



## ENERGY STATEMENT

**New Dwelling at 35 Grays Lane  
Hitchin  
Hertfordshire  
SG5 2HH**

**December 2025**



## PROJECT DETAILS:

**CLIENT:** Pentangle Design Group  
21a Bancroft  
Hitchin  
Hertfordshire  
SG5 1JW

**PROJECT:** 35 Grays Lane  
Hitchin  
Hertfordshire  
SG5 2HH

**JOB NUMBER:** 25353

**REPORT NUMBER:** 25353/ADF/R01

**DATE ISSUED:** December 2025

**PREPARED BY:**

**Adrian Fell**      **Director**



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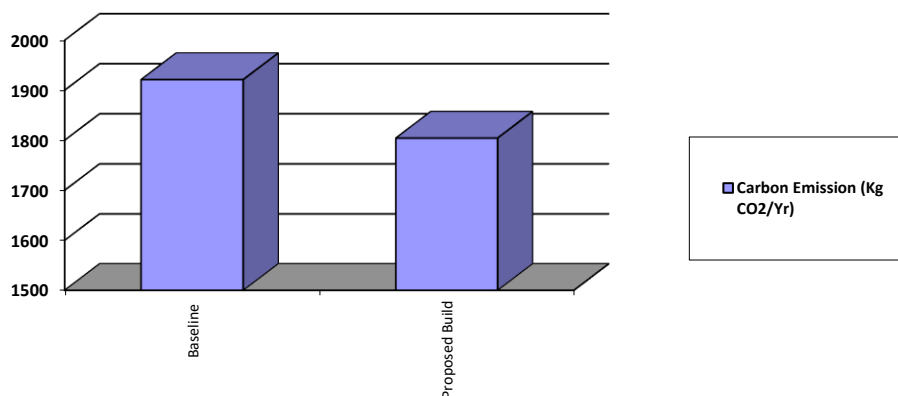
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## 1. Executive Summary

### 1.1 Overall results

From the calculations contained within this report, the CO<sup>2</sup> emissions are as follows;

|                                        | CO2 emissions<br>(kg CO <sub>2</sub> /Yr) | CO2<br>emissions<br>savings % |
|----------------------------------------|-------------------------------------------|-------------------------------|
| Target Emission Rate CO <sub>2</sub>   | 1828                                      |                               |
| Proposed Emission Rate CO <sub>2</sub> | 5340                                      | 65.77                         |



An average of 65.77% reduction in annual carbon emissions has been achieved, exceeding the recommended 35% reduction in carbon dioxide emissions as stipulated by North Herts Council planning policy.

The property will also achieve a regulated Energy use Intensity (EUI) of 18.07 kWh/m<sup>2</sup>/Pa.

### Key energy efficient design measures

The development proposals include the provision of thermal elements (i.e. walls, floors, and roofs) and controlled fittings (i.e. windows and doors) in excess of the requirements of Part L1 of the Building Regulations 2021. Furthermore, the heating system shall perform in excess of the minimum requirements.

### 1.2 Summary of proposed heating systems

The proposed heating systems use a high efficiency gas condensing system boiler with appropriate controls for the size of the dwelling.

## 2. Introduction

Compass Energy Solutions Limited have been asked to produce an Energy Statement relating to a Planning Application for a new dwelling at 35 Grays Lane, Hitchin, Hertfordshire, SG5 2HH.

The requirement for newly created dwellings to reduce their carbon emissions below that as required by Building Regulations is now a well-established feature of Planning Policy. This Energy Statement sets out the applicable policies on energy, the methodology for, and the results from an energy demand assessment. It contains details of the energy efficiency measures being incorporated within the re-development and shows that these will reduce the total carbon dioxide emissions by over 65%.

It also includes an overview of possible renewable energy technologies and identifies the technology most suitable for this development and reasons why other technologies have had to be excluded.

## 3. Planning policies

North Herts Council Supplementary Planning Document for Sustainability sets out how the development proposals should comply to achieve the following;

| Optimising Passive Design & Fabric Performance          |                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|---------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                         | Bronze                                                                                                                                                                                                                                                                                                                                                                                                                                            | Silver                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Gold                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Minor residential schemes less than 10 dwellings</b> | <ul style="list-style-type: none"> <li>✓ Achieve an EPC rating of at least C on all dwellings</li> <li>✓ Submit a Sustainability &amp; Energy Statement showing compliance with Policy and Building Regulations (this should include the Energy Use Intensity (EUI) &amp; the total Space Heating Demand (SHD) calculations with recommendations on methods that could be investigated during technical design to improve performance)</li> </ul> | <ul style="list-style-type: none"> <li>✓ Achieve 80% EPC ratings of at least B and 20% rating of at least C</li> <li>✓ Submit a Sustainability &amp; Energy Statement showing: <ul style="list-style-type: none"> <li>• maximisation of solar gain through site layout, orientation, and design (for the purpose of energy efficiency)</li> <li>• measures to prevent over-heating</li> <li>• lower carbon alternatives to gas boilers</li> <li>• on-site reductions of 35% (minimum) in CO<sub>2</sub> emissions over and above Building Regulations Part L (including</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>✓ Achieve an EPC rating of B on all dwellings</li> <li>✓ Submit a Sustainability &amp; Energy Statement showing: <ul style="list-style-type: none"> <li>• on-site reductions of 50% (minimum) in CO<sub>2</sub> emissions over and above Building Regs Part L (including at least 10% reductions through fabric first measures)</li> <li>• commitment to achieve Passivhaus certification and site assessment at planning stage using Passive House Planning Package (PHPP) to confirm</li> </ul> </li> </ul> |
|                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <ul style="list-style-type: none"> <li>at least 10% reductions through fabric first measures) (inclusive of MHVR)</li> <li>• EUI ≤ 60 kWh/m<sup>2</sup>/yr (inclusive of estimated unregulated energy) (<a href="#">RIBA 2025</a>)</li> <li>• SHD ≤ 30 kWh/m<sup>2</sup>/yr (<a href="#">Passivhaus low energy building</a>) or ≤ 40 kWh/m<sup>2</sup>/yr (<a href="#">AECB/ Energiesprong new build</a>)</li> </ul>                                                                                                                                                                           | <ul style="list-style-type: none"> <li>compliance against Passivhaus Classic, Plus or Premium.</li> <li>Or <ul style="list-style-type: none"> <li>• assessment of the development using <a href="#">CIBSE TM54</a> or alternative operational energy modelling software and confirms compliance with LETI or <a href="#">RIBA 2030</a> standards: <ul style="list-style-type: none"> <li>○ EUI ≤35 kWh/m<sup>2</sup>/yr</li> <li>○ SHD ≤15 kWh/m<sup>2</sup>/yr</li> </ul> </li> </ul> </li> </ul>                                                   |

