in dwelling        | -1774.2776         | 1.5037                              | -2667.9340                 |
| PV Unit electricity exported                | -5075.7803         | 0.4602                              | -2335.6990                 |
| Total                                       |                    |                                     | -5003.6330 (283)           |
| Total Primary energy kWh/year               |                    |                                     | 5201.9804 (286)            |

## SAP 10 EPC IMPROVEMENTS

### Plot 1-Gas Boiler

Current energy efficiency rating: A 101  
Current environmental impact rating: A 93

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

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

Measures omitted - SAP change or cost saving too small:  
N Solar water heating + 0.6 -£ 43 -212 kg (22.3%)

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

Potential energy efficiency rating: A 101  
Potential environmental impact rating: A 93

Fuel prices for cost data on this page from database revision number 567 TEST (07 Mar 2025)  
Recommendation texts revision number 6.1 (11 Jun 2019)

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

|                          | Current    | Potential  | Saving     |
|--------------------------|------------|------------|------------|
| Electricity              | £118       | £118       | £0         |
| Mains gas                | £570       | £570       | £0         |
| Space heating            | £420       | £420       | £0         |
| Water heating            | £173       | £173       | £0         |
| Lighting                 | £96        | £96        | £0         |
| Generated (PV)           | -£757      | -£757      | £0         |
| Total cost of fuels      | -£69       | -£69       | £0         |
| Total cost of uses       | -£68       | -£68       | £0         |
| Delivered energy         | 11 kWh/m²  | 11 kWh/m²  | 0 kWh/m²   |
| Carbon dioxide emissions | 1.0 tonnes | 1.0 tonnes | 0.0 tonnes |
| CO2 emissions per m²     | 5 kg/m²    | 5 kg/m²    | 0 kg/m²    |
| Primary energy           | 28 kWh/m²  | 28 kWh/m²  | 0 kWh/m²   |

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

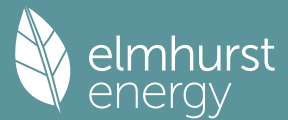
### 1. Overall dwelling characteristics

|                                                        | Area<br>(m2) | Storey height<br>(m)            | Volume<br>(m3)         |
|--------------------------------------------------------|--------------|---------------------------------|------------------------|
| Main dwelling                                          |              |                                 |                        |
| Ground floor                                           | 89.7000 (1b) | x 2.4000 (2b)                   | = 215.2800 (1b) - (3b) |
| First floor                                            | 61.8000 (1c) | x 2.6000 (2c)                   | = 160.6800 (1c) - (3c) |
| Second floor                                           | 34.1000 (1d) | x 2.7000 (2d)                   | = 92.0700 (1d) - (3d)  |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 185.6000     |                                 | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 468.0300 (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) |

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Number of blocked chimneys  
Number of intermittent extract fans  
Number of passive vents  
Number of flueless gas fires

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) =  
Pressure Test  
Pressure Test Method  
Measured/design AF50  
Infiltration rate  
Number of sides sheltered

Air changes per hour  
40.0000 / (5) = 0.0855 (8)  
Yes  
Blower Door  
5.0000 (17)  
0.3355 (18)  
1 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.9250 (20)  
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3103 (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 |        |        |        |        |        |        |        |        |        |        |        |        |       |
| Effective ac    | 0.3956 | 0.3879 | 0.3801 | 0.3413 | 0.3336 | 0.2948 | 0.2948 | 0.2870 | 0.3103 | 0.3336 | 0.3491 | 0.3646 | (22b) |
|                 | 0.5783 | 0.5752 | 0.5722 | 0.5583 | 0.5556 | 0.5435 | 0.5435 | 0.5412 | 0.5481 | 0.5556 | 0.5609 | 0.5665 | (25)  |

## 3. Heat losses and heat loss parameter

| Element                                        | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K     | A x U<br>W/K | K-value<br>kJ/m2K | A x K<br>kJ/K |       |
|------------------------------------------------|-------------|----------------|---------------|----------------------|--------------|-------------------|---------------|-------|
| Main dwelling                                  |             |                |               |                      |              |                   |               |       |
| Windows                                        |             |                | 20.6100       | 1.1450               | 23.5992      |                   |               | (27)  |
| Roof Windows                                   |             |                | 8.8800        | 1.1450               | 10.1679      |                   |               | (27a) |
| Door                                           |             |                | 1.8900        | 1.2000               | 2.2680       |                   |               | (26)  |
| Heat Loss Floor                                |             |                | 89.7000       | 0.1100               | 9.8670       | 110.0000          | 9867.0000     | (28a) |
| Cavity Wall                                    | 139.7000    | 22.5000        | 117.2000      | 0.1800               | 21.0960      | 60.0000           | 7032.0000     | (29a) |
| Stud Wall                                      | 28.1000     |                | 28.1000       | 0.1100               | 3.0910       | 9.0000            | 252.9000      | (29a) |
| Flat Roof                                      | 23.5000     | 6.0000         | 17.5000       | 0.1400               | 2.4500       | 9.0000            | 157.5000      | (30)  |
| Plane Roof                                     | 55.2000     |                | 55.2000       | 0.1132               | 6.2491       | 9.0000            | 496.8000      | (30)  |
| Slope Roof                                     | 13.4000     | 2.8800         | 10.5200       | 0.1300               | 1.3676       | 9.0000            | 94.6800       | (30)  |
| Total net area of external elements Aum(A, m2) |             |                | 349.6000      |                      |              |                   |               | (31)  |
| Fabric heat loss, W/K = Sum (A x U)            |             |                |               | (26)...(30) + (32) = | 80.1558      |                   |               | (33)  |
| Main dwelling                                  |             |                |               |                      |              |                   |               |       |
| Party Wall                                     |             |                | 72.7000       | 0.0000               | 0.0000       | 0.0000            | 0.0000        | (32)  |
| Internal Wall                                  |             |                | 216.2000      |                      |              | 9.0000            | 1945.8000     | (32c) |
| Internal Ceiling                               |             |                | 61.8000       |                      |              | 9.0000            | 556.2000      | (32e) |
| Internal Ceiling 2                             |             |                | 34.1000       |                      |              | 9.0000            | 306.9000      | (32e) |

Heat capacity Cm = Sum(A x k)  
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K (28)...(30) + (32) + (32a)...(32e) = 20709.7800 (34)  
List of Thermal Bridges 111.5829 (35)

| Element                                                    | Length  | Psi-value | Total  |                                    |
|------------------------------------------------------------|---------|-----------|--------|------------------------------------|
| K1 Element                                                 | 16.8000 | 0.0400    | 0.6720 |                                    |
| E2 Other lintels (including other steel lintels)           | 15.9000 | 0.0300    | 0.4770 |                                    |
| E3 Sill                                                    | 31.6000 | 0.0300    | 0.9480 |                                    |
| E4 Jamb                                                    | 28.1000 | 0.0600    | 1.6860 |                                    |
| E5 Ground floor (normal)                                   | 41.1000 | 0.0700    | 2.8770 |                                    |
| E6 Intermediate floor within a dwelling                    | 15.4000 | 0.0900    | 1.3860 |                                    |
| E16 Corner (normal)                                        | 15.4000 | 0.0600    | 0.9240 |                                    |
| E18 Party wall between dwellings                           | 6.2000  | 0.0800    | 0.4960 |                                    |
| R1 Head of roof window                                     | 6.2000  | 0.0600    | 0.3720 |                                    |
| R2 Sill of roof window                                     | 11.2000 | 0.0800    | 0.8960 |                                    |
| R3 Jamb of roof window                                     |         |           |        | 10.7340 (36)                       |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |         |           |        | 0.0000 (36a)                       |
| Point Thermal bridges                                      |         |           |        | (33) + (36) + (36a) = 90.8898 (37) |
| Total fabric heat loss                                     |         |           |        |                                    |

