

# Former Filling Station, 76 Mayes Road, Wood Green, London N22

## Energy Assessment Report

Issue for Discharge of Planning Condition 17(a)

Issue P2 – 17 December 2021

FORMER FILLING STATION, 76 MAYES ROAD, WOOD  
GREEN, LONDON N22

ENERGY ASSESSMENT REPORT

ISSUE FOR DISCHARGE OF PLANNING CONDITION 17(A)

Quality Assurance Page

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# 1 Executive Summary

## 1.1 Introduction

This Energy Assessment Report has been prepared by Meinhardt (UK) Ltd on behalf of Weston Homes and is submitted to discharge Planning Condition 17(a) for the proposed development at the Former Filling Station, 76 Mayes Road, Wood Green, London N22, which was granted planning permission in May 2021 under the reference HGY/2020/0795.

The purpose of this Energy Assessment report is to confirm that the development proposes to connect to the Haringey District Energy Scheme (when available) and prior to commencement, demonstrate the final ‘as designed’ energy performance of the development in comparison to the consented Energy Strategy Report produced by JAW Sustainability dated 24<sup>th</sup> April 2020 (referred to as the “consented energy strategy” throughout this report).

## 1.2 Carbon Reduction Policy and Targets

### National Policy

In June 2019 the UK Government made a commitment to bring all greenhouse gas emissions to net zero by 2050. This has been followed by further commitments in December 2020 and April 2021, to reducing economy-wide greenhouse gas emissions by at least 68% by 2030 and by 78% by 2035, compared to 1990 levels.

An interim update in Building Regulations Part L is expected later this year that will deliver a 31% reduction in carbon emissions for domestic buildings and a 27% reduction for non-domestic.

Further consultation is expected on the new Future Homes Standard and Future Buildings Standard which are intended to be introduced in 2025.

### London Plan (2021)

Major development should be net zero-carbon, with a minimum on-site reduction of at least 35 per cent beyond Building Regulations Part L 2013 requirements.

Residential development should achieve 10 per cent, and non-residential development should achieve 15 per cent reduction through energy efficiency measures.

Where the zero-carbon target cannot be fully achieved on-site, any shortfall should be provided, either through a cash in lieu contribution to the borough’s carbon offset fund, or off-site provided that an alternative proposal is identified and delivery is certain.

### Energy Assessment Guidance (2020)

Planning guidance was published by the GLA, in April 2020 on the preparation of energy assessments, to clarify the requirements for compliance with some of the new policies of the new London Plan.

The guidance expects that SAP 10.0 carbon emission factors will be used unless the proposed development is in a Heat Network Priority Area and there is potential to connect to an existing network using gas-engine CHP or a new network using low-emission CHP.

### London Borough of Haringey Development Management DPD (2017)

The London Borough of Haringey Development Management DPD reflects the policies of the London Plan and requires proposed developments to apply the energy hierarchy to minimise energy use in order to meet, and if possible exceed, minimum carbon dioxide reduction requirements.

It requires that all development proposals should prioritise connection to existing or planned future DE networks.

## 1.3 Carbon Reduction Strategy

The energy strategy follows the London Plan’s updated energy hierarchy approach of ‘Be Lean’, ‘Be Clean’, ‘Be Green’, and ‘Be Seen’ as detailed in policy SI2.

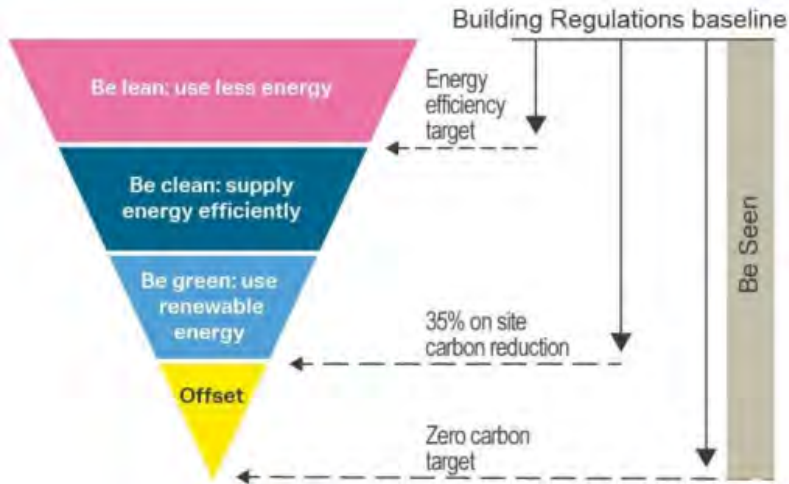


Figure 1: The energy hierarchy and associated targets

The development has been assessed using the latest version (2012) of the Standard Assessment Procedure (SAP) for the residential dwellings and IES dynamic thermal modelling software (SBEM) in line with the relevant National Calculation Methodology (NCM) guidance for the appropriate non-residential areas.

## 1.4 Carbon Factors

Planning Condition 17(a) refers to the minimum carbon savings using SAP 10 carbon emission factors as identified in the consented energy strategy, so the results of the assessment have been manually converted to demonstrate the performance using the SAP 10 carbon emission factors.

The results of the assessment using SAP 2012 carbon emission factors are provided in Appendix A.4.

## 1.5 Consented Energy Strategy

Below are summarised the carbon emissions and savings for the consented development as detailed in Table 3-15 of the Energy Strategy Report by JAW Sustainability dated 24<sup>th</sup> April 2020 based on a connection to the Haringey District Energy Scheme using SAP10 carbon emissions factors.

|                            | Residential                      |                                |          | Commercial                       |                                |          |
|----------------------------|----------------------------------|--------------------------------|----------|----------------------------------|--------------------------------|----------|
|                            | CO <sub>2</sub> Emissions (T/yr) | CO <sub>2</sub> Savings (T/yr) | % Saving | CO <sub>2</sub> Emissions (T/yr) | CO <sub>2</sub> Savings (T/yr) | % Saving |
| Baseline                   | 77.16                            |                                |          | 8.39                             |                                |          |
| Be lean                    | 63.09                            | 14.07                          | 18.23%   | 6.97                             | 1.42                           | 17%      |
| Be clean                   | 29.41                            | 33.68                          | 43.6%    | 6.97                             | 0.00                           | 0.0%     |
| Be green                   | 24.05                            | 5.36                           | 6.95%    | 5.09                             | 1.88                           | 22%      |
| Cumulative on site savings |                                  | 53.10                          | 68.82%   |                                  | 3.30                           | 39%      |

Table 1: Regulated carbon dioxide emissions and savings from each stage of the energy hierarchy for consented scheme with district heating (SAP10 emissions factors)

Below are summarised the carbon offset payments for the consented development as detailed on Page 14 of the Energy Strategy Report by JAW Sustainability dated 24<sup>th</sup> April 2020 based on a connection to the Haringey District Energy Scheme using SAP10 carbon emissions factors.

|             | Shortfall on zero carbon          |                                   |                            |
|-------------|-----------------------------------|-----------------------------------|----------------------------|
|             | Carbon emissions (tonnes / annum) | 30 year carbon emissions (tonnes) | Offset payment (£95/tonne) |
| Residential | 24.05                             | 722                               | £68,552                    |
| Commercial  | 5.09                              | 153                               | £14,498                    |

**Table 2: Carbon offset payments for consented scheme with district heating (SAP10 emissions factors)**

1.6 ‘As Designed’ Energy Strategy

In accordance with the consented energy strategy, Weston Homes propose to connect the residential element of the development to the Haringey District Energy Scheme when it becomes available (expected to be around 2024 to 2026). The design provides appropriate facilities for the future connection, including designated space for the heat substation and buried pipework from the site boundary to the substation.

Below are summarised the carbon emissions and savings for the final ‘as designed’ scheme proposed by Weston Homes based on a connection to the Haringey District Energy Scheme using SAP10 carbon emissions factors.

|                            | Residential                      |                                |          | Commercial                       |                                |          |
|----------------------------|----------------------------------|--------------------------------|----------|----------------------------------|--------------------------------|----------|
|                            | CO <sub>2</sub> Emissions (T/yr) | CO <sub>2</sub> Savings (T/yr) | % Saving | CO <sub>2</sub> Emissions (T/yr) | CO <sub>2</sub> Savings (T/yr) | % Saving |
| Baseline                   | 78.18                            |                                |          | 16.16                            |                                |          |
| Be lean                    | 69.54                            | 8.64                           | 11.1%    | 11.81                            | 4.35                           | 26.89%   |
| Be clean                   | 16.33                            | 53.21                          | 68.06%   | 11.81                            | 0.00                           | 0.0%     |
| Be green                   | 9.89                             | 6.44                           | 8.23%    | 9.54                             | 2.28                           | 14.08%   |
| Cumulative on site savings |                                  | 68.29                          | 87.35%   |                                  | 6.62                           | 40.98%   |

**Table 3: Regulated carbon dioxide emissions and savings from each stage of the energy hierarchy for final ‘as designed’ scheme with district heating (SAP10 emissions factors)**

In accordance with the consented energy strategy, it is proposed to install communal gas fired boilers as an interim measure to serve the residential heating load of the development until the Haringey District Energy Scheme is available. The carbon emissions and savings for this interim arrangement are detailed in Appendix A.5.

Residential Carbon Emissions and Savings

The expected carbon dioxide emissions at each stage of the hierarchy are shown in the graph below for the residential parts of the final ‘as designed’ scheme.

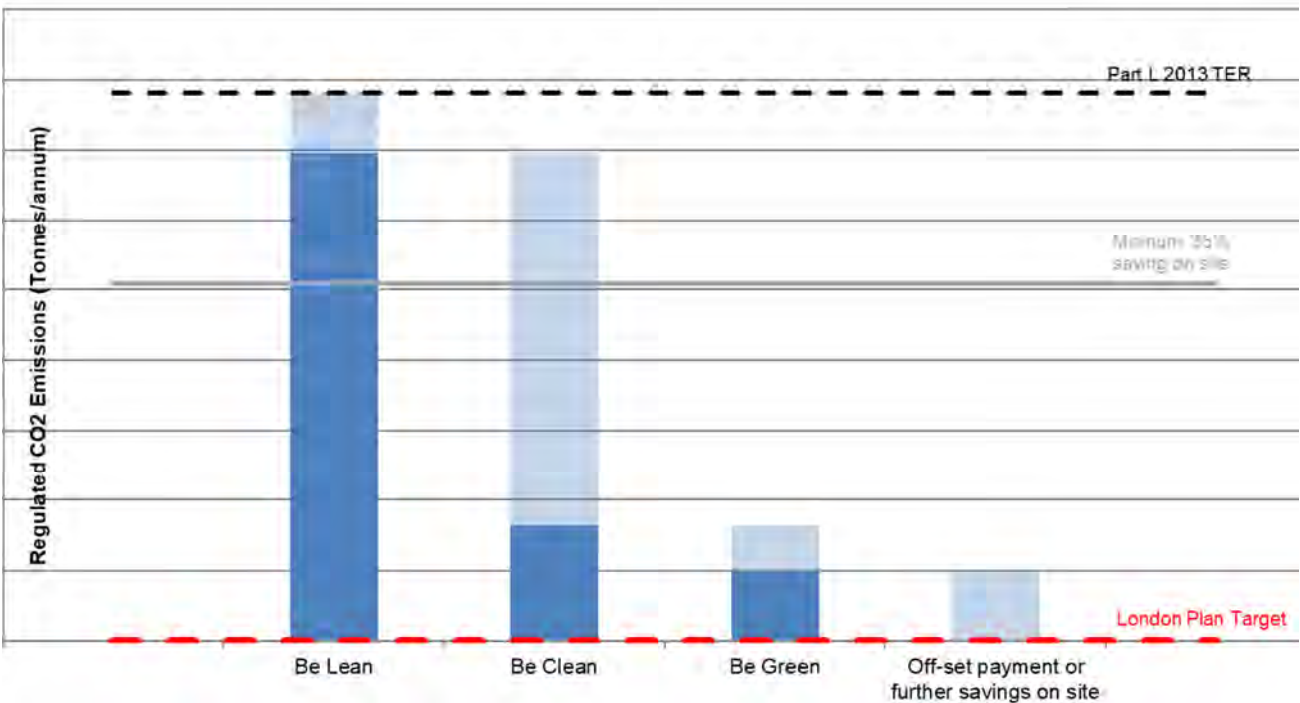


**Figure 2: Residential energy hierarchy and targets for the final ‘as designed’ scheme with district heating**

The graph above demonstrates that the residential element of the final ‘as designed’ scheme significantly exceeds the 68.82% savings in the consented scheme, achieving an overall on-site reduction of 87.35% in regulated carbon dioxide emissions over Part L 2013.