## 4. Calculation methodology

The energy demand has been predicted in accordance with the requirements set out above. The space heating, hot water and lighting energy demand was calculated using the SAP 10 calculation methodology, and referenced in the current version of the Building Regulations (Part L1 2021).

The starting point was to determine the performance of the "compliant case" for the dwelling, using the typical orientation and a level of insulation and building services equipment performance consistent with the development achieving compliance with Approved Document L1 2021. The specific energy consumption figures for space heating, hot water and lighting were then extracted. The calculations were then repeated using the U-values, boiler efficiency, proportion of dedicated low energy lighting, and heating controls proposed for the scheme. These results permitted the benefit of the energy efficiency measures to be determined.

These "actual case" results were then used when evaluating the options for renewable energy needed and the saving in carbon dioxide emissions that the proposed technologies could provide. The results obtained from this analysis are presented in the following sections and summarised graphically in Section 1.

## 5. Energy demand and efficiency

### 5.1 Baseline assessment

The total energy demand has been calculated taking full account of energy demands for space heating and hot water, and electricity for pumps, fans, lights and appliances. The "compliant case" was determined by using the typical orientation for each dwelling and the use of building elements (walls, windows etc.) with U-values consistent with achieving compliance with Approved Document Part LA: 2013.

The baseline threshold U-Values are as follows;

|                  |                                                                                     |
|------------------|-------------------------------------------------------------------------------------|
| Heat loss floors | 0.13 W/m <sup>2</sup> K                                                             |
| Walls:           | 0.18 W/m <sup>2</sup> K                                                             |
| Roofs:           | 0.11 W/m <sup>2</sup> K                                                             |
| Doors:           | 1.00 W/m <sup>2</sup> K                                                             |
| Windows:         | 1.15 W/m <sup>2</sup> K                                                             |
| Boilers:         | 92.4% efficient condensing system boiler with programmer, room thermostat and TRV's |
| Air Permeability | 5.0 m <sup>3</sup> /hm <sup>2</sup>                                                 |
| Ventilation      | Standard intermittent extract fans                                                  |

### 5.2 Energy efficiency measures

Having established a "compliant case" the calculations were repeated using the actual heating system, proposed U-values, actual proposed proportion of dedicated low energy light fittings.

The actual proposed U-Values are as follows;

|                  |                                                                            |
|------------------|----------------------------------------------------------------------------|
| Heat loss floors | 0.11 W/m <sup>2</sup> K                                                    |
| External walls   | 0.17 W/m <sup>2</sup> K                                                    |
| Roofs            | 0.13 – 0.14 W/m <sup>2</sup> K                                             |
| Doors:           | 0.80 W/m <sup>2</sup> K                                                    |
| Windows:         | 0.90 W/m <sup>2</sup> K                                                    |
| Heating:         | 2 x Mitsubishi Ecodan 11.2kW air source heat pumps with underfloor heating |
| Air Permeability | 4.0 m <sup>3</sup> /hm <sup>2</sup>                                        |
| Ventilation      | Decentralised Mechanical Ventilation with heat recovery                    |

**Table 1 - Proposed Carbon Emission Figures**

| Annual Emissions (kg CO <sub>2</sub> /yr)          | 5340   |
|----------------------------------------------------|--------|
| Improved Annual Emissions (kg CO <sub>2</sub> /yr) | 1828   |
| Percentage Improvement                             | 65.77% |

## 6. Consideration of Combined Heat and Power and Trigenation systems

Combined Heat and Power (CHP) and Combined Cooling Heat and Power (CCHP) or Trigenation Systems are recognised as a very desirable way of reducing energy wastage and resulting carbon dioxide emissions. While generally operating on fossil fuel, mainly natural gas, their advantage is that the waste heat normally associated with electricity generation is put to good use providing space heating and hot water. This means that the overall fuel efficiency can be increased significantly — typically to above 80% compared to 30 — 40% for grid electricity. The main effect is to approximately halve the carbon dioxide emissions associated with electricity use on the development for all the electricity produced by the CHP plant.

However community heating systems are not considered to be viable on developments of less than approximately 100 units. Although micro-CHP devices are now becoming more available data to support energy and carbon saving from CHP is still developing and "these devices are unlikely to be appropriate for highly insulated houses with small heat losses" (ODPM, 2006).

For these reasons CHP is not regarded as viable on this development.

## 7. Consideration of Renewable Energy Technologies

### 7.1 Overview of renewable energy

Renewable energy is defined as energy derived from energy flows that occur naturally and repeatedly in the environment. It may be contrasted with energy sources that can be depleted such as fossil fuels or nuclear power.

Renewable energy technologies, can be summarised as follows:

- Solar thermal — direct heating of water for space heating or domestic hot water;
- Photovoltaic — direct generation of electricity from sunlight;
- Hydroelectricity — use of water cycle driven flows to generate electricity;
- Wind turbines — use of solar driven air movement to generate electricity;
- Heat pumps — extraction of heat from the earth, atmosphere or water bodies;
- Bio-fuels — combustion of solid or liquid bio-fuels to produce heat or electricity;

The technologies, and their potential application to this site are discussed in more detail in the following sections. However, one further pertinent point must be made. The reason for adopting renewable energy technologies is to reduce greenhouse gas emissions — mainly carbon dioxide. And none of the technologies are wholly "zero carbon".

