

# Energy Report

|                  |                                                            |
|------------------|------------------------------------------------------------|
| Dwelling Address | Bluestone Drive, 9, Stockport, Greater Manchester, SK4 3PX |
| Reference        | Plot 01 Church Lane, Middleton-Church Lane, Middleton      |
| Assessment Date  | 03/06/2025                                                 |
| Submission Date  |                                                            |
| Property Type    | House, Detached                                            |
| Total Floor Area | 164                                                        |

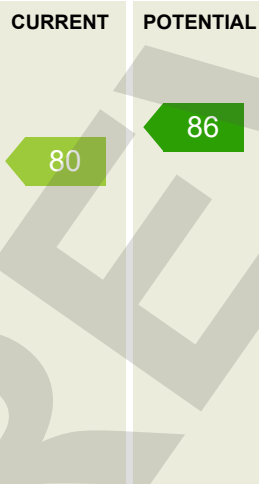
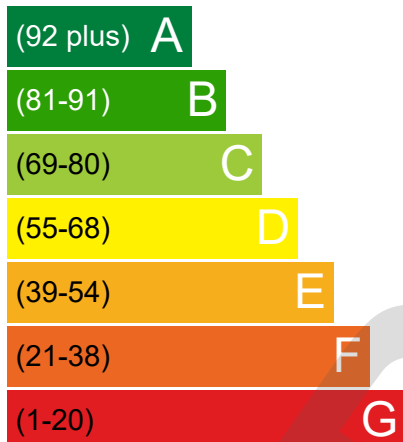
This Energy Report has been generated using the UK's National Calculation Methodology for dwellings, Standard Assessment Procedure (SAP). This methodology is used to assess the energy efficiency of dwellings which is calculated based on a dwelling's heating, hot water, ventilation and lighting usage.

This document is not an Energy Performance Certificate (EPC) as required by the Energy Performance of Buildings Regulations

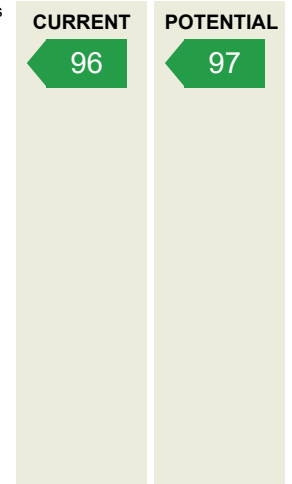
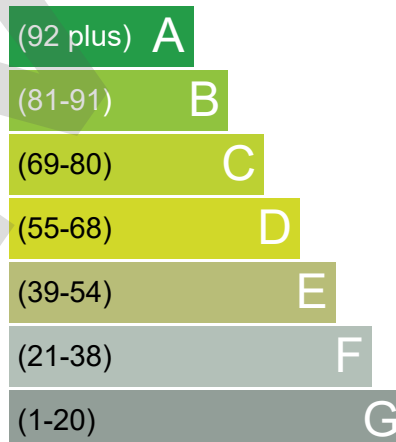
## Energy Efficiency Rating

## Carbon Dioxide (CO<sub>2</sub>) Emissions Rating

Most energy efficient - lower running costs



Very environmentally friendly - lower CO<sub>2</sub> emissions



## Additional ratings for your home

|           | Primary Energy | Energy   | Carbon | Cost      | HTC     |
|-----------|----------------|----------|--------|-----------|---------|
| CURRENT   | 38.90 kWh      | 4110 kWh | 615 kg | 1071.08 £ | 188 W/K |
| POTENTIAL | 28.19 kWh      | 2926 kWh | 459 kg | 762.51 £  | 188 W/K |

## Breakdown of property's energy performance

Each feature is assessed as one of the following:

|           |      |         |      |           |
|-----------|------|---------|------|-----------|
| Very Poor | Poor | Average | Good | Very Good |
|-----------|------|---------|------|-----------|

| Feature               | Description                                                              | Energy Performance |
|-----------------------|--------------------------------------------------------------------------|--------------------|
| Walls                 | Average thermal transmittance 0.18 W/m <sup>2</sup> K                    | Very Good          |
| Roof                  | Average thermal transmittance 0.16 W/m <sup>2</sup> K                    | Very Good          |
| Floor                 | Average thermal transmittance 0.12 W/m <sup>2</sup> K                    | Very Good          |
| Windows               | High performance glazing                                                 | Good               |
| Main heating          | Air source heat pump, radiators and underfloor, electric                 | Good               |
| Main heating controls | Time and temperature zone control                                        | Very Good          |
| Secondary heating     | None                                                                     |                    |
| Hot water             | From main system                                                         | Average            |
| Lighting              | Good lighting efficiency                                                 | Good               |
| Air tightness         | Air permeability [AP50] = 5.0 m <sup>3</sup> /h.m <sup>2</sup> (assumed) | Good               |

## Recommendations

The recommended measures provided below will help to improve the energy efficiency of the dwelling. To reach the dwelling's potential energy rating all of the recommended measures shown below would need to be installed. Having these measures installed individually or in any other order may give a different result when compared with the cumulative potential rating.

| Recommended measures | Cumulative savings (per year) | Cumulative rating | Typical costs   | Incremental savings (per year) | Cumulative CO2 rating |
|----------------------|-------------------------------|-------------------|-----------------|--------------------------------|-----------------------|
| Solar water heating  | £71                           | B 81              | £4,000 - £6,000 | £71                            | A 96                  |
| Photovoltaic         | £309                          | B 86              | £3,500 - £5,500 | £238                           | A 97                  |

The typical cost is based on average installation prices across the country so may not be representative of the actual costs in your area.

## Estimated energy costs of the dwelling

The table below shows the estimated running costs of the space and water heating and lighting within the dwelling. It does not include the energy used from household appliances. The estimated annual costs after potential improvements indicates the total energy cost if all recommended measures named above were installed.

|                                                                                             | Estimated annual costs | Estimated annual costs after potential improvements | Potential future savings                                                             |
|---------------------------------------------------------------------------------------------|------------------------|-----------------------------------------------------|--------------------------------------------------------------------------------------|
| Lighting   | £77                    | £77                                                 |  |
| Heating    | £571                   | £592                                                |                                                                                      |
| Hot Water  | £423                   | £331                                                |                                                                                      |
| New Technologies e.g. Impact of PV                                                          | £0                     | -(£238)                                             |                                                                                      |
| TOTAL                                                                                       | £1071                  | £763                                                |                                                                                      |

## Estimated energy use and potential savings



Space Heating  
**2191**  
kWh per year



Water Heating  
**1625**  
kWh per year

## About this document

Created by:  
Company/Trading name:  
Phone number:  
Email address:

### Disclaimer

This Energy Report should not under any circumstances be treated as a Condition Survey and cannot be used to indicate that any element of the dwelling (e.g. heating system) is working correctly.

This Energy Report must not be used in situations where an Energy Performance Certificate (EPC) is required.

This Energy Report is generated from a set of data inputs which may not reflect the actual dimensions, services or construction of the dwelling.

The calculation used to generate this report reflects the SAP Methodology current at the time of report generation.

## Glossary terms for additional metrics

|                           |                                                                                                                                                                                                                                                                       |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Primary Energy            | The measure of the energy required for lighting, heating and hot water in a property. This includes the efficiency of the property's heating system, power station efficiency for electricity and the energy used to produce the fuel and deliver it to the property. |
| Energy Used               | The estimated amount of fuel energy for lighting, heating and hot water for the property. The estimate is based on typical usage which is likely to be different to actual consumption.                                                                               |
| Carbon (CO <sub>2</sub> ) | The current emissions based on the energy estimates.                                                                                                                                                                                                                  |
| Cost                      | The estimated cost of energy. The cost of each unit of fuel is based on an industry standard which is likely to be different to those the occupier actually pays.                                                                                                     |
| Heat Transfer Coefficient | Heat flow through the property envelope where internal and external temperatures are different.                                                                                                                                                                       |

# Predicted Energy Assessment



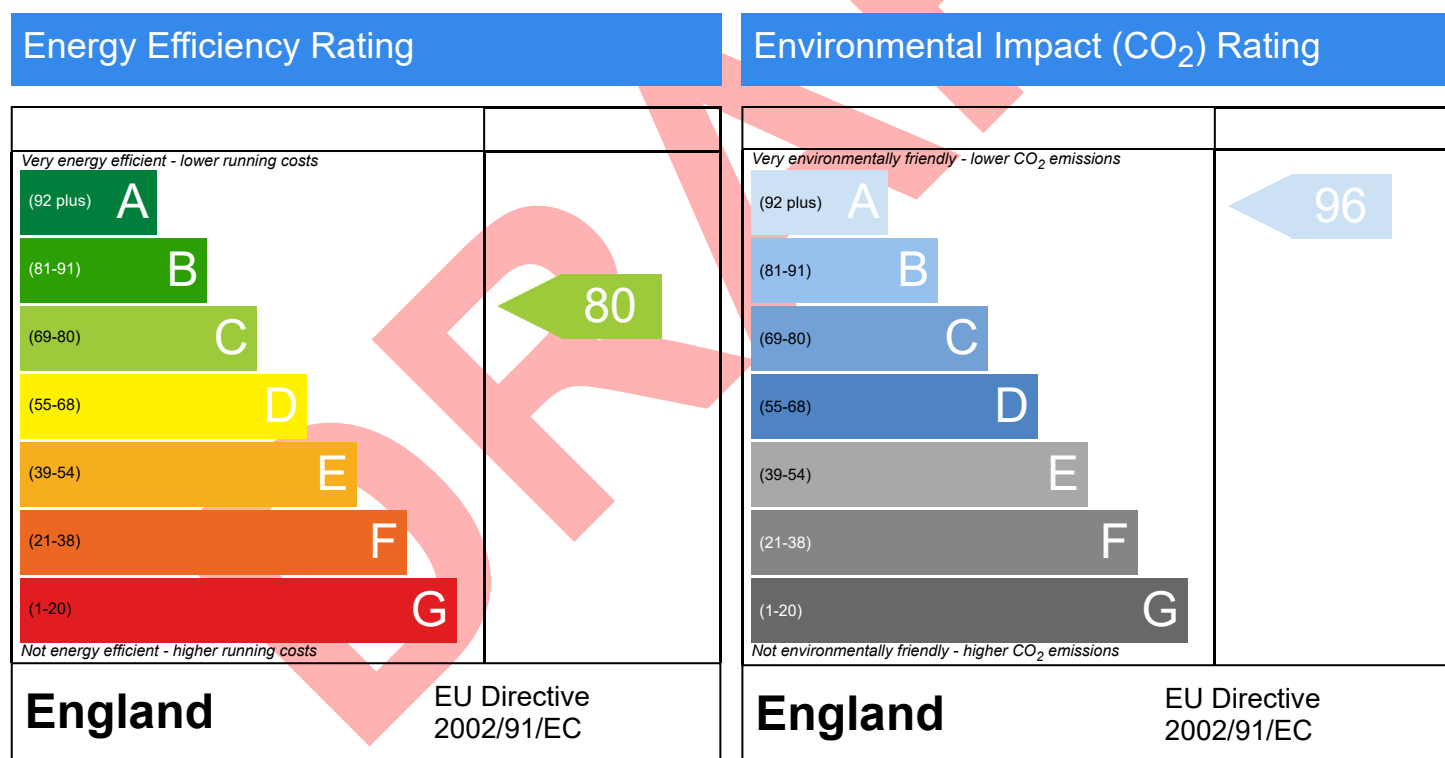
Bluestone Drive, 9, Stockport, Greater Manchester, SK4 3PX

Dwelling type:  
Date of assessment:  
Produced by:  
Total floor area:  
DRRN:

House, Detached  
10/06/2025  
Daniel Watt  
164.15 m<sup>2</sup>

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

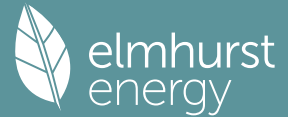
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO<sub>2</sub>) emissions.



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO<sub>2</sub>) emissions. The higher the rating the less impact it has on the environment.

# Full SAP Calculation Printout



|                                    |                                                            |               |       |                        |                |            |
|------------------------------------|------------------------------------------------------------|---------------|-------|------------------------|----------------|------------|
| Property Reference                 | Plot 01 Church Lane, Middleton                             |               |       |                        | Issued on Date | 10/06/2025 |
| Assessment Reference               | Church Lane,Middleton                                      | Prop Type Ref |       | Church Lane, Middleton |                |            |
| Property                           | Bluestone Drive, 9, Stockport, Greater Manchester, SK4 3PX |               |       |                        |                |            |
|                                    |                                                            |               |       |                        |                |            |
| SAP Rating                         | 80 C                                                       | DER           | 4.07  | TER                    | 10.89          |            |
| Environmental                      | 96 A                                                       | % DER < TER   |       |                        |                | 62.63      |
| CO <sub>2</sub> Emissions (t/year) | 0.62                                                       | DFEE          | 43.21 | TFEE                   | 43.74          |            |
| Compliance Check                   | See BREL                                                   | % DFEE < TFEE |       |                        |                | 1.20       |
| % DPER < TPER                      | 26.02                                                      | DPER          | 42.25 | TPER                   | 57.11          |            |
|                                    |                                                            |               |       |                        |                |            |
| Assessor Details                   | Mr. Daniel Watt                                            |               |       |                        | Assessor ID    | AV75-0001  |
| 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                                           | 58.1600 (1b)              | x 2.4000 (2b)                   | = 139.5840 (1b) - (3b)      |
| First floor                                            | 56.8200 (1c)              | x 2.6000 (2c)                   | = 147.7320 (1c) - (3c)      |
| Second floor                                           | 49.1700 (1d)              | x 2.9000 (2d)                   | = 142.5930 (1d) - (3d)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 164.1500                  |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 429.9090 (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) =             | 0.0930 (8)   |
| Pressure test                                                                                    | Yes                         |              |
| Pressure Test Method                                                                             | Blower Door                 |              |
| Measured/design AP50                                                                             | 5.0000                      | (17)         |
| Infiltration rate                                                                                | 0.3430                      | (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) =        | 0.3173 (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 | 0.4046 | 0.3966 | 0.3887 | 0.3490 | 0.3411 | 0.3014 | 0.3014 | 0.2935 | 0.3173 | 0.3411 | 0.3570 | 0.3728 (22b) |
| Effective ac    | 0.5818 | 0.5787 | 0.5755 | 0.5609 | 0.5582 | 0.5454 | 0.5454 | 0.5431 | 0.5503 | 0.5582 | 0.5637 | 0.5695 (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                                                  |                         |                            |                           |                               |              |                                      |                  |
| Door                                                           |                         |                            | 2.0000                    | 1.3000                        | 2.6000       |                                      | (26)             |
| Window                                                         |                         |                            | 28.0400                   | 1.2357                        | 34.6502      |                                      | (27)             |
| Roof Light                                                     |                         |                            | 2.4000                    | 1.2357                        | 2.9658       |                                      | (27a)            |
| Heatloss Floor 1                                               |                         |                            | 58.1600                   | 0.1200                        | 6.9792       | 110.0000                             | 6397.6000 (28a)  |
| External Wall                                                  | 233.4600                | 30.0400                    | 203.4200                  | 0.1800                        | 36.6156      | 140.0000                             | 28478.8009 (29a) |
| External Roof                                                  | 61.4600                 | 2.4000                     | 59.0600                   | 0.1600                        | 9.4496       | 9.0000                               | 531.5400 (30)    |
| Total net area of external elements Aum(A, m <sup>2</sup> )    |                         |                            | 353.0800                  |                               |              |                                      | (31)             |
| Fabric heat loss, W/K = Sum (A x U)                            |                         |                            |                           | (26)...(30) + (32) =          | 93.2604      |                                      | (33)             |
| Main dwelling                                                  |                         |                            |                           |                               |              |                                      |                  |
| Internal Wall                                                  |                         |                            | 234.2200                  |                               |              | 100.0000                             | 23422.0001 (32c) |
| Internal Floor                                                 |                         |                            | 56.8200                   |                               |              | 18.0000                              | 1022.7600 (32d)  |
| Internal Floor                                                 |                         |                            | 49.1700                   |                               |              | 18.0000                              | 885.0600 (32d)   |
| Internal Ceiling                                               |                         |                            | 56.8200                   |                               |              | 9.0000                               | 511.3800 (32e)   |
| Internal Ceiling                                               |                         |                            | 49.1700                   |                               |              | 9.0000                               | 442.5300 (32e)   |
| Heat capacity Cm = Sum(A x k)                                  |                         |                            |                           |                               |              | (28)...(30) + (32) + (32a)...(32e) = | 61691.6711 (34)  |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K |                         |                            |                           |                               |              |                                      | 375.8250 (35)    |
| List of Thermal Bridges                                        |                         |                            |                           |                               |              |                                      |                  |