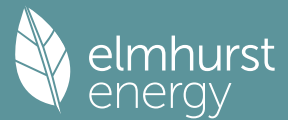
|                                                                     |          |          |          |          |          |          |          |          |          |          |          |          |      |
|---------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) |          |          |          |          |          |          |          |          |          |          |          |          |      |
| (38)m                                                               | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |      |
|                                                                     | 89.3130  | 88.8436  | 88.3835  | 86.2224  | 85.8181  | 83.9359  | 83.9359  | 83.5873  | 84.6609  | 85.8181  | 86.6360  | 87.4912  | (38) |
| Heat transfer coeff                                                 | 180.2028 | 179.7334 | 179.2733 | 177.1122 | 176.7079 | 174.8257 | 174.8257 | 174.4771 | 175.5507 | 176.7079 | 177.5259 | 178.3810 | (39) |
| Average = Sum(39)m / 12 =                                           |          |          |          |          |          |          |          |          |          |          |          | 177.1103 |      |

|               |        |        |        |        |        |        |        |        |        |        |        |        |      |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| HLP           | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |      |
| HLP (average) | 0.9709 | 0.9684 | 0.9659 | 0.9543 | 0.9521 | 0.9419 | 0.9419 | 0.9401 | 0.9459 | 0.9521 | 0.9565 | 0.9611 | (40) |
| Days in month | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31     |      |

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

|                                                             |          |          |          |          |          |          |          |          |          |                    |          |           |             |
|-------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------------------|----------|-----------|-------------|
| Assumed occupancy                                           |          |          |          |          |          |          |          |          |          |                    |          |           | 2.9832 (42) |
| Hot water usage for mixer showers                           |          |          |          |          |          |          |          |          |          |                    |          |           |             |
|                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000             | 0.0000   | 0.0000    | (42a)       |
| Hot water usage for baths                                   |          |          |          |          |          |          |          |          |          |                    |          |           |             |
|                                                             | 85.6425  | 84.3706  | 82.5794  | 79.2769  | 76.8041  | 74.0621  | 72.5809  | 74.3595  | 76.2961  | 79.2302            | 82.6007  | 85.3529   | (42b)       |
| Hot water usage for other uses                              |          |          |          |          |          |          |          |          |          |                    |          |           |             |
|                                                             | 45.1804  | 43.5375  | 41.8946  | 40.2517  | 38.6087  | 36.9658  | 36.9658  | 38.6087  | 40.2517  | 41.8946            | 43.5375  | 45.1804   | (42c)       |
| Average daily hot water use (litres/day)                    |          |          |          |          |          |          |          |          |          |                    |          | 120.4772  | (43)        |
|                                                             | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct                | Nov      | Dec       |             |
| Daily hot water use                                         | 130.8229 | 127.9081 | 124.4740 | 119.5286 | 115.4128 | 111.0279 | 109.5468 | 112.9683 | 116.5478 | 121.1247           | 126.1382 | 130.5334  | (44)        |
| Energy content                                              | 207.1915 | 182.1394 | 191.3120 | 163.6287 | 155.3678 | 136.5217 | 132.4873 | 139.8783 | 143.7150 | 164.3651           | 179.7070 | 204.3837  | (45)        |
| Energy content (annual)                                     |          |          |          |          |          |          |          |          |          | Total = Sum(45)m = |          | 2000.6976 |             |
| Distribution loss (46)m = 0.15 x (45)m                      |          |          |          |          |          |          |          |          |          |                    |          |           |             |
|                                                             | 31.0787  | 27.3209  | 28.6968  | 24.5443  | 23.3052  | 20.4783  | 19.8731  | 20.9817  | 21.5573  | 24.6548            | 26.9560  | 30.6576   | (46)        |
| Water storage loss:                                         |          |          |          |          |          |          |          |          |          |                    |          |           |             |
| Store volume                                                |          |          |          |          |          |          |          |          |          |                    |          | 300.0000  | (47)        |
| a) If manufacturer declared loss factor is known (kWh/day): |          |          |          |          |          |          |          |          |          |                    |          | 1.5900    | (48)        |
| Temperature factor from Table 2b                            |          |          |          |          |          |          |          |          |          |                    |          | 0.5400    | (49)        |
| Enter (49) or (54) in (55)                                  |          |          |          |          |          |          |          |          |          |                    |          | 0.8586    | (55)        |
| Total storage loss                                          |          |          |          |          |          |          |          |          |          |                    |          |           |             |
|                                                             | 26.6166  | 24.0408  | 26.6166  | 25.7580  | 26.6166  | 25.7580  | 26.6166  | 26.6166  | 25.7580  | 26.6166            | 25.7580  | 26.6166   | (56)        |
| If cylinder contains dedicated solar storage                |          |          |          |          |          |          |          |          |          |                    |          |           |             |
|                                                             | 26.6166  | 24.0408  | 26.6166  | 25.7580  | 26.6166  | 25.7580  | 26.6166  | 26.6166  | 25.7580  | 26.6166            | 25.7580  | 26.6166   | (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)        |