This is because when the whole life cycle is taken into account some energy has to be put into every system to manufacture and maintain the equipment (which has a finite life) or to operate the equipment, and generally at present this energy is derived from non-renewable sources. Examples include the energy needed to refine and process the silicon used to manufacture photovoltaic panels and the diesel fuel used to produce and transport wood pellets.

Finally, due to the constantly changing and innovative nature of the renewable energy industry even similar products can differ in vital practical details which means that detailed design of installations must be undertaken

by experts, often working closely with the product manufacturers, as virtually no two products are identical or interchangeable.

The following sections contain a summary of each technology that is potentially applicable and a comparison of the advantages and disadvantages of technologies relevant to this development.

## **7.2 Solar thermal panels**

A typical solar thermal (hot water) panel can provide 400 kWh of useable hot water per year for every square metre of panel. However, the maximum panel area that can generally be used on a typical house is 6m<sup>2</sup> to avoid excessive summer panel temperatures or the need for an over-sized hot water cylinder, and in fact the calculated usable output per m<sup>2</sup> drops rapidly with panels above 3 m<sup>2</sup>. This is likely to limit the maximum carbon dioxide saving. However, due to the lower carbon savings associated with this technology, solar thermal panels are not suitable on this development.

## **7.3 Photovoltaic panels**

Photovoltaic panels are panels of semiconductor material that produce electricity when exposed to light. They are connected to the building electricity supply via a device called an inverter which converts the output to a form which is compatible with the mains electricity voltage and frequency. This also allows excess electricity to be exported at times when the instantaneous demand from the dwellings is less than that being produced by the panels. This ensures that all the electricity produced is used and achieves a reduction in carbon dioxide emissions. For all purposes relating to Planning, the exported electricity is by convention treated as if it were used on site.

The output of photovoltaic panels is generally specified as kW peak, or kWp. The panel area required to produce an output of 1 kWp varies with panel technology, but a typical 1 kWp mono-crystalline panel would have an area of 7m<sup>2</sup> and produce an annual electricity output of 830kWh.

Due to the cost of the systems, PV has been considered unsuitable on this development.

## **7.4 Hydroelectricity**

There is no water source nearby which could be utilised as an energy source. Also, to site a plant within a water course requires a licence from the Authority (who own or manage it) which is usually granted at a high cost, thus making the payback period less attractive than other forms of low or zero carbon technologies. Hydroelectricity has been considered unsuitable on this development.

## **7.5 Wind turbines**

Micro wind turbines produce electricity and can be grid-connected in the same way as photovoltaic panels. Although wind turbines are one of the most cost effective renewable energy technologies, for smaller turbines the capital cost is relatively high compared to the amount of power generated. Adjacent buildings create turbulence and the location affects wind speed and to be effective an average wind speed of no less than 5m/s is required. Due to the location of the site, along with the installation cost, the development is considered unsuitable for a wind turbine.

## **7.6 Heat pumps**

Heat pumps collect low temperature heat from renewable sources and concentrate it to a usable temperature. Fossil fuel based (grid) electricity is generally required to operate the pumps and the renewable component of the output is therefore by convention taken as the difference between the output energy and the input energy. A typical heat pump will deliver 3 kWh of useful energy for every 1 kWh of input energy. A heat pump operating in this way would therefore be deemed to have delivered 2 kWh of renewable energy.

In this case, ground source heat pumps are considered not to be feasible due to the cost. However, air source heat pumps are more cost effective, and significantly reduce carbon emissions. Therefore, air source heat pumps are considered suitable for this development.

## **7.7 Bio-fuels**

Key planning and design issues include the building space and organisation to accommodate and operate the plant. The plant would be floor standing, requiring floor space of potentially 1000x1500m for access and maintenance. Facilities are required for ash disposal and sufficient fuel storage must be provided along with loading access for the fuel to be safely and efficiently delivered and stored. It is also often the case that wood fuel costs more than gas reducing the economic benefit of such a scheme particularly in small dwellings.

This option is considered to be unsuitable due to the restricted site and therefore limited floor space available for any plant and storage space.

## 8. Renewable energy proposals and results

Based on the review completed in the preceding section, air source heat pumps have been selected as the most appropriate technology.

Whilst it is not technically or financially feasible to improve the fabric energy efficiency so that 10% carbon savings can be accomplished when compared to the notional building, the fact that a 65.77% carbon reduction improvement over and above Part L1 2021 compliance is a considerable achievement.

In addition, the property will also achieve a regulated Energy use Intensity (EUI) of 18.07 kWh/m<sup>2</sup>/Pa.

## 9. Water Efficiency

North Herts Council requires that new residential developments are designed so that mains water consumption would meet a target of 110 litres or less per head per day, including an allowance of 5 litres or less per head per day for external water consumption.

The calculation methodology is contained within Approved Document G of the Building Regulations, and the proposed specification to achieve the 110 litres per person per day is listed in the table below.

| PRODUCT                                          | SPECIFICATION    | PARAMETER                |
|--------------------------------------------------|------------------|--------------------------|
| W/C                                              | 5/2.5 Dual Flush | Litres Per Flush         |
| Basin Taps                                       | 4                | Litres per Minute        |
| Kitchen Taps                                     | 6                | Litres per Minute        |
| Shower                                           | 9                | Litres per Minute        |
| Bath                                             | 170              | Litres per Minute        |
| Washing Machine                                  | 8.17             | Litres per Kilo dry load |
| Dishwasher                                       | 1.25             | Litres per Place Setting |
| <b>Total Consumption (Litres / Person / Day)</b> |                  | <b>109.9</b>             |

## 10. Conclusion

The results show that the development proposal meets the applicable planning policies that relate to energy conservation and carbon reduction.