# Full SAP Calculation Printout



|                                                                  |         |                       |                |
|------------------------------------------------------------------|---------|-----------------------|----------------|
| K1 Element                                                       | Length  | Psi-value             | Total          |
| E2 Other lintels (including other steel lintels)                 | 20.6000 | 0.0300                | 0.6180         |
| E3 Sill                                                          | 19.6500 | 0.0400                | 0.7860         |
| E4 Jamb                                                          | 56.2000 | 0.0500                | 2.8100         |
| E5 Ground floor (normal)                                         | 32.0100 | 0.1600                | 5.1216         |
| E6 Intermediate floor within a dwelling                          | 40.7000 | 0.0010                | 0.0407         |
| E16 Corner (normal)                                              | 44.6000 | 0.0900                | 4.0140         |
| E17 Corner (inverted - internal area greater than external area) | 13.0000 | -0.0900               | -1.1700        |
| E11 Eaves (insulation at rafter level)                           | 13.4000 | 0.0400                | 0.5360         |
| E13 Gable (insulation at rafter level)                           | 26.4800 | 0.0400                | 1.0592         |
| R1 Head of roof window                                           | 3.2000  | 0.0800                | 0.2560         |
| R2 Sill of roof window                                           | 3.2000  | 0.0600                | 0.1920         |
| R3 Jamb of roof window                                           | 6.0000  | 0.0800                | 0.4800         |
| R4 Ridge (vaulted ceiling)                                       | 14.7000 | 0.0500                | 0.7350         |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)       |         |                       | 15.4785 (36)   |
| Point Thermal bridges                                            |         |                       | (36a) = 0.0000 |
| Total fabric heat loss                                           |         | (33) + (36) + (36a) = | 108.7389 (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                                                 | 82.5458  | 82.0949  | 81.6530  | 79.5772  | 79.1889  | 77.3810  | 77.3810  | 77.0462  | 78.0773  | 79.1889  | 79.9745  | 80.7959       |
| Average = Sum(39)m / 12 =                                           | 191.2846 | 190.8338 | 190.3918 | 188.3161 | 187.9277 | 186.1198 | 186.1198 | 185.7850 | 186.8162 | 187.9277 | 188.7134 | 189.5348      |
|                                                                     |          |          |          |          |          |          |          |          |          |          |          | 188.3142 (39) |

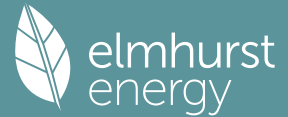
|               |        |        |        |        |        |        |        |        |        |        |        |             |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------------|
| HLP           | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec         |
| HLP (average) | 1.1653 | 1.1626 | 1.1599 | 1.1472 | 1.1449 | 1.1338 | 1.1338 | 1.1318 | 1.1381 | 1.1449 | 1.1496 | 1.1546      |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31          |
|               |        |        |        |        |        |        |        |        |        |        |        | 1.1472 (40) |

|                                                                 |          |          |          |          |          |          |          |          |          |                                        |          |                                                                                             |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------------------------------|----------|---------------------------------------------------------------------------------------------|
| 4. Water heating energy requirements (kWh/year)                 |          |          |          |          |          |          |          |          |          |                                        |          |                                                                                             |
| Assumed occupancy                                               |          |          |          |          |          |          |          |          |          |                                        |          | 2.9547 (42)                                                                                 |
| Hot water usage for mixer showers                               |          |          |          |          |          |          |          |          |          |                                        |          |                                                                                             |
|                                                                 | 71.8962  | 70.7955  | 69.1733  | 66.6779  | 64.4420  | 61.3141  | 58.8401  | 61.7323  | 63.1870  | 66.2851                                | 69.5115  | 71.8314 (42a)                                                                               |
| Hot water usage for baths                                       |          |          |          |          |          |          |          |          |          |                                        |          |                                                                                             |
|                                                                 | 31.1325  | 30.6625  | 29.9939  | 28.9927  | 28.0904  | 26.8482  | 25.9058  | 27.0582  | 27.6630  | 28.8938                                | 30.1734  | 31.1078 (42b)                                                                               |
| Hot water usage for other uses                                  |          |          |          |          |          |          |          |          |          |                                        |          |                                                                                             |
|                                                                 | 44.8887  | 43.2563  | 41.6240  | 39.9917  | 38.3594  | 36.7271  | 36.7271  | 38.3594  | 39.9917  | 41.6240                                | 43.2563  | 44.8887 (42c)                                                                               |
| Average daily hot water use (litres/day)                        |          |          |          |          |          |          |          |          |          |                                        |          | 135.9578 (43)                                                                               |
|                                                                 |          |          |          |          |          |          |          |          |          |                                        |          |                                                                                             |
| Daily hot water use                                             | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct                                    | Nov      | Dec                                                                                         |
|                                                                 | 147.9174 | 144.7144 | 140.7913 | 135.6623 | 130.8918 | 124.8894 | 121.4730 | 127.1499 | 130.8417 | 136.8029                               | 142.9413 | 147.8278 (44)                                                                               |
| Energy conte                                                    | 217.7599 | 191.4864 | 201.1879 | 177.2089 | 168.6673 | 144.4304 | 134.2312 | 149.6578 | 151.7698 | 176.2844                               | 193.1899 | 217.0960 (45)                                                                               |
| Energy content (annual)                                         |          |          |          |          |          |          |          |          |          | Total = Sum(45)m =                     |          | 2122.9699                                                                                   |
| Distribution loss (46)m = 0.15 x (45)m                          |          |          |          |          |          |          |          |          |          |                                        |          |                                                                                             |
|                                                                 | 32.6640  | 28.7230  | 30.1782  | 26.5813  | 25.3001  | 21.6646  | 20.1347  | 22.4487  | 22.7655  | 26.4427                                | 28.9785  | 32.5644 (46)                                                                                |
| Water storage loss:                                             |          |          |          |          |          |          |          |          |          |                                        |          |                                                                                             |
| Store volume                                                    |          |          |          |          |          |          |          |          |          |                                        |          | 300.0000 (47)                                                                               |
| b) If manufacturer declared loss factor is not known :          |          |          |          |          |          |          |          |          |          |                                        |          |                                                                                             |
| Hot water storage loss factor from Table 2 (kWh/litre/day)      |          |          |          |          |          |          |          |          |          |                                        |          | 0.0103 (51)                                                                                 |
| Volume factor from Table 2a                                     |          |          |          |          |          |          |          |          |          |                                        |          | 0.7368 (52)                                                                                 |
| Temperature factor from Table 2b                                |          |          |          |          |          |          |          |          |          |                                        |          | 0.5400 (53)                                                                                 |
| Enter (49) or (54) in (55)                                      |          |          |          |          |          |          |          |          |          |                                        |          | 1.2281 (55)                                                                                 |
| Total storage loss                                              |          |          |          |          |          |          |          |          |          |                                        |          |                                                                                             |
|                                                                 | 38.0698  | 34.3856  | 38.0698  | 36.8417  | 38.0698  | 36.8417  | 38.0698  | 38.0698  | 36.8417  | 38.0698                                | 36.8417  | 38.0698 (56)                                                                                |
| If cylinder contains dedicated solar storage                    |          |          |          |          |          |          |          |          |          |                                        |          |                                                                                             |
|                                                                 | 38.0698  | 34.3856  | 38.0698  | 36.8417  | 38.0698  | 36.8417  | 38.0698  | 38.0698  | 36.8417  | 38.0698                                | 36.8417  | 38.0698 (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 |          |          |          |          |          |          |          |          |          |                                        |          |                                                                                             |
|                                                                 | 279.0921 | 246.8832 | 262.5201 | 236.5626 | 229.9995 | 203.7841 | 195.5634 | 210.9900 | 211.1236 | 237.6166                               | 252.5436 | 278.4282 (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                                                 |          |          |          |          |          |          |          |          |          |                                        |          |                                                                                             |
|                                                                 | 279.0921 | 246.8832 | 262.5201 | 236.5626 | 229.9995 | 203.7841 | 195.5634 | 210.9900 | 211.1236 | 237.6166                               | 252.5436 | 278.4282 (64)                                                                               |
|                                                                 |          |          |          |          |          |          |          |          |          | Total per year (kWh/year) = Sum(64)m = |          | 2845.1070 (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                        |          |          |          |          |          |          |          |          |          |                                        |          |                                                                                             |
|                                                                 | 121.4709 | 107.9867 | 115.9607 | 106.4049 | 105.1476 | 95.5061  | 93.6976  | 98.8270  | 97.9465  | 107.6803                               | 111.7186 | 121.2502 (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     | 177.2795  | 177.2795  | 177.2795  | 177.2795  | 177.2795  | 177.2795  | 177.2795  | 177.2795  | 177.2795  | 177.2795  | 177.2795  | 177.2795 (66)  |
|                                                                                     | 41.6966   | 37.0346   | 30.1185   | 22.8017   | 17.0445   | 14.3897   | 15.5486   | 20.2106   | 27.1267   | 34.4435   | 40.2007   | 42.8555 (67)   |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 500.7977  | 505.9944  | 492.8989  | 465.0200  | 429.8279  | 396.7524  | 374.6558  | 369.4591  | 382.5547  | 410.4335  | 445.6256  | 478.7012 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 55.6826   | 55.6826   | 55.6826   | 55.6826   | 55.6826   | 55.6826   | 55.6826   | 55.6826   | 55.6826   | 55.6826   | 55.6826   | 55.6826 (69)   |
| Pumps, fans                                                                         | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000 (70)    |
| Losses e.g. evaporation (negative values) (Table 5)                                 |           |           |           |           |           |           |           |           |           |           |           |                |
|                                                                                     | -118.1863 | -118.1863 | -118.1863 | -118.1863 | -118.1863 | -118.1863 | -118.1863 | -118.1863 | -118.1863 | -118.1863 | -118.1863 | -118.1863 (71) |
| Water heating gains (Table 5)                                                       |           |           |           |           |           |           |           |           |           |           |           |                |
|                                                                                     | 163.2674  | 160.6945  | 155.8612  | 147.7846  | 141.3275  | 132.6473  | 125.9377  | 132.8319  | 136.0367  | 144.7316  | 155.1648  | 162.9707 (72)  |
| Total internal gains                                                                | 820.5375  | 818.4993  | 793.6544  | 750.3821  | 702.9757  | 658.5652  | 630.9179  | 637.2775  | 660.4939  | 704.3845  | 755.7669  | 799.3032 (73)  |

|                |      |  |            |  |               |  |               |  |          |  |       |  |
|----------------|------|--|------------|--|---------------|--|---------------|--|----------|--|-------|--|
| 6. Solar gains |      |  |            |  |               |  |               |  |          |  |       |  |
| [Jan]          |      |  |            |  |               |  |               |  |          |  |       |  |
|                | Area |  | Solar flux |  | g             |  | FF            |  | Access   |  | Gains |  |
|                | m2   |  | Table 6a   |  | Specific data |  | Specific data |  | factor   |  | W     |  |
|                |      |  | W/m2       |  | or Table 6b   |  | or Table 6c   |  | Table 6d |  |       |  |

# Full SAP Calculation Printout



|       |  |  |         |  |         |  |        |  |        |  |        |  |              |
|-------|--|--|---------|--|---------|--|--------|--|--------|--|--------|--|--------------|
| North |  |  | 2.3500  |  | 10.6334 |  | 0.7000 |  | 0.7000 |  | 0.7700 |  | 8.4853 (74)  |
| East  |  |  | 12.5500 |  | 19.6403 |  | 0.7000 |  | 0.7000 |  | 0.7700 |  | 83.6990 (76) |
| South |  |  | 4.7900  |  | 46.7521 |  | 0.7000 |  | 0.7000 |  | 0.7700 |  | 76.0441 (78) |
| West  |  |  | 8.3500  |  | 19.6403 |  | 0.7000 |  | 0.7000 |  | 0.7700 |  | 55.6882 (80) |
| North |  |  | 2.4000  |  | 26.0000 |  | 0.7000 |  | 0.7000 |  | 1.0000 |  | 27.5184 (82) |

|             |           |           |           |           |           |           |           |           |           |           |           |           |      |
|-------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------|
| Solar gains | 251.4351  | 470.5811  | 736.8541  | 1037.2337 | 1252.2980 | 1276.9427 | 1217.5348 | 1055.9776 | 842.8308  | 547.0332  | 309.3326  | 209.6346  | (83) |
| Total gains | 1071.9726 | 1289.0804 | 1530.5085 | 1787.6159 | 1955.2737 | 1935.5079 | 1848.4527 | 1693.2551 | 1503.3247 | 1251.4176 | 1065.0995 | 1008.9377 | (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                                                                         | 89.5868 | 89.7984 | 90.0069 | 90.9990 | 91.1870 | 92.0728 | 92.0728 | 92.2387 | 91.7296 | 91.1870 | 90.8074 | 90.4139 |              |
| alpha                                                                       | 6.9725  | 6.9866  | 7.0005  | 7.0666  | 7.0791  | 7.1382  | 7.1382  | 7.1492  | 7.1153  | 7.0791  | 7.0538  | 7.0276  |              |
| util living area                                                            | 0.9997  | 0.9987  | 0.9928  | 0.9548  | 0.8219  | 0.6079  | 0.4423  | 0.5028  | 0.8001  | 0.9842  | 0.9990  | 0.9998  | (86)         |
| MIT                                                                         | 20.2131 | 20.3311 | 20.5212 | 20.7556 | 20.9068 | 20.9513 | 20.9560 | 20.9554 | 20.9260 | 20.7027 | 20.4096 | 20.1940 | (87)         |
| Th 2                                                                        | 19.9479 | 19.9501 | 19.9522 | 19.9625 | 19.9644 | 19.9733 | 19.9733 | 19.9749 | 19.9699 | 19.9644 | 19.9605 | 19.9565 | (88)         |
| util rest of house                                                          | 0.9995  | 0.9980  | 0.9889  | 0.9321  | 0.7564  | 0.5144  | 0.3396  | 0.3919  | 0.7068  | 0.9724  | 0.9983  | 0.9997  | (89)         |
| MIT 2                                                                       | 19.0283 | 19.1812 | 19.4248 | 19.7185 | 19.8747 | 19.9154 | 19.9173 | 19.9189 | 19.8984 | 19.6637 | 19.2908 | 19.0110 | (90)         |
| Living area fraction                                                        |         |         |         |         |         |         |         |         |         |         |         |         | 0.1654 (91)  |
| MIT                                                                         | 19.2243 | 19.3714 | 19.6061 | 19.8900 | 20.0454 | 20.0868 | 20.0891 | 20.0903 | 20.0684 | 19.8356 | 19.4759 | 19.2067 | (92)         |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT                                                                | 19.2243 | 19.3714 | 19.6061 | 19.8900 | 20.0454 | 20.0868 | 20.0891 | 20.0903 | 20.0684 | 19.8356 | 19.4759 | 19.2067 | (93)         |