Commercial Carbon Emissions and Savings

The expected carbon dioxide emissions at each stage of the hierarchy are shown in the graph below for the commercial parts of the final ‘as designed’ scheme.

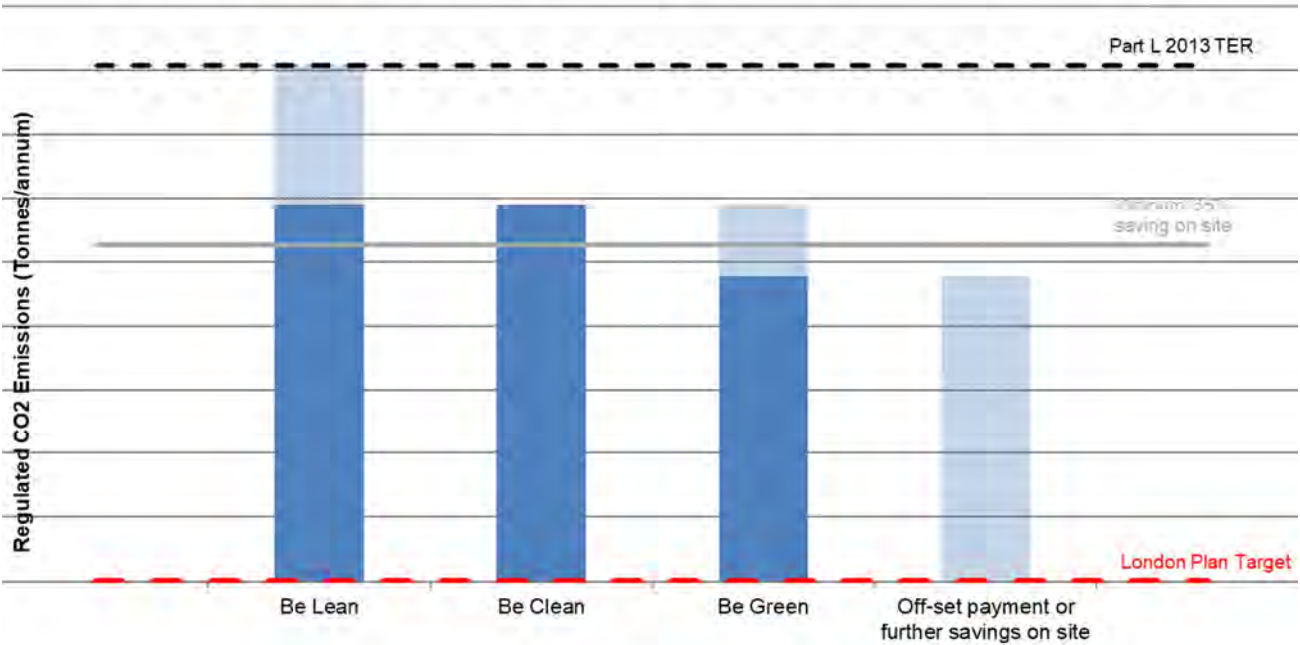


**Figure 3: Commercial energy hierarchy and targets for the final ‘as designed’ scheme with district heating**

The graph above demonstrates that the commercial element of the final ‘as designed’ scheme exceeds the 39% savings in the consented scheme, achieving an overall on-site reduction of 40.98% in regulated carbon dioxide emissions over Part L 2013.

**Carbon Offset**

Below are summarised the carbon offset payments for the final ‘as designed’ scheme proposed by Weston Homes based on a connection to the Haringey District Energy Scheme using SAP10 carbon emissions factors.

|             | Shortfall on zero carbon             |                                      |                               |
|-------------|--------------------------------------|--------------------------------------|-------------------------------|
|             | Carbon emissions<br>(tonnes / annum) | 30 year carbon emissions<br>(tonnes) | Offset payment<br>(£95/tonne) |
| Residential | 9.89                                 | 297                                  | £28,192                       |
| Commercial  | 9.54                                 | 286                                  | £27,183                       |

**Table 4: Carbon offset payments for the final ‘as designed’ scheme with district heating (SAP10 emissions factors)**

## 2 Introduction

### 2.1 This Submission

This Energy Assessment Report has been prepared by Meinhardt (UK) Ltd on behalf of Weston Homes and is submitted to discharge Planning Condition 17(a) for the proposed development at the Former Filling Station, 76 Mayes Road, Wood Green, London N22, which was granted planning permission in May 2021 under the reference HGY/2020/0795.

The purpose of this Energy Assessment report is to confirm that the development proposes to connect to the Haringey District Energy Scheme (when available) and prior to commencement, demonstrate the final 'as designed' energy performance of the development in comparison to the consented Energy Strategy Report produced by JAW Sustainability dated 24<sup>th</sup> April 2020.

### 2.2 Extant Planning Permission

Planning permission (ref: HGY/2020/0795) was granted in May 2021 for redevelopment of the site to provide a single building of between 4 and 9 storeys in height, comprising 75 residential units (C3) and 953 sqm of flexible commercial floorspace (Use Classes A1-A5, B1 and B8), with associated cycle parking, plant, refuse and recycling provision, landscaping and all necessary ancillary and enabling works.

This Energy Assessment report is submitted to the London Borough of Haringey in order to discharge Planning Condition 17(a) detailed below.

|                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PRE-COMMENCEMENT: Energy Plan |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 17.                           | (a) Prior to the commencement of development, an updated Energy Assessment should be submitted to the Local Planning Authority for approval. This should demonstrate that the development will connect to the Decentralised Energy Network at Wood Green and provide the calculated deferred carbon offset contribution approach. A minimum carbon dioxide saving of 47.9% should be achieved against a Building Regulations 2013 Part L scheme for the domestic element and a 39% saving for the non-domestic element, in line with the fabric efficiencies set out in the Energy Strategy prepared by JAW Sustainability (dated 24 April 2020). |

## 3 Establishing Energy Demand and Emissions

### 3.1 Carbon Reduction Targets

#### National Policy

In June 2019 the UK Government made a commitment to bring all greenhouse gas emissions to net zero by 2050. This has been followed by further commitments in December 2020 and April 2021, to reducing economy-wide greenhouse gas emissions by at least 68% by 2030 and by 78% by 2035, compared to 1990 levels.

An interim update in Building Regulations Part L is expected later this year that will deliver a 31% reduction in carbon emissions for domestic buildings and a 27% reduction for non-domestic.

Further consultation is expected on the new Future Homes Standard and Future Buildings Standard which are intended to be introduced in 2025.

#### London Plan (2021)

Major development should be net zero-carbon, with a minimum on-site reduction of at least 35 per cent beyond Building Regulations Part L 2013 requirements.

Residential development should achieve 10 per cent, and non-residential development should achieve 15 per cent reduction through energy efficiency measures.

Where the zero-carbon target cannot be fully achieved on-site, any shortfall should be provided, either through a cash in lieu contribution to the borough's carbon offset fund, or off-site provided that an alternative proposal is identified and delivery is certain.

Carbon emissions from any other part of the development i.e. unregulated emissions, should be calculated and minimised.

#### Energy Assessment Guidance (2020)

Planning guidance was published by the GLA, in April 2020 on the preparation of energy assessments, to clarify the requirements for compliance with some of the new policies of the new London Plan.

The guidance expects that SAP 10.0 carbon emission factors will be used unless the proposed development is in a Heat Network Priority Area and there is potential to connect to an existing network using gas-engine CHP or a new network using low-emission CHP.

#### London Borough of Haringey Development Management DPD (2017)

The London Borough of Haringey Development Management DPD reflects the policies of the London Plan and requires proposed developments to apply the energy hierarchy to minimise energy use in order to meet, and if possible exceed, minimum carbon dioxide reduction requirements.

It requires that all development proposals should prioritise connection to existing or planned future DE networks.

### 3.2 Carbon Reduction Strategy

The energy strategy follows the London Plan's updated energy hierarchy approach of 'Be Lean', 'Be Clean', 'Be Green', and 'Be Seen' as detailed in policy SI2.

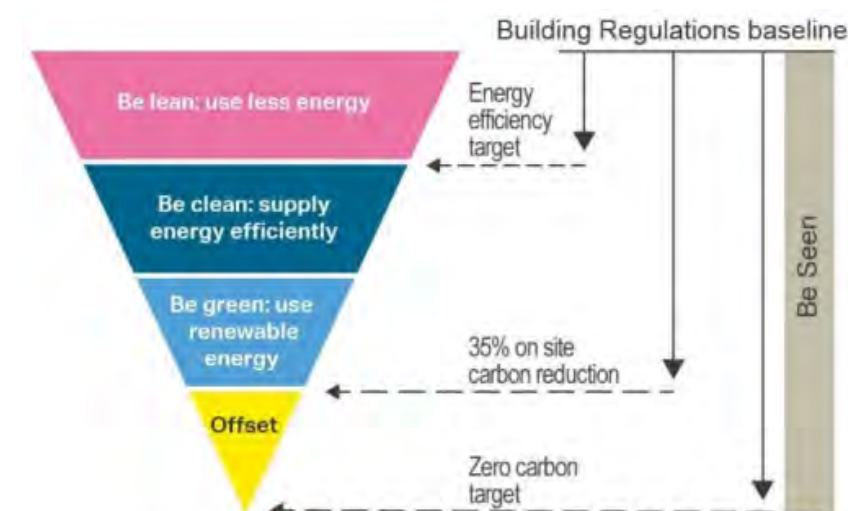


Figure 4: The energy hierarchy and associated targets

### 3.3 Calculation Methodology

#### Residential

Building Regulations Part L1A SAP calculations have been undertaken by Stansted Environmental Services Ltd (SES), using Elmhurst software, for all of the 43 No. apartment types across the development. The calculations include apartments at the lowest level, intermediate floors and at the top floor.

A selection of the Compliance output sheets and DER worksheets are provided in Appendix A.1 for the 'Be Lean' stage of the hierarchy, in Appendix A.2 for the 'Be Green' stage.

#### Non-Residential

Building Regulations Part L2A modelling has been undertaken, using IES dynamic thermal modelling software (SBEM) in line with the relevant National Calculation Methodology (NCM) guidance, for the commercial units at ground floor.

The BRUKL output sheets are provided in Appendix A.3 for the 'Be Lean' for the 'Be Green' stages of the hierarchy.

### 3.4 Carbon Factors

Planning Condition 17(a) refers to the minimum carbon savings using SAP 10 carbon emission factors as identified in the consented energy strategy, so the results of the assessment have been manually converted to demonstrate the performance using the SAP 10 carbon emission factors.

The results of the assessment using SAP 2012 carbon emission factors are provided in Appendix A.4.

## 4 Demand Reduction (Be Lean)

Energy demand is significantly reduced beyond Part L requirements, achieving a 11.1% reduction in carbon emissions over Part L 2013 for the residential and a 26.9% reduction for the commercial, through passive design and energy efficiency measures alone.

The table below details the breakdown of regulated energy demand by energy use, for each space type, at the 'Be Lean' stage of the hierarchy for the final 'as designed' scheme.

| Space Type  | Regulated Energy Demand (MWh/year) |           |          |           |         |
|-------------|------------------------------------|-----------|----------|-----------|---------|
|             | Heating                            | Hot Water | Lighting | Auxiliary | Cooling |
| Residential | 106.3                              | 182.2     | 22.4     | 16.0      | 0.0     |
| Commercial  | 9.6                                | 1.7       | 29.5     | 6.0       | 20.6    |
| Total       | 115.9                              | 183.9     | 51.9     | 22.0      | 20.6    |

Table 5: Breakdown of regulated energy demand at the Be Lean stage for the 'as designed' scheme

The chart below details the breakdown of regulated energy demand by energy use, at the 'Be Lean' stage of the hierarchy for the detailed application.