Compared to the Part L1 2021 compliant baseline referenced in this report, the development proposals include energy efficiency measures that reduce the carbon dioxide emissions by in excess of the recommended target.

# Appendix 1 – SAP Worksheets

|                                    |                                         |               |                |            |       |
|------------------------------------|-----------------------------------------|---------------|----------------|------------|-------|
| Plot Reference                     | 35 Grays Lane, Hitchin                  |               | Issued on Date | 15/12/2025 |       |
| Assessment Reference               | Energy Statement                        | Plot Type Ref |                |            |       |
| Plot Address                       | 35, Grays Lane, Hitchin, Herts, SG5 2HH |               | SAP Version    | 10.2       |       |
|                                    |                                         |               |                |            |       |
| SAP Rating                         | 84 B                                    | DER           | 2.73           | TER        | 7.97  |
| Environmental                      | 97 A                                    | % DER < TER   | 65.75          |            |       |
| CO <sub>2</sub> Emissions (t/year) | 1.73                                    | DFEE          | 41.06          | TFEE       | 41.35 |
| Compliance Check                   | See BREL                                | % DFEE < TFEE | 0.71           |            |       |
| % DPER < TPER                      | 34.04                                   | DPER          | 28.18          | TPER       | 42.72 |
|                                    |                                         |               |                |            |       |
| Mr. Adrian Fell                    |                                         | Assessor ID   | N222-0001      |            |       |
| Client                             | Pentangle Design Architects, Jon Read   |               |                |            |       |

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

1. Overall dwelling characteristics

|                                                        | Area<br>(m <sup>2</sup> ) |   | Storey height<br>(m) |                                   | Volume<br>(m <sup>3</sup> ) |  |
|--------------------------------------------------------|---------------------------|---|----------------------|-----------------------------------|-----------------------------|--|
| Main dwelling                                          |                           |   |                      |                                   |                             |  |
| Basement floor                                         | 236.3800 (1a)             | x | 2.7300 (2a)          | =                                 | 645.3174 (1a) - (3a)        |  |
| Ground floor                                           | 168.7100 (1b)             | x | 2.9500 (2b)          | =                                 | 497.6945 (1b) - (3b)        |  |
| First floor                                            | 151.3800 (1c)             | x | 2.7700 (2c)          | =                                 | 419.3226 (1c) - (3c)        |  |
| Second floor                                           | 113.2400 (1d)             | x | 2.8000 (2d)          | =                                 | 317.0720 (1d) - (3d)        |  |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 669.7100                  |   |                      |                                   | (4)                         |  |
| Dwelling volume                                        |                           |   |                      | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 1879.4065 (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                                                 | 1 * 10 =                    | 10.0000 (6c)                                       |  |
| Number of flues attached to solid fuel boiler                                                      | 0 * 20 =                    | 0.0000 (6d)                                        |  |
| Number of flues attached to other heater                                                           | 0 * 35 =                    | 0.0000 (6e)                                        |  |
| Number of blocked chimneys                                                                         | 0 * 20 =                    | 0.0000 (6f)                                        |  |
| Number of intermittent extract fans                                                                | 0 * 10 =                    | 0.0000 (7a)                                        |  |
| Number of passive vents                                                                            | 0 * 10 =                    | 0.0000 (7b)                                        |  |
| Number of flueless gas fires                                                                       | 0 * 40 =                    | 0.0000 (7c)                                        |  |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = |                             | Air changes per hour<br>10.0000 / (5) = 0.0053 (8) |  |
| Pressure test                                                                                      |                             | Yes                                                |  |
| Pressure Test Method                                                                               |                             | Blower Door                                        |  |
| Measured/design AP50                                                                               |                             | 4.0000 (17)                                        |  |
| Infiltration rate                                                                                  |                             | 0.2053 (18)                                        |  |
| Number of sides sheltered                                                                          |                             | 2 (19)                                             |  |
| Shelter factor                                                                                     | (20) = 1 - [0.075 x (19)] = | 0.8500 (20)                                        |  |
| Infiltration rate adjusted to include shelter factor                                               | (21) = (18) x (20) =        | 0.1745 (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                                                                                         | 0.2225 | 0.2182 | 0.2138 | 0.1920 | 0.1876 | 0.1658 | 0.1658 | 0.1614 | 0.1745 | 0.1876 | 0.1963 | 0.2051 (22b) |
| Mechanical extract ventilation - decentralised                                                          |        |        |        |        |        |        |        |        |        |        |        |              |
| If mechanical ventilation                                                                               |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23b) |
| Effective ac                                                                                            | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 (25)  |

3. Heat losses and heat loss parameter

| Element           | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K    |
|-------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|------------------|
| Main dwelling     |                         |                            |                           |                               |              |                                |                  |
| Windows           |                         |                            | 48.5400                   | 0.8687                        | 42.1680      |                                | (27)             |
| Glazed Doors      |                         |                            | 10.9200                   | 1.1450                        | 12.5038      |                                | (27)             |
| Solid Door        |                         |                            | 1.8900                    | 1.0000                        | 1.8900       |                                | (26)             |
| Velux             |                         |                            | 1.0800                    | 0.7752                        | 0.8372       |                                | (27a)            |
| Basement Floor    |                         |                            | 236.3800                  | 0.1100                        | 26.0018      | 110.0000                       | 26001.8000 (28)  |
| Floor Over Garage |                         |                            | 8.6000                    | 0.1200                        | 1.0320       | 0.0000                         | 0.0000 (28b)     |
| Basement Wall     | 175.5900                |                            | 175.5900                  | 0.1500                        | 26.3385      | 190.0000                       | 33362.1000 (29a) |
| Cavity Wall       | 303.9100                | 57.5700                    | 246.3400                  | 0.1700                        | 41.8778      | 110.0000                       | 27097.4000 (29a) |
| Dormer            | 10.0000                 | 1.8900                     | 8.1100                    | 0.1800                        | 1.4598       | 9.0000                         | 72.9900 (29a)    |
| Sheltered Wall    | 22.7400                 | 1.8900                     | 20.8500                   | 0.1700                        | 3.5445       | 140.0000                       | 2919.0000 (29a)  |
| GF Flat Roof      | 19.3700                 |                            | 19.3700                   | 0.1400                        | 2.7118       | 9.0000                         | 174.3300 (30)    |
| Pitched Roof      | 165.1900                | 1.0800                     | 164.1100                  | 0.1400                        | 22.9754      | 9.0000                         | 1476.9900 (30)   |
| Crown Roof        | 65.4000                 |                            | 65.4000                   | 0.1300                        | 8.5020       | 9.0000                         | 588.6000 (30)    |