## 8. Space heating requirement

|                                                                                |           |           |           |           |           |           |          |          |           |               |           |           |       |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|----------|----------|-----------|---------------|-----------|-----------|-------|
|                                                                                | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul      | Aug      | Sep       | Oct           | Nov       | Dec       |       |
| Utilisation                                                                    | 0.9993    | 0.9974    | 0.9871    | 0.9302    | 0.7620    | 0.5250    | 0.3512   | 0.4045   | 0.7166    | 0.9703        | 0.9979    | 0.9996    | (94)  |
| Useful gains                                                                   | 1071.2483 | 1285.7198 | 1510.7924 | 1662.8084 | 1489.9886 | 1016.1405 | 649.1489 | 684.9721 | 1077.3026 | 1214.3124     | 1062.8167 | 1008.4905 | (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                                                               | 2854.7886 | 2761.6354 | 2495.3039 | 2069.5953 | 1568.3263 | 1021.1943 | 649.3898 | 685.6087 | 1114.9920 | 1735.6189     | 2335.4907 | 2844.2863 | (97)  |
| Space heating kWh                                                              | 1326.9539 | 991.8153  | 732.4766  | 292.8866  | 58.2833   | 0.0000    | 0.0000   | 0.0000   | 0.0000    | 387.8520      | 916.3253  | 1365.8321 | (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |           |           |          |          |           |               |           | 6072.4250 |       |
| 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                                                              | 1326.9539 | 991.8153  | 732.4766  | 292.8866  | 58.2833   | 0.0000    | 0.0000   | 0.0000   | 0.0000    | 387.8520      | 916.3253  | 1365.8321 | (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |           |           |          |          |           |               |           | 6072.4250 |       |
| Space heating per m2                                                           |           |           |           |           |           |           |          |          |           | (98c) / (4) = |           | 36.9931   | (99)  |

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

|                                                                                                              |           |          |          |          |          |          |          |          |          |          |          |           |                 |
|--------------------------------------------------------------------------------------------------------------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                        |           |          |          |          |          |          |          |          |          |          |          |           | 0.0000 (201)    |
| Fraction of space heat from main system(s)                                                                   |           |          |          |          |          |          |          |          |          |          |          |           | 1.0000 (202)    |
| Efficiency of main space heating system 1 (in %)                                                             |           |          |          |          |          |          |          |          |          |          |          |           | 249.9000 (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                                                                                    | 1326.9539 | 991.8153 | 732.4766 | 292.8866 | 58.2833  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 387.8520 | 916.3253 | 1365.8321 | (98)            |
| Space heating efficiency (main heating system 1)                                                             | 249.9000  | 249.9000 | 249.9000 | 249.9000 | 249.9000 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 249.9000 | 249.9000 | 249.9000  | (210)           |
| Space heating fuel (main heating system)                                                                     | 530.9940  | 396.8849 | 293.1079 | 117.2015 | 23.3226  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 155.2029 | 366.6768 | 546.5514  | (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                                                                                    | 279.0921  | 246.8832 | 262.5201 | 236.5626 | 229.9995 | 203.7841 | 195.5634 | 210.9900 | 211.1236 | 237.6166 | 252.5436 | 278.4282  | (64)            |
| Efficiency of water heater (217)m                                                                            | 175.1000  | 175.1000 | 175.1000 | 175.1000 | 175.1000 | 175.1000 | 175.1000 | 175.1000 | 175.1000 | 175.1000 | 175.1000 | 175.1000  | (216)           |
| Fuel for water heating, kWh/month                                                                            | 159.3901  | 140.9955 | 149.9258 | 135.1014 | 131.3532 | 116.3816 | 111.6867 | 120.4968 | 120.5731 | 135.7034 | 144.2282 | 159.0110  | (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                                                                                                 | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (231)           |
| Lighting                                                                                                     | 36.4968   | 29.2791  | 26.3626  | 19.3144  | 14.9190  | 12.1889  | 13.6096  | 17.6903  | 22.9779  | 30.1482  | 34.0524  | 37.5112   | (232)           |
| Electricity generated by PVs (Appendix M) (negative quantity) (233a)m                                        | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (233a)          |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m                              | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (234a)          |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m                  | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235a)          |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235c)          |
| Electricity generated by PVs (Appendix M) (negative quantity) (233b)m                                        | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (233b)          |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m                              | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (234b)          |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m                  | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235b)          |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235d)          |
| Annual totals kWh/year                                                                                       |           |          |          |          |          |          |          |          |          |          |          |           |                 |
| Space heating fuel - main system 1                                                                           |           |          |          |          |          |          |          |          |          |          |          |           | 2429.9420 (211) |
| Space heating fuel - main system 2                                                                           |           |          |          |          |          |          |          |          |          |          |          |           | 0.0000 (213)    |
| Space heating fuel - secondary                                                                               |           |          |          |          |          |          |          |          |          |          |          |           | 0.0000 (215)    |

# Full SAP Calculation Printout



|                                                               |           |        |
|---------------------------------------------------------------|-----------|--------|
| Efficiency of water heater                                    | 175.1000  |        |
| Water heating fuel used                                       | 1624.8470 | (219)  |
| Space cooling fuel                                            | 0.0000    | (221)  |
| Electricity for pumps and fans:                               |           |        |
| Total electricity for the above, kWh/year                     | 0.0000    | (231)  |
| Electricity for lighting (calculated in Appendix L)           | 294.5503  | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q) |           |        |
| PV generation                                                 | 0.0000    | (233)  |
| Wind generation                                               | 0.0000    | (234)  |
| Hydro-electric generation (Appendix N)                        | 0.0000    | (235a) |
| Electricity generated - Micro CHP (Appendix N)                | 0.0000    | (235)  |
| Appendix Q - special features                                 |           |        |
| Energy saved or generated                                     | -0.0000   | (236)  |
| Energy used                                                   | 0.0000    | (237)  |
| Total delivered energy for all uses                           | 4349.3392 | (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               | 2429.9420        | 16.4900             | 400.6974            | (240)  |
| Total CO2 associated with community systems |                  |                     | 0.0000              | (473)  |
| Water heating (other fuel)                  | 1624.8470        | 16.4900             | 267.9373            | (247)  |
| Energy for instantaneous electric shower(s) | 0.0000           | 16.4900             | 0.0000              | (247a) |
| Pumps, fans and electric keep-hot           | 0.0000           | 0.0000              | 0.0000              | (249)  |
| Energy for lighting                         | 294.5503         | 16.4900             | 48.5713             | (250)  |
| Additional standing charges                 |                  |                     | 0.0000              | (251)  |
| Total energy cost                           |                  |                     | 717.2060            | (255)  |

## 11a. SAP rating - Individual heating systems

|                                  |                                         |         |       |
|----------------------------------|-----------------------------------------|---------|-------|
| Energy cost deflator (Table 12): |                                         | 0.3600  | (256) |
| Energy cost factor (ECF)         | $[(255) \times (256)] / [(4) + 45.0] =$ | 1.2345  | (257) |
| SAP value                        |                                         | 79.9889 |       |
| SAP rating (Section 12)          |                                         | 80      | (258) |
| SAP band                         |                                         | C       |       |

## 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               | 2429.9420          | 0.1565                        | 380.3012                 | (261) |
| Total CO2 associated with community systems |                    |                               | 0.0000                   | (373) |
| Water heating (other fuel)                  | 1624.8470          | 0.1408                        | 228.8581                 | (264) |
| Space and water heating                     |                    |                               | 609.1593                 | (265) |
| Pumps, fans and electric keep-hot           | 0.0000             | 0.0000                        | 0.0000                   | (267) |
| Energy for lighting                         | 294.5503           | 0.1443                        | 42.5127                  | (268) |
| Total CO2, kg/year                          |                    |                               | 651.6720                 | (272) |
| CO2 emissions per m2                        |                    |                               | 3.9700                   | (273) |
| EI value                                    |                    |                               | 95.8248                  |       |
| EI rating                                   |                    |                               | 96                       | (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

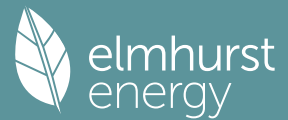
## 1. Overall dwelling characteristics

|                                                        | Area<br>(m2) | Storey height<br>(m)              | Volume<br>(m3)         |  |
|--------------------------------------------------------|--------------|-----------------------------------|------------------------|--|
| Main dwelling                                          |              |                                   |                        |  |
| Ground floor                                           | 58.1600 (1b) | x 2.4000 (2b)                     | = 139.5840 (1b) - (3b) |  |
| First floor                                            | 56.8200 (1c) | x 2.6000 (2c)                     | = 147.7320 (1c) - (3c) |  |
| Second floor                                           | 49.1700 (1d) | x 2.9000 (2d)                     | = 142.5930 (1d) - (3d) |  |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 164.1500     |                                   | (4)                    |  |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 429.9090 (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) = | 0.0930 (8)           |
| Pressure test                                                                                      |                 | Yes                  |
| Pressure Test Method                                                                               |                 | Blower Door          |

# Full SAP Calculation Printout



Measured/design AP50 5.0000 (17)  
Infiltration rate 0.3430 (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) = 0.3173 (21)

|                 |        |        |        |        |        |        |        |        |        |        |        |        |       |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|
| Wind speed      | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |       |
| Wind factor     | 4.3000 | 4.2000 | 4.3000 | 3.9000 | 3.9000 | 3.4000 | 3.3000 | 3.3000 | 3.4000 | 3.8000 | 3.8000 | 3.9000 | (22)  |
| Adj infilt rate | 1.0750 | 1.0500 | 1.0750 | 0.9750 | 0.9750 | 0.8500 | 0.8250 | 0.8250 | 0.8500 | 0.9500 | 0.9500 | 0.9750 | (22a) |
| Effective ac    | 0.3411 | 0.3332 | 0.3411 | 0.3094 | 0.3094 | 0.2697 | 0.2618 | 0.2618 | 0.2697 | 0.3014 | 0.3014 | 0.3094 | (22b) |
|                 | 0.5582 | 0.5555 | 0.5582 | 0.5479 | 0.5479 | 0.5364 | 0.5343 | 0.5343 | 0.5364 | 0.5454 | 0.5454 | 0.5479 | (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                                  |             |                |               |                  |                      |                   |               |       |
| Door                                           |             |                | 2.0000        | 1.3000           | 2.6000               |                   |               | (26)  |
| Window                                         |             |                | 28.0400       | 1.2357           | 34.6502              |                   |               | (27)  |
| Roof Light                                     |             |                | 2.4000        | 1.2357           | 2.9658               |                   |               | (27a) |
| Heatloss Floor 1                               |             |                | 58.1600       | 0.1200           | 6.9792               | 110.0000          | 6397.6000     | (28a) |
| External Wall                                  | 233.4600    | 30.0400        | 203.4200      | 0.1800           | 36.6156              | 140.0000          | 28478.8009    | (29a) |
| External Roof                                  | 61.4600     | 2.4000         | 59.0600       | 0.1600           | 9.4496               | 9.0000            | 531.5400      | (30)  |
| Total net area of external elements Aum(A, m2) |             |                | 353.0800      |                  |                      |                   |               | (31)  |
| Fabric heat loss, W/K = Sum (A x U)            |             |                |               |                  | (26)...(30) + (32) = | 93.2604           |               | (33)  |
| Main dwelling                                  |             |                |               |                  |                      |                   |               |       |
| Internal Wall                                  |             |                | 234.2200      |                  |                      | 100.0000          | 23422.0001    | (32c) |
| Internal Floor                                 |             |                | 56.8200       |                  |                      | 18.0000           | 1022.7600     | (32d) |
| Internal Floor                                 |             |                | 49.1700       |                  |                      | 18.0000           | 885.0600      | (32d) |
| Internal Ceiling                               |             |                | 56.8200       |                  |                      | 9.0000            | 511.3800      | (32e) |
| Internal Ceiling                               |             |                | 49.1700       |                  |                      | 9.0000            | 442.5300      | (32e) |

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 61691.6711 (34)  
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 375.8250 (35)

| List of Thermal Bridges                                          | Length  | Psi-value | Total   |
|------------------------------------------------------------------|---------|-----------|---------|
| K1 Element                                                       |         |           |         |
| E2 Other lintels (including other steel lintels)                 | 20.6000 | 0.0300    | 0.6180  |
| E3 Sill                                                          | 19.6500 | 0.0400    | 0.7860  |
| E4 Jamb                                                          | 56.2000 | 0.0500    | 2.8100  |
| E5 Ground floor (normal)                                         | 32.0100 | 0.1600    | 5.1216  |
| E6 Intermediate floor within a dwelling                          | 40.7000 | 0.0010    | 0.0407  |
| E16 Corner (normal)                                              | 44.6000 | 0.0900    | 4.0140  |
| E17 Corner (inverted - internal area greater than external area) | 13.0000 | -0.0900   | -1.1700 |
| E11 Eaves (insulation at rafter level)                           | 13.4000 | 0.0400    | 0.5360  |
| E13 Gable (insulation at rafter level)                           | 26.4800 | 0.0400    | 1.0592  |
| R1 Head of roof window                                           | 3.2000  | 0.0800    | 0.2560  |
| R2 Sill of roof window                                           | 3.2000  | 0.0600    | 0.1920  |
| R3 Jamb of roof window                                           | 6.0000  | 0.0800    | 0.4800  |
| R4 Ridge (vaulted ceiling)                                       | 14.7000 | 0.0500    | 0.7350  |