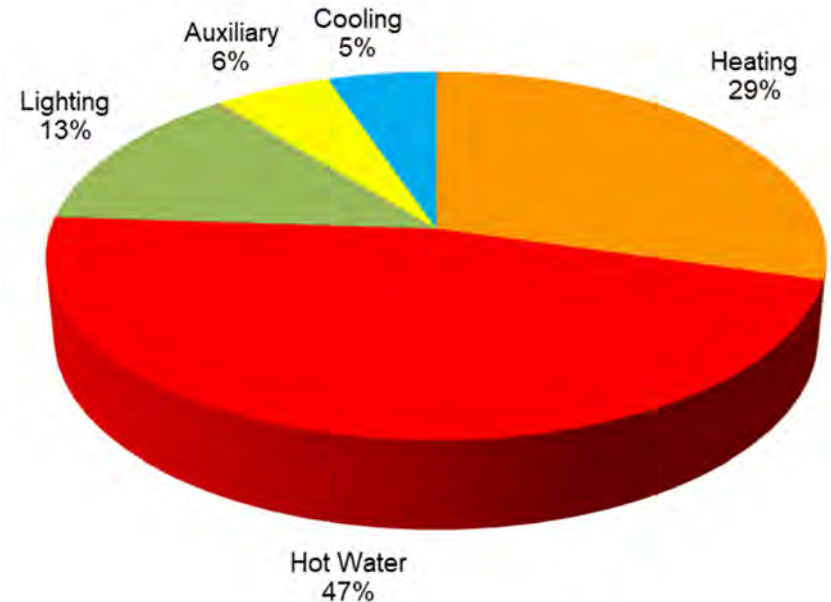


Figure 5: Breakdown of regulated energy demand at the Be Lean stage for the 'as designed' scheme

The table below details the breakdown of regulated CO<sub>2</sub> emissions by energy use, for each space type, at the 'Be Lean' stage of the hierarchy for the detailed application.

| Space Type  | Regulated CO <sub>2</sub> Emissions (kg CO <sub>2</sub> /year) |           |          |           |         |
|-------------|----------------------------------------------------------------|-----------|----------|-----------|---------|
|             | Heating                                                        | Hot Water | Lighting | Auxiliary | Cooling |
| Residential | 22.3                                                           | 38.3      | 5.2      | 3.7       | 0.0     |
| Commercial  | 2.2                                                            | 0.4       | 6.9      | 1.4       | 0.9     |
| Total       | 24.5                                                           | 38.7      | 12.1     | 5.1       | 0.9     |

Table 6: Breakdown of regulated CO<sub>2</sub> emissions at the Be Lean stage for the 'as designed' scheme

The chart below details the breakdown of CO<sub>2</sub> emissions by energy use, at the 'Be Lean' stage of the hierarchy.

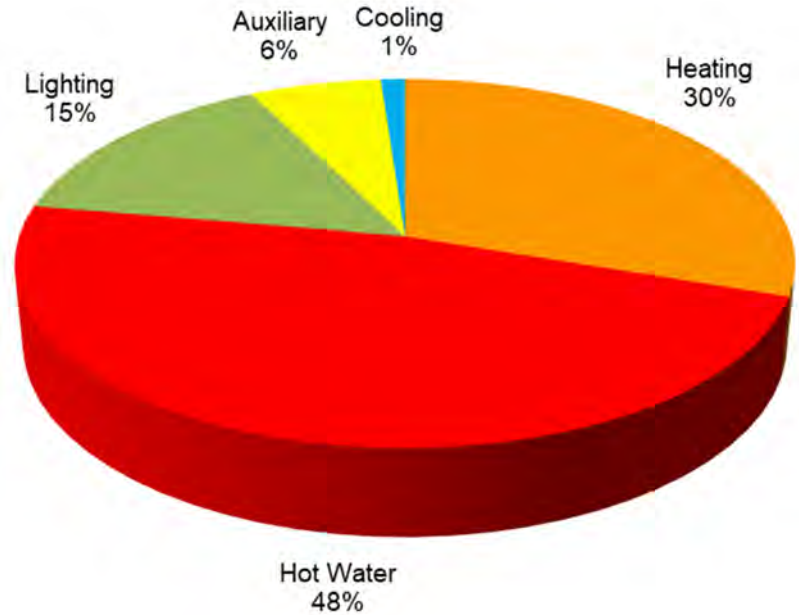


Figure 6: Breakdown of regulated CO<sub>2</sub> emissions at the Be Lean stage for the 'as designed' scheme

The demand reduction is achieved by a combination of the measures including those detailed below:-

### 4.1

#### Building Fabric Insulation

The thermal performance of the building fabric is significantly improved over Part L 2013 minimum requirements as below:-

| Fabric Element | Residential 'U' Values (W/m <sup>2</sup> K) | Commercial 'U' Values (W/m <sup>2</sup> K) |
|----------------|---------------------------------------------|--------------------------------------------|
| External Walls | 0.17                                        | 0.17                                       |
| Floor          | 0.11                                        | 0.15                                       |
| Roof           | 0.11                                        | 0.18                                       |
| Windows        | 1.20                                        | 1.50                                       |

Table 7: Proposed fabric 'U' values for the 'as designed' scheme

The consented energy strategy used a U Value of 0.13 W/m<sup>2</sup> K for the external walls for the residential and commercial elements. SES's assessment has confirmed that an average U Value of 0.13 W/m<sup>2</sup> K is not achievable across the whole building as there are some areas of the external wall where there is not sufficient space to install the full thickness of insulation – for example on the outer face of the perimeter structural columns. Therefore, an average wall U value of 0.17 W/m<sup>2</sup> K is proposed for the 'as designed' scheme.

The other U values remain as detailed in the consented energy strategy.

### 4.2

#### Thermal Bridging

As part of the SAP modelling, SES have sought to reduce heat loss by calculating the thermal bridge Y-value for all residential apartments predominantly using Accredited Construction Details (ACDs). Their calculations demonstrate that the y-value ranges from 0.06 to 0.16 for the development.

The consented energy strategy used an average  $y$ -value 0.08 to all apartments, which is aligned with Enhanced Construction Details. From the testing completed by SES we have shown this value to not be achievable using Accredited Construction Details, as such we have utilised the calculated  $y$ -values within our calculations.

#### 4.3 Air Tightness

The target air permeability remains as  $3 \text{ m}^3/(\text{h m}^2)$  at 50 Pa for the residential and  $5 \text{ m}^3/(\text{h m}^2)$  at 50 Pa for the commercial as detailed in the consented energy strategy.

#### 4.4 Solar Gain

The  $g$ -value of the glazing generally remains as 0.4 for the residential and 0.3 for the commercial as detailed in the consented energy strategy.

The  $g$ -value for north facing windows and those that are facing into the central courtyard (shaded by the building) on the residential will be adjusted to 0.45 as overheating performance is not affected.

#### 4.5 Heating Systems

In accordance with GLA Energy Assessment guidance, at the Be Lean stage of the hierarchy we have assumed gas boilers with the SAP/SBEM standard efficiency of 93.5% for the residential and 91% for the commercial.

Heating will be provided to the residential via radiators with thermostatic radiator valves (TRV's). The heating system will be controlled by a programmer and room thermostat.

The consented energy strategy used a boiler efficiency of 97% which is not achievable for this scheme. Refer to Section 5.2 below.

#### 4.6 Cooling

##### Residential

Active mechanical cooling is not proposed for the residential apartments

Natural ventilation via openable windows and increased mechanical ventilation proposed to prevent overheating in summer. Refer to separate Overheating Risk Assessment report.

##### Commercial

For the commercial units, active cooling is proposed via Variable Refrigerant Flow (VRF), DX multi-split or DX split systems (as appropriate) with a minimum seasonal efficiency of 5.1 as detailed in the consented energy strategy.

#### 4.7 Ventilation Systems

##### Residential

Ventilation to the residential apartments to provide fresh air and extract moisture/pollutants in accordance with Building Regulations Part F will be via individual Mechanical Ventilation with Heat Recovery (MHVR) units. Each unit will achieve a Specific Fan Power of between  $0.42$  and  $0.44 \text{ W}/(\text{l/s})$  and a heat recovery efficiency of up to 91%, depending on the number of wet rooms.

This is an improvement over the consented energy strategy which used a SFP of  $0.5 \text{ W}/(\text{l/s})$  and a heat recovery efficiency of 90%.

##### Non-Residential

For the commercial units it is proposed that that a local commercial MVHR unit will be provided for each that will achieve a Specific Fan Power of less than  $1.5 \text{ W}/(\text{l/s})$  and a heat recovery efficiency of at least 90% as detailed in the consented energy strategy.

#### 4.8 Lighting

Energy efficient LED lighting will be used throughout the proposed development.

Occupancy control and daylight sensors will be used in the commercial units as detailed in the consented energy strategy.

The efficacy of the lighting in the commercial units has been set at  $80 \text{ lm/W}$  as detailed in the consented energy strategy.

5 Heating Infrastructure (Be Clean)

5.1 Haringey District Energy Scheme

Overview

The development is in an area highlighted as a Decentralised Energy “Connection Zone” within the Haringey Development Management DPD, as shown in the figure below.

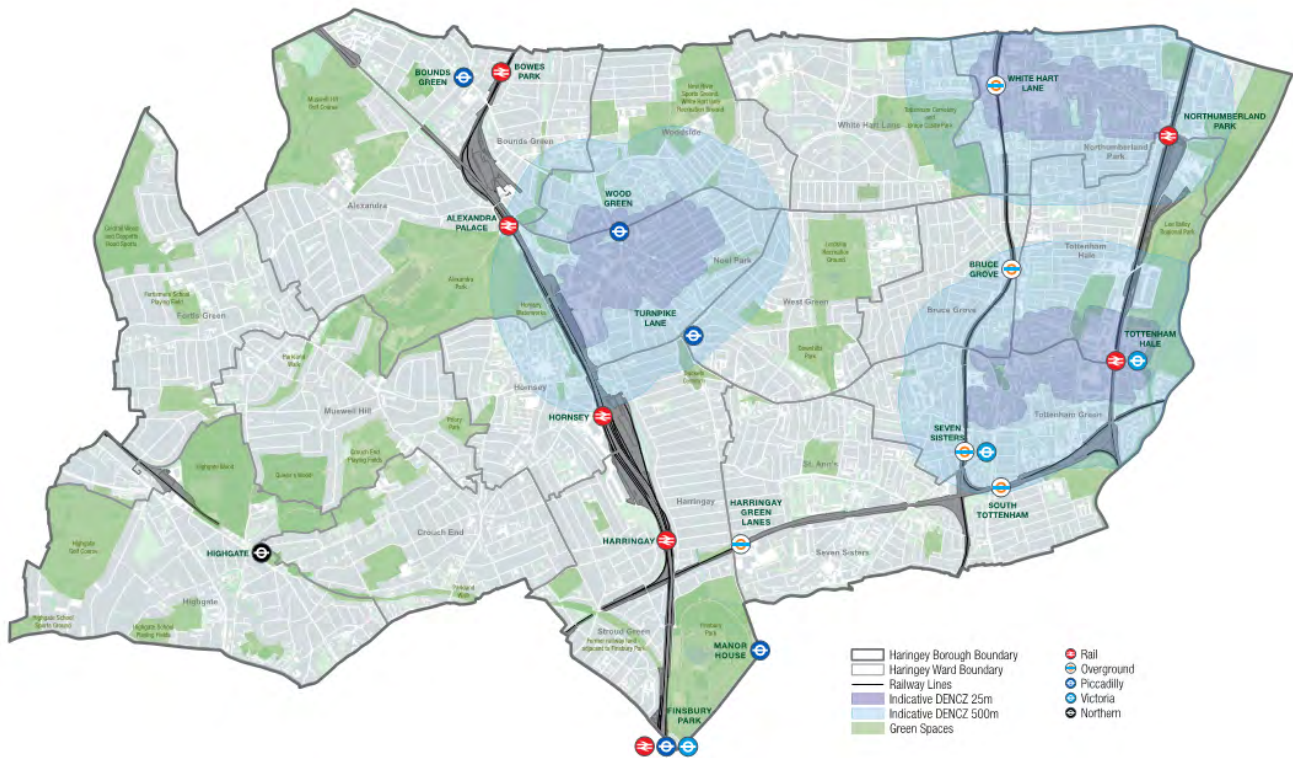


Figure 7: Haringey Development Management DPD indicative decentralised energy “connection zones”

The London Borough of Haringey has plans to deliver a number of district energy schemes across the borough providing low carbon heat supplies and where applicable electricity as well. It is intended that these schemes are delivered through a wholly owned energy services company (ESCo) which is to be formed by the borough.