$$C_p = \sum (A_i \times C_{p,i}) \quad (28) \dots (30) + (32) + (32a) \dots (32e) = 192343.4400 \quad (34)$$

|                                                            |                       |          |      |
|------------------------------------------------------------|-----------------------|----------|------|
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |                       |          |      |
| Point Thermal bridges                                      | (36a) =               | 0.0000   | (36) |
| Total fabric heat loss                                     | (33) + (36) + (36a) = | 246.8552 | (37) |

| 4. Water heating energy requirements (kWh/year)                                |          |          |          |          |          |          |          |          |          |          |          |                              |
|--------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------------------------------|
| Assumed occupancy                                                              |          |          |          |          |          |          |          |          |          |          |          | 3.6126 (42)                  |
| Hot water usage for mixer showers                                              | 95.3895  | 93.9560  | 91.8671  | 87.8703  | 84.9208  | 81.6315  | 79.7619  | 81.8350  | 84.1075  | 87.6392  | 91.7218  | 95.0240 (42a)                |
| Hot water usage for baths                                                      | 36.5860  | 36.0426  | 35.2775  | 33.8667  | 32.8103  | 31.6389  | 31.0062  | 31.7660  | 32.5933  | 33.8467  | 35.2865  | 36.4623 (42b)                |
| Hot water usage for other uses                                                 | 51.6262  | 49.7488  | 47.8715  | 45.9942  | 44.1169  | 42.2396  | 42.2396  | 44.1169  | 45.9942  | 47.8715  | 49.7488  | 51.6262 (42c)                |
| Average daily hot water use (litres/day)                                       |          |          |          |          |          |          |          |          |          |          |          | 168.7998 (43)                |
|                                                                                | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec                          |
| Daily hot water use                                                            | 183.6016 | 179.7475 | 175.0161 | 167.7312 | 161.8480 | 155.5100 | 153.0077 | 157.7179 | 162.6950 | 169.3574 | 176.7572 | 183.1125 (44)                |
| Energy content (annual)                                                        | 290.7801 | 255.9580 | 268.9932 | 229.6156 | 217.8785 | 191.2177 | 185.0495 | 195.2877 | 200.6192 | 229.8164 | 251.8230 | 286.7099 (45)                |
| Distribution loss (46)m = 0.15 x (45)m                                         |          |          |          |          |          |          |          |          |          |          |          | Total = Sum(45)m = 2803.7487 |
|                                                                                | 43.6170  | 38.3937  | 40.3490  | 34.4423  | 32.6818  | 28.6827  | 27.7574  | 29.2932  | 30.0929  | 34.4725  | 37.7735  | 43.0065 (46)                 |
| Water storage loss (or HIU loss):                                              |          |          |          |          |          |          |          |          |          |          |          |                              |
| Store volume                                                                   |          |          |          |          |          |          |          |          |          |          |          | 300.0000 (47)                |
| a) If manufacturer declared loss factor is known (kWh/day):                    |          |          |          |          |          |          |          |          |          |          |          | 2.3800 (48)                  |
| Temperature factor from Table 2b                                               |          |          |          |          |          |          |          |          |          |          |          | 0.5400 (49)                  |
| Enter (49) or (54) in (55)                                                     |          |          |          |          |          |          |          |          |          |          |          | 1.2852 (55)                  |
| Total storage loss                                                             | 39.8412  | 35.9856  | 39.8412  | 38.5560  | 39.8412  | 38.5560  | 39.8412  | 39.8412  | 38.5560  | 39.8412  | 38.5560  | 39.8412 (56)                 |
| If cylinder contains dedicated solar storage                                   |          |          |          |          |          |          |          |          |          |          |          |                              |
|                                                                                | 39.8412  | 35.9856  | 39.8412  | 38.5560  | 39.8412  | 38.5560  | 39.8412  | 39.8412  | 38.5560  | 39.8412  | 38.5560  | 39.8412 (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                |          |          |          |          |          |          |          |          |          |          |          |                              |
|                                                                                | 353.8837 | 312.9548 | 332.0968 | 290.6836 | 280.9821 | 252.2857 | 248.1531 | 258.3913 | 261.6872 | 292.9200 | 312.8910 | 349.8135 (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                                                                | 353.8837 | 312.9548 | 332.0968 | 290.6836 | 280.9821 | 252.2857 | 248.1531 | 258.3913 | 261.6872 | 292.9200 | 312.8910 | 349.8135 (64)                |
| Total per year (kWh/year)                                                      |          |          |          |          |          |          |          |          |          |          |          | 3546.7427 (64)               |
| Electric shower(s)                                                             |          |          |          |          |          |          |          |          |          |          |          | 3547 (64)                    |
|                                                                                | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (64a)                 |
| Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (64a)                 |
| Heat gains from water heating, kWh/month                                       |          |          |          |          |          |          |          |          |          |          |          |                              |
|                                                                                | 147.1673 | 130.7035 | 139.9231 | 125.2016 | 122.9275 | 112.4343 | 112.0118 | 115.4160 | 115.5603 | 126.8968 | 132.5856 | 145.8139 (65)                |