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|                                                                                |          |          |          |          |          |          |          |          |          |          |          |                |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| Total heat required for water heating calculated for each month                |          |          |          |          |          |          |          |          |          |          |          |                |
|                                                                                | 257.0705 | 227.1914 | 241.1910 | 211.8987 | 205.2468 | 184.7917 | 182.3663 | 189.7573 | 191.9850 | 214.2441 | 227.9770 | 254.2627 (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                                                                | 257.0705 | 227.1914 | 241.1910 | 211.8987 | 205.2468 | 184.7917 | 182.3663 | 189.7573 | 191.9850 | 214.2441 | 227.9770 | 254.2627 (64)  |
| Total per year (kWh/year) = Sum(64)m =                                         |          |          |          |          |          |          |          |          |          |          |          | 2587.9826 (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                                       | 108.7944 | 96.6029  | 103.5144 | 93.0225  | 91.5630  | 84.0095  | 83.9552  | 86.4127  | 86.4013  | 94.5546  | 98.3686  | 107.8608 (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                                                                               | 178.9890  | 178.9890  | 178.9890  | 178.9890  | 178.9890  | 178.9890  | 178.9890  | 178.9890  | 178.9890  | 178.9890  | 178.9890  | 178.9890 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 51.9195   | 46.1144   | 37.5028   | 28.3920   | 21.2234   | 17.9176   | 19.3607   | 25.1657   | 33.7774   | 42.8881   | 50.0568   | 53.3625 (67)   |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 533.0527  | 538.5841  | 524.6452  | 494.9707  | 457.5120  | 422.3061  | 398.7864  | 393.2550  | 407.1940  | 436.8684  | 474.3271  | 509.5330 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 55.8821   | 55.8821   | 55.8821   | 55.8821   | 55.8821   | 55.8821   | 55.8821   | 55.8821   | 55.8821   | 55.8821   | 55.8821   | 55.8821 (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)                                 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 (71) |
| Water heating gains (Table 5)                                                       | 146.2290  | 143.7544  | 139.1323  | 129.1980  | 123.0686  | 116.6798  | 112.8431  | 116.1462  | 120.0017  | 127.0895  | 136.6230  | 144.9742 (72)  |
| Total internal gains                                                                | 849.7463  | 846.9980  | 819.8253  | 771.1057  | 720.3489  | 672.4486  | 646.5351  | 650.1119  | 676.5181  | 725.3911  | 779.5520  | 826.4147 (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   |                |
|-------------|-----------|-----------|-----------|------------|--------------------------------|-----------------------------------|------------------------------------|-----------|------------------------------|-----------|--------------|----------------|
|             |           |           |           |            |                                |                                   |                                    |           |                              |           |              |                |
| Northeast   |           |           |           | 10.6800    | 11.2829                        | 0.7600                            | 0.7000                             |           | 0.7700                       |           | 44.4261 (75) |                |
| Southwest   |           |           |           | 7.2900     | 36.7938                        | 0.7600                            | 0.7000                             |           | 0.7700                       |           | 98.8889 (79) |                |
| Northwest   |           |           |           | 2.6400     | 11.2829                        | 0.7600                            | 0.7000                             |           | 0.7700                       |           | 10.9817 (81) |                |
| Northeast   |           |           |           | 2.1600     | 17.4137                        | 0.7600                            | 0.7000                             |           | 1.0000                       |           | 18.0094 (82) |                |
| Southwest   |           |           |           | 0.7200     | 38.2331                        | 0.7600                            | 0.7000                             |           | 1.0000                       |           | 13.1803 (82) |                |
| Horizontal  |           |           |           | 6.0000     | 26.0000                        | 0.7600                            | 0.7000                             |           | 1.0000                       |           | 74.6928 (82) |                |
|             |           |           |           |            |                                |                                   |                                    |           |                              |           |              |                |
| Solar gains | 260.1792  | 498.7084  | 818.4381  | 1223.5480  | 1548.1778                      | 1611.5461                         | 1522.9377                          | 1271.7321 | 958.5595                     | 588.9725  | 322.0232     | 215.7874 (83)  |
| Total gains | 1109.9255 | 1345.7064 | 1638.2634 | 1994.6537  | 2268.5268                      | 2283.9947                         | 2169.4729                          | 1921.8440 | 1635.0776                    | 1314.3636 | 1101.5752    | 1042.2022 (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                                                                         | 31.9236 | 32.0069 | 32.0891 | 32.4806 | 32.5549 | 32.9054 | 32.9054 | 32.9712 | 32.7695 | 32.5549 | 32.4049 | 32.2496      |
| alpha                                                                       | 3.1282  | 3.1338  | 3.1393  | 3.1654  | 3.1703  | 3.1937  | 3.1937  | 3.1981  | 3.1846  | 3.1703  | 3.1603  | 3.1500       |
| util living area                                                            | 0.9717  | 0.9493  | 0.8981  | 0.7865  | 0.6273  | 0.4629  | 0.3461  | 0.4023  | 0.6375  | 0.8693  | 0.9552  | 0.9763 (86)  |
| MIT                                                                         | 19.3227 | 19.5790 | 19.9780 | 20.4305 | 20.7216 | 20.8529 | 20.8886 | 20.8796 | 20.7641 | 20.3308 | 19.7394 | 19.2783 (87) |
| Th 2                                                                        | 20.1076 | 20.1098 | 20.1118 | 20.1216 | 20.1234 | 20.1320 | 20.1320 | 20.1336 | 20.1287 | 20.1234 | 20.1197 | 20.1159 (88) |
| util rest of house                                                          | 0.9673  | 0.9418  | 0.8835  | 0.7586  | 0.5845  | 0.4073  | 0.2809  | 0.3318  | 0.5791  | 0.8445  | 0.9473  | 0.9726 (89)  |
| MIT 2                                                                       | 18.1190 | 18.4438 | 18.9426 | 19.4963 | 19.8272 | 19.9694 | 19.9999 | 19.9957 | 19.8868 | 19.3939 | 18.6578 | 18.0686 (90) |
| Living area fraction                                                        | 18.6021 | 18.8995 | 19.3582 | 19.8713 | 20.1862 | 20.3240 | 20.3566 | 20.3505 | 20.2390 | 19.7700 | 19.0920 | 18.5542 (91) |
| MIT                                                                         | 18.6021 | 18.8995 | 19.3582 | 19.8713 | 20.1862 | 20.3240 | 20.3566 | 20.3505 | 20.2390 | 19.7700 | 19.0920 | 18.5542 (92) |
| Temperature adjustment                                                      | 18.4521 | 18.7495 | 19.2082 | 19.7213 | 20.0362 | 20.1740 | 20.2066 | 20.2005 | 20.0890 | 19.6200 | 18.9420 | 18.4042 (93) |
| adjusted MIT                                                                | 18.4521 | 18.7495 | 19.2082 | 19.7213 | 20.0362 | 20.1740 | 20.2066 | 20.2005 | 20.0890 | 19.6200 | 18.9420 | 18.4042 (93) |

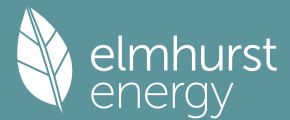
## 8. Space heating requirement

|                                                                                |               |           |           |           |           |          |          |          |           |           |           |                 |
|--------------------------------------------------------------------------------|---------------|-----------|-----------|-----------|-----------|----------|----------|----------|-----------|-----------|-----------|-----------------|
| Utilisation                                                                    | 0.9568        | 0.9274    | 0.8660    | 0.7445    | 0.5800    | 0.4101   | 0.2866   | 0.3374   | 0.5762    | 0.8278    | 0.9338    | 0.9632 (94)     |
| Useful gains                                                                   | 1061.9293     | 1248.0644 | 1418.7698 | 1485.1028 | 1315.6754 | 936.6273 | 621.8413 | 648.4800 | 942.1952  | 1087.9896 | 1028.5994 | 1003.8714 (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                                                               | 2550.2566     | 2489.2174 | 2278.2402 | 1916.5768 | 1473.0784 | 974.4850 | 630.5337 | 663.0966 | 1051.3682 | 1593.9017 | 2102.2575 | 2533.7515 (97)  |
| Space heating kWh                                                              | 1107.3155     | 834.0548  | 639.4459  | 310.6613  | 117.1079  | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 376.3986  | 773.0338  | 1138.2308 (98a) |
| Space heating requirement - total per year (kWh/year)                          | 1107.3155     | 834.0548  | 639.4459  | 310.6613  | 117.1079  | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 376.3986  | 773.0338  | 5296.2486       |
| 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        | 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                                                              | 1107.3155     | 834.0548  | 639.4459  | 310.6613  | 117.1079  | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 376.3986  | 773.0338  | 1138.2308 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) | 1107.3155     | 834.0548  | 639.4459  | 310.6613  | 117.1079  | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 376.3986  | 773.0338  | 5296.2486       |
| Space heating per m <sup>2</sup>                                               | (98c) / (4) = |           |           |           |           |          |          |          |           |           |           | 28.5358 (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) |