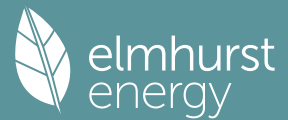
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 15.4785 (36)  
Point Thermal bridges (36a) = 0.0000  
Total fabric heat loss (33) + (36) + (36a) = 108.7389 (37)

|                                                                     |          |          |          |          |          |          |          |          |          |          |          |          |      |
|---------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| 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                                                 | 79.1889  | 78.8094  | 79.1889  | 77.7247  | 77.7247  | 76.0953  | 75.7962  | 75.7962  | 76.0953  | 77.3810  | 77.3810  | 77.7247  | (38) |
| Average = Sum(39)m / 12 =                                           | 187.9277 | 187.5483 | 187.9277 | 186.4635 | 186.4635 | 184.8342 | 184.5351 | 184.5351 | 184.8342 | 186.1198 | 186.1198 | 186.4635 | (39) |
|                                                                     |          |          |          |          |          |          |          |          |          |          |          | 186.1477 |      |
| HLP                                                                 | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |      |
| HLP (average)                                                       | 1.1449   | 1.1425   | 1.1449   | 1.1359   | 1.1359   | 1.1260   | 1.1242   | 1.1242   | 1.1260   | 1.1338   | 1.1338   | 1.1359   | (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                                               |          |          |          |          |          |          |          |          |          |          |          |          | 2.9547 (42)   |
| Hot water usage for mixer showers                               |          |          |          |          |          |          |          |          |          |          |          |          |               |
| Hot water usage for baths                                       | 71.8962  | 70.7955  | 69.1733  | 66.6779  | 64.4420  | 61.3141  | 58.8401  | 61.7323  | 63.1870  | 66.2851  | 69.5115  | 71.8314  | (42a)         |
| Hot water usage for other uses                                  | 31.1325  | 30.6625  | 29.9939  | 28.9927  | 28.0904  | 26.8482  | 25.9058  | 27.0582  | 27.6630  | 28.8938  | 30.1734  | 31.1078  | (42b)         |
| Average daily hot water use (litres/day)                        | 44.8887  | 43.2563  | 41.6240  | 39.9917  | 38.3594  | 36.7271  | 36.7271  | 38.3594  | 39.9917  | 41.6240  | 43.2563  | 44.8887  | (42c)         |
|                                                                 |          |          |          |          |          |          |          |          |          |          |          | 135.9578 | (43)          |
| Daily hot water use                                             | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |               |
| Energy conte                                                    | 147.9174 | 144.7144 | 140.7913 | 135.6623 | 130.8918 | 124.8894 | 121.4730 | 127.1499 | 130.8417 | 136.8029 | 142.9413 | 147.8278 | (44)          |
| Energy content (annual)                                         | 217.7599 | 191.4864 | 201.1879 | 177.2089 | 168.6673 | 144.4304 | 134.2312 | 149.6578 | 151.7698 | 176.2844 | 193.1899 | 217.0960 | (45)          |
| Distribution loss (46)m = 0.15 x (45)m                          |          |          |          |          |          |          |          |          |          |          |          |          |               |
| Water storage loss:                                             | 32.6640  | 28.7230  | 30.1782  | 26.5813  | 25.3001  | 21.6646  | 20.1347  | 22.4487  | 22.7655  | 26.4427  | 28.9785  | 32.5644  | (46)          |
| Store volume                                                    |          |          |          |          |          |          |          |          |          |          |          |          | 300.0000 (47) |
| b) If manufacturer declared loss factor is not known :          |          |          |          |          |          |          |          |          |          |          |          |          |               |
| Hot water storage loss factor from Table 2 (kWh/litre/day)      |          |          |          |          |          |          |          |          |          |          |          |          | 0.0103 (51)   |
| Volume factor from Table 2a                                     |          |          |          |          |          |          |          |          |          |          |          |          | 0.7368 (52)   |
| Temperature factor from Table 2b                                |          |          |          |          |          |          |          |          |          |          |          |          | 0.5400 (53)   |
| Enter (49) or (54) in (55)                                      |          |          |          |          |          |          |          |          |          |          |          |          | 1.2281 (55)   |
| Total storage loss                                              | 38.0698  | 34.3856  | 38.0698  | 36.8417  | 38.0698  | 36.8417  | 38.0698  | 38.0698  | 36.8417  | 38.0698  | 36.8417  | 38.0698  | (56)          |
| If cylinder contains dedicated solar storage                    |          |          |          |          |          |          |          |          |          |          |          |          |               |
| Primary loss                                                    | 38.0698  | 34.3856  | 38.0698  | 36.8417  | 38.0698  | 36.8417  | 38.0698  | 38.0698  | 36.8417  | 38.0698  | 36.8417  | 38.0698  | (57)          |
| Combi 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)          |
| Total heat required for water heating calculated for each month | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (61)          |
| WWHRS                                                           | 279.0921 | 246.8832 | 262.5201 | 236.5626 | 229.9995 | 203.7841 | 195.5634 | 210.9900 | 211.1236 | 237.6166 | 252.5436 | 278.4282 | (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)         |
|                                                                 |          |          |          |          |          |          |          |          |          |          |          |          | (63d)         |

# Full SAP Calculation Printout



|                                          |                                                                                             |          |          |          |          |          |          |          |          |          |          |               |
|------------------------------------------|---------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Output from w/h                          | 279.0921                                                                                    | 246.8832 | 262.5201 | 236.5626 | 229.9995 | 203.7841 | 195.5634 | 210.9900 | 211.1236 | 237.6166 | 252.5436 | 278.4282 (64) |
|                                          | Total per year (kWh/year) = Sum(64)m = 2845.1070 (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 | 121.4709                                                                                    | 107.9867 | 115.9607 | 106.4049 | 105.1476 | 95.5061  | 93.6976  | 98.8270  | 97.9465  | 107.6803 | 111.7186 | 121.2502 (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                                                                               | 177.2795  | 177.2795  | 177.2795  | 177.2795  | 177.2795  | 177.2795  | 177.2795  | 177.2795  | 177.2795  | 177.2795  | 177.2795  | 177.2795  | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 41.6966   | 37.0346   | 30.1185   | 22.8017   | 17.0445   | 14.3897   | 15.5486   | 20.2106   | 27.1267   | 34.4435   | 40.2007   | 42.8555   | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 500.7977  | 505.9944  | 492.8989  | 465.0200  | 429.8279  | 396.7524  | 374.6558  | 369.4591  | 382.5547  | 410.4335  | 445.6256  | 478.7012  | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 55.6826   | 55.6826   | 55.6826   | 55.6826   | 55.6826   | 55.6826   | 55.6826   | 55.6826   | 55.6826   | 55.6826   | 55.6826   | 55.6826   | (69) |
| Pumps, fans                                                                         | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -118.1863 | -118.1863 | -118.1863 | -118.1863 | -118.1863 | -118.1863 | -118.1863 | -118.1863 | -118.1863 | -118.1863 | -118.1863 | -118.1863 | (71) |
| Water heating gains (Table 5)                                                       | 163.2674  | 160.6945  | 155.8612  | 147.7846  | 141.3275  | 132.6473  | 125.9377  | 132.8319  | 136.0367  | 144.7316  | 155.1648  | 162.9707  | (72) |
| Total internal gains                                                                | 820.5375  | 818.4993  | 793.6544  | 750.3821  | 702.9757  | 658.5652  | 630.9179  | 637.2775  | 660.4939  | 704.3845  | 755.7669  | 799.3032  | (73) |

## 6. Solar gains

| [Jan]       |           |           |           |           | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 |           | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c |           | Access<br>factor<br>Table 6d |          | Gains<br>W   |  |
|-------------|-----------|-----------|-----------|-----------|------------|--------------------------------|-----------|-----------------------------------|------------------------------------|-----------|------------------------------|----------|--------------|--|
| North       |           |           |           |           | 2.3500     | 9.3942                         |           | 0.7000                            | 0.7000                             |           | 0.7700                       |          | 7.4965 (74)  |  |
| East        |           |           |           |           | 12.5500    | 17.3606                        |           | 0.7000                            | 0.7000                             |           | 0.7700                       |          | 73.9839 (76) |  |
| South       |           |           |           |           | 4.7900     | 41.2355                        |           | 0.7000                            | 0.7000                             |           | 0.7700                       |          | 67.0713 (78) |  |
| West        |           |           |           |           | 8.3500     | 17.3606                        |           | 0.7000                            | 0.7000                             |           | 0.7700                       |          | 49.2244 (80) |  |
| North       |           |           |           |           | 2.4000     | 23.0000                        |           | 0.7000                            | 0.7000                             |           | 1.0000                       |          | 24.3432 (82) |  |
|             |           |           |           |           |            |                                |           |                                   |                                    |           |                              |          |              |  |
| Solar gains | 222.1192  | 426.4719  | 697.7525  | 1001.9008 | 1179.9115  | 1231.6968                      | 1146.1120 | 988.0639                          | 827.4063                           | 529.8289  | 290.1958                     | 199.3744 | (83)         |  |
| Total gains | 1042.6567 | 1244.9712 | 1491.4069 | 1752.2829 | 1882.8872  | 1890.2620                      | 1777.0299 | 1625.3413                         | 1487.9002                          | 1234.2134 | 1045.9626                    | 998.6776 | (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                                                                         | 91.1870                               | 91.3715 | 91.1870 | 91.9031 | 91.9031 | 92.7132 | 92.8635 | 92.8635 | 92.7132 | 92.0728 | 92.0728 | 91.9031      |
| alpha                                                                       | 7.0791                                | 7.0914  | 7.0791  | 7.1269  | 7.1269  | 7.1809  | 7.1909  | 7.1909  | 7.1809  | 7.1382  | 7.1382  | 7.1269       |
| util living area                                                            | 0.9996                                | 0.9985  | 0.9918  | 0.9417  | 0.7696  | 0.5349  | 0.4046  | 0.4645  | 0.7669  | 0.9792  | 0.9988  | 0.9997 (86)  |
| MIT                                                                         | 20.2673                               | 20.3792 | 20.5588 | 20.7960 | 20.9283 | 20.9548 | 20.9565 | 20.9562 | 20.9355 | 20.7404 | 20.4541 | 20.2465 (87) |
| Th 2                                                                        | 19.9644                               | 19.9662 | 19.9644 | 19.9716 | 19.9716 | 19.9796 | 19.9811 | 19.9811 | 19.9796 | 19.9733 | 19.9733 | 19.9716 (88) |
| util rest of house                                                          | 0.9994                                | 0.9977  | 0.9872  | 0.9123  | 0.6911  | 0.4374  | 0.2992  | 0.3497  | 0.6664  | 0.9631  | 0.9979  | 0.9996 (89)  |
| MIT 2                                                                       | 19.1116                               | 19.2564 | 19.4827 | 19.7729 | 19.8994 | 19.9235 | 19.9256 | 19.9255 | 19.9144 | 19.7173 | 19.3585 | 19.0910 (90) |
| Living area fraction                                                        | fLA = Living area / (4) = 0.1654 (91) |         |         |         |         |         |         |         |         |         |         |              |
| MIT                                                                         | 19.3028                               | 19.4421 | 19.6607 | 19.9422 | 20.0696 | 20.0941 | 20.0961 | 20.0960 | 20.0833 | 19.8865 | 19.5397 | 19.2821 (92) |
| Temperature adjustment                                                      | 0.0000                                |         |         |         |         |         |         |         |         |         |         |              |
| adjusted MIT                                                                | 19.3028                               | 19.4421 | 19.6607 | 19.9422 | 20.0696 | 20.0941 | 20.0961 | 20.0960 | 20.0833 | 19.8865 | 19.5397 | 19.2821 (93) |

## 8. Space heating requirement

|                                                                                | Jan       | Feb       | Mar       | Apr       | May       | Jun      | Jul      | Aug      | Sep       | Oct       | Nov           | Dec       |       |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|----------|----------|----------|-----------|-----------|---------------|-----------|-------|
| Utilisation                                                                    | 0.9992    | 0.9972    | 0.9854    | 0.9112    | 0.6991    | 0.4484   | 0.3111   | 0.3627   | 0.6774    | 0.9613    | 0.9974        | 0.9995    | (94)  |
| Useful gains                                                                   | 1041.8738 | 1241.4280 | 1469.5905 | 1596.7610 | 1316.2981 | 847.6472 | 552.8025 | 589.5190 | 1007.9305 | 1186.3904 | 1043.2653     | 998.1525  | (95)  |
| Ext temp.                                                                      | 5.0000    | 5.6000    | 7.1000    | 9.7000    | 12.8000   | 15.5000  | 17.1000  | 16.9000  | 14.5000   | 11.2000   | 7.7000        | 4.8000    | (96)  |
| Heat loss rate W                                                               |           |           |           |           |           |          |          |          |           |           |               |           |       |
| Space heating kWh                                                              | 2687.8853 | 2596.0682 | 2360.5076 | 1909.7882 | 1355.5065 | 849.1432 | 552.8885 | 589.7756 | 1031.9899 | 1616.7256 | 2203.6027     | 2700.3922 | (97)  |
| Space heating requirement - total per year (kWh/year)                          | 1224.6326 | 910.3182  | 662.8423  | 225.3796  | 29.1710   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 320.1694  | 835.4429      | 1266.4663 | (98a) |
| Solar heating kWh                                                              |           |           |           |           |           |          |          |          |           |           |               | 5474.4224 |       |
| 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                                                              | 1224.6326 | 910.3182  | 662.8423  | 225.3796  | 29.1710   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 320.1694  | 835.4429      | 1266.4663 | (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |           |          |          |          |           |           |               | 5474.4224 |       |
| Space heating per m2                                                           |           |           |           |           |           |          |          |          |           |           | (98c) / (4) = | 33.3501   | (99)  |

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

|                                                                       |           |          |          |          |         |        |        |        |        |          |          |                |      |
|-----------------------------------------------------------------------|-----------|----------|----------|----------|---------|--------|--------|--------|--------|----------|----------|----------------|------|
| Fraction of space heat from secondary/supplementary system (Table 11) |           |          |          |          |         |        |        |        |        |          |          | 0.0000 (201)   |      |
| Fraction of space heat from main system(s)                            |           |          |          |          |         |        |        |        |        |          |          | 1.0000 (202)   |      |
| Efficiency of main space heating system 1 (in %)                      |           |          |          |          |         |        |        |        |        |          |          | 249.9000 (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                                             | 1224.6326 | 910.3182 | 662.8423 | 225.3796 | 29.1710 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 320.1694 | 835.4429 | 1266.4663      | (98) |
| Space heating efficiency (main heating system 1)                      |           |          |          |          |         |        |        |        |        |          |          |                |      |

# Full SAP Calculation Printout



|                                                                                                      |          |          |          |          |          |          |          |          |          |          |          |           |        |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|--------|
| Space heating fuel (main heating system)                                                             | 249.9000 | 249.9000 | 249.9000 | 249.9000 | 249.9000 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 249.9000 | 249.9000 | 249.9000  | (210)  |
| Space heating efficiency (main heating system 2)                                                     | 490.0491 | 364.2730 | 265.2430 | 90.1879  | 11.6731  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 128.1190 | 334.3109 | 506.7893  | (211)  |
| 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    | (212)  |
| 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    | (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                                                                            | 279.0921 | 246.8832 | 262.5201 | 236.5626 | 229.9995 | 203.7841 | 195.5634 | 210.9900 | 211.1236 | 237.6166 | 252.5436 | 278.4282  | (64)   |
| Efficiency of water heater (217)m                                                                    | 175.1000 | 175.1000 | 175.1000 | 175.1000 | 175.1000 | 175.1000 | 175.1000 | 175.1000 | 175.1000 | 175.1000 | 175.1000 | 175.1000  | (216)  |
| Fuel for water heating, kWh/month                                                                    | 159.3901 | 140.9955 | 149.9258 | 135.1014 | 131.3532 | 116.3816 | 111.6867 | 120.4968 | 120.5731 | 135.7034 | 144.2282 | 159.0110  | (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                                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (231)  |
| Lighting                                                                                             | 36.4968  | 29.2791  | 26.3626  | 19.3144  | 14.9190  | 12.1889  | 13.6096  | 17.6903  | 22.9779  | 30.1482  | 34.0524  | 37.5112   | (232)  |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (234a) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235a) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235c) |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (233b) |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (234b) |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235b) |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (235d) |
| Annual totals kWh/year                                                                               |          |          |          |          |          |          |          |          |          |          |          |           |        |
| Space heating fuel - main system 1                                                                   |          |          |          |          |          |          |          |          |          |          |          | 2190.6452 | (211)  |
| Space heating fuel - main system 2                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (213)  |
| Space heating fuel - secondary                                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (215)  |
| Efficiency of water heater                                                                           |          |          |          |          |          |          |          |          |          |          |          | 175.1000  |        |
| Water heating fuel used                                                                              |          |          |          |          |          |          |          |          |          |          |          | 1624.8470 | (219)  |
| Space cooling fuel                                                                                   |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (221)  |
| Electricity for pumps and fans:                                                                      |          |          |          |          |          |          |          |          |          |          |          |           |        |
| Total electricity for the above, kWh/year                                                            |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |          |          |          |          |          |          |          |          |          |          |          | 294.5503  | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |          |          |          |          |          |          |          |          |          |          |           |        |
| PV generation                                                                                        |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (233)  |
| Wind generation                                                                                      |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (234)  |
| Hydro-electric generation (Appendix N)                                                               |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (235a) |
| Electricity generated - Micro CHP (Appendix N)                                                       |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (235)  |
| Appendix Q - special features                                                                        |          |          |          |          |          |          |          |          |          |          |          |           |        |
| Energy saved or generated                                                                            |          |          |          |          |          |          |          |          |          |          |          | -0.0000   | (236)  |
| Energy used                                                                                          |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (237)  |
| Total delivered energy for all uses                                                                  |          |          |          |          |          |          |          |          |          |          |          | 4110.0424 | (238)  |