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6. Solar gains

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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                    | 95.9297 | 95.9297 | 95.9297 | 95.9297 | 95.9297 | 95.9297 | 95.9297 | 95.9297 | 95.9297                   | 95.9297 | 95.9297 | 95.9297       |
| alpha                  | 7.3953  | 7.3953  | 7.3953  | 7.3953  | 7.3953  | 7.3953  | 7.3953  | 7.3953  | 7.3953                    | 7.3953  | 7.3953  | 7.3953        |
| util living area       | 1.0000  | 1.0000  | 0.9998  | 0.9983  | 0.9859  | 0.9088  | 0.7414  | 0.8143  | 0.9785                    | 0.9994  | 1.0000  | 1.0000 (86)   |
| Living                 | 20.1216 | 20.2085 | 20.3473 | 20.5433 | 20.7436 | 20.8968 | 20.9475 | 20.9379 | 20.8181                   | 20.5577 | 20.3013 | 20.1029       |
| Non living             | 19.1615 | 19.2731 | 19.4511 | 19.7022 | 19.9554 | 20.1291 | 20.1682 | 20.1634 | 20.0480                   | 19.7210 | 19.3921 | 19.1375       |
| 24 / 16                | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0                         | 0       | 0       | 0             |
| 24 / 9                 | 3       | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0                         | 0       | 0       | 0             |
| 16 / 9                 | 28      | 0       | 0       | 0       | 0       | 0       | 0       | 0       | 0                         | 0       | 0       | 10            |
| MIT                    | 20.5506 | 20.2085 | 20.3473 | 20.5433 | 20.7436 | 20.8968 | 20.9475 | 20.9379 | 20.8181                   | 20.5577 | 20.3013 | 20.2284 (87)  |
| Th2 (88a)m             | 20.2260 | 20.2260 | 20.2260 | 20.2260 | 20.2260 | 20.2260 | 20.2260 | 20.2260 | 20.2260                   | 20.2260 | 20.2260 | 20.2260 (88a) |
| ni2,m (89a)m           | 1.0000  | 0.9999  | 0.9997  | 0.9974  | 0.9770  | 0.8526  | 0.6266  | 0.7072  | 0.9596                    | 0.9990  | 1.0000  | 1.0000 (89a)  |
| MIT2 (90a)m            | 19.8016 | 19.2731 | 19.4511 | 19.7022 | 19.9554 | 20.1291 | 20.1682 | 20.1634 | 20.0480                   | 19.7210 | 19.3921 | 19.3336 (90a) |
| Th2 (88b)m             | 20.2260 | 20.2260 | 20.2260 | 20.2260 | 20.2260 | 20.2260 | 20.2260 | 20.2260 | 20.2260                   | 20.2260 | 20.2260 | 20.2260 (88b) |
| ni2,m (89b)m           | 1.0000  | 0.9999  | 0.9997  | 0.9974  | 0.9770  | 0.8526  | 0.6266  | 0.7072  | 0.9596                    | 0.9990  | 1.0000  | 1.0000 (89b)  |
| MIT2 (90b)m            | 19.1615 | 19.2731 | 19.4511 | 19.7022 | 19.9554 | 20.1291 | 20.1682 | 20.1634 | 20.0480                   | 19.7210 | 19.3921 | 19.1375 (90b) |
| MIT 2                  | 19.4404 | 19.2731 | 19.4511 | 19.7022 | 19.9554 | 20.1291 | 20.1682 | 20.1634 | 20.0480                   | 19.7210 | 19.3921 | 19.2230 (90c) |
| Living area fraction   |         |         |         |         |         |         |         |         | fLA = Living area / (4) = |         |         | 0.1138 (91)   |
| MIT                    | 19.5668 | 19.3795 | 19.5531 | 19.7980 | 20.0451 | 20.2164 | 20.2569 | 20.2515 | 20.1356                   | 19.8162 | 19.4955 | 19.3374 (92)  |
| Temperature adjustment |         |         |         |         |         |         |         |         |                           |         |         | 0.0000        |
| adjusted MIT           | 19.5668 | 19.3795 | 19.5531 | 19.7980 | 20.0451 | 20.2164 | 20.2569 | 20.2515 | 20.1356                   | 19.8162 | 19.4955 | 19.3374 (93)  |

| 8. Space heating requirement                                                   |           |           |           |           |           |           |           |           |           |           |               |                 |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|---------------|-----------------|
|                                                                                | Jan       | Feb       | Mar       | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct       | Nov           | Dec             |
| Utilisation                                                                    | 1.0000    | 0.9999    | 0.9996    | 0.9967    | 0.9741    | 0.8518    | 0.6315    | 0.7111    | 0.9565    | 0.9987    | 0.9999        | 1.0000 (94)     |
| Useful gains                                                                   | 1918.7639 | 2352.0905 | 2685.4995 | 3074.3501 | 3248.7963 | 2835.2356 | 2008.9932 | 2083.3106 | 2550.2024 | 2257.8577 | 1945.2995     | 1809.2692 (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                                                               | 8502.9545 | 8064.4836 | 7270.0293 | 6069.7035 | 4647.8541 | 3128.1224 | 2036.7396 | 2145.1488 | 3361.5753 | 5133.0321 | 6903.7832     | 8430.8746 (97)  |
| Space heating kWh                                                              | 4898.6378 | 3838.7282 | 3410.8901 | 2156.6545 | 1040.8990 | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 2139.1298 | 3570.1083     | 4926.4744 (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |           |           |           |           |           |           |           |               | 25981.5222      |
| 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                                                              | 4898.6378 | 3838.7282 | 3410.8901 | 2156.6545 | 1040.8990 | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 2139.1298 | 3570.1083     | 4926.4744 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |           |           |           |           |           |           |               | 25981.5222      |
| Space heating per m2                                                           |           |           |           |           |           |           |           |           |           |           | (98c) / (4) = | 38.7952 (99)    |