Plans have been developed to construct a series of low carbon heating networks across the Borough in North Tottenham, Wood Green and Tottenham Hale. Supplies from these schemes will come on line progressively over the next few years.

These heat supplies will be delivered via an area wide heat network and through heat supply contracts entered into by the Haringey ESCo (HESCO) with each heat consumer. These heat supplies will be delivered by energy centres being developed and/or adopted by the HESCO.

Connection to the Network

In accordance with the consented energy strategy, Weston Homes propose to connect the residential element of the development to the Haringey District Energy Scheme when it becomes available. From the initial discussions held with London Borough of Haringey heat is expected to be available to the development around 2024 to 2026.

The design provides appropriate facilities for the future connection, including designated space for the heat substation and buried pipework from the site boundary to the substation.

The design of the site heat distribution will generally be in accordance with the HESCO Technical Specification, with any specific derogations agreed with HESCO.

Refer to the separate package submitted to discharge Planning Condition 17(b) which demonstrates that the scheme has made sufficient provision to connect to the network.

Carbon Content of Heat

In correspondence dated 3<sup>rd</sup> November 2021, London Borough of Haringey provided the BRE methodology for calculation of the carbon content of the heat delivered by the district heat network and confirmed the carbon content to be used for this development at 0.058 kg CO<sub>2</sub> per kWh (using SAP 2012 carbon emission factors).

Using the same BRE methodology, the carbon content using SAP10 carbon emission factors has been calculated at 0.030 kg CO<sub>2</sub> per kWh, as detailed below.

|                                            | Units                   | SAP2012 | SAP10 |
|--------------------------------------------|-------------------------|---------|-------|
| Heat delivered                             | kWh                     | 1       | 1     |
| Distribution loss factor                   |                         | 1       | 1     |
| EfW fraction                               |                         | 0.97    | 0.97  |
| Back up boiler efficiency                  |                         | 0.85    | 0.85  |
| Back up boiler fraction                    |                         | 0.03    | 0.03  |
| EfW heat                                   | kWh                     | 0.97    | 0.97  |
| Boiler heat                                | kWh                     | 0.035   | 0.035 |
| Heat required                              | kWh                     | 1.005   | 1.005 |
| Heat to electricity ratio                  |                         | 10      | 10    |
| EfW heat contributing to carbon factor     | kWh                     | 0.097   | 0.097 |
| SAP electricity displaced from grid factor | kg CO <sub>2</sub> /kWh | 0.519   | 0.233 |
| SAP mains gas factor                       | kg CO <sub>2</sub> /kWh | 0.216   | 0.21  |
| EfW carbon factor                          | kg CO <sub>2</sub> /kWh | 0.050   | 0.023 |
| Back up boiler carbon factor               | kg CO <sub>2</sub> /kWh | 0.008   | 0.007 |
| Carbon factor for EfW                      | kg CO <sub>2</sub> /kWh | 0.058   | 0.030 |

Table 8: Carbon content calculation using BRE methodology

The consented energy strategy used a carbon content of 0.081kg CO<sub>2</sub> per kWh.

Carbon Savings

The district heat network will provide a 68.06% reduction in carbon emissions over Part L 2013 for the residential, saving 53.21 tonnes of CO<sub>2</sub> per year (using SAP10 carbon emissions factors).

5.2 Interim Gas Fired Boilers

In accordance with the consented energy strategy, it is proposed to install communal gas fired boilers as an interim measure to serve the residential heating load of the development until the Haringey District Energy Scheme is available.

The carbon emissions and savings for this interim arrangement are detailed in Appendix A.5.

The consented energy strategy used a boiler efficiency of 97% which is not achievable by any of the manufacturers we have contacted, for the size of boilers required for this project. The boiler type referred to by

JAW in their previous response to the planning comments is a small 60kW unit unsuitable for this scheme (Boiler Type Remeha Gas 120 ACE, as noted within 'Caxton Road - Response to Planning Energy Comments').

The highest seasonal efficiency offered by the boiler manufacturers contacted is 95%, so this figure has been used for this energy assessment.

### 5.3 Commercial

For the commercial units, space heating is proposed via Variable Refrigerant Flow (VRF), DX multi-split or DX split systems (as appropriate) with a minimum seasonal efficiency of 3.4 as detailed in the consented energy strategy.

As these systems use heat pumps which is classed as a renewable technology, the carbon savings are identified at the Be Green stage of the hierarchy.

In accordance with the consented energy strategy, hot water will be generated by instantaneous electric heaters. For consistency with the consented energy strategy, the carbon savings are identified at the Be Green stage of the hierarchy.

## 6 Renewable Energy (Be Green)

### 6.1 Photovoltaics (PVs)

The consented energy strategy included 86 No. panels with a 20% efficiency, providing a total peak output of 28 kW<sub>p</sub> (around 355W<sub>p</sub> per panel).

Weston Homes have carried out an assessment which confirms that there is only sufficient space on the roof for 65 No. panels. Please refer to drawing provided in Appendix A.6.

It is proposed to increase the efficiency of the panels to around 23% to compensate for the reduce quantity. Each of the proposed panels will achieve an output of 425W<sub>p</sub>, providing a total output of 27.6 kW<sub>p</sub>.

The PVs will provide a 8.23% reduction in carbon emissions over Part L 2013 for the residential, saving 6.44 tonnes of CO<sub>2</sub> per year (using SAP10 carbon emissions factors).

### 6.2 Air Source Heat Pumps

As described above, heat pumps are proposed to provide the heating and cooling for the commercial units.

The Variable Refrigerant Flow (VRF), DX multi-split or DX split systems (as appropriate) are expected to have a minimum seasonal efficiency of 3.4 in heating mode, and 5.1 in cooling mode as detailed in the consented energy strategy.

The heat pumps will provide a 14.08% reduction in carbon emissions over Part L 2013 for the residential, saving 2.28 tonnes of CO<sub>2</sub> per year (using SAP10 carbon emissions factors).

## Appendix A.1 – SAP Calculations (Be Lean)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



|                      |        |                |            |
|----------------------|--------|----------------|------------|
| Property Reference   | 116823 | Issued on Date | 17/12/2021 |
| Assessment Reference | Plot 5 | Prop Type Ref  | FF         |
| Property             |        |                |            |

|                                    |      |             |       |      |       |
|------------------------------------|------|-------------|-------|------|-------|
| SAP Rating                         | 82 B | DER         | 20.49 | TER  | 23.02 |
| Environmental                      | 86 B | % DER<TER   | 10.98 |      |       |
| CO <sub>2</sub> Emissions (t/year) | 1.03 | DFEE        | 52.18 | TFEE | 69.12 |
| General Requirements Compliance    | Fail | % DFEE<TFEE | 24.51 |      |       |

|                  |                                                                                    |             |           |
|------------------|------------------------------------------------------------------------------------|-------------|-----------|
| Assessor Details | Mr. Richard Denteh, Meinhardt UK, Tel: 02078317969, richard.denteh@meinhardt.co.uk | Assessor ID | T596-0001 |
|------------------|------------------------------------------------------------------------------------|-------------|-----------|

|        |  |
|--------|--|
| Client |  |
|--------|--|

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

#### DWELLING AS DESIGNED

Ground-floor flat, total floor area 58 m<sup>2</sup>

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

#### 1a TER and DER

Fuel for main heating: Mains gas  
Fuel factor: 1.00 (mains gas)  
Target Carbon Dioxide Emission Rate (TER) 23.02 kgCO<sub>2</sub>/m<sup>2</sup>  
Dwelling Carbon Dioxide Emission Rate (DER) 20.49 kgCO<sub>2</sub>/m<sup>2</sup>OK

#### 1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 69.1 kWh/m<sup>2</sup>/yr  
Dwelling Fabric Energy Efficiency (DFEE) 52.2 kWh/m<sup>2</sup>/yrOK

#### 2 Fabric U-values

| Element                   | Average          | Highest          |    |
|---------------------------|------------------|------------------|----|
| External wall             | 0.17 (max. 0.30) | 0.26 (max. 0.70) | OK |
| Party wall                | 0.00 (max. 0.20) | -                | OK |
| Floor                     | 0.09 (max. 0.25) | 0.09 (max. 0.70) | OK |
| Roof (no roof)            |                  |                  |    |
| Openings and curtain wall | 1.23 (max. 2.00) | 1.40 (max. 3.30) | OK |

#### 2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

#### 3 Air permeability

|                                 |                     |    |
|---------------------------------|---------------------|----|
| Air permeability at 50 pascals: | 3.00 (design value) |    |
| Maximum                         | 10.0                | OK |

#### 4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas  
Data from manufacturer: . .

Efficiency: 93%

Minimum: 88% OK

Secondary heating system:

None

#### 5 Cylinder insulation

Hot water storage: Nominal cylinder loss: 2.56 kWh/day  
Permitted by DBSCG 1.89 Fail

Primary pipework insulated:

Yes

OK

#### 6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls:

Cylinderstat

OK

Not independent timer for DHW

Fail

Boiler interlock

Yes

OK

#### 7 Low energy lights

Percentage of fixed lights with low-energy fittings: 100%  
Minimum 75% OK

#### 8 Mechanical ventilation

Continuous supply and extract system  
Specific fan power: 0.25  
Maximum 1.5 OK  
MVHR efficiency: 91%  
Minimum: 70% OK

#### 9 Summertime temperature

Overheating risk (Thames Valley): Slight OK  
Based on:  
Overshading: Average  
Windows facing North West: 11.40 m<sup>2</sup>, No overhang  
Air change rate: 6.00 ach  
Blinds/curtains: None

#### 10 Key features

|                       |                                      |
|-----------------------|--------------------------------------|
| External wall U-value | 0.14 W/m <sup>2</sup> K              |
| Party wall U-value    | 0.00 W/m <sup>2</sup> K              |
| Party wall U-value    | 0.00 W/m <sup>2</sup> K              |
| Party wall U-value    | 0.00 W/m <sup>2</sup> K              |
| Exposed floor U-value | 0.08 W/m <sup>2</sup> K              |
| Air permeability      | 3.0 m <sup>3</sup> /m <sup>2</sup> h |

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)  
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

#### 1. Overall dwelling dimensions

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)              | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|-----------------------------------|-----------------------------|
| Ground floor                                           | 57.5000 (1b)              | x 2.7700 (2b)                     | = 159.2750 (1b) - (3b)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 57.5000                   |                                   | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 159.2750 (5)                |