# Full SAP Calculation Printout



|                                                                                                      |           |           |           |           |           |           |           |           |           |           |           |            |        |
|------------------------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------------|--------|
| 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                                                                            | 1107.3155 | 834.0548  | 639.4459  | 310.6613  | 117.1079  | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 376.3986  | 773.0338  | 1138.2308  | (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)                                                             | 1246.9769 | 939.2509  | 720.0968  | 349.8438  | 131.8782  | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 423.8723  | 870.5336  | 1281.7914  | (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                                                                            | 257.0705  | 227.1914  | 241.1910  | 211.8987  | 205.2468  | 184.7917  | 182.3663  | 189.7573  | 191.9850  | 214.2441  | 227.9770  | 254.2627   | (64)   |
| Efficiency of water heater                                                                           | 86.9523   | 86.7065   | 86.1392   | 84.9165   | 82.8505   | 79.8000   | 79.8000   | 79.8000   | 79.8000   | 85.3100   | 86.5762   | 87.0082    | (216)  |
| Fuel for water heating, kWh/month                                                                    | 295.6455  | 262.0234  | 280.0012  | 249.5377  | 247.7314  | 231.5686  | 228.5292  | 237.7911  | 240.5828  | 251.1360  | 263.3251  | 292.2285   | (217)  |
| Space cooling fuel requirement                                                                       | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000     | (219)  |
| (221)m                                                                                               | 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)  |
| Pumps and Fa                                                                                         | 45.4448   | 36.4575   | 32.8259   | 24.0497   | 18.5767   | 15.1773   | 16.9463   | 22.0274   | 28.6114   | 37.5397   | 42.4010   | 46.7079    | (231)  |
| Lighting                                                                                             | -92.0670  | -124.4227 | -170.8547 | -180.6546 | -183.8788 | -167.4022 | -165.0567 | -161.0089 | -151.7796 | -137.1226 | -98.9876  | -79.9797   | (232)  |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000     | (233a) |
| (233a)m                                                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000     | (234a) |
| 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     | (235a) |
| (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     | (235a) |
| 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     | (235c) |
| (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     | (235c) |
| 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) |
| (235c)m                                                                                              | -77.6467  | -166.5178 | -341.8534 | -525.9843 | -702.0207 | -707.8638 | -696.9055 | -584.2645 | -418.8719 | -239.8092 | -103.9230 | -60.9143   | (235d) |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000     | (233b) |
| (233b)m                                                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000     | (234b) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000     | (234b) |
| (234b)m                                                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000     | (235b) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000     | (235b) |
| (235b)m                                                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000     | (235d) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000     | (235d) |
| (235d)m                                                                                              |           |           |           |           |           |           |           |           |           |           |           |            |        |
| Annual totals kWh/year                                                                               |           |           |           |           |           |           |           |           |           |           |           |            |        |
| Space heating fuel - main system 1                                                                   |           |           |           |           |           |           |           |           |           |           |           | 5964.2439  | (211)  |
| Space heating fuel - main system 2                                                                   |           |           |           |           |           |           |           |           |           |           |           | 0.0000     | (213)  |
| Space heating fuel - secondary                                                                       |           |           |           |           |           |           |           |           |           |           |           | 0.0000     | (215)  |
| Efficiency of water heater                                                                           |           |           |           |           |           |           |           |           |           |           |           | 79.8000    | (216)  |
| Water heating fuel used                                                                              |           |           |           |           |           |           |           |           |           |           |           | 3080.1006  | (219)  |
| Space cooling fuel                                                                                   |           |           |           |           |           |           |           |           |           |           |           | 0.0000     | (221)  |
| Electricity for pumps and fans:                                                                      |           |           |           |           |           |           |           |           |           |           |           |            |        |
| central heating pump                                                                                 |           |           |           |           |           |           |           |           |           |           |           | 41.0000    | (230c) |
| main heating flue fan                                                                                |           |           |           |           |           |           |           |           |           |           |           | 45.0000    | (230e) |
| Total electricity for the above, kWh/year                                                            |           |           |           |           |           |           |           |           |           |           |           | 86.0000    | (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |           |           |           |           |           |           |           |           |           |           |           | 366.7656   | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |           |           |           |           |           |           |           |           |           |           |           | -6339.7902 | (233)  |
| PV generation                                                                                        |           |           |           |           |           |           |           |           |           |           |           | 0.0000     | (234)  |
| Wind generation                                                                                      |           |           |           |           |           |           |           |           |           |           |           | 0.0000     | (235a) |
| Hydro-electric generation (Appendix N)                                                               |           |           |           |           |           |           |           |           |           |           |           | 0.0000     | (235)  |
| 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                                                                  |           |           |           |           |           |           |           |           |           |           |           | 3157.3199  | (238)  |

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

|                                             | Fuel<br>kWh/year | Fuel price<br>p/kWh | Fuel cost<br>£/year |        |
|---------------------------------------------|------------------|---------------------|---------------------|--------|
| Space heating - main system 1               | 5964.2439        | 3.6400              | 217.0985            | (240)  |
| Total CO2 associated with community systems |                  |                     | 0.0000              | (473)  |
| Water heating (other fuel)                  | 3080.1006        | 3.6400              | 112.1157            | (247)  |
| Energy for instantaneous electric shower(s) | 0.0000           | 16.4900             | 0.0000              | (247a) |
| Pumps, fans and electric keep-hot           | 86.0000          | 16.4900             | 14.1814             | (249)  |
| Energy for lighting                         | 366.7656         | 16.4900             | 60.4796             | (250)  |
| Additional standing charges                 |                  |                     | 92.0000             | (251)  |
| Energy saving/generation technologies       |                  |                     |                     |        |
| PV Unit electricity used in dwelling        | -1713.2150       | 16.4900             | -282.5092           |        |
| PV Unit electricity exported                | -4626.5751       | 5.5900              | -258.6256           |        |
| Total                                       |                  |                     | -541.1347           | (252)  |
| Total energy cost                           |                  |                     | -45.2595            | (255)  |

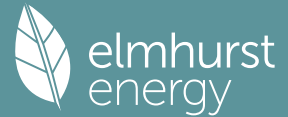
## 11a. SAP rating - Individual heating systems

|                                  |  |          |       |
|----------------------------------|--|----------|-------|
| Energy cost deflator (Table 12): |  | 0.3600   | (256) |
| Energy cost factor (ECF)         |  | -0.0707  | (257) |
| SAP value                        |  | 101.1453 |       |
| SAP rating (Section 12)          |  | 101      | (258) |
| SAP band                         |  | A        |       |

## 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               | 5964.2439          | 0.2100                        | 1252.4912                | (261) |
| Total CO2 associated with community systems |                    |                               | 0.0000                   | (373) |
| Water heating (other fuel)                  | 3080.1006          | 0.2100                        | 646.8211                 | (264) |
| Space and water heating                     |                    |                               | 1899.3123                | (265) |