## 10a. Fuel costs - using BEDF prices (572)

|                                             | Fuel kWh/year | Fuel price p/kWh | Fuel cost £/year |        |
|---------------------------------------------|---------------|------------------|------------------|--------|
| Space heating - main system 1               | 2190.6452     | 26.0600          | 570.8821         | (240)  |
| Total CO2 associated with community systems |               |                  | 0.0000           | (473)  |
| Water heating (other fuel)                  | 1624.8470     | 26.0600          | 423.4351         | (247)  |
| Energy for instantaneous electric shower(s) | 0.0000        | 26.0600          | 0.0000           | (247a) |
| Pumps, fans and electric keep-hot           | 0.0000        | 0.0000           | 0.0000           | (249)  |
| Energy for lighting                         | 294.5503      | 26.0600          | 76.7598          | (250)  |
| Additional standing charges                 |               |                  | 0.0000           | (251)  |
| Total energy cost                           |               |                  | 1071.0771        | (255)  |

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

|                                             | Energy kWh/year | Emission factor kg CO2/kWh | Emissions kg CO2/year |       |
|---------------------------------------------|-----------------|----------------------------|-----------------------|-------|
| Space heating - main system 1               | 2190.6452       | 0.1569                     | 343.6934              | (261) |
| Total CO2 associated with community systems |                 |                            | 0.0000                | (373) |
| Water heating (other fuel)                  | 1624.8470       | 0.1408                     | 228.8581              | (264) |
| Space and water heating                     |                 |                            | 572.5515              | (265) |
| Pumps, fans and electric keep-hot           | 0.0000          | 0.0000                     | 0.0000                | (267) |
| Energy for lighting                         | 294.5503        | 0.1443                     | 42.5127               | (268) |
| Total CO2, kg/year                          |                 |                            | 615.0642              | (272) |

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

|                                             | Energy kWh/year | Primary energy factor kg CO2/kWh | Primary energy kWh/year |       |
|---------------------------------------------|-----------------|----------------------------------|-------------------------|-------|
| Space heating - main system 1               | 2190.6452       | 1.5808                           | 3463.0292               | (275) |
| Total CO2 associated with community systems |                 |                                  | 0.0000                  | (473) |
| Water heating (other fuel)                  | 1624.8470       | 1.5208                           | 2471.0756               | (278) |
| Space and water heating                     |                 |                                  | 5934.1048               | (279) |
| Pumps, fans and electric keep-hot           | 0.0000          | 0.0000                           | 0.0000                  | (281) |
| Energy for lighting                         | 294.5503        | 1.5338                           | 451.7910                | (282) |
| Total Primary energy kWh/year               |                 |                                  | 6385.8959               | (286) |

## SAP 10 EPC IMPROVEMENTS

# Full SAP Calculation Printout



Church Lane, Middleton

Current energy efficiency rating: C 80  
Current environmental impact rating: A 96

N Solar water heating Recommended  
U Solar photovoltaic panels Recommended  
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change  
N Solar water heating + 1.3 -£ 71 -33 kg (5.4%)  
U Solar photovoltaic panels + 4.4 -£ 238 -122 kg (21.0%)

| Recommended measures      | Typical annual savings | Energy efficiency | Environmental impact |
|---------------------------|------------------------|-------------------|----------------------|
| Solar water heating       | £71                    | 0.20 kg/m²        | B 81 A 96            |
| Solar photovoltaic panels | £238                   | 0.75 kg/m²        | B 86 A 97            |
| Total Savings             | £309                   | 0.95 kg/m²        |                      |

Potential energy efficiency rating: B 86  
Potential environmental impact rating: A 97

Fuel prices for cost data on this page from database revision number 572 TEST (30 May 2025)  
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, North West England):

|                          | Current    | Potential  | Saving     |
|--------------------------|------------|------------|------------|
| Electricity              | £1071      | £1000      | £71        |
| Space heating            | £571       | £592       | -£21       |
| Water heating            | £423       | £331       | £92        |
| Lighting                 | £77        | £77        | £0         |
| Generated (PV)           | -£0        | -£238      | £238       |
| Total cost of fuels      | £1071      | £762       | £309       |
| Total cost of uses       | £1071      | £762       | £309       |
| Delivered energy         | 25 kWh/m²  | 18 kWh/m²  | 7 kWh/m²   |
| Carbon dioxide emissions | 0.6 tonnes | 0.5 tonnes | 0.2 tonnes |
| CO2 emissions per m²     | 4 kg/m²    | 3 kg/m²    | 1 kg/m²    |
| Primary energy           | 39 kWh/m²  | 28 kWh/m²  | 11 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

| Main dwelling                                          | Area (m²)    | Storey height (m)               | Volume (m³)            |
|--------------------------------------------------------|--------------|---------------------------------|------------------------|
| Ground floor                                           | 58.1600 (1b) | x 2.4000 (2b)                   | = 139.5840 (1b) - (3b) |
| First floor                                            | 56.8200 (1c) | x 2.6000 (2c)                   | = 147.7320 (1c) - (3c) |
| Second floor                                           | 49.1700 (1d) | x 2.9000 (2d)                   | = 142.5930 (1d) - (3d) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 164.1500     |                                 | (4)                    |
| Dwelling volume                                        |              | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 429.9090 (5)         |

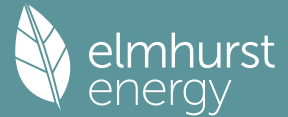
## 2. Ventilation rate

|                                                    | 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) = 0.0930 (8)  
Pressure test  
Pressure Test Method  
Measured/design AP50  
Infiltration rate  
Number of sides sheltered  
Shelter factor  
Infiltration rate adjusted to include shelter factor  
(20) = 1 - [0.075 x (19)] = 0.9250 (20)  
(21) = (18) x (20) = 0.3173 (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 | 0.4046 | 0.3966 | 0.3887 | 0.3490 | 0.3411 | 0.3014 | 0.3014 | 0.2935 | 0.3173 | 0.3411 | 0.3570 | 0.3728 (22b) |
| Effective ac    | 0.5818 | 0.5787 | 0.5755 | 0.5609 | 0.5582 | 0.5454 | 0.5454 | 0.5431 | 0.5503 | 0.5582 | 0.5637 | 0.5695 (25)  |

# Full SAP Calculation Printout



## 3. Heat losses and heat loss parameter

| Element                                        | Gross<br>m2 | Openings<br>m2 | NetArea<br>m2 | U-value<br>W/m2K     | A x U<br>W/K | K-value<br>kJ/m2K | A x K<br>kJ/K |       |
|------------------------------------------------|-------------|----------------|---------------|----------------------|--------------|-------------------|---------------|-------|
| Main dwelling                                  |             |                |               |                      |              |                   |               |       |
| Door                                           |             |                | 2.0000        | 1.3000               | 2.6000       |                   |               | (26)  |
| Window                                         |             |                | 28.0400       | 1.2357               | 34.6502      |                   |               | (27)  |
| Roof Light                                     |             |                | 2.4000        | 1.2357               | 2.9658       |                   |               | (27a) |
| Heatloss Floor 1                               |             |                | 58.1600       | 0.1200               | 6.9792       | 110.0000          | 6397.6000     | (28a) |
| External Wall                                  | 233.4600    | 30.0400        | 203.4200      | 0.1800               | 36.6156      | 140.0000          | 28478.8009    | (29a) |
| External Roof                                  | 61.4600     | 2.4000         | 59.0600       | 0.1600               | 9.4496       | 9.0000            | 531.5400      | (30)  |
| Total net area of external elements Aum(A, m2) |             |                | 353.0800      |                      |              |                   |               | (31)  |
| Fabric heat loss, W/K = Sum (A x U)            |             |                |               | (26)...(30) + (32) = | 93.2604      |                   |               | (33)  |
| Main dwelling                                  |             |                |               |                      |              |                   |               |       |
| Internal Wall                                  |             |                | 234.2200      |                      |              | 100.0000          | 23422.0001    | (32c) |
| Internal Floor                                 |             |                | 56.8200       |                      |              | 18.0000           | 1022.7600     | (32d) |
| Internal Floor                                 |             |                | 49.1700       |                      |              | 18.0000           | 885.0600      | (32d) |
| Internal Ceiling                               |             |                | 56.8200       |                      |              | 9.0000            | 511.3800      | (32e) |
| Internal Ceiling                               |             |                | 49.1700       |                      |              | 9.0000            | 442.5300      | (32e) |

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 61691.6711 (34)  
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 375.8250 (35)

### List of Thermal Bridges

| K1 Element                                                       | Length  | Psi-value | Total   |
|------------------------------------------------------------------|---------|-----------|---------|
| E2 Other lintels (including other steel lintels)                 | 20.6000 | 0.0300    | 0.6180  |
| E3 Sill                                                          | 19.6500 | 0.0400    | 0.7860  |
| E4 Jamb                                                          | 56.2000 | 0.0500    | 2.8100  |
| E5 Ground floor (normal)                                         | 32.0100 | 0.1600    | 5.1216  |
| E6 Intermediate floor within a dwelling                          | 40.7000 | 0.0010    | 0.0407  |
| E16 Corner (normal)                                              | 44.6000 | 0.0900    | 4.0140  |
| E17 Corner (inverted - internal area greater than external area) | 13.0000 | -0.0900   | -1.1700 |
| E11 Eaves (insulation at rafter level)                           | 13.4000 | 0.0400    | 0.5360  |
| E13 Gable (insulation at rafter level)                           | 26.4800 | 0.0400    | 1.0592  |
| R1 Head of roof window                                           | 3.2000  | 0.0800    | 0.2560  |
| R2 Sill of roof window                                           | 3.2000  | 0.0600    | 0.1920  |
| R3 Jamb of roof window                                           | 6.0000  | 0.0800    | 0.4800  |
| R4 Ridge (vaulted ceiling)                                       | 14.7000 | 0.0500    | 0.7350  |

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 15.4785 (36)  
Point Thermal bridges (36a) = 0.0000  
Total fabric heat loss (33) + (36) + (36a) = 108.7389 (37)

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

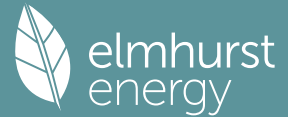
|                           | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |          |
|---------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| (38)m                     | 82.5458  | 82.0949  | 81.6530  | 79.5772  | 79.1889  | 77.3810  | 77.3810  | 77.0462  | 78.0773  | 79.1889  | 79.9745  | 80.7959  | (38)     |
| Heat transfer coeff       | 191.2846 | 190.8338 | 190.3918 | 188.3161 | 187.9277 | 186.1198 | 186.1198 | 185.7850 | 186.8162 | 187.9277 | 188.7134 | 189.5348 | (39)     |
| Average = Sum(39)m / 12 = |          |          |          |          |          |          |          |          |          |          |          |          | 188.3142 |

|               | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec    |        |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| HLP           | 1.1653 | 1.1626 | 1.1599 | 1.1472 | 1.1449 | 1.1338 | 1.1338 | 1.1318 | 1.1381 | 1.1449 | 1.1496 | 1.1546 | (40)   |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        |        | 1.1472 |
| Days in mont  | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31     |        |

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

|                                                                 |          |          |          |          |           |          |          |          |          |          |               |               |                              |
|-----------------------------------------------------------------|----------|----------|----------|----------|-----------|----------|----------|----------|----------|----------|---------------|---------------|------------------------------|
| Assumed occupancy                                               |          |          |          |          |           |          |          |          |          |          |               |               | 2.9547 (42)                  |
| Hot water usage for mixer showers                               |          |          |          |          |           |          |          |          |          |          |               |               |                              |
| 71.8962                                                         | 70.7955  | 69.1733  | 66.6779  | 64.4420  | 61.3141   | 58.8401  | 61.7323  | 63.1870  | 66.2851  | 69.5115  | 71.8314       | (42a)         |                              |
| Hot water usage for baths                                       |          |          |          |          |           |          |          |          |          |          |               |               |                              |
| 31.1325                                                         | 30.6625  | 29.9939  | 28.9927  | 28.0904  | 26.8482   | 25.9058  | 27.0582  | 27.6630  | 28.8938  | 30.1734  | 31.1078       | (42b)         |                              |
| Hot water usage for other uses                                  |          |          |          |          |           |          |          |          |          |          |               |               |                              |
| 44.8887                                                         | 43.2563  | 41.6240  | 39.9917  | 38.3594  | 36.7271   | 36.7271  | 38.3594  | 39.9917  | 41.6240  | 43.2563  | 44.8887       | (42c)         |                              |
| Average daily hot water use (litres/day)                        |          |          |          |          |           |          |          |          |          |          |               |               | 135.9578 (43)                |
| Daily hot water use                                             |          |          |          |          |           |          |          |          |          |          |               |               |                              |
| 147.9174                                                        | 144.7144 | 140.7913 | 135.6623 | 130.8918 | 124.8894  | 121.4730 | 127.1499 | 130.8417 | 136.8029 | 142.9413 | 147.8278      | (44)          |                              |
| Energy content (annual)                                         |          |          |          |          |           |          |          |          |          |          |               |               |                              |
| 217.7599                                                        | 191.4864 | 201.1879 | 177.2089 | 168.6673 | 144.4304  | 134.2312 | 149.6578 | 151.7698 | 176.2844 | 193.1899 | 217.0960      | (45)          |                              |
| Distribution loss (46)m = 0.15 x (45)m                          |          |          |          |          |           |          |          |          |          |          |               |               | Total = Sum(45)m = 2122.9699 |
| 32.6640                                                         | 28.7230  | 30.1782  | 26.5813  | 25.3001  | 21.6646   | 20.1347  | 22.4487  | 22.7655  | 26.4427  | 28.9785  | 32.5644       | (46)          |                              |
| Water storage loss:                                             |          |          |          |          |           |          |          |          |          |          |               |               |                              |
| Store volume                                                    |          |          |          |          |           |          |          |          |          |          |               |               | 300.0000 (47)                |
| b) If manufacturer declared loss factor is not known :          |          |          |          |          |           |          |          |          |          |          |               |               |                              |
| Hot water storage loss factor from Table 2 (kWh/litre/day)      |          |          |          |          |           |          |          |          |          |          |               |               | 0.0103 (51)                  |
| Volume factor from Table 2a                                     |          |          |          |          |           |          |          |          |          |          |               |               | 0.7368 (52)                  |
| Temperature factor from Table 2b                                |          |          |          |          |           |          |          |          |          |          |               |               | 0.5400 (53)                  |
| Enter (49) or (54) in (55)                                      |          |          |          |          |           |          |          |          |          |          |               |               | 1.2281 (55)                  |
| Total storage loss                                              |          |          |          |          |           |          |          |          |          |          |               |               |                              |
| 38.0698                                                         | 34.3856  | 38.0698  | 36.8417  | 38.0698  | 36.8417   | 38.0698  | 38.0698  | 36.8417  | 38.0698  | 36.8417  | 38.0698       | (56)          |                              |
| If cylinder contains dedicated solar storage                    |          |          |          |          |           |          |          |          |          |          |               |               |                              |
| 38.0698                                                         | 34.3856  | 38.0698  | 36.8417  | 38.0698  | 36.8417   | 38.0698  | 38.0698  | 36.8417  | 38.0698  | 36.8417  | 38.0698       | (57)          |                              |
| Primary loss                                                    | 23.2624  | 21.0112  | 21.8667  | 15.7584  | 10.4681   | 9.9053   | 10.2355  | 11.1660  | 17.1091  | 21.8667  | 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 |          |          |          |          |           |          |          |          |          |          |               |               |                              |
| 279.0921                                                        | 246.8832 | 261.1243 | 229.8090 | 217.2052 | 191.1774  | 182.5364 | 198.8935 | 205.7207 | 236.2208 | 252.5436 | 278.4282 (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) |                              |
| Aperture area of solar collector                                |          |          |          |          |           |          |          |          |          |          |               |               | 3.0000 (H1)                  |
| Zero-loss collector efficiency                                  |          |          |          |          |           |          |          |          |          |          |               |               | 0.8000 (H2)                  |
| Collector linear heat loss coefficient                          |          |          |          |          |           |          |          |          |          |          |               |               | 1.8000 (H3)                  |
| Collector 2nd order heat loss coefficient                       |          |          |          |          |           |          |          |          |          |          |               |               | 0.0000 (H4)                  |
| Collector loop efficiency                                       |          |          |          |          |           |          |          |          |          |          |               |               | 0.9000 (H5)                  |
| Incidence angle modifier                                        |          |          |          |          |           |          |          |          |          |          |               |               | 1.0000 (H6)                  |
| Overshading factor                                              |          |          |          |          |           |          |          |          |          |          |               |               | 0.8000 (H8)                  |
| Overall heat loss coefficient of system                         |          |          |          |          |           |          |          |          |          |          |               |               | 6.5000 (H10)                 |
| Heat loss coefficient of collector loop                         |          |          |          |          |           |          |          |          |          |          |               |               | 3.9667 (H11)                 |
| Dedicated solar storage volume                                  |          |          |          |          |           |          |          |          |          |          |               |               | 75.0000 (H12)                |
| Effective solar volume                                          |          |          |          |          |           |          |          |          |          |          |               |               | 75.0000 (H14)                |
| Reference volume                                                |          |          |          |          |           |          |          |          |          |          |               |               | 225.0000 (H15)               |
| Storage tank correction coefficient                             |          |          |          |          |           |          |          |          |          |          |               |               | 1.3161 (H16)                 |
| Heat delivered to hot water                                     |          |          |          |          |           |          |          |          |          |          |               |               | 588.7611 (H24)               |
| Heat delivered to space heating                                 |          |          |          |          |           |          |          |          |          |          |               |               | 0.0000 (H29)                 |
| Solar input                                                     |          |          |          |          |           |          |          |          |          |          |               |               | 588.7611                     |
| Solar input                                                     | -0.0000  | -10.1072 | -52.1087 | -77.5145 | -103.3439 | -93.9480 | -91.0332 | -81.6722 | -54.2051 | -24.8284 | -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                                                 |          |          |          |          |           |          |          |          |          |          |               |               |                              |
| 279.0921                                                        | 236.7760 | 209.0157 | 152.2945 | 113.8613 | 97.2294   | 91.5033  | 117.2213 | 151.5156 | 211.3925 | 252.5436 | 278.4282 (64) |               |                              |