#### 2. Ventilation rate

|                              | main<br>heating | secondary<br>heating | other | total | m <sup>3</sup> per hour |
|------------------------------|-----------------|----------------------|-------|-------|-------------------------|
| Number of chimneys           | 0               | +                    | 0     | =     | 0 * 40 = 0.0000 (6a)    |
| Number of open flues         | 0               | +                    | 0     | =     | 0 * 20 = 0.0000 (6b)    |
| Number of intermittent 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)+(7a)+(7b)+(7c) = | 0.0000 / (5) = | 0.0000 (8)  |
| Pressure test                                                             |                | Yes         |
| Measured/design AP50                                                      |                | 3.0000      |
| Infiltration rate                                                         |                | 0.1500 (18) |
| Number of sides sheltered                                                 |                | 3 (19)      |

|                                                      |                             |             |
|------------------------------------------------------|-----------------------------|-------------|
| Shelter factor                                       | (20) = 1 - [0.075 x (19)] = | 0.7750 (20) |
| Infiltration rate adjusted to include shelter factor | (21) = (18) x (20) =        | 0.1163 (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                                                                              | 0.1482 | 0.1453 | 0.1424 | 0.1279 | 0.1250 | 0.1104 | 0.1104 | 0.1075 | 0.1163 | 0.1250 | 0.1308 | 0.1366 (22b)  |
| Balanced mechanical ventilation with heat recovery                                           |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a)  |
| If mechanical ventilation:                                                                   |        |        |        |        |        |        |        |        |        |        |        | 63.7000 (23c) |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = |        |        |        |        |        |        |        |        |        |        |        |               |
| Effective ac                                                                                 | 0.3237 | 0.3268 | 0.3239 | 0.3094 | 0.3065 | 0.2919 | 0.2919 | 0.2890 | 0.2978 | 0.3065 | 0.3123 | 0.3181 (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  | R-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K   |
|------------------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|---------------|--------------------------------|-----------------|
| Windows (UW = 1.20)                                                    |                         |                            | 11.4000                   | 1.1450                        | 13.0534       |                                | (27)            |
| Front Door                                                             |                         |                            | 2.1600                    | 1.4000                        | 3.0240        |                                | (26)            |
| Exposed Floor to commercial                                            |                         |                            | 57.5000                   | 0.0900                        | 5.1750        |                                | (28b)           |
| Unipanel column                                                        | 12.2000                 |                            | 12.2000                   | 0.2600                        | 3.1720        | 136.7400                       | 1668.2280 (29a) |
| Unipanel wall                                                          | 45.6300                 | 2.1600                     | 43.4700                   | 0.1400                        | 6.0858        | 30.9500                        | 1345.3965 (29a) |
| Curtain wall                                                           | 11.5200                 | 11.4000                    | 0.1200                    | 1.2000                        | 0.1440        | 14.0000                        | 1.6800 (29a)    |
| Total net area of external elements A <sub>ext</sub> (m <sup>2</sup> ) |                         |                            | 126.8500                  |                               |               |                                | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                                    |                         |                            |                           |                               | (25)...(30) = | 30.6542                        | (32)            |
| Party Ceilings 1                                                       |                         |                            | 57.5000                   |                               |               | 40.0000                        | 2300.0000 (32b) |
| Internal Wall 1                                                        |                         |                            | 66.6700                   |                               |               | 9.0000                         | 600.0300 (32c)  |

|                                                                |                                      |                |
|----------------------------------------------------------------|--------------------------------------|----------------|
| Heat capacity Cm = Sum(A x K)                                  | (28)...(30) + (32) + (32a)...(32e) = | 5915.3345 (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K |                                      | 102.8754 (35)  |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)     |                                      | 12.7076 (36)   |
| Total fabric heat loss                                         | (33) + (36) =                        | 43.3618 (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                     | 17.3303 | 17.1775 | 17.0248 | 16.2610 | 16.1082 | 15.3445 | 15.3445 | 15.1917 | 15.6500 | 16.1082 | 16.4137 | 16.7192 (38) |
| Heat transfer coeff       | 60.6921 | 60.5393 | 60.3866 | 59.6228 | 59.4701 | 58.7063 | 58.7063 | 58.5535 | 59.0118 | 59.4701 | 59.7756 | 60.0811 (39) |
| Average = Sum(39)m / 12 = |         |         |         |         |         |         |         |         |         |         |         | 59.5846 (39) |

|               | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec         |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------------|
| HLP           | 1.0555 | 1.0529 | 1.0502 | 1.0369 | 1.0343 | 1.0210 | 1.0210 | 1.0183 | 1.0263 | 1.0343 | 1.0396 | 1.0449 (40) |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 1.0363 (40) |
| Days in month | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31 (41)     |

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

|                                          |  |  |  |  |  |  |  |  |  |  |  |              |
|------------------------------------------|--|--|--|--|--|--|--|--|--|--|--|--------------|
| Assumed occupancy                        |  |  |  |  |  |  |  |  |  |  |  | 1.9101 (42)  |
| Average daily hot water use (litres/day) |  |  |  |  |  |  |  |  |  |  |  | 79.5658 (43) |

|                     | Jan      | Feb      | Mar      | Apr      | May     | Jun     | Jul     | Aug     | Sep     | Oct      | Nov      | Dec           |
|---------------------|----------|----------|----------|----------|---------|---------|---------|---------|---------|----------|----------|---------------|
| Daily hot water use | 81.0224  | 84.3398  | 81.1572  | 77.9785  | 78.1719 | 71.6093 | 71.6093 | 74.7919 | 77.9743 | 81.1572  | 84.3398  | 87.0224 (44)  |
| Energy cont         | 129.7932 | 115.5180 | 117.1404 | 102.1258 | 97.9922 | 84.5598 | 78.3571 | 89.9159 | 90.9898 | 106.0398 | 115.7508 | 125.6978 (45) |

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

|                                                                 |          |          |          |          |          |          |          |          |          |          |          |          |         |         |         |         |         |         |                    |                |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------|---------|---------|---------|---------|---------|--------------------|----------------|
| Energy content (annual)                                         |          |          |          |          |          |          |          |          |          |          |          |          |         |         |         |         |         |         | Total = Sum(45)m = | 1251.8806 (45) |
| Distribution loss (46)m = 0.15 x (45)m                          |          |          |          |          |          |          |          |          |          |          |          |          |         |         |         |         |         |         |                    |                |
| 19.4690                                                         | 17.0277  | 17.5711  | 15.3189  | 14.6988  | 12.6840  | 11.7536  | 13.4874  | 13.6485  | 15.9060  | 17.3626  | 18.8547  | (46)     |         |         |         |         |         |         |                    |                |
| Water storage loss:                                             |          |          |          |          |          |          |          |          |          |          |          |          |         |         |         |         |         |         |                    |                |
| Store volume                                                    |          |          |          |          |          |          |          |          |          |          |          |          |         |         |         |         |         |         |                    | 150.0000 (47)  |
| b) If manufacturer declared loss factor is not known :          |          |          |          |          |          |          |          |          |          |          |          |          |         |         |         |         |         |         |                    |                |
| Hot water storage loss factor from Table 2 (kWh/litre/day)      |          |          |          |          |          |          |          |          |          |          |          |          |         |         |         |         |         |         |                    | 0.0191 (51)    |
| Volume factor from Table 2a                                     |          |          |          |          |          |          |          |          |          |          |          |          |         |         |         |         |         |         |                    | 0.9283 (52)    |
| Temperature factor from Table 2b                                |          |          |          |          |          |          |          |          |          |          |          |          |         |         |         |         |         |         |                    | 0.6000 (53)    |
| Enter (49) or (54) in (55)                                      |          |          |          |          |          |          |          |          |          |          |          |          |         |         |         |         |         |         |                    | 1.5960 (55)    |
| Total storage loss                                              | 49.4758  | 44.6878  | 49.4758  | 47.8798  | 49.4758  | 47.8798  | 49.4758  | 49.4758  | 47.8798  | 49.4758  | 47.8798  | 49.4758  | 47.8798 | 49.4758 | 47.8798 | 49.4758 | 47.8798 | 49.4758 | 47.8798            | (56)           |
| If cylinder contains dedicated solar storage                    |          |          |          |          |          |          |          |          |          |          |          |          |         |         |         |         |         |         |                    |                |
| 49.4758                                                         | 44.6878  | 49.4758  | 47.8798  | 49.4758  | 47.8798  | 49.4758  | 47.8798  | 49.4758  | 47.8798  | 49.4758  | 47.8798  | 49.4758  | 47.8798 | 49.4758 | 47.8798 | 49.4758 | 47.8798 | 49.4758 | 47.8798            | (57)           |
| Primary loss                                                    | 31.1612  | 28.1456  | 31.1612  | 30.1560  | 31.1612  | 22.5120  | 23.2624  | 23.2624  | 22.5120  | 31.1612  | 30.1560  | 31.1612  | 30.1560 | 31.1612 | 30.1560 | 31.1612 | 30.1560 | 31.1612 | 30.1560            | (59)           |
| Total heat required for water heating calculated for each month |          |          |          |          |          |          |          |          |          |          |          |          |         |         |         |         |         |         |                    |                |
| 210.4302                                                        | 186.3514 | 197.7774 | 180.1616 | 178.6291 | 154.9516 | 151.0953 | 162.6541 | 161.3816 | 186.6768 | 193.7865 | 206.3348 | (62)     |         |         |         |         |         |         |                    |                |
| Solar input                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (63)     |         |         |         |         |         |         |                    |                |
| Output from w/h                                                 | 210.4302 | 186.3514 | 197.7774 | 180.1616 | 178.6291 | 154.9516 | 151.0953 | 162.6541 | 161.3816 | 186.6768 | 193.7865 | 206.3348 | (64)    |         |         |         |         |         |                    |                |
| Heat gains from water heating, kWh/month                        | 107.6658 | 96.0114  | 103.4588 | 96.3855  | 97.0920  | 84.4296  | 84.2443  | 88.0876  | 86.5675  | 99.7678  | 100.9157 | 106.3041 | (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                                                                               | 95.5071  | 95.5071  | 95.5071  | 95.5071  | 95.5071  | 95.5071  | 95.5071  | 95.5071  | 95.5071  | 95.5071  | 95.5071  | 95.5071 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 14.9712  | 13.2973  | 10.8141  | 8.1870   | 6.1198   | 5.1666   | 5.5827   | 7.2566   | 9.7398   | 12.3670  | 14.4341  | 15.3873 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 166.6008 | 168.3296 | 163.9731 | 154.6986 | 142.9912 | 131.9880 | 124.6371 | 122.9083 | 127.2648 | 136.5393 | 148.2467 | 159.2500 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 32.5507  | 32.5507  | 32.5507  | 32.5507  | 32.5507  | 32.5507  | 32.5507  | 32.5507  | 32.5507  | 32.5507  | 32.5507  | 32.5507 (69)  |
| Pumps, fans                                                                         | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000 (70)   |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -76.4056 | -76.4056 | -76.4056 | -76.4056 | -76.4056 | -76.4056 | -76.4056 | -76.4056 | -76.4056 | -76.4056 | -76.4056 | -76.4056 (71) |
| Water heating gains (Table 5)                                                       | 144.7121 | 142.8742 | 139.0575 | 133.8687 | 130.5000 | 117.2633 | 113.2315 | 118.3973 | 120.2327 | 134.0965 | 140.1608 | 142.8819 (72) |
| Total internal gains                                                                | 380.9363 | 379.1532 | 368.4968 | 351.4064 | 334.2632 | 309.0700 | 298.1035 | 303.2143 | 311.8894 | 337.6549 | 357.4936 | 372.1712 (73) |

#### 6. Solar gains

| [Jan]       |          |          | Area<br>m <sup>2</sup> | Solar flux<br>Table 6a<br>W/m <sup>2</sup> |          | Specific data<br>or Table 6b |          | Specific data<br>or Table 6c |          | FF | Access<br>factor<br>Table 6d |          | Gains<br>W   |      |
|-------------|----------|----------|------------------------|--------------------------------------------|----------|------------------------------|----------|------------------------------|----------|----|------------------------------|----------|--------------|------|
| Northwest   |          |          | 11.4000                | 11.2829                                    |          | 0.4000                       |          | 0.7000                       |          |    | 0.7700                       |          | 24,9585 (81) |      |
| Solar gains | 24.9585  | 50.8037  | 91.5322                | 150.3221                                   | 202.0625 | 215.4200                     | 201.5210 | 160.6549                     | 111.5334 |    | 62.0862                      | 31.4042  | 20.3824      | (83) |
| Total gains | 405.8948 | 429.9569 | 460.0290               | 501.7285                                   | 536.3256 | 524.4899                     | 499.6244 | 463.8692                     | 423.4228 |    | 399.7411                     | 388.8979 | 392.5536     | (84) |