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|                                              |            |        |                 |
|----------------------------------------------|------------|--------|-----------------|
| Pumps, fans and electric keep-hot            | 86.0000    | 0.1387 | 11.9293 (267)   |
| Energy for lighting                          | 366.7656   | 0.1443 | 52.9356 (268)   |
| Energy saving/generation technologies        |            |        |                 |
| PV Unit electricity used in dwelling         | -1713.2150 | 0.1359 | -232.7531       |
| PV Unit electricity exported                 | -4626.5751 | 0.1253 | -579.9359       |
| Total                                        |            |        | -812.6890 (269) |
| Total CO <sub>2</sub> , kg/year              |            |        | 1151.4882 (272) |
| CO <sub>2</sub> emissions per m <sup>2</sup> |            |        | 6.2000 (273)    |
| EI value                                     |            |        | 93.3088         |
| EI rating                                    |            |        | 93 (274)        |
| EI band                                      |            |        | A               |

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

## 1. Overall dwelling characteristics

| Main dwelling                                          | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)              | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|-----------------------------------|-----------------------------|
| Ground floor                                           | 89.7000 (1b)              | x 2.4000 (2b)                     | = 215.2800 (1b) - (3b)      |
| First floor                                            | 61.8000 (1c)              | x 2.6000 (2c)                     | = 160.6800 (1c) - (3c)      |
| Second floor                                           | 34.1000 (1d)              | x 2.7000 (2d)                     | = 92.0700 (1d) - (3d)       |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 185.6000                  |                                   | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 468.0300 (5)                |

## 2. Ventilation rate

|                                                                                                    |                             |              |
|----------------------------------------------------------------------------------------------------|-----------------------------|--------------|
| Number of open chimneys                                                                            | 0 * 80 =                    | 0.0000 (6a)  |
| Number of open flues                                                                               | 0 * 20 =                    | 0.0000 (6b)  |
| Number of chimneys / flues attached to closed fire                                                 | 0 * 10 =                    | 0.0000 (6c)  |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 =                    | 0.0000 (6d)  |
| Number of flues attached to other heater                                                           | 0 * 35 =                    | 0.0000 (6e)  |
| Number of blocked chimneys                                                                         | 0 * 20 =                    | 0.0000 (6f)  |
| Number of intermittent extract fans                                                                | 4 * 10 =                    | 40.0000 (7a) |
| Number of passive vents                                                                            | 0 * 10 =                    | 0.0000 (7b)  |
| Number of flueless gas fires                                                                       | 0 * 40 =                    | 0.0000 (7c)  |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = | 40.0000 / (5) =             | 0.0855 (8)   |
| Pressure test                                                                                      | Yes                         |              |
| Pressure Test Method                                                                               | Blower Door                 |              |
| Measured/design AP50                                                                               | 5.0000                      | (17)         |
| Infiltration rate                                                                                  | 0.3355                      | (18)         |
| Number of sides sheltered                                                                          | 1                           | (19)         |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = | 0.9250 (20)  |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) =        | 0.3103 (21)  |

|                 |        |        |        |        |        |        |        |        |        |        |        |              |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed      | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
| Wind factor     | 4.6000 | 4.4000 | 4.4000 | 4.1000 | 4.1000 | 3.7000 | 3.7000 | 3.5000 | 3.8000 | 4.2000 | 4.0000 | 4.3000 (22)  |
| Adj infilt rate | 1.1500 | 1.1000 | 1.1000 | 1.0250 | 1.0250 | 0.9250 | 0.9250 | 0.8750 | 0.9500 | 1.0500 | 1.0000 | 1.0750 (22a) |
| Effective ac    | 0.3569 | 0.3413 | 0.3413 | 0.3181 | 0.3181 | 0.2870 | 0.2870 | 0.2715 | 0.2948 | 0.3258 | 0.3103 | 0.3336 (22b) |
|                 | 0.5637 | 0.5583 | 0.5583 | 0.5506 | 0.5506 | 0.5412 | 0.5412 | 0.5369 | 0.5435 | 0.5531 | 0.5481 | 0.5556 (25)  |

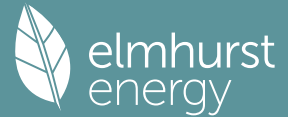
## 3. Heat losses and heat loss parameter

| Element                                                     | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K   |
|-------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|-----------------|
| Main dwelling                                               |                         |                            |                           |                               |              |                                |                 |
| Windows                                                     |                         |                            | 20.6100                   | 1.1450                        | 23.5992      |                                | (27)            |
| Roof Windows                                                |                         |                            | 8.8800                    | 1.1450                        | 10.1679      |                                | (27a)           |
| Door                                                        |                         |                            | 1.8900                    | 1.2000                        | 2.2680       |                                | (26)            |
| Heat Loss Floor                                             |                         |                            | 89.7000                   | 0.1100                        | 9.8670       | 110.0000                       | 9867.0000 (28a) |
| Cavity Wall                                                 | 139.7000                | 22.5000                    | 117.2000                  | 0.1800                        | 21.0960      | 60.0000                        | 7032.0000 (29a) |
| Stud Wall                                                   | 28.1000                 |                            | 28.1000                   | 0.1100                        | 3.0910       | 9.0000                         | 252.9000 (29a)  |
| Flat Roof                                                   | 23.5000                 | 6.0000                     | 17.5000                   | 0.1400                        | 2.4500       | 9.0000                         | 157.5000 (30)   |
| Plane Roof                                                  | 55.2000                 |                            | 55.2000                   | 0.1132                        | 6.2491       | 9.0000                         | 496.8000 (30)   |
| Slope Roof                                                  | 13.4000                 | 2.8800                     | 10.5200                   | 0.1300                        | 1.3676       | 9.0000                         | 94.6800 (30)    |
| Total net area of external elements Aum(A, m <sup>2</sup> ) |                         |                            | 349.6000                  |                               |              |                                | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                         |                         |                            |                           | (26)...(30) + (32) =          | 80.1558      |                                | (33)            |
| Main dwelling                                               |                         |                            |                           |                               |              |                                |                 |
| Party Wall                                                  |                         |                            | 72.7000                   | 0.0000                        | 0.0000       | 0.0000                         | 0.0000 (32)     |
| Internal Wall                                               |                         |                            | 216.2000                  |                               |              | 9.0000                         | 1945.8000 (32c) |
| Internal Ceiling                                            |                         |                            | 61.8000                   |                               |              | 9.0000                         | 556.2000 (32e)  |
| Internal Ceiling 2                                          |                         |                            | 34.1000                   |                               |              | 9.0000                         | 306.9000 (32e)  |

Heat capacity Cm = Sum(A x k)  
Thermal mass parameter (TMP = Cm / TFA) in kJ/m<sup>2</sup>K  
(28)...(30) + (32) + (32a)...(32e) = 20709.7800 (34)  
111.5829 (35)

|                                                  |         |           |        |
|--------------------------------------------------|---------|-----------|--------|
| List of Thermal Bridges                          | Length  | Psi-value | Total  |
| K1 Element                                       | 16.8000 | 0.0400    | 0.6720 |
| E2 Other lintels (including other steel lintels) | 15.9000 | 0.0300    | 0.4770 |
| E3 Sill                                          | 31.6000 | 0.0300    | 0.9480 |
| E4 Jamb                                          | 28.1000 | 0.0600    | 1.6860 |
| E5 Ground floor (normal)                         | 41.1000 | 0.0700    | 2.8770 |
| E6 Intermediate floor within a dwelling          | 15.4000 | 0.0900    | 1.3860 |
| E16 Corner (normal)                              | 15.4000 | 0.0600    | 0.9240 |
| E18 Party wall between dwellings                 | 6.2000  | 0.0800    | 0.4960 |
| R1 Head of roof window                           |         |           |        |