# Full SAP Calculation Printout



|                                                                                |          |          |          |          |         |         |         |                                        |         |          |              |                |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|---------|---------|---------|----------------------------------------|---------|----------|--------------|----------------|
|                                                                                |          |          |          |          |         |         |         | Total per year (kWh/year) = Sum(64)m = |         |          |              | 2190.8735 (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 (64a) |                |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |          |         |         |         | 0.0000 (64a)                           |         |          |              |                |
| Heat gains from water heating, kWh/month                                       | 121.4709 | 107.9867 | 114.8441 | 101.0021 | 94.9122 | 85.4207 | 83.2761 | 89.1498                                | 93.6242 | 106.5637 | 111.7186     | 121.2502 (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                                                                               | 177.2795  | 177.2795  | 177.2795  | 177.2795  | 177.2795  | 177.2795  | 177.2795  | 177.2795  | 177.2795  | 177.2795  | 177.2795  | 177.2795 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 41.6966   | 37.0346   | 30.1185   | 22.8017   | 17.0445   | 14.3897   | 15.5486   | 20.2106   | 27.1267   | 34.4435   | 40.2007   | 42.8555 (67)   |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 500.7977  | 505.9944  | 492.8989  | 465.0200  | 429.8279  | 396.7524  | 374.6558  | 369.4591  | 382.5547  | 410.4335  | 445.6256  | 478.7012 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 55.6826   | 55.6826   | 55.6826   | 55.6826   | 55.6826   | 55.6826   | 55.6826   | 55.6826   | 55.6826   | 55.6826   | 55.6826   | 55.6826 (69)   |
| Pumps, fans                                                                         | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000 (70)    |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -118.1863 | -118.1863 | -118.1863 | -118.1863 | -118.1863 | -118.1863 | -118.1863 | -118.1863 | -118.1863 | -118.1863 | -118.1863 | -118.1863 (71) |
| Water heating gains (Table 5)                                                       | 163.2674  | 160.6945  | 154.3604  | 140.2806  | 127.5701  | 118.6399  | 111.9302  | 119.8250  | 130.0335  | 143.2308  | 155.1648  | 162.9707 (72)  |
| Total internal gains                                                                | 820.5375  | 818.4993  | 792.1536  | 742.8781  | 689.2184  | 644.5577  | 616.9104  | 624.2705  | 654.4907  | 702.8837  | 755.7669  | 799.3032 (73)  |

## 6. Solar gains

| [Jan]       |           |           |           |           |           | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d |           | Gains<br>W     |
|-------------|-----------|-----------|-----------|-----------|-----------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|-----------|----------------|
| North       |           |           |           |           |           | 2.3500     | 10.6334                        | 0.7000                            | 0.7000                             | 0.7700                       |           | 8.4853 (74)    |
| East        |           |           |           |           |           | 12.5500    | 19.6403                        | 0.7000                            | 0.7000                             | 0.7700                       |           | 83.6990 (76)   |
| South       |           |           |           |           |           | 4.7900     | 46.7521                        | 0.7000                            | 0.7000                             | 0.7700                       |           | 76.0441 (78)   |
| West        |           |           |           |           |           | 8.3500     | 19.6403                        | 0.7000                            | 0.7000                             | 0.7700                       |           | 55.6882 (80)   |
| North       |           |           |           |           |           | 2.4000     | 26.0000                        | 0.7000                            | 0.7000                             | 1.0000                       |           | 27.5184 (82)   |
|             |           |           |           |           |           |            |                                |                                   |                                    |                              |           |                |
| Solar gains | 251.4351  | 470.5811  | 736.8541  | 1037.2337 | 1252.2980 | 1276.9427  | 1217.5348                      | 1055.9776                         | 842.8308                           | 547.0332                     | 309.3326  | 209.6346 (83)  |
| Total gains | 1071.9726 | 1289.0804 | 1529.0077 | 1780.1119 | 1941.5164 | 1921.5005  | 1834.4452                      | 1680.2482                         | 1497.3215                          | 1249.9168                    | 1065.0995 | 1008.9377 (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                                                                         | 89.5868                               | 89.7984 | 90.0069 | 90.9990 | 91.1870 | 92.0728 | 92.0728 | 92.2387 | 91.7296 | 91.1870 | 90.8074 | 90.4139      |
| alpha                                                                       | 6.9725                                | 6.9866  | 7.0005  | 7.0666  | 7.0791  | 7.1382  | 7.1382  | 7.1492  | 7.1153  | 7.0791  | 7.0538  | 7.0276       |
| util living area                                                            | 0.9997                                | 0.9987  | 0.9928  | 0.9557  | 0.8256  | 0.6120  | 0.4456  | 0.5066  | 0.8023  | 0.9844  | 0.9990  | 0.9998 (86)  |
| MIT                                                                         | 20.2131                               | 20.3311 | 20.5207 | 20.7537 | 20.9053 | 20.9511 | 20.9559 | 20.9553 | 20.9255 | 20.7022 | 20.4096 | 20.1940 (87) |
| Th 2                                                                        | 19.9479                               | 19.9501 | 19.9522 | 19.9625 | 19.9644 | 19.9733 | 19.9733 | 19.9749 | 19.9699 | 19.9644 | 19.9605 | 19.9565 (88) |
| util rest of house                                                          | 0.9995                                | 0.9980  | 0.9889  | 0.9334  | 0.7605  | 0.5181  | 0.3421  | 0.3950  | 0.7091  | 0.9726  | 0.9983  | 0.9997 (89)  |
| MIT 2                                                                       | 19.0283                               | 19.1812 | 19.4242 | 19.7163 | 19.8735 | 19.9153 | 19.9173 | 19.9189 | 19.8981 | 19.6632 | 19.2908 | 19.0110 (90) |
| Living area fraction                                                        | FLA = Living area / (4) = 0.1654 (91) |         |         |         |         |         |         |         |         |         |         |              |
| MIT                                                                         | 19.2243                               | 19.3714 | 19.6055 | 19.8879 | 20.0442 | 20.0866 | 20.0891 | 20.0903 | 20.0680 | 19.8350 | 19.4759 | 19.2067 (92) |
| Temperature adjustment                                                      | 0.0000                                |         |         |         |         |         |         |         |         |         |         |              |
| adjusted MIT                                                                | 19.2243                               | 19.3714 | 19.6055 | 19.8879 | 20.0442 | 20.0866 | 20.0891 | 20.0903 | 20.0680 | 19.8350 | 19.4759 | 19.2067 (93) |

## 8. Space heating requirement

|                                                                                |                            |           |           |           |           |           |          |          |           |           |           |                 |
|--------------------------------------------------------------------------------|----------------------------|-----------|-----------|-----------|-----------|-----------|----------|----------|-----------|-----------|-----------|-----------------|
| Utilisation                                                                    | 0.9993                     | 0.9974    | 0.9872    | 0.9314    | 0.7660    | 0.5287    | 0.3539   | 0.4076   | 0.7189    | 0.9705    | 0.9979    | 0.9996 (94)     |
| Useful gains                                                                   | 1071.2483                  | 1285.7198 | 1509.4134 | 1657.9581 | 1487.2194 | 1015.8934 | 649.1351 | 684.9361 | 1076.4853 | 1213.0718 | 1062.8167 | 1008.4905 (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                                                               | 2854.7886                  | 2761.6354 | 2495.1890 | 2069.1945 | 1568.1051 | 1021.1739 | 649.3884 | 685.6052 | 1114.9264 | 1735.5163 | 2335.4907 | 2844.2863 (97)  |
| Space heating kWh                                                              | 1326.9539                  | 991.8153  | 733.4170  | 296.0902  | 60.1789   | 0.0000    | 0.0000   | 0.0000   | 0.0000    | 388.6987  | 916.3253  | 1365.8321 (98a) |
| Space heating requirement - total per year (kWh/year)                          |                            |           |           |           |           |           |          |          |           |           |           | 6079.3115       |
| 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                                                              | 1326.9539                  | 991.8153  | 733.4170  | 296.0902  | 60.1789   | 0.0000    | 0.0000   | 0.0000   | 0.0000    | 388.6987  | 916.3253  | 1365.8321 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |                            |           |           |           |           |           |          |          |           |           |           | 6079.3115       |
| Space heating per m2                                                           | (98c) / (4) = 37.0351 (99) |           |           |           |           |           |          |          |           |           |           |                 |

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

|                                                                       |           |          |          |          |          |        |        |        |        |          |          |                |
|-----------------------------------------------------------------------|-----------|----------|----------|----------|----------|--------|--------|--------|--------|----------|----------|----------------|
| Fraction of space heat from secondary/supplementary system (Table 11) |           |          |          |          |          |        |        |        |        |          |          | 0.0000 (201)   |
| Fraction of space heat from main system(s)                            |           |          |          |          |          |        |        |        |        |          |          | 1.0000 (202)   |
| Efficiency of main space heating system 1 (in %)                      |           |          |          |          |          |        |        |        |        |          |          | 249.9000 (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                                             | 1326.9539 | 991.8153 | 733.4170 | 296.0902 | 60.1789  | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 388.6987 | 916.3253 | 1365.8321 (98) |
| Space heating efficiency (main heating system 1)                      | 249.9000  | 249.9000 | 249.9000 | 249.9000 | 249.9000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 249.9000 | 249.9000 | 249.9000 (210) |
| Space heating fuel (main heating system)                              |           |          |          |          |          |        |        |        |        |          |          |                |

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|                                                                                                      |          |          |          |           |           |           |           |          |          |          |           |        |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|-----------|-----------|-----------|-----------|----------|----------|----------|-----------|--------|
| 530.9940                                                                                             | 396.8849 | 293.4842 | 118.4835 | 24.0812   | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 155.5417 | 366.6768 | 546.5514  | (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                                                                            |          |          |          |           |           |           |           |          |          |          |           |        |
| 279.0921                                                                                             | 236.7760 | 209.0157 | 152.2945 | 113.8613  | 97.2294   | 91.5033   | 117.2213  | 151.5156 | 211.3925 | 252.5436 | 278.4282  | (64)   |
| Efficiency of water heater                                                                           |          |          |          |           |           |           |           |          |          |          |           |        |
| (217)m                                                                                               | 175.1000 | 175.1000 | 175.1000 | 175.1000  | 175.1000  | 175.1000  | 175.1000  | 175.1000 | 175.1000 | 175.1000 | 175.1000  | (216)  |
| Fuel for water heating, kWh/month                                                                    |          |          |          |           |           |           |           |          |          |          |           |        |
| 159.3901                                                                                             | 135.2233 | 119.3693 | 86.9757  | 65.0264   | 55.5279   | 52.2577   | 66.9453   | 86.5309  | 120.7267 | 144.2282 | 159.0110  | (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    | (221)  |
| Pumps and Fa                                                                                         |          |          |          |           |           |           |           |          |          |          |           |        |
| 6.7945                                                                                               | 6.1370   | 6.7945   | 6.5753   | 6.7945    | 6.5753    | 6.7945    | 6.5753    | 6.7945   | 6.5753   | 6.7945   | 6.7945    | (231)  |
| Lighting                                                                                             |          |          |          |           |           |           |           |          |          |          |           |        |
| 36.4968                                                                                              | 29.2791  | 26.3626  | 19.3144  | 14.9190   | 12.1889   | 13.6096   | 17.6903   | 22.9779  | 30.1482  | 34.0524  | 37.5112   | (232)  |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |           |           |           |           |          |          |          |           |        |
| (233a)m                                                                                              | -40.6220 | -61.8685 | -93.8245 | -106.8400 | -112.6007 | -104.1360 | -102.4267 | -95.8357 | -83.4879 | -70.7384 | -45.9215  | (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    | (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    | (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    | (235c) |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |           |           |           |           |          |          |          |           |        |
| (233b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (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    | (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    | (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    | (235d) |
| Annual totals kWh/year                                                                               |          |          |          |           |           |           |           |          |          |          |           |        |
| Space heating fuel - main system 1                                                                   |          |          |          |           |           |           |           |          |          |          | 2432.6977 | (211)  |
| Space heating fuel - main system 2                                                                   |          |          |          |           |           |           |           |          |          |          | 0.0000    | (213)  |
| Space heating fuel - secondary                                                                       |          |          |          |           |           |           |           |          |          |          | 0.0000    | (215)  |
| Efficiency of water heater                                                                           |          |          |          |           |           |           |           |          |          |          | 175.1000  | (216)  |
| Water heating fuel used                                                                              |          |          |          |           |           |           |           |          |          |          | 1251.2128 | (219)  |
| Space cooling fuel                                                                                   |          |          |          |           |           |           |           |          |          |          | 0.0000    | (221)  |
| Electricity for pumps and fans:                                                                      |          |          |          |           |           |           |           |          |          |          |           |        |
| pump for solar water heating                                                                         |          |          |          |           |           |           |           |          |          |          | 80.0000   | (230g) |
| Total electricity for the above, kWh/year                                                            |          |          |          |           |           |           |           |          |          |          | 80.0000   | (231)  |
| Electricity for lighting (calculated in Appendix L)                                                  |          |          |          |           |           |           |           |          |          |          | 294.5503  | (232)  |
| Energy saving/generation technologies (Appendices M ,N and Q)                                        |          |          |          |           |           |           |           |          |          |          |           |        |
| PV generation                                                                                        |          |          |          |           |           |           |           |          |          |          | -952.9200 | (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                                                                  |          |          |          |           |           |           |           |          |          |          | 3105.5407 | (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               | 2432.6977        | 16.4900             | 401.1518 (240)      |
| Total CO2 associated with community systems |                  |                     | 0.0000 (473)        |
| Water heating (other fuel)                  | 1251.2128        | 16.4900             | 206.3250 (247)      |
| Energy for instantaneous electric shower(s) | 0.0000           | 16.4900             | 0.0000 (247a)       |
| Pumps, fans and electric keep-hot           | 0.0000           | 0.0000              | 0.0000 (249)        |
| Pump for solar water heating                | 80.0000          | 16.4900             | 13.1920 (249)       |
| Energy for lighting                         | 294.5503         | 16.4900             | 48.5713 (250)       |
| Additional standing charges                 |                  |                     | 0.0000 (251)        |
| Energy saving/generation technologies       |                  |                     |                     |
| PV Unit electricity used in dwelling        | -952.9200        | 16.4900             | -157.1365           |
| PV Unit electricity exported                | 0.0000           | 5.5900              | 0.0000              |
| Total                                       |                  |                     | -157.1365 (252)     |
| Total energy cost                           |                  |                     | 512.1037 (255)      |