[illegible]

| 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                                        | 4461.1025          | 1.5719                              | 7012.3514 (275)            |
| Space heating - main system 2                                        | 4461.1025          | 1.5719                              | 7012.3514 (276)            |
| Total CO2 associated with community systems                          |                    |                                     | 0.0000 (473)               |
| Water heating (other fuel)                                           | 2078.3146          | 1.5213                              | 3161.7171 (278)            |
| Space and water heating                                              |                    |                                     | 17186.4198 (279)           |
| Pumps, fans and electric keep-hot                                    | 340.0572           | 1.5128                              | 514.4386 (281)             |
| Energy for lighting                                                  | 763.2782           | 1.5338                              | 1170.7416 (282)            |
| Total Primary energy kWh/year                                        |                    |                                     | 18871.6000 (286)           |
| Dwelling Primary energy Rate (DPER)                                  |                    |                                     | 28.1800 (287)              |

| Main dwelling                                          | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)              | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|-----------------------------------|-----------------------------|
| Basement floor                                         | 236.9800 (1a)             | x 2.7300 (2a)                     | = 645.3174 (1a) - (3a)      |
| Ground floor                                           | 169.7100 (1b)             | x 2.9500 (2b)                     | = 497.6945 (1b) - (3b)      |
| First floor                                            | 151.3800 (1c)             | x 2.7700 (2c)                     | = 419.3226 (1c) - (3c)      |
| Second floor                                           | 113.2400 (1d)             | x 2.8000 (2d)                     | = 317.0720 (1d) - (3d)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 669.7100                  |                                   | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 1879.4065 (5)               |

|                                          |          |          |          |          |          |          |          |          |          |          |          |          |               |
|------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Assumed occupancy                        |          |          |          |          |          |          |          |          |          |          |          |          | 3.6126 (42)   |
| Hot water usage for mixer showers        |          |          |          |          |          |          |          |          |          |          |          |          |               |
|                                          | 84.7907  | 83.5164  | 81.6596  | 78.1069  | 75.4851  | 72.5614  | 70.8995  | 72.7422  | 74.7622  | 77.9015  | 81.5305  | 84.4658  | (42a)         |
| Hot water usage for baths                |          |          |          |          |          |          |          |          |          |          |          |          |               |
|                                          | 36.5860  | 36.0426  | 35.2775  | 33.8667  | 32.8103  | 31.6389  | 31.0062  | 31.7660  | 32.5933  | 33.8467  | 35.2865  | 36.4623  | (42b)         |
| Hot water usage for other uses           |          |          |          |          |          |          |          |          |          |          |          |          |               |
|                                          | 51.6262  | 49.7488  | 47.8715  | 45.9942  | 44.1169  | 42.2396  | 42.2396  | 44.1169  | 45.9942  | 47.8715  | 49.7488  | 51.6262  | (42c)         |
| Average daily hot water use (litres/day) |          |          |          |          |          |          |          |          |          |          |          |          | 159.0280 (43) |
|                                          | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |               |
| Daily hot water use                      |          |          |          |          |          |          |          |          |          |          |          |          |               |
|                                          | 173.0028 | 169.3079 | 164.8086 | 157.9678 | 152.4123 | 146.4398 | 144.1452 | 148.6251 | 153.3497 | 159.6197 | 166.5659 | 172.5543 | (44)          |
| Energy content                           | 273.9942 | 241.0922 | 253.3047 | 216.2500 | 205.1763 | 180.0648 | 174.3311 | 184.0289 | 189.0955 | 216.6024 | 237.3036 | 270.1783 | (45)          |



|                                                                                |           |           |           |           |           |        |        |        |        |               |           |            |        |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|--------|--------|--------|--------|---------------|-----------|------------|--------|
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |           |           |        |        |        |        |               |           |            | 0.0000 |
| Space heating kWh                                                              | 4875.7761 | 3927.7557 | 3505.5510 | 2222.2116 | 1109.1339 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 2186.9055     | 3616.3126 | 4948.9307  | (98c)  |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |           |           |        |        |        |        |               |           | 26392.5772 |        |
| Space heating per m2                                                           |           |           |           |           |           |        |        |        |        | (98c) / (4) = |           | 39.4090    | (99)   |

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9a. Energy requirements - Individual heating systems, including micro-CHP  
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|                                                                       |  |  |  |  |  |  |  |  |  |  |  |  |               |
|-----------------------------------------------------------------------|--|--|--|--|--|--|--|--|--|--|--|--|---------------|
| Fraction of space heat from secondary/supplementary system (Table 11) |  |  |  |  |  |  |  |  |  |  |  |  | 0.0000 (201)  |
| Fraction of space heat from main system(s)                            |  |  |  |  |  |  |  |  |  |  |  |  | 1.0000 (202)  |
| Efficiency of main space heating system 1 (in %)                      |  |  |  |  |  |  |  |  |  |  |  |  | 92.3000 (206) |
| Efficiency of main space heating system 2 (in %)                      |  |  |  |  |  |  |  |  |  |  |  |  | 0.0000 (207)  |
| Efficiency of secondary/supplementary heating system, %               |  |  |  |  |  |  |  |  |  |  |  |  | 0.0000 (208)  |