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|                                                            |         |                       |              |
|------------------------------------------------------------|---------|-----------------------|--------------|
| R2 Sill of roof window                                     | 6.2000  | 0.0600                | 0.3720       |
| R3 Jamb of roof window                                     | 11.2000 | 0.0800                | 0.8960       |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |         |                       | 10.7340 (36) |
| Point Thermal bridges                                      |         |                       | 0.0000       |
| Total fabric heat loss                                     |         | (33) + (36) + (36a) = | 90.8898 (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                                                 | 87.0589  | 86.2224  | 86.2224  | 85.0373  | 85.0373  | 83.5873  | 83.5873  | 82.9181  | 83.9359  | 85.4230  | 84.6609  | 85.8181 (38)  |
| Average = Sum(39)m / 12 =                                           | 177.9488 | 177.1122 | 177.1122 | 175.9271 | 175.9271 | 174.4771 | 174.4771 | 173.8079 | 174.8257 | 176.3129 | 175.5507 | 176.7079 (39) |
|                                                                     |          |          |          |          |          |          |          |          |          |          |          | 175.8489      |
| HLP                                                                 | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
| HLP (average)                                                       | 0.9588   | 0.9543   | 0.9543   | 0.9479   | 0.9479   | 0.9401   | 0.9401   | 0.9365   | 0.9419   | 0.9500   | 0.9459   | 0.9521 (40)   |
| Days in mont                                                        | 31       | 28       | 31       | 30       | 31       | 30       | 31       | 31       | 30       | 31       | 30       | 31            |

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

|                                                                                |          |          |          |          |          |          |          |          |          |          |          |                              |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------------------------------|
| Assumed occupancy                                                              |          |          |          |          |          |          |          |          |          |          |          | 2.9832 (42)                  |
| Hot water usage for mixer showers                                              |          |          |          |          |          |          |          |          |          |          |          |                              |
| 0.0000                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (42a)                        |
| Hot water usage for baths                                                      |          |          |          |          |          |          |          |          |          |          |          |                              |
| 85.6425                                                                        | 84.3706  | 82.5794  | 79.2769  | 76.8041  | 74.0621  | 72.5809  | 74.3595  | 76.2961  | 79.2302  | 82.6007  | 85.3529  | (42b)                        |
| Hot water usage for other uses                                                 |          |          |          |          |          |          |          |          |          |          |          |                              |
| 45.1804                                                                        | 43.5375  | 41.8946  | 40.2517  | 38.6087  | 36.9658  | 36.9658  | 38.6087  | 40.2517  | 41.8946  | 43.5375  | 45.1804  | (42c)                        |
| Average daily hot water use (litres/day)                                       |          |          |          |          |          |          |          |          |          |          |          | 120.4772 (43)                |
|                                                                                | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec                          |
| Daily hot water use                                                            | 130.8229 | 127.9081 | 124.4740 | 119.5286 | 115.4128 | 111.0279 | 109.5468 | 112.9683 | 116.5478 | 121.1247 | 126.1382 | 130.5334 (44)                |
| Energy conte                                                                   | 207.1915 | 182.1394 | 191.3120 | 163.6287 | 155.3678 | 136.5217 | 132.4873 | 139.8783 | 143.7150 | 164.3651 | 179.7070 | 204.3837 (45)                |
| Energy content (annual)                                                        |          |          |          |          |          |          |          |          |          |          |          | Total = Sum(45)m = 2000.6976 |
| Distribution loss (46)m = 0.15 x (45)m                                         |          |          |          |          |          |          |          |          |          |          |          |                              |
| 31.0787                                                                        | 27.3209  | 28.6968  | 24.5443  | 23.3052  | 20.4783  | 19.8731  | 20.9817  | 21.5573  | 24.6548  | 26.9560  | 30.6576  | (46)                         |
| Water storage loss:                                                            |          |          |          |          |          |          |          |          |          |          |          |                              |
| Store volume                                                                   |          |          |          |          |          |          |          |          |          |          |          | 300.0000 (47)                |
| a) If manufacturer declared loss factor is known (kWh/day):                    |          |          |          |          |          |          |          |          |          |          |          | 1.5900 (48)                  |
| Temperature factor from Table 2b                                               |          |          |          |          |          |          |          |          |          |          |          | 0.5400 (49)                  |
| Enter (49) or (54) in (55)                                                     |          |          |          |          |          |          |          |          |          |          |          | 0.8586 (55)                  |
| Total storage loss                                                             |          |          |          |          |          |          |          |          |          |          |          |                              |
| 26.6166                                                                        | 24.0408  | 26.6166  | 25.7580  | 26.6166  | 25.7580  | 26.6166  | 26.6166  | 25.7580  | 26.6166  | 25.7580  | 26.6166  | (56)                         |
| If cylinder contains dedicated solar storage                                   |          |          |          |          |          |          |          |          |          |          |          |                              |
| 26.6166                                                                        | 24.0408  | 26.6166  | 25.7580  | 26.6166  | 25.7580  | 26.6166  | 26.6166  | 25.7580  | 26.6166  | 25.7580  | 26.6166  | (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  | (59)                         |
| Combi loss                                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (61)                         |
| Total heat required for water heating calculated for each month                |          |          |          |          |          |          |          |          |          |          |          |                              |
| 257.0705                                                                       | 227.1914 | 241.1910 | 211.8987 | 205.2468 | 184.7917 | 182.3663 | 189.7573 | 191.9850 | 214.2441 | 227.9770 | 254.2627 | (62)                         |
| WWHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (63a)                        |
| PV diverter                                                                    | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | (63b)                        |
| Solar input                                                                    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (63c)                        |
| FGHRS                                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (63d)                        |
| Output from w/h                                                                | 257.0705 | 227.1914 | 241.1910 | 211.8987 | 205.2468 | 184.7917 | 182.3663 | 189.7573 | 191.9850 | 214.2441 | 227.9770 | 254.2627 (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                                       |          |          |          |          |          |          |          |          |          |          |          |                              |
| 108.7944                                                                       | 96.6029  | 103.5144 | 93.0225  | 91.5630  | 84.0095  | 83.9552  | 86.4127  | 86.4013  | 94.5546  | 98.3686  | 107.8608 | (65)                         |