## 11a. SAP rating - Individual heating systems

|                                  |                                  |              |
|----------------------------------|----------------------------------|--------------|
| Energy cost deflator (Table 12): |                                  | 0.3600 (256) |
| Energy cost factor (ECF)         | [(255) x (256)] / [(4) + 45.0] = | 0.8815 (257) |
| SAP value                        |                                  | 85.7115      |
| SAP rating (Section 12)          |                                  | 86 (258)     |
| SAP band                         |                                  | B            |

## 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               | 2432.6977          | 0.1565                        | 380.6883 (261)           |
| Total CO2 associated with community systems |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                  | 1251.2128          | 0.1451                        | 181.5355 (264)           |
| Space and water heating                     |                    |                               | 562.2238 (265)           |
| Pumps, fans and electric keep-hot           | 80.0000            | 0.1387                        | 11.0970 (267)            |
| Energy for lighting                         | 294.5503           | 0.1443                        | 42.5127 (268)            |
| Energy saving/generation technologies       |                    |                               |                          |
| PV Unit electricity used in dwelling        | -952.9200          | 0.1343                        | -127.9990                |
| PV Unit electricity exported                | 0.0000             | 0.0000                        | 0.0000                   |
| Total                                       |                    |                               | -127.9990 (269)          |
| Total CO2, kg/year                          |                    |                               | 487.8345 (272)           |
| CO2 emissions per m2                        |                    |                               | 2.9700 (273)             |

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EI value  
EI rating  
EI band

96.8745  
97 (274)  
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                                           | 58.1600 (1b)              | x 2.4000 (2b)                     | = 139.5840 (1b) - (3b)      |
| First floor                                            | 56.8200 (1c)              | x 2.6000 (2c)                     | = 147.7320 (1c) - (3c)      |
| Second floor                                           | 49.1700 (1d)              | x 2.9000 (2d)                     | = 142.5930 (1d) - (3d)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 164.1500                  |                                   | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 429.9090 (5)                |

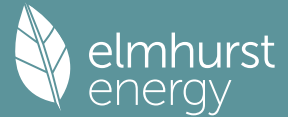
## 2. Ventilation rate

|                                                                                                    |                                                                                                                                     |              |
|----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|--------------|
| 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) =                                                                                                                     | 0.0930 (8)   |
| Pressure test                                                                                      | Yes                                                                                                                                 |              |
| Pressure Test Method                                                                               | Blower Door                                                                                                                         |              |
| Measured/design AP50                                                                               | 5.0000                                                                                                                              | (17)         |
| Infiltration rate                                                                                  | 0.3430                                                                                                                              | (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) =                                                                                                                | 0.3173 (21)  |
| Wind speed                                                                                         | Jan 4.3000 Feb 4.2000 Mar 4.3000 Apr 3.9000 May 3.9000 Jun 3.4000 Jul 3.3000 Aug 3.3000 Sep 3.4000 Oct 3.8000 Nov 3.8000 Dec 3.9000 | (22)         |
| Wind factor                                                                                        | 1.0750 1.0500 1.0750 0.9750 0.9750 0.8500 0.8250 0.8250 0.8500 0.9500 0.9500 0.9750                                                 | (22a)        |
| Adj infilt rate                                                                                    | 0.3411 0.3332 0.3411 0.3094 0.3094 0.2697 0.2618 0.2618 0.2697 0.3014 0.3014 0.3094                                                 | (22b)        |
| Effective ac                                                                                       | 0.5582 0.5555 0.5582 0.5479 0.5479 0.5364 0.5343 0.5343 0.5364 0.5454 0.5454 0.5479                                                 | (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                                                    |             |                |                      |                  |                                      |                   |               |       |
| Door                                                             |             |                | 2.0000               | 1.3000           | 2.6000                               |                   |               | (26)  |
| Window                                                           |             |                | 28.0400              | 1.2357           | 34.6502                              |                   |               | (27)  |
| Roof Light                                                       |             |                | 2.4000               | 1.2357           | 2.9658                               |                   |               | (27a) |
| Heatloss Floor 1                                                 |             |                | 58.1600              | 0.1200           | 6.9792                               | 110.0000          | 6397.6000     | (28a) |
| External Wall                                                    | 233.4600    | 30.0400        | 203.4200             | 0.1800           | 36.6156                              | 140.0000          | 28478.8009    | (29a) |
| External Roof                                                    | 61.4600     | 2.4000         | 59.0600              | 0.1600           | 9.4496                               | 9.0000            | 531.5400      | (30)  |
| Total net area of external elements Aum(A, m2)                   |             |                | 353.0800             |                  |                                      |                   |               | (31)  |
| Fabric heat loss, W/K = Sum (A x U)                              |             |                | (26)...(30) + (32) = |                  | 93.2604                              |                   |               | (33)  |
| Main dwelling                                                    |             |                |                      |                  |                                      |                   |               |       |
| Internal Wall                                                    |             |                | 234.2200             |                  |                                      | 100.0000          | 23422.0001    | (32c) |
| Internal Floor                                                   |             |                | 56.8200              |                  |                                      | 18.0000           | 1022.7600     | (32d) |
| Internal Floor                                                   |             |                | 49.1700              |                  |                                      | 18.0000           | 885.0600      | (32d) |
| Internal Ceiling                                                 |             |                | 56.8200              |                  |                                      | 9.0000            | 511.3800      | (32e) |
| Internal Ceiling                                                 |             |                | 49.1700              |                  |                                      | 9.0000            | 442.5300      | (32e) |
| Heat capacity Cm = Sum(A x k)                                    |             |                |                      |                  | (28)...(30) + (32) + (32a)...(32e) = |                   | 61691.6711    | (34)  |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K                |             |                |                      |                  |                                      |                   | 375.8250      | (35)  |
| List of Thermal Bridges                                          |             |                |                      |                  |                                      |                   |               |       |
| K1 Element                                                       |             |                |                      | Length           | Psi-value                            | Total             |               |       |
| E2 Other lintels (including other steel lintels)                 |             |                |                      | 20.6000          | 0.0300                               | 0.6180            |               |       |
| E3 Sill                                                          |             |                |                      | 19.6500          | 0.0400                               | 0.7860            |               |       |
| E4 Jamb                                                          |             |                |                      | 56.2000          | 0.0500                               | 2.8100            |               |       |
| E5 Ground floor (normal)                                         |             |                |                      | 32.0100          | 0.1600                               | 5.1216            |               |       |
| E6 Intermediate floor within a dwelling                          |             |                |                      | 40.7000          | 0.0010                               | 0.0407            |               |       |
| E16 Corner (normal)                                              |             |                |                      | 44.6000          | 0.0900                               | 4.0140            |               |       |
| E17 Corner (inverted - internal area greater than external area) |             |                |                      | 13.0000          | -0.0900                              | -1.1700           |               |       |
| E11 Eaves (insulation at rafter level)                           |             |                |                      | 13.4000          | 0.0400                               | 0.5360            |               |       |
| E13 Gable (insulation at rafter level)                           |             |                |                      | 26.4800          | 0.0400                               | 1.0592            |               |       |
| R1 Head of roof window                                           |             |                |                      | 3.2000           | 0.0800                               | 0.2560            |               |       |
| R2 Sill of roof window                                           |             |                |                      | 3.2000           | 0.0600                               | 0.1920            |               |       |
| R3 Jamb of roof window                                           |             |                |                      | 6.0000           | 0.0800                               | 0.4800            |               |       |
| R4 Ridge (vaulted ceiling)                                       |             |                |                      | 14.7000          | 0.0500                               | 0.7350            |               |       |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)       |             |                |                      |                  |                                      |                   | 15.4785       | (36)  |
| Point Thermal bridges                                            |             |                |                      |                  |                                      | (36a) =           | 0.0000        |       |
| Total fabric heat loss                                           |             |                |                      |                  | (33) + (36) + (36a) =                |                   | 108.7389      | (37)  |

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|                           |          |          |          |          |          |          |          |          |          |          |          |               |
|---------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| (38)m                     | 79.1889  | 78.8094  | 79.1889  | 77.7247  | 77.7247  | 76.0953  | 75.7962  | 75.7962  | 76.0953  | 77.3810  | 77.3810  | 77.7247 (38)  |
| Heat transfer coeff       | 187.9277 | 187.5483 | 187.9277 | 186.4635 | 186.4635 | 184.8342 | 184.5351 | 184.5351 | 184.8342 | 186.1198 | 186.1198 | 186.4635 (39) |
| Average = Sum(39)m / 12 = |          |          |          |          |          |          |          |          |          |          |          | 186.1477      |
|                           | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
| HLP                       | 1.1449   | 1.1425   | 1.1449   | 1.1359   | 1.1359   | 1.1260   | 1.1242   | 1.1242   | 1.1260   | 1.1338   | 1.1338   | 1.1359 (40)   |
| HLP (average)             |          |          |          |          |          |          |          |          |          |          |          | 1.1340        |
| Days in mont              | 31       | 28       | 31       | 30       | 31       | 30       | 31       | 31       | 30       | 31       | 30       | 31            |

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

|                                                                                |          |          |          |          |          |          |          |          |          |          |          |               |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Assumed occupancy                                                              |          |          |          |          |          |          |          |          |          |          |          | 2.9547 (42)   |
| Hot water usage for mixer showers                                              |          |          |          |          |          |          |          |          |          |          |          |               |
| Hot water usage for baths                                                      |          |          |          |          |          |          |          |          |          |          |          |               |
| Hot water usage for other uses                                                 |          |          |          |          |          |          |          |          |          |          |          |               |
| Average daily hot water use (litres/day)                                       |          |          |          |          |          |          |          |          |          |          |          |               |
|                                                                                | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
| Daily hot water use                                                            | 147.9174 | 144.7144 | 140.7913 | 135.6623 | 130.8918 | 124.8894 | 121.4730 | 127.1499 | 130.8417 | 136.8029 | 142.9413 | 147.8278 (44) |
| Energy conte                                                                   | 217.7599 | 191.4864 | 201.1879 | 177.2089 | 168.6673 | 144.4304 | 134.2312 | 149.6578 | 151.7698 | 176.2844 | 193.1899 | 217.0960 (45) |
| Energy content (annual)                                                        |          |          |          |          |          |          |          |          |          |          |          |               |
| Distribution loss (46)m = 0.15 x (45)m                                         |          |          |          |          |          |          |          |          |          |          |          |               |
| Water storage loss:                                                            |          |          |          |          |          |          |          |          |          |          |          |               |
| Store volume                                                                   |          |          |          |          |          |          |          |          |          |          |          | 300.0000 (47) |
| b) If manufacturer declared loss factor is not known :                         |          |          |          |          |          |          |          |          |          |          |          |               |
| Hot water storage loss factor from Table 2 (kWh/litre/day)                     |          |          |          |          |          |          |          |          |          |          |          | 0.0103 (51)   |
| Volume factor from Table 2a                                                    |          |          |          |          |          |          |          |          |          |          |          | 0.7368 (52)   |
| Temperature factor from Table 2b                                               |          |          |          |          |          |          |          |          |          |          |          | 0.5400 (53)   |
| Enter (49) or (54) in (55)                                                     |          |          |          |          |          |          |          |          |          |          |          | 1.2281 (55)   |
| Total storage loss                                                             |          |          |          |          |          |          |          |          |          |          |          |               |
| If cylinder contains dedicated solar storage                                   |          |          |          |          |          |          |          |          |          |          |          |               |
| Primary loss                                                                   |          |          |          |          |          |          |          |          |          |          |          |               |
| Combi loss                                                                     |          |          |          |          |          |          |          |          |          |          |          |               |
| Total heat required for water heating calculated for each month                |          |          |          |          |          |          |          |          |          |          |          |               |
| WWHRS                                                                          |          |          |          |          |          |          |          |          |          |          |          |               |
| PV diverter                                                                    |          |          |          |          |          |          |          |          |          |          |          |               |
| Aperture area of solar collector                                               |          |          |          |          |          |          |          |          |          |          |          |               |
| Zero-loss collector efficiency                                                 |          |          |          |          |          |          |          |          |          |          |          |               |
| Collector linear heat loss coefficient                                         |          |          |          |          |          |          |          |          |          |          |          |               |
| Collector 2nd order heat loss coefficient                                      |          |          |          |          |          |          |          |          |          |          |          |               |
| Collector loop efficiency                                                      |          |          |          |          |          |          |          |          |          |          |          |               |
| Incidence angle modifier                                                       |          |          |          |          |          |          |          |          |          |          |          |               |
| Overshading factor                                                             |          |          |          |          |          |          |          |          |          |          |          |               |
| Overall heat loss coefficient of system                                        |          |          |          |          |          |          |          |          |          |          |          |               |
| Heat loss coefficient of collector loop                                        |          |          |          |          |          |          |          |          |          |          |          |               |
| Dedicated solar storage volume                                                 |          |          |          |          |          |          |          |          |          |          |          |               |
| Effective solar volume                                                         |          |          |          |          |          |          |          |          |          |          |          |               |
| Reference volume                                                               |          |          |          |          |          |          |          |          |          |          |          |               |
| Storage tank correction coefficient                                            |          |          |          |          |          |          |          |          |          |          |          |               |
| Heat delivered to hot water                                                    |          |          |          |          |          |          |          |          |          |          |          |               |
| Heat delivered to space heating                                                |          |          |          |          |          |          |          |          |          |          |          |               |
| Solar input                                                                    |          |          |          |          |          |          |          |          |          |          |          |               |
| Solar input                                                                    | -0.0000  | -5.6967  | -47.8119 | -74.6979 | -97.4290 | -90.9152 | -84.9735 | -75.1633 | -52.9457 | -23.2229 | -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                                                                | 279.0921 | 241.1865 | 213.3124 | 155.1111 | 119.7762 | 100.2622 | 97.5630  | 123.7302 | 152.7750 | 212.9979 | 252.5436 | 278.4282 (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                                       | 121.4709 | 107.9867 | 114.8441 | 101.0021 | 94.9122  | 85.4207  | 83.2761  | 89.1498  | 93.6242  | 106.5637 | 111.7186 | 121.2502 (65) |