|                                                  | Jan       | Feb       | Mar       | Apr       | May       | Jun    | Jul    | Aug    | Sep    | Oct       | Nov       | Dec       |       |
|--------------------------------------------------|-----------|-----------|-----------|-----------|-----------|--------|--------|--------|--------|-----------|-----------|-----------|-------|
| Space heating requirement                        | 4875.7761 | 3927.7557 | 3505.5510 | 2222.2116 | 1109.1339 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 2186.9055 | 3616.3126 | 4948.9307 | (98)  |
| Space heating efficiency (main heating system 1) | 92.3000   | 92.3000   | 92.3000   | 92.3000   | 92.3000   | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 92.3000   | 92.3000   | 92.3000   | (210) |
| Space heating fuel (main heating system)         | 5282.5310 | 4255.4233 | 3797.9967 | 2407.5965 | 1201.6619 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 2369.3451 | 3917.9985 | 5361.7884 | (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                                                                                    | 293.8602  | 259.7652  | 276.0353  | 243.2624  | 236.1023   | 213.0969   | 210.7399   | 219.0289   | 221.3065  | 246.3171  | 261.2850  | 290.7622   | (64)   |
| Efficiency of water heater (217)m                                                                            | 88.2343   | 88.1831   | 88.0749   | 87.8227   | 87.0764    | 79.8000    | 79.8000    | 79.8000    | 79.8000   | 87.7976   | 88.1302   | 79.8000    | (216)  |
| Fuel for water heating, kWh/month                                                                            | 333.0452  | 294.5749  | 313.4096  | 276.9926  | 271.1439   | 267.0388   | 264.0850   | 274.4723   | 277.3264  | 280.5510  | 296.4759  | 329.4841   | (219)  |
| Space cooling fuel requirement (221)m                                                                        | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000     | 0.0000     | 0.0000     | 0.0000     | 0.0000    | 0.0000    | 0.0000    | 0.0000     | (221)  |
| Pumps and Fa                                                                                                 | 7.3041    | 6.5973    | 7.3041    | 7.0685    | 7.3041     | 7.0685     | 7.3041     | 7.3041     | 7.0685    | 7.3041    | 7.0685    | 7.3041     | (231)  |
| Lighting                                                                                                     | 88.3661   | 70.8906   | 63.8291   | 46.7639   | 36.1218    | 29.5118    | 32.9515    | 42.8316    | 55.6341   | 72.9949   | 82.4476   | 90.8221    | (232)  |
| Electricity generated by PVs (Appendix M) (negative quantity) (233a)m                                        | -184.9782 | -244.1647 | -328.3372 | -343.9214 | -350.0132  | -318.5735  | -313.8079  | -305.7187  | -289.5439 | -265.8531 | -196.9860 | -161.8662  | (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                                        | -161.1286 | -330.4858 | -642.3314 | -944.8294 | -1231.2141 | -1231.4487 | -1217.6717 | -1039.7044 | -773.3588 | -466.6120 | -212.9812 | -128.1437  | (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                                                                           |           |           |           |           |            |            |            |            |           |           |           | 28594.3415 | (211)  |
| Space heating fuel - main system 2                                                                           |           |           |           |           |            |            |            |            |           |           |           | 0.0000     | (213)  |
| Space heating fuel - secondary                                                                               |           |           |           |           |            |            |            |            |           |           |           | 0.0000     | (215)  |
| Efficiency of water heater                                                                                   |           |           |           |           |            |            |            |            |           |           |           | 79.8000    |        |
| Water heating fuel used                                                                                      |           |           |           |           |            |            |            |            |           |           |           | 3478.5999  | (219)  |
| Space cooling fuel                                                                                           |           |           |           |           |            |            |            |            |           |           |           | 0.0000     | (221)  |

|                                                     |  |  |  |  |  |  |  |  |  |  |  |          |       |
|-----------------------------------------------------|--|--|--|--|--|--|--|--|--|--|--|----------|-------|
| Electricity for pumps and fans:                     |  |  |  |  |  |  |  |  |  |  |  |          |       |
| Total electricity for the above, kWh/year           |  |  |  |  |  |  |  |  |  |  |  | 86.0000  | (231) |
| Electricity for lighting (calculated in Appendix L) |  |  |  |  |  |  |  |  |  |  |  | 713.1650 | (232) |

|                                                               |  |  |  |  |  |  |  |  |  |  |  |             |        |
|---------------------------------------------------------------|--|--|--|--|--|--|--|--|--|--|--|-------------|--------|
| Energy saving/generation technologies (Appendices M ,N and Q) |  |  |  |  |  |  |  |  |  |  |  |             |        |
| PV generation                                                 |  |  |  |  |  |  |  |  |  |  |  | -11683.6737 | (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                           |  |  |  |  |  |  |  |  |  |  |  | 21188.4327  | (238)  |

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12a. Carbon dioxide emissions - Individual heating systems including micro-CHP  
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|                                               | Energy kWh/year | Emission factor kg CO2/kWh | Emissions kg CO2/year |       |
|-----------------------------------------------|-----------------|----------------------------|-----------------------|-------|
| Space heating - main system 1                 | 28594.3415      | 0.2100                     | 6004.8117             | (261) |
| Total CO2 associated with community systems   |                 |                            | 0.0000                | (373) |
| Water heating (other fuel)                    | 3478.5999       | 0.2100                     | 730.5060              | (264) |
| Space and water heating                       |                 |                            | 6735.3177             | (265) |
| Pumps, fans and electric keep-hot             | 86.0000         | 0.1387                     | 11.9293               | (267) |
| Energy for lighting                           | 713.1650        | 0.1443                     | 102.9318              | (268) |
| Energy saving/generation technologies         |                 |                            |                       |       |
| PV Unit electricity used in dwelling          | -3303.7639      | 0.1361                     | -449.7473             |       |
| PV Unit electricity exported                  | -8379.9098      | 0.1265                     | -1060.1189            |       |
| Total                                         |                 |                            | -1509.8663            | (269) |
| Total CO2, kg/year                            |                 |                            | 5340.3124             | (272) |
| EPC Target Carbon Dioxide Emission Rate (TER) |                 |                            | 7.9700                | (273) |

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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               | 28594.3415      | 1.1300                           | 32311.6058              | (275) |
| Total CO2 associated with community systems |                 |                                  | 0.0000                  | (473) |
| Water heating (other fuel)                  | 3478.5999       | 1.1300                           | 3930.8179               | (278) |
| Space and water heating                     |                 |                                  | 36242.4237              | (279) |

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