#### 7. Mean internal temperature (heating season)

|                                                                                         |         |         |         |         |         |         |         |         |         |         |         |              |              |
|-----------------------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|--------------|
| Temperature during heating periods in the living area from Table 9, T <sub>hi</sub> (C) |         |         |         |         |         |         |         |         |         |         |         |              | 21.0000 (85) |
| Utilisation factor for gains for living area, n <sub>li</sub> (see Table 9a)            |         |         |         |         |         |         |         |         |         |         |         |              |              |
| tau                                                                                     | 27.0735 | 27.1418 | 27.2105 | 27.5591 | 27.6298 | 27.9893 | 27.9893 | 28.0623 | Sep     | Oct     | Nov     | Dec          |              |
| alpha                                                                                   | 2.8049  | 2.8095  | 2.8140  | 2.8373  | 2.8420  | 2.8660  | 2.8660  | 2.8708  | 2.8563  | 2.8420  | 2.8326  | 2.8233       |              |
| util living area                                                                        | 0.5525  | 0.9413  | 0.9151  | 0.8555  | 0.7510  | 0.6086  | 0.4761  | 0.5224  | 0.7260  | 0.8742  | 0.9345  | 0.9563 (86)  |              |
| MIT                                                                                     | 19.0215 | 19.1997 | 19.5626 | 20.0717 | 20.5221 | 20.8194 | 20.9347 | 20.9136 | 20.6819 | 20.1445 | 19.5165 | 18.9919 (87) |              |
| Th 2                                                                                    | 20.0373 | 20.0395 | 20.0417 | 20.0527 | 20.0549 | 20.0659 | 20.0659 | 20.0681 | 20.0615 | 20.0549 | 20.0505 | 20.0461 (88) |              |
| util rest of house                                                                      | 0.9458  | 0.9329  | 0.9025  | 0.8329  | 0.7108  | 0.5435  | 0.3883  | 0.4343  | 0.6687  | 0.8499  | 0.9237  | 0.9501 (89)  |              |
| MIT 2                                                                                   | 18.2346 | 18.4114 | 18.7689 | 19.2679 | 19.6872 | 19.9514 | 20.0356 | 20.0255 | 19.8426 | 19.3473 | 18.7338 | 18.2118 (90) |              |
| Living area fraction                                                                    | 19.6847 | 18.8623 | 19.2229 | 19.7277 | 20.1648 | 20.4479 | 20.5499 | 20.5335 | 20.3227 | 19.8033 | 19.1815 | 18.6580 (92) |              |
| Temperature adjustment                                                                  |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |              |
| adjusted MIT                                                                            | 18.6847 | 18.8623 | 19.2229 | 19.7277 | 20.1648 | 20.4479 | 20.5499 | 20.5335 | 20.3227 | 19.8033 | 19.1815 | 18.6580 (93) |              |

#### 8. Space heating requirement

|                      | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct          | Nov      | Dec            |
|----------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------------|----------|----------------|
| Utilisation          | 0.9340   | 0.9204   | 0.8896   | 0.8242   | 0.7159   | 0.5713   | 0.4351   | 0.4798   | 0.6859   | 0.8425       | 0.9118   | 0.9389 (94)    |
| Useful gains         | 379.0975 | 395.7251 | 409.2609 | 413.5254 | 383.9303 | 299.6168 | 217.3684 | 222.5803 | 290.4177 | 336.7857     | 354.6128 | 368.5522 (95)  |
| Ext temp.            | 4.3000   | 4.9000   | 6.5000   | 8.9000   | 14.6000  | 16.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000      | 7.1000   | 4.2000 (96)    |
| Heat loss rate W     | 873.0369 | 845.2688 | 768.2917 | 645.5757 | 503.4007 | 343.3085 | 231.8841 | 242.0310 | 367.2113 | 547.3222     | 722.1781 | 868.6522 (97)  |
| Month factor         | 1.0000   | 1.0000   | 1.0000   | 1.0000   | 1.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 1.0000       | 1.0000   | 1.0000 (98)    |
| Space heating kWh    | 367.4909 | 302.0934 | 267.1189 | 167.0762 | 88.8860  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 156.6392     | 264.6470 | 372.0744 (99)  |
| Space heating        |          |          |          |          |          |          |          |          |          |              |          | 1896.0260 (99) |
| Space heating per m2 |          |          |          |          |          |          |          |          |          |              |          | 34.5396 (99)   |
|                      |          |          |          |          |          |          |          |          |          | (98) / (4) = |          |                |

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| 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP |                    |                                            |                                       |
|--------------------------------------------------------------------------------|--------------------|--------------------------------------------|---------------------------------------|
|                                                                                | Energy<br>kWh/year | Emission factor<br>kg CO <sub>2</sub> /kWh | Emissions<br>kg CO <sub>2</sub> /year |
| Space heating - main system 1                                                  | 2147.0551          | 0.2160                                     | 463.7639 (241)                        |
| Space heating - secondary                                                      | 0.0000             | 0.0000                                     | 0.0000 (263)                          |
| Water heating (other fuel)                                                     | 2346.1949          | 0.2160                                     | 506.7791 (264)                        |
| Space and water heating                                                        |                    |                                            | 970.5420 (265)                        |
| Pumps and fans                                                                 | 135.7236           | 0.5190                                     | 70.4405 (267)                         |
| Energy for lighting                                                            | 264.3961           | 0.5190                                     | 137.2216 (268)                        |
| Total CO <sub>2</sub> , kg/year                                                |                    |                                            | 1178.2041 (272)                       |
| Dwelling Carbon Dioxide Emission Rate (DER)                                    |                    |                                            | 20.4900 (273)                         |

| 16 CO <sub>2</sub> EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES |  |     |             |
|-----------------------------------------------------------------------------------------------------------------------|--|-----|-------------|
|                                                                                                                       |  |     |             |
| DER                                                                                                                   |  |     | 20.4900 EC1 |
| Total Floor Area                                                                                                      |  | TFA | 57,5000     |
| Assumed number of occupants                                                                                           |  | N   | 1.9101      |
| CO <sub>2</sub> emission factor in Table 12 for electricity displaced from grid                                       |  | EF  | 0.5190      |
| CO <sub>2</sub> emissions from appliances, equation (L14)                                                             |  |     | 17,1694 EC2 |
| CO <sub>2</sub> emissions from cooking, equation (L16)                                                                |  |     | 2.8668 EC3  |
| Total CO <sub>2</sub> emissions                                                                                       |  |     | 40,5263 EC4 |
| Residual CO <sub>2</sub> emissions offset from biofuel CBE                                                            |  |     | 0.0000 EC5  |
| Additional allowable electricity generation, kWh/m <sup>2</sup> /year                                                 |  |     | 0.0000 EC6  |
| Resulting CO <sub>2</sub> emissions offset from additional allowable electricity generation                           |  |     | 0.0000 EC7  |
| Net CO <sub>2</sub> emissions                                                                                         |  |     | 40,5263 EC8 |

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SAP2012 Calculator (Design  
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| 4. Water heating energy requirements (kWh/year)              |                                   |          |          |          |         |         |         |         |         |          |          |               |
|--------------------------------------------------------------|-----------------------------------|----------|----------|----------|---------|---------|---------|---------|---------|----------|----------|---------------|
| Assumed occupancy                                            |                                   |          |          |          |         |         |         |         |         |          |          | 1.9101 (42)   |
| Average daily hot water use (litres/day)                     |                                   |          |          |          |         |         |         |         |         |          |          | 79.5658 (43)  |
|                                                              | Jan                               | Feb      | Mar      | Apr      | May     | Jun     | Jul     | Aug     | Sep     | Oct      | Nov      | Dec           |
| Daily hot water use                                          |                                   |          |          |          |         |         |         |         |         |          |          |               |
|                                                              | 87.5224                           | 84.3398  | 81.1572  | 77.9745  | 74.7919 | 71.6093 | 71.6093 | 74.7919 | 77.9745 | 81.1572  | 84.3398  | 87.5224 (44)  |
| Energy content                                               | 129.7932                          | 113.5180 | 117.1404 | 102.1258 | 97.9922 | 84.5598 | 78.3571 | 89.9159 | 90.9898 | 106.0398 | 115.7508 | 125.6978 (45) |
| Energy content (annual)                                      | Total = Sum(45)m = 1251.8806 (45) |          |          |          |         |         |         |         |         |          |          |               |
| Distribution loss (46)m = 0.15 x (45)m                       | 19.4690                           | 17.0277  | 17.5711  | 18.3189  | 14.6988 | 12.6840 | 11.7536 | 13.4874 | 13.6485 | 15.9060  | 17.3626  | 18.8547 (46)  |
| Water storage loss:                                          |                                   |          |          |          |         |         |         |         |         |          |          |               |
| Store volume                                                 | 150.0000 (47)                     |          |          |          |         |         |         |         |         |          |          |               |
| a) If manufacturer declared loss factor is known (kWh/day)1: | 1.3938 (48)                       |          |          |          |         |         |         |         |         |          |          |               |
| Temperature factor from Table 2b                             | 0.5400 (49)                       |          |          |          |         |         |         |         |         |          |          |               |

Regs Region: England  
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# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

|                                                                 |             |          |          |          |          |          |          |          |          |          |          |               |
|-----------------------------------------------------------------|-------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Enter (49) or (54) in (55)                                      | 0.7527 (55) |          |          |          |          |          |          |          |          |          |          |               |
| Total storage loss                                              | 23.3325     | 21.0745  | 23.3325  | 22.5798  | 23.3325  | 22.5798  | 23.3325  | 23.3325  | 22.5798  | 23.3325  | 22.5798  | 23.3325 (56)  |
| If cylinder contains dedicated solar storage                    | 23.3325     | 21.0745  | 23.3325  | 22.5798  | 23.3325  | 22.5798  | 23.3325  | 23.3325  | 22.5798  | 23.3325  | 22.5798  | 23.3325 (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)  |
| Total heat required for water heating calculated for each month | 176.3881    | 155.6037 | 163.7353 | 147.2177 | 144.5871 | 129.6516 | 124.9520 | 136.5108 | 136.0816 | 152.6347 | 160.8426 | 172.2927 (62) |
| 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 (63)   |
| Outout from w/h                                                 | 176.3881    | 155.6037 | 163.7353 | 147.2177 | 144.5871 | 129.6516 | 124.9520 | 136.5108 | 136.0816 | 152.6347 | 160.8426 | 172.2927 (64) |
| Heat gains from water heating, kWh/month                        | 80.4322     | 71.4133  | 76.2251  | 70.0303  | 69.8583  | 64.1898  | 63.3297  | 67.1730  | 66.3276  | 72.5342  | 74.5606  | 78.0704 (65)  |

### 3. 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                                                                               | 95.5071  | 95.5071  | 95.5071  | 95.5071  | 95.5071  | 95.5071  | 95.5071  | 95.5071  | 95.5071  | 95.5071  | 95.5071  | 95.5071 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 14.9712  | 13.2973  | 10.8141  | 8.1870   | 6.1198   | 5.1666   | 5.5827   | 7.2566   | 9.7398   | 12.3670  | 14.4341  | 15.3873 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 166.6008 | 166.3296 | 163.9731 | 154.6986 | 142.9912 | 131.9880 | 124.6371 | 122.9083 | 127.2648 | 136.5393 | 148.2467 | 159.2500 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 32.5507  | 32.5507  | 32.5507  | 32.5507  | 32.5507  | 32.5507  | 32.5507  | 32.5507  | 32.5507  | 32.5507  | 32.5507  | 32.5507 (69)  |
| Pumps, fans                                                                         | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000 (70)   |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -76.4056 | -76.4056 | -76.4056 | -76.4056 | -76.4056 | -76.4056 | -76.4056 | -76.4056 | -76.4056 | -76.4056 | -76.4056 | -76.4056 (71) |
| Water heating gains (Table 5)                                                       | 108.1078 | 106.2698 | 102.4531 | 97.2643  | 93.8956  | 89.1522  | 85.1205  | 90.2862  | 92.1216  | 97.4922  | 103.5564 | 106.2775 (72) |
| Total internal gains                                                                | 344.3319 | 342.5488 | 331.8924 | 314.8020 | 297.6588 | 280.9589 | 269.9924 | 275.1033 | 283.7784 | 301.0505 | 320.8893 | 335.5668 (73) |