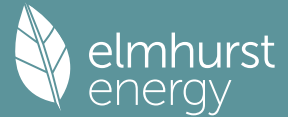
## 5. Internal gains (see Table 5 and 5a)

|                                                                                     |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Metabolic gains (Table 5), Watts                                                    |          |          |          |          |          |          |          |          |          |          |          |               |
| (66)m                                                                               | 177.2795 | 177.2795 | 177.2795 | 177.2795 | 177.2795 | 177.2795 | 177.2795 | 177.2795 | 177.2795 | 177.2795 | 177.2795 | 177.2795 (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     |          |          |          |          |          |          |          |          |          |          |          |               |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 |          |          |          |          |          |          |          |          |          |          |          |               |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    |          |          |          |          |          |          |          |          |          |          |          |               |
| Pumps, fans                                                                         | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (70)   |
| Losses e.g. evaporation (negative values) (Table 5)                                 |          |          |          |          |          |          |          |          |          |          |          |               |
| Water heating gains (Table 5)                                                       | 163.2674 | 160.6945 | 154.3604 | 140.2806 | 127.5701 | 118.6399 | 111.9302 | 119.8250 | 130.0335 | 143.2308 | 155.1648 | 162.9707 (72) |
| Total internal gains                                                                | 820.5375 | 818.4993 | 792.1536 | 742.8781 | 689.2184 | 644.5577 | 616.9104 | 624.2705 | 654.4907 | 702.8837 | 755.7669 | 799.3032 (73) |

## 6. Solar gains

| [Jan] | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W   |
|-------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|--------------|
| North | 2.3500     | 9.3942                         | 0.7000                            | 0.7000                             | 0.7700                       | 7.4965 (74)  |
| East  | 12.5500    | 17.3606                        | 0.7000                            | 0.7000                             | 0.7700                       | 73.9839 (76) |
| South | 4.7900     | 41.2355                        | 0.7000                            | 0.7000                             | 0.7700                       | 67.0713 (78) |
| West  | 8.3500     | 17.3606                        | 0.7000                            | 0.7000                             | 0.7700                       | 49.2244 (80) |

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|             |           |           |           |           |           |           |           |           |           |           |              |               |
|-------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|--------------|---------------|
| North       | 2.4000    |           | 23.0000   |           | 0.7000    |           | 0.7000    |           | 1.0000    |           | 24.3432 (82) |               |
| Solar gains | 222.1192  | 426.4719  | 697.7525  | 1001.9008 | 1179.9115 | 1231.6968 | 1146.1120 | 988.0639  | 827.4063  | 529.8289  | 290.1958     | 199.3744 (83) |
| Total gains | 1042.6567 | 1244.9712 | 1489.9061 | 1744.7789 | 1869.1299 | 1876.2546 | 1763.0224 | 1612.3344 | 1481.8970 | 1232.7126 | 1045.9626    | 998.6776 (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                                                                         | 91.1870                   | 91.3715 | 91.1870 | 91.9031 | 91.9031 | 92.7132 | 92.8635 | 92.8635 | 92.7132 | 92.0728 | 92.0728 | 91.9031      |
| alpha                                                                       | 7.0791                    | 7.0914  | 7.0791  | 7.1269  | 7.1269  | 7.1809  | 7.1909  | 7.1909  | 7.1809  | 7.1382  | 7.1382  | 7.1269       |
| util living area                                                            | 0.9996                    | 0.9985  | 0.9918  | 0.9428  | 0.7738  | 0.5388  | 0.4078  | 0.4682  | 0.7693  | 0.9794  | 0.9988  | 0.9997 (86)  |
| MIT                                                                         | 20.2673                   | 20.3792 | 20.5583 | 20.7942 | 20.9274 | 20.9547 | 20.9565 | 20.9561 | 20.9351 | 20.7399 | 20.4541 | 20.2465 (87) |
| Th 2                                                                        | 19.9644                   | 19.9662 | 19.9644 | 19.9716 | 19.9716 | 19.9796 | 19.9811 | 19.9811 | 19.9796 | 19.9733 | 19.9733 | 19.9716 (88) |
| util rest of house                                                          | 0.9994                    | 0.9977  | 0.9873  | 0.9138  | 0.6954  | 0.4406  | 0.3015  | 0.3525  | 0.6687  | 0.9633  | 0.9979  | 0.9996 (89)  |
| MIT 2                                                                       | 19.1116                   | 19.2564 | 19.4821 | 19.7710 | 19.8987 | 19.9235 | 19.9256 | 19.9255 | 19.9142 | 19.7167 | 19.3585 | 19.0910 (90) |
| Living area fraction                                                        | fLA = Living area / (4) = |         |         |         |         |         |         |         |         |         |         |              |
| MIT                                                                         | 19.3028                   | 19.4421 | 19.6601 | 19.9403 | 20.0689 | 20.0940 | 20.0961 | 20.0960 | 20.0831 | 19.8860 | 19.5397 | 19.2821 (92) |
| Temperature adjustment                                                      | 0.0000                    |         |         |         |         |         |         |         |         |         |         |              |
| adjusted MIT                                                                | 19.3028                   | 19.4421 | 19.6601 | 19.9403 | 20.0689 | 20.0940 | 20.0961 | 20.0960 | 20.0831 | 19.8860 | 19.5397 | 19.2821 (93) |

## 8. Space heating requirement

|                                                                                |                            |           |           |           |           |          |          |          |           |           |           |                 |
|--------------------------------------------------------------------------------|----------------------------|-----------|-----------|-----------|-----------|----------|----------|----------|-----------|-----------|-----------|-----------------|
|                                                                                | Jan                        | Feb       | Mar       | Apr       | May       | Jun      | Jul      | Aug      | Sep       | Oct       | Nov       | Dec             |
| Utilisation                                                                    | 0.9992                     | 0.9972    | 0.9854    | 0.9127    | 0.7034    | 0.4517   | 0.3136   | 0.3656   | 0.6798    | 0.9615    | 0.9974    | 0.9995 (94)     |
| Useful gains                                                                   | 1041.8738                  | 1241.4280 | 1468.2277 | 1592.4701 | 1314.6856 | 847.5677 | 552.7972 | 589.5034 | 1007.3669 | 1185.2196 | 1043.2653 | 998.1525 (95)   |
| Ext temp.                                                                      | 5.0000                     | 5.6000    | 7.1000    | 9.7000    | 12.8000   | 15.5000  | 17.1000  | 16.9000  | 14.5000   | 11.2000   | 7.7000    | 4.8000 (96)     |
| Heat loss rate W                                                               | 2687.8853                  | 2596.0682 | 2360.3952 | 1909.4380 | 1355.3785 | 849.1362 | 552.8879 | 589.7739 | 1031.9447 | 1616.6296 | 2203.6027 | 2700.3922 (97)  |
| Space heating kWh                                                              | 1224.6326                  | 910.3182  | 663.7726  | 228.2169  | 30.2755   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 320.9690  | 835.4429  | 1266.4663 (98a) |
| Space heating requirement - total per year (kWh/year)                          | 5480.0941                  |           |           |           |           |          |          |          |           |           |           |                 |
| 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                                                              | 1224.6326                  | 910.3182  | 663.7726  | 228.2169  | 30.2755   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 320.9690  | 835.4429  | 1266.4663 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) | 5480.0941                  |           |           |           |           |          |          |          |           |           |           |                 |
| Space heating per m2                                                           | (98c) / (4) = 33.3847 (99) |           |           |           |           |          |          |          |           |           |           |                 |

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

|                                                                                                              |                 |          |          |           |           |           |          |          |          |          |          |                 |
|--------------------------------------------------------------------------------------------------------------|-----------------|----------|----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                                        |                 |          |          |           |           |           |          |          |          |          |          | 0.0000 (201)    |
| Fraction of space heat from main system(s)                                                                   |                 |          |          |           |           |           |          |          |          |          |          | 1.0000 (202)    |
| Efficiency of main space heating system 1 (in %)                                                             |                 |          |          |           |           |           |          |          |          |          |          | 249.9000 (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                                                                                    | 1224.6326       | 910.3182 | 663.7726 | 228.2169  | 30.2755   | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 320.9690 | 835.4429 | 1266.4663 (98)  |
| Space heating efficiency (main heating system 1)                                                             | 249.9000        | 249.9000 | 249.9000 | 249.9000  | 249.9000  | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 249.9000 | 249.9000 | 249.9000 (210)  |
| Space heating fuel (main heating system)                                                                     | 490.0491        | 364.2730 | 265.6153 | 91.3233   | 12.1150   | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 128.4390 | 334.3109 | 506.7893 (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                                                                                    | 279.0921        | 241.1865 | 213.3124 | 155.1111  | 119.7762  | 100.2622  | 97.5630  | 123.7302 | 152.7750 | 212.9979 | 252.5436 | 278.4282 (64)   |
| Efficiency of water heater (217)m                                                                            | 175.1000        | 175.1000 | 175.1000 | 175.1000  | 175.1000  | 175.1000  | 175.1000 | 175.1000 | 175.1000 | 175.1000 | 175.1000 | 175.1000 (216)  |
| Fuel for water heating, kWh/month                                                                            | 159.3901        | 137.7422 | 121.8232 | 88.5843   | 68.4045   | 57.2600   | 55.7184  | 70.6626  | 87.2502  | 121.6436 | 144.2282 | 159.0110 (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                                                                                                 | 6.7945          | 6.1370   | 6.7945   | 6.5753    | 6.7945    | 6.5753    | 6.7945   | 6.7945   | 6.5753   | 6.7945   | 6.5753   | 6.7945 (231)    |
| Lighting                                                                                                     | 36.4968         | 29.2791  | 26.3626  | 19.3144   | 14.9190   | 12.1889   | 13.6096  | 17.6903  | 22.9779  | 30.1482  | 34.0524  | 37.5112 (232)   |
| Electricity generated by PVs (Appendix M) (negative quantity) (233a)m                                        | -36.2084        | -56.6178 | -89.2776 | -102.8838 | -107.6928 | -102.1064 | -99.1630 | -92.2129 | -82.4829 | -68.3603 | -43.2258 | -32.9645 (233a) |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m                              | 0.0000          | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234a)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m                  | 0.0000          | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235a)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m | 0.0000          | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235c)   |
| Electricity generated by PVs (Appendix M) (negative quantity) (233b)m                                        | 0.0000          | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (233b)   |
| Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m                              | 0.0000          | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (234b)   |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m                  | 0.0000          | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235b)   |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m | 0.0000          | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (235d)   |
| Annual totals kWh/year                                                                                       |                 |          |          |           |           |           |          |          |          |          |          |                 |
| Space heating fuel - main system 1                                                                           | 2192.9148 (211) |          |          |           |           |           |          |          |          |          |          |                 |
| Space heating fuel - main system 2                                                                           | 0.0000 (213)    |          |          |           |           |           |          |          |          |          |          |                 |
| Space heating fuel - secondary                                                                               | 0.0000 (215)    |          |          |           |           |           |          |          |          |          |          |                 |
| Efficiency of water heater                                                                                   | 175.1000        |          |          |           |           |           |          |          |          |          |          |                 |
| Water heating fuel used                                                                                      | 1271.7182 (219) |          |          |           |           |           |          |          |          |          |          |                 |
| Space cooling fuel                                                                                           | 0.0000 (221)    |          |          |           |           |           |          |          |          |          |          |                 |

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|                                                     |                |
|-----------------------------------------------------|----------------|
| Electricity for pumps and fans:                     |                |
| pump for solar water heating                        | 80.0000 (230g) |
| Total electricity for the above, kWh/year           | 80.0000 (231)  |
| Electricity for lighting (calculated in Appendix L) | 294.5503 (232) |

|                                                               |                 |
|---------------------------------------------------------------|-----------------|
| Energy saving/generation technologies (Appendices M ,N and Q) |                 |
| PV generation                                                 | -913.1964 (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                           | 2925.9868 (238) |

## 10a. Fuel costs - using BEDF prices (572)

|                                             | Fuel<br>kWh/year | Fuel price<br>p/kWh | Fuel cost<br>£/year |
|---------------------------------------------|------------------|---------------------|---------------------|
| Space heating - main system 1               | 2192.9148        | 26.0600             | 571.4736 (240)      |
| Total CO2 associated with community systems |                  |                     | 0.0000 (473)        |
| Water heating (other fuel)                  | 1271.7182        | 26.0600             | 331.4098 (247)      |
| Energy for instantaneous electric shower(s) | 0.0000           | 26.0600             | 0.0000 (247a)       |
| Pumps, fans and electric keep-hot           | 0.0000           | 0.0000              | 0.0000 (249)        |
| Pump for solar water heating                | 80.0000          | 26.0600             | 20.8480 (249)       |
| Energy for lighting                         | 294.5503         | 26.0600             | 76.7598 (250)       |
| Additional standing charges                 |                  |                     | 0.0000 (251)        |
| Energy saving/generation technologies       |                  |                     |                     |
| PV Unit electricity used in dwelling        | -913.1964        | 26.0600             | -237.9790           |
| PV Unit electricity exported                | 0.0000           | 5.8100              | 0.0000              |
| Total                                       |                  |                     | -237.9790 (252)     |
| Total energy cost                           |                  |                     | 762.5122 (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               | 2192.9148          | 0.1569                        | 344.0145 (261)           |
| Total CO2 associated with community systems |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                  | 1271.7182          | 0.1449                        | 184.2107 (264)           |
| Space and water heating                     |                    |                               | 528.2252 (265)           |
| Pumps, fans and electric keep-hot           | 80.0000            | 0.1387                        | 11.0970 (267)            |
| Energy for lighting                         | 294.5503           | 0.1443                        | 42.5127 (268)            |
| Energy saving/generation technologies       |                    |                               |                          |
| PV Unit electricity used in dwelling        | -913.1964          | 0.1340                        | -122.3961                |
| PV Unit electricity exported                | 0.0000             | 0.0000                        | 0.0000                   |
| Total                                       |                    |                               | -122.3961 (269)          |
| Total CO2, kg/year                          |                    |                               | 459.4388 (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               | 2192.9148          | 1.5808                              | 3466.4885 (275)            |
| Total CO2 associated with community systems |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                  | 1271.7182          | 1.5358                              | 1953.0959 (278)            |
| Space and water heating                     |                    |                                     | 5419.5844 (279)            |
| Pumps, fans and electric keep-hot           | 80.0000            | 1.5128                              | 121.0240 (281)             |
| Energy for lighting                         | 294.5503           | 1.5338                              | 451.7910 (282)             |
| Energy saving/generation technologies       |                    |                                     |                            |
| PV Unit electricity used in dwelling        | -913.1964          | 1.4953                              | -1365.5414                 |
| PV Unit electricity exported                | 0.0000             | 0.0000                              | 0.0000                     |
| Total                                       |                    |                                     | -1365.5414 (283)           |
| Total Primary energy kWh/year               |                    |                                     | 4626.8580 (286)            |