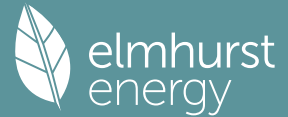
## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |           |           |           |           |           |           |           |           |           |           |           |               |
|-------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|---------------|
| 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     | 178.9890  | 178.9890  | 178.9890  | 178.9890  | 178.9890  | 178.9890  | 178.9890  | 178.9890  | 178.9890  | 178.9890  | 178.9890  | (66)          |
| 51.9195                                                                             | 46.1144   | 37.5028   | 28.3920   | 21.2234   | 17.9176   | 19.3607   | 25.1657   | 33.7774   | 42.8881   | 50.0568   | 53.3625   | (67)          |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 |           |           |           |           |           |           |           |           |           |           |           |               |
| 533.0527                                                                            | 538.5841  | 524.6452  | 494.9707  | 457.5120  | 422.3061  | 398.7864  | 393.2550  | 407.1940  | 436.8684  | 474.3271  | 509.5330  | (68)          |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    |           |           |           |           |           |           |           |           |           |           |           |               |
| 55.8821                                                                             | 55.8821   | 55.8821   | 55.8821   | 55.8821   | 55.8821   | 55.8821   | 55.8821   | 55.8821   | 55.8821   | 55.8821   | 55.8821   | (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    | (70)          |
| Losses e.g. evaporation (negative values) (Table 5)                                 |           |           |           |           |           |           |           |           |           |           |           |               |
| -119.3260                                                                           | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | -119.3260 | (71)          |
| Water heating gains (Table 5)                                                       |           |           |           |           |           |           |           |           |           |           |           |               |
| 146.2290                                                                            | 143.7544  | 139.1323  | 129.1980  | 123.0686  | 116.6798  | 112.8431  | 116.1462  | 120.0017  | 127.0895  | 136.6230  | 144.9742  | (72)          |
| Total internal gains                                                                | 849.7463  | 846.9980  | 819.8253  | 771.1057  | 720.3489  | 672.4486  | 646.5351  | 650.1119  | 676.5181  | 725.3911  | 779.5520  | 826.4147 (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    |           |           |                |
|-------------|-----------|-----------|-----------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|---------------|-----------|-----------|----------------|
| Northeast   |           |           |           | 10.6800    | 13.7804                        | 0.7600                            | 0.7000                             | 0.7700                       | 54.2598 (75)  |           |           |                |
| Southwest   |           |           |           | 7.2900     | 43.0593                        | 0.7600                            | 0.7000                             | 0.7700                       | 115.7282 (79) |           |           |                |
| Northwest   |           |           |           | 2.6400     | 13.7804                        | 0.7600                            | 0.7000                             | 0.7700                       | 13.4125 (81)  |           |           |                |
| Northeast   |           |           |           | 2.1600     | 21.4042                        | 0.7600                            | 0.7000                             | 1.0000                       | 22.1364 (82)  |           |           |                |
| Southwest   |           |           |           | 0.7200     | 45.8318                        | 0.7600                            | 0.7000                             | 1.0000                       | 15.7999 (82)  |           |           |                |
| Horizontal  |           |           |           | 6.0000     | 32.0000                        | 0.7600                            | 0.7000                             | 1.0000                       | 91.9296 (82)  |           |           |                |
| Solar gains | 313.2664  | 526.4122  | 852.1393  | 1308.0253  | 1603.6127                      | 1765.3541                         | 1651.8521                          | 1414.2183                    | 1067.1087     | 659.4501  | 372.7717  | 261.0608 (83)  |
| Total gains | 1163.0127 | 1373.4102 | 1671.9645 | 2079.1310  | 2323.9616                      | 2437.8027                         | 2298.3872                          | 2064.3301                    | 1743.6268     | 1384.8413 | 1152.3237 | 1087.4755 (84) |

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## 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                                                                         | 32.3279 | 32.4806 | 32.4806 | 32.6994 | 32.6994 | 32.9712 | 32.9712 | 33.0981 | 32.9054 | 32.6279 | 32.7695 | 32.5549      |
| alpha                                                                       | 3.1552  | 3.1654  | 3.1654  | 3.1800  | 3.1800  | 3.1981  | 3.1981  | 3.2065  | 3.1937  | 3.1752  | 3.1846  | 3.1703       |
| util living area                                                            | 0.9657  | 0.9427  | 0.8840  | 0.7503  | 0.5814  | 0.3876  | 0.2774  | 0.3143  | 0.5757  | 0.8401  | 0.9446  | 0.9711 (86)  |
| MIT                                                                         | 19.4429 | 19.6807 | 20.0791 | 20.5215 | 20.7700 | 20.8773 | 20.8972 | 20.8944 | 20.8086 | 20.4236 | 19.8609 | 19.4014 (87) |
| Th 2                                                                        | 20.1178 | 20.1216 | 20.1216 | 20.1270 | 20.1270 | 20.1336 | 20.1336 | 20.1366 | 20.1320 | 20.1252 | 20.1287 | 20.1234 (88) |
| util rest of house                                                          | 0.9605  | 0.9342  | 0.8674  | 0.7189  | 0.5356  | 0.3317  | 0.2139  | 0.2451  | 0.5136  | 0.8104  | 0.9349  | 0.9666 (89)  |
| MIT 2                                                                       | 18.2788 | 18.5806 | 19.0749 | 19.6064 | 19.8816 | 19.9918 | 20.0072 | 20.0089 | 19.9325 | 19.5053 | 18.8170 | 18.2306 (90) |
| Living area fraction                                                        | 18.7461 | 19.0222 | 19.4780 | 19.9737 | 20.2382 | 20.3473 | 20.3644 | 20.3644 | 20.2842 | 19.8739 | 19.2360 | 18.7006 (91) |
| MIT                                                                         | 18.7461 | 19.0222 | 19.4780 | 19.9737 | 20.2382 | 20.3473 | 20.3644 | 20.3644 | 20.2842 | 19.8739 | 19.2360 | 18.7006 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | -0.1500      |
| adjusted MIT                                                                | 18.5961 | 18.8722 | 19.3280 | 19.8237 | 20.0882 | 20.1973 | 20.2144 | 20.2144 | 20.1342 | 19.7239 | 19.0860 | 18.5506 (93) |