### 6. Solar gains

|             |          |            |          |               |          |          |              |
|-------------|----------|------------|----------|---------------|----------|----------|--------------|
| [Jan]       | Area     | Solar flux | g        | Specific data | FF       | Access   | Gains        |
|             | m2       | Table 6a   | W/m2     | or Table 6b   | Factor   | Table 6d | W            |
| Northwest   | 11.4000  | 11.2829    | 0.6300   |               | 0.7000   |          | 39.3096 (81) |
| Solar gains | 39.3096  | 80.0159    | 144.1632 | 236.7574      | 318.2484 | 339.2865 | 317.3955     |
| Total gains | 383.6415 | 422.5647   | 476.0556 | 551.5594      | 615.9072 | 620.2454 | 587.3880     |

### 7. Mean internal temperature (heating season)

|                                                                             |              |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|--------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Thl (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                                                                         | 51.0841      | 51.1762 | 51.2667 | 51.6962 | 51.7773 | 52.1585 | 52.1585 | 52.2297 | 52.0110 | 51.7773 | 51.6134 | 51.4431      |
| alpha                                                                       | 4.4056       | 4.4117  | 4.4178  | 4.4464  | 4.4518  | 4.4772  | 4.4772  | 4.4820  | 4.4674  | 4.4518  | 4.4409  | 4.4295       |
| util living area                                                            | 0.9968       | 0.9946  | 0.9872  | 0.9584  | 0.8729  | 0.7103  | 0.5522  | 0.6256  | 0.8701  | 0.9771  | 0.9942  | 0.9974 (86)  |
| MIT                                                                         | 19.5479      | 19.6842 | 19.9616 | 20.3594 | 20.7165 | 20.9219 | 20.9802 | 20.9663 | 20.7946 | 20.3492 | 19.8847 | 19.5228 (87) |
| Th 2                                                                        | 19.7946      | 19.7965 | 19.7983 | 19.8071 | 19.8087 | 19.8163 | 19.8163 | 19.8177 | 19.8134 | 19.8087 | 19.8054 | 19.8019 (88) |
| util rest of house                                                          | 0.9957       | 0.9926  | 0.9823  | 0.9417  | 0.8227  | 0.6088  | 0.4142  | 0.4838  | 0.7977  | 0.9649  | 0.9918  | 0.9964 (89)  |
| MIT 2                                                                       | 17.8839      | 18.0840 | 18.4880 | 19.0605 | 19.5345 | 19.7659 | 19.8095 | 19.8044 | 19.6464 | 19.0566 | 18.3833 | 17.8523 (90) |
| Living area fraction                                                        | 18.8357      | 18.9993 | 19.3309 | 19.8035 | 20.2106 | 20.4272 | 20.4791 | 20.4690 | 20.3032 | 19.7959 | 19.2421 | 18.8078 (92) |
| Temperature adjustment                                                      | 0.0000       | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000  | 0.0000 (93)  |

### 8. Space heating requirement

|                      |           |           |          |          |          |          |          |          |          |          |          |                |
|----------------------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| Utilisation          | Jan       | Feb       | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec            |
| Useful gains         | 381.5092  | 418.7225  | 466.4672 | 519.3620 | 518.3148 | 411.8283 | 289.8755 | 299.4670 | 382.0070 | 384.7649 | 366.7323 | 365.8721 (94)  |
| Ext temp.            | 4.3000    | 4.9000    | 6.5000   | 8.3000   | 11.7000  | 14.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000  | 7.1000   | 4.2000 (96)    |
| Heat loss rate W     | 1136.2007 | 1100.1084 | 999.3736 | 842.1922 | 656.3359 | 446.1047 | 296.9730 | 311.0847 | 476.2400 | 709.1891 | 939.3685 | 1133.8710 (97) |
| Month fracti         | 1.0000    | 1.0000    | 1.0000   | 1.0000   | 1.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 1.0000   | 1.0000   | 1.0000 (97a)   |
| Space heating kWh    | 561.4905  | 457.8914  | 396.4824 | 232.4378 | 102.6876 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 241.3716 | 412.2981 | 571.3168 (98)  |
| Space heating        |           |           |          |          |          |          |          |          |          |          |          | 2975.9760 (98) |
| Space heating per m2 |           |           |          |          |          |          |          |          |          |          |          | 51.7561 (99)   |

### 8c. Space cooling requirement

Not applicable

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

### 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 %)                      | 93.5000 (206)   |          |          |          |          |          |          |          |          |          |          |                 |
| Efficiency of secondary/supplementary heating system, %               | 0.0000 (208)    |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating requirement                                             | 3182.8621 (211) |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating requirement                                             | Jan             | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec             |
| Space heating requirement                                             | 561.4905        | 457.8914 | 396.4824 | 232.4378 | 102.6876 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 241.3716 | 412.2981 | 571.3168 (98)   |
| Space heating efficiency (main heating system 1)                      | 93.5000         | 93.5000  | 93.5000  | 93.5000  | 93.5000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 93.5000  | 93.5000  | 93.5000 (210)   |
| Space heating fuel (main heating system)                              | 600.5246        | 489.7234 | 424.0453 | 248.5965 | 109.8264 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 258.1514 | 440.9605 | 611.0340 (211)  |
| Water heating requirement                                             | 0.0000          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)    |
| Water heating                                                         | 176.3881        | 155.6037 | 163.7353 | 147.2177 | 144.5871 | 129.6516 | 124.9520 | 136.5108 | 136.0816 | 152.6347 | 160.8426 | 172.2927 (64)   |
| Water heating requirement                                             | 176.3881        | 155.6037 | 163.7353 | 147.2177 | 144.5871 | 129.6516 | 124.9520 | 136.5108 | 136.0816 | 152.6347 | 160.8426 | 172.2927 (64)   |
| Efficiency of water heater                                            | 87.6893         | 87.5234  | 87.0871  | 86.0271  | 83.9204  | 79.8000  | 79.8000  | 79.8000  | 79.8000  | 86.0312  | 87.2181  | 87.7731 (217)   |
| Fuel for water heating, kWh/month                                     | 201.1512        | 177.7852 | 188.0132 | 171.1294 | 172.2907 | 162.4707 | 156.5814 | 171.0662 | 170.5283 | 177.4176 | 184.4143 | 196.2932 (219)  |
| Annual totals kWh/year                                                |                 |          |          |          |          |          |          |          |          |          |          | 2129.1417 (219) |
| Space heating fuel - main system                                      |                 |          |          |          |          |          |          |          |          |          |          | 3182.8621 (211) |
| Space heating fuel - secondary                                        |                 |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)    |
| Electricity for pumps and fans:                                       |                 |          |          |          |          |          |          |          |          |          |          | 30.0000 (230c)  |
| central heating pump                                                  |                 |          |          |          |          |          |          |          |          |          |          | 45.0000 (230e)  |
| main heating flow fan                                                 |                 |          |          |          |          |          |          |          |          |          |          | 75.0000 (231)   |
| Total electricity for the above, kWh/year                             |                 |          |          |          |          |          |          |          |          |          |          | 264.3961 (232)  |
| Electricity for lighting (calculated in Appendix L)                   |                 |          |          |          |          |          |          |          |          |          |          | 5651.3999 (238) |
| Total delivered energy for all uses                                   |                 |          |          |          |          |          |          |          |          |          |          |                 |

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

|                                                                                                   |                 |                 |
|---------------------------------------------------------------------------------------------------|-----------------|-----------------|
| Energy                                                                                            | Emission factor | Emissions       |
| kWh/year                                                                                          | kg CO2/kWh      | kg CO2/year     |
| Space heating - main system 1                                                                     | 0.2160          | 687.4982 (261)  |
| Space heating - secondary                                                                         | 0.0000          | 0.0000 (263)    |
| Water heating (other fuel)                                                                        | 0.2160          | 459.8946 (264)  |
| Space and water heating                                                                           |                 | 1147.3928 (265) |
| Pumps and fans                                                                                    | 0.3190          | 38.9250 (267)   |
| Energy for lighting                                                                               | 0.3190          | 137.2216 (268)  |
| Total CO2, kg/m2/year                                                                             |                 | 1323.5394 (272) |
| Emissions per m2 for space and water heating                                                      |                 | 19.9547 (272a)  |
| Fuel factor (main gas)                                                                            |                 | 1.0000          |
| Emissions per m2 for lighting                                                                     |                 | 2.3865 (272b)   |
| Emissions per m2 for pumps and fans                                                               |                 | 0.6770 (272c)   |
| Target Carbon Dioxide Emission Rate (TER) = (19.9547 * 1.00) + 2.3865 + 0.6770, rounded to 2 d.p. |                 | 23.0200 (273)   |

# BASIC COMPLIANCE REPORT

## Calculation Type: New Build (As Designed)



|                      |        |                |            |
|----------------------|--------|----------------|------------|
| Property Reference   | 116823 | Issued on Date | 17/12/2021 |
| Assessment Reference | Plot 5 | Prop Type Ref  | FF         |
| Property             |        |                |            |

|                                    |      |             |       |      |       |
|------------------------------------|------|-------------|-------|------|-------|
| SAP Rating                         | 82 B | DER         | 20.49 | TER  | 23.02 |
| Environmental                      | 86 B | % DER<TER   | 10.98 |      |       |
| CO <sub>2</sub> Emissions (t/year) | 1.03 | DFEE        | 52.18 | TFEE | 69.12 |
| General Requirements Compliance    | Fail | % DFEE<TFEE | 24.51 |      |       |

|                  |                                                                                    |             |           |
|------------------|------------------------------------------------------------------------------------|-------------|-----------|
| Assessor Details | Mr. Richard Denteh, Meinhardt UK, Tel: 02078317969, richard.denteh@meinhardt.co.uk | Assessor ID | T596-0001 |
|------------------|------------------------------------------------------------------------------------|-------------|-----------|

|        |  |
|--------|--|
| Client |  |
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### SUMMARY FOR INPUT DATA FOR New Build (As Designed)

#### Criterion 1 – Achieving the TER and TFEE rate

##### 1a TER and DER

|                                             |                                                           |
|---------------------------------------------|-----------------------------------------------------------|
| Fuel for main heating                       | Mains gas                                                 |
| Fuel factor                                 | 1.00 (mains gas)                                          |
| Target Carbon Dioxide Emission Rate (TER)   | 23.02 kgCO <sub>2</sub> /m <sup>2</sup>                   |
| Dwelling Carbon Dioxide Emission Rate (DER) | 20.49 kgCO <sub>2</sub> /m <sup>2</sup> <span>Pass</span> |
|                                             | -2.53 (-11.0%) kgCO <sub>2</sub> /m <sup>2</sup>          |

##### 1b TFEE and DFEE

|                                          |                                                |
|------------------------------------------|------------------------------------------------|
| Target Fabric Energy Efficiency (TFEE)   | 69.12 kWh/m <sup>2</sup> /yr                   |
| Dwelling Fabric Energy Efficiency (DFEE) | 52.18 kWh/m <sup>2</sup> /yr <span>Pass</span> |
|                                          | -16.9 (-24.5%) kWh/m <sup>2</sup> /yr          |

#### Criterion 2 – Limits on design flexibility

##### Limiting Fabric Standards

##### 2 Fabric U-values

| Element                   | Average          | Highest          |                   |
|---------------------------|------------------|------------------|-------------------|
| External wall             | 0.17 (max. 0.30) | 0.26 (max. 0.70) | <span>Pass</span> |
| Party wall                | 0.00 (max. 0.20) | -                | <span>Pass</span> |
| Floor                     | 0.09 (max. 0.25) | 0.09 (max. 0.70) | <span>Pass</span> |
| Openings and curtain wall | 1.23 (max. 2.00) | 1.40 (max. 3.30) | <span>Pass</span> |

##### 2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

##### 3 Air permeability

|                                |                        |
|--------------------------------|------------------------|
| Air permeability at 50 pascals | 3.00 (design value)    |
| Maximum                        | 10.0 <span>Pass</span> |