## 8. Space heating requirement

|                                                                                |           |           |           |           |           |          |          |          |          |               |           |                 |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|---------------|-----------|-----------------|
|                                                                                | Jan       | Feb       | Mar       | Apr       | May       | Jun      | Jul      | Aug      | Sep      | Oct           | Nov       | Dec             |
| Utilisation                                                                    | 0.9488    | 0.9193    | 0.8500    | 0.7071    | 0.5334    | 0.3359   | 0.2199   | 0.2515   | 0.5138   | 0.7947        | 0.9202    | 0.9561 (94)     |
| Useful gains                                                                   | 1103.4092 | 1262.5467 | 1421.1986 | 1470.1147 | 1239.6990 | 818.8049 | 505.3161 | 519.0894 | 895.8108 | 1100.5975     | 1060.3618 | 1039.6872 (95)  |
| Ext temp.                                                                      | 4.7000    | 5.3000    | 7.0000    | 9.5000    | 12.4000   | 15.4000  | 17.3000  | 17.2000  | 14.6000  | 11.1000       | 7.6000    | 4.7000 (96)     |
| Heat loss rate W                                                               | 2472.7869 | 2403.7964 | 2183.4318 | 1816.2236 | 1352.5588 | 837.0110 | 508.5025 | 523.9193 | 967.5215 | 1520.5085     | 2016.3813 | 2447.5069 (97)  |
| Space heating kWh                                                              | 1018.8170 | 766.9198  | 567.1015  | 249.1984  | 83.9677   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 312.4138      | 688.3340  | 1047.4178 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |           |          |          |          |          |               |           | 4734.1701       |
| 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                                                              | 1018.8170 | 766.9198  | 567.1015  | 249.1984  | 83.9677   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 312.4138      | 688.3340  | 1047.4178 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |           |          |          |          |          |               |           | 4734.1701       |
| Space heating per m2                                                           |           |           |           |           |           |          |          |          |          | (98c) / (4) = |           | 25.5074 (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                                                                            | 1018.8170 | 766.9198  | 567.1015  | 249.1984  | 83.9677   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 312.4138  | 688.3340  | 1047.4178 (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)                                                             | 1147.3165 | 863.6485  | 638.6278  | 280.6288  | 94.5582   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 351.8174  | 775.1509  | 1179.5246 (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                                                                            | 257.0705  | 227.1914  | 241.1910  | 211.8987  | 205.2468  | 184.7917  | 182.3663  | 189.7573  | 191.9850  | 214.2441  | 227.9770  | 254.2627 (64)   |                  |
| Efficiency of water heater (217)m                                                                    | 86.8270   | 86.5687   | 85.9089   | 84.4243   | 82.2193   | 79.8000   | 79.8000   | 79.8000   | 79.8000   | 84.9046   | 86.3763   | 86.8859 (216)   |                  |
| Fuel for water heating, kWh/month                                                                    | 296.0722  | 262.4406  | 280.7522  | 250.9924  | 249.6333  | 231.5686  | 228.5292  | 237.7911  | 240.5828  | 252.3351  | 263.9347  | 292.6398 (219)  |                  |
| Space cooling fuel requirement                                                                       |           |           |           |           |           |           |           |           |           |           |           |                 |                  |
| (221)m                                                                                               | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000 (221)    |                  |
| Pumps and Fa                                                                                         | 7.3041    | 6.5973    | 7.3041    | 7.0685    | 7.3041    | 7.0685    | 7.3041    | 7.3041    | 7.0685    | 7.3041    | 7.0685    | 7.3041 (231)    |                  |
| Lighting                                                                                             | 45.4448   | 36.4575   | 32.8259   | 24.0497   | 18.5767   | 15.1773   | 16.9463   | 22.0274   | 28.6114   | 37.5397   | 42.4010   | 46.7079 (232)   |                  |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |           |           |           |           |           |           |           |           |           |           |           |                 |                  |
| (233a)m                                                                                              | -104.2013 | -127.9525 | -173.3124 | -183.7198 | -184.7961 | -169.3012 | -166.7320 | -164.1137 | -156.4386 | -144.2145 | -108.2265 | -91.2688 (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                                                                                              | -99.8293  | -177.8810 | -356.5605 | -564.7293 | -724.4677 | -781.2785 | -759.9244 | -656.9105 | -473.5016 | -275.5209 | -126.1271 | -79.0494 (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                                                                   |           |           |           |           |           |           |           |           |           |           |           |                 | 5331.2726 (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                                                                              |           |           |           |           |           |           |           |           |           |           |           |                 | 3087.2719 (219)  |
| Space cooling fuel                                                                                   |           |           |           |           |           |           |           |           |           |           |           |                 | 0.0000 (221)     |
| Electricity for pumps and fans:                                                                      |           |           |           |           |           |           |           |           |           |           |           |                 |                  |
| central heating pump                                                                                 |           |           |           |           |           |           |           |           |           |           |           |                 | 41.0000 (230c)   |
| main heating flue fan                                                                                |           |           |           |           |           |           |           |           |           |           |           |                 | 45.0000 (230e)   |
| Total electricity for the above, kWh/year                                                            |           |           |           |           |           |           |           |           |           |           |           |                 | 86.0000 (231)    |
| Electricity for lighting (calculated in Appendix L)                                                  |           |           |           |           |           |           |           |           |           |           |           |                 | 366.7656 (232)   |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |           |           |           |           |           |           |           |           |           |           |           |                 |                  |
| PV generation                                                                                        |           |           |           |           |           |           |           |           |           |           |           |                 | -6850.0579 (233) |
| Wind generation                                                                                      |           |           |           |           |           |           |           |           |           |           |           |                 | 0.0000 (234)     |

# Full SAP Calculation Printout



|                                                |                 |
|------------------------------------------------|-----------------|
| 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            | 2021.2522 (238) |

## 10a. Fuel costs - using BEDF prices (567)

|                                             | Fuel<br>kWh/year | Fuel price<br>p/kWh | Fuel cost<br>£/year |
|---------------------------------------------|------------------|---------------------|---------------------|
| Space heating - main system 1               | 5331.2726        | 5.6000              | 298.5513 (240)      |
| Total CO2 associated with community systems |                  |                     | 0.0000 (473)        |
| Water heating (other fuel)                  | 3087.2719        | 5.6000              | 172.8872 (247)      |
| Energy for instantaneous electric shower(s) | 0.0000           | 26.0600             | 0.0000 (247a)       |
| Pumps, fans and electric keep-hot           | 86.0000          | 26.0600             | 22.4116 (249)       |
| Energy for lighting                         | 366.7656         | 26.0600             | 95.5791 (250)       |
| Additional standing charges                 |                  |                     | 99.0000 (251)       |
| Energy saving/generation technologies       |                  |                     |                     |
| PV Unit electricity used in dwelling        | -1774.2776       | 26.0600             | -462.3767           |
| PV Unit electricity exported                | -5075.7803       | 5.8100              | -294.9028           |
| Total                                       |                  |                     | -757.2796 (252)     |
| Total energy cost                           |                  |                     | -68.8504 (255)      |

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

|                                             | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|---------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1               | 5331.2726          | 0.2100                        | 1119.5673 (261)          |
| Total CO2 associated with community systems |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                  | 3087.2719          | 0.2100                        | 648.3271 (264)           |
| Space and water heating                     |                    |                               | 1767.8944 (265)          |
| Pumps, fans and electric keep-hot           | 86.0000            | 0.1387                        | 11.9293 (267)            |
| Energy for lighting                         | 366.7656           | 0.1443                        | 52.9356 (268)            |
| Energy saving/generation technologies       |                    |                               |                          |
| PV Unit electricity used in dwelling        | -1774.2776         | 0.1363                        | -241.7609                |
| PV Unit electricity exported                | -5075.7803         | 0.1254                        | -636.4385                |
| Total                                       |                    |                               | -878.1993 (269)          |
| Total CO2, kg/year                          |                    |                               | 954.5599 (272)           |

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

|                                             | Energy<br>kWh/year | Primary energy factor<br>kg CO2/kWh | Primary energy<br>kWh/year |
|---------------------------------------------|--------------------|-------------------------------------|----------------------------|
| Space heating - main system 1               | 5331.2726          | 1.1300                              | 6024.3381 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 3087.2719          | 1.1300                              | 3488.6173 (278)            |
| Space and water heating                     |                    |                                     | 9512.9554 (279)            |
| Pumps, fans and electric keep-hot           | 86.0000            | 1.5128                              | 130.1008 (281)             |
| Energy for lighting                         | 366.7656           | 1.5338                              | 562.5573 (282)             |
| Energy saving/generation technologies       |                    |                                     |                            |
| PV Unit electricity used in dwelling        | -1774.2776         | 1.5037                              | -2667.9340                 |
| PV Unit electricity exported                | -5075.7803         | 0.4602                              | -2335.6990                 |
| Total                                       |                    |                                     | -5003.6330 (283)           |
| Total Primary energy kWh/year               |                    |                                     | 5201.9804 (286)            |