##### Limiting System Efficiencies

##### 4 Heating efficiency

# BASIC COMPLIANCE REPORT

## Calculation Type: New Build (As Designed)



|                     |                                                        |                   |
|---------------------|--------------------------------------------------------|-------------------|
| Main heating system | Boiler system with radiators or underfloor - Mains gas | <span>Pass</span> |
|                     | Data from manufacturer                                 |                   |
|                     | Efficiency: 93%                                        |                   |
|                     | Minimum: 88%                                           |                   |

|                          |      |  |
|--------------------------|------|--|
| Secondary heating system | None |  |
|--------------------------|------|--|

##### 5 Cylinder insulation

|                            |                                     |                   |
|----------------------------|-------------------------------------|-------------------|
| Hot water storage          | Nominal cylinder loss: 2.66 kWh/day | <span>Fail</span> |
|                            | Permitted by DBSCG 1.89             |                   |
| Primary pipework insulated | Yes                                 | <span>Pass</span> |

##### 6 Controls

|                        |                                      |                   |
|------------------------|--------------------------------------|-------------------|
| Space heating controls | Programmer, room thermostat and TRVs | <span>Pass</span> |
| Hot water controls     | Cylinderstat                         | <span>Pass</span> |
|                        | Not independent timer for DHW        | <span>Fail</span> |
|                        | Yes                                  | <span>Pass</span> |

##### 7 Low energy lights

|                                                     |       |                   |
|-----------------------------------------------------|-------|-------------------|
| Percentage of fixed lights with low-energy fittings | 100 % |                   |
| Minimum                                             | 75 %  | <span>Pass</span> |

##### 8 Mechanical ventilation

|                                      |      |                   |
|--------------------------------------|------|-------------------|
| Continuous supply and extract system |      |                   |
| Specific fan power                   | 0.25 |                   |
| Maximum                              | 1.5  | <span>Pass</span> |
| MVHR efficiency                      | 91 % |                   |
| Minimum                              | 70 % | <span>Pass</span> |

#### Criterion 3 – Limiting the effects of heat gains in summer

##### 9 Summertime temperature

|                                  |                                    |                   |
|----------------------------------|------------------------------------|-------------------|
| Overheating risk (Thames Valley) | Slight                             | <span>Pass</span> |
| Based on:                        |                                    |                   |
| Overshading                      | Average                            |                   |
| Windows facing North West        | 11.40 m <sup>2</sup> . No overhang |                   |
| Air change rate                  | 6.00 ach                           |                   |
| Blinds/curtains                  | None                               |                   |

#### Criterion 4 – Building performance consistent with DER and DFEE rate

##### Party Walls

| Type | U-value |                    |                   |
|------|---------|--------------------|-------------------|
|      |         | W/m <sup>2</sup> K | <span>Pass</span> |
|      |         | W/m <sup>2</sup> K | <span>Pass</span> |
|      |         | W/m <sup>2</sup> K | <span>Pass</span> |

##### Air permeability and pressure testing

##### 3 Air permeability

|                                |                        |
|--------------------------------|------------------------|
| Air permeability at 50 pascals | 3.00 (design value)    |
| Maximum                        | 10.0 <span>Pass</span> |

## BASIC COMPLIANCE REPORT

### Calculation Type: New Build (As Designed)



#### 10 Key features

|                       |      |                                  |
|-----------------------|------|----------------------------------|
| External wall U-value | 0.14 | W/m <sup>2</sup> K               |
| Party wall U-value    | 0.00 | W/m <sup>2</sup> K               |
| Party wall U-value    | 0.00 | W/m <sup>2</sup> K               |
| Party wall U-value    | 0.00 | W/m <sup>2</sup> K               |
| Exposed floor U-value | 0.09 | W/m <sup>2</sup> K               |
| Air permeability      | 3.0  | m <sup>3</sup> /m <sup>2</sup> h |

*This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.*

## FULL SAP CALCULATION PRINTOUT

### Calculation Type: New Build (As Designed)



|                      |              |                |            |
|----------------------|--------------|----------------|------------|
| Property Reference   | 116842       | Issued on Date | 17/12/2021 |
| Assessment Reference | Plot 54 / 58 | Prop Type Ref  | Mid Floor  |
| Property             |              |                |            |

|                                    |      |             |       |      |       |
|------------------------------------|------|-------------|-------|------|-------|
| SAP Rating                         | 86 B | DER         | 13.59 | TER  | 15.10 |
| Environmental                      | 89 B | % DER<TER   | 9.99  |      |       |
| CO <sub>2</sub> Emissions (t/year) | 1.01 | DFEE        | 34.88 | TFEE | 39.41 |
| General Requirements Compliance    | Fail | % DFEE<TFEE | 11.50 |      |       |

|                  |                                                                                       |             |           |
|------------------|---------------------------------------------------------------------------------------|-------------|-----------|
| Assessor Details | Mr. Richard Denteh, Meinhardt UK, Tel: 02078317969,<br>richard.denteh@meinhardt.co.uk | Assessor ID | T596-0001 |
|------------------|---------------------------------------------------------------------------------------|-------------|-----------|

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| Client |  |
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# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

#### DWELLING AS DESIGNED

Mid-floor flat, total floor area 86 m²

This report covers items included within the SAP calculations.  
It is not a complete report of regulations compliance.

1a TER and DER  
Fuel for main heating:Mains gas  
Fuel factor:1.00 (mains gas)  
Target Carbon Dioxide Emission Rate (TER) 15.10 kgCO<sub>2</sub>/m²  
Dwelling Carbon Dioxide Emission Rate (DER) 13.59 kgCO<sub>2</sub>/m²OK

1b TFEE and DFEE  
Target Fabric Energy Efficiency (TFEE)39.4 kWh/m²/yr  
Dwelling Fabric Energy Efficiency (DFEE)34.9 kWh/m²/yrOK

2 Fabric U-values  
Element Average Highest  
External wall 0.19 (max. 0.30) 0.26 (max. 0.70) OK  
Party wall 0.00 (max. 0.20) - OK  
Floor (no floor)  
Roof (no roof)  
Openings and curtain wall 1.22 (max. 2.00) 1.40 (max. 3.30) OR

2a Thermal bridging  
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability  
Air permeability at 50 pascals: 3.00 (design value)  
Maximum 10.0 OK

4 Heating efficiency  
Main heating system: Boiler system with radiators or underfloor - Mains gas  
Data from manufacturer: . .

Efficiency: 93%  
Minimum: 88% OK

Secondary heating system: None

5 Cylinder insulation  
Hot water storage  
Permitted by DBSCG 1.89 Fail  
Primary pipework insulated: Yes OK

6 Controls  
Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls: Cylinderstat OK  
Not independent timer for DHW Fail

Boiler interlock: Yes OK

7 Low energy lights  
Percentage of fixed lights with low-energy fittings:100%  
Minimum 75% OK

8 Mechanical ventilation  
Continuous supply and extract system  
Specific fan power: 0.55  
Maximum 1.5 OK  
MVHR efficiency: 92%  
Minimum: 70% OK

9 Summertime temperature  
Overheating risk (Thames Valley): Slight OK  
Based on:  
Overshading: Average  
Windows facing North East: 11.16 m², No overhang  
Windows facing South East: 12.21 m², No overhang  
Air change rate: 6.00 ach  
Blinds/curtains: None

10 Key features  
External wall U-value 0.14 W/m²K  
Party wall U-value 0.00 W/m²K  
Party wall U-value 0.00 W/m²K  
Air permeability 3.0 m³/m²h

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)  
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

#### 1. Overall dwelling dimensions

|                                                        | Area (m²)    | Storey height (m) | Volume (m³)                                    |
|--------------------------------------------------------|--------------|-------------------|------------------------------------------------|
| Ground floor                                           | 85.5300 (1b) | 2.7700 (2b)       | 236.9181 (1b) - (3b)                           |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 85.5300      |                   | (4)                                            |
| Dwelling volume                                        |              |                   | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 236.9181 (5) |

#### 2. Ventilation rate

|                              | main heating | secondary heating | other | total    | m³ per hour |
|------------------------------|--------------|-------------------|-------|----------|-------------|
| Number of chimneys           | 0            | 0                 | 0     | 0 * 40 = | 0.0000 (6a) |
| Number of open flues         | 0            | 0                 | 0     | 0 * 20 = | 0.0000 (6b) |
| Number of intermittent fans  | 0            | 0                 | 0     | 0 * 10 = | 0.0000 (7a) |
| Number of passive vents      | 0            | 0                 | 0     | 0 * 10 = | 0.0000 (7b) |
| Number of flueless gas fires | 0            | 0                 | 0     | 0 * 40 = | 0.0000 (7c) |

Air changes per hour  
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 0.0000 / (5) = 0.0000 (8)  
Pressure test Yes  
Measured/design AP50 3.0000  
Infiltration rate 0.1500 (18)  
Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)  
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1275 (21)

|                                                                                              | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec           |
|----------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------------|
| Wind speed                                                                                   | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)   |
| Wind factor                                                                                  | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a)  |
| Adj infilt rate                                                                              | 0.1626 | 0.1594 | 0.1562 | 0.1403 | 0.1371 | 0.1211 | 0.1211 | 0.1179 | 0.1275 | 0.1371 | 0.1434 | 0.1498 (22b)  |
| Balanced mechanical ventilation with heat recovery                                           |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a)  |
| If mechanical ventilation:                                                                   |        |        |        |        |        |        |        |        |        |        |        | 78.2000 (23c) |
| If balanced with heat recovery; efficiency in % allowing for in-use factor (from Table 4b) = |        |        |        |        |        |        |        |        |        |        |        |               |
| Effective ac                                                                                 | 0.2716 | 0.2684 | 0.2652 | 0.2493 | 0.2461 | 0.2301 | 0.2301 | 0.2269 | 0.2365 | 0.2461 | 0.2524 | 0.2588 (25)   |

#### 3. Heat losses and heat loss parameter

| Element                                                    | Gross m² | Openings m² | NetArea m²           | U-value W/m²K | A x U W/K | K-value kJ/m²K                       | A x K kJ/K      |
|------------------------------------------------------------|----------|-------------|----------------------|---------------|-----------|--------------------------------------|-----------------|
| Windows (UW = 1.20)                                        |          |             | 23.3700              | 1.1450        | 26.7595   |                                      | (27)            |
| Front Door                                                 |          |             | 2.1200               | 1.4000        | 2.9680    |                                      | (26)            |
| Unipanel column                                            | 10.9900  |             | 10.9900              | 0.2600        | 2.8574    | 136.7400                             | 1502.7726 (29a) |
| Unipanel wall                                              | 17.1200  | 2.1200      | 15.0000              | 0.1400        | 2.1000    | 30.9500                              | 464.2500 (29a)  |
| Curtain wall                                               | 23.7400  | 23.3700     | 0.3700               | 1.2000        | 0.4440    | 14.0000                              | 5.1800 (29a)    |
| Total net area of external elements Aum(A, m²)             |          |             | 51.8500              |               |           |                                      | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                        |          |             | (26)...(30) + (32) = |               | 35.1289   |                                      | (33)            |
| Party Wall 2                                               |          |             | 39.1400              | 0.0000        | 0.0000    | 20.0000                              | 782.8000 (32)   |
| Party Wall 1 lift & staircore                              |          |             | 21.1300              | 0.0000        | 0.0000    | 180.0000                             | 3803.4000 (32)  |
| Party Floor 1                                              |          |             | 85.5300              |               |           | 40.0000                              | 3421.2000 (32d) |
| Party Ceilings 1                                           |          |             | 85.5300              |               |           | 40.0000                              | 3421.2000 (32b) |
| Internal Wall 1                                            |          |             | 165.8100             |               |           | 9.0000                               | 1492.2900 (32c) |
| Internal Wall 2                                            |          |             | 4.8800               |               |           | 75.0000                              | 366.0000 (32c)  |
| Heat capacity Cm = Sum(A x k)                              |          |             |                      |               |           | (28)...(30) + (32) + (32a)...(32e) = | 13259.0926 (34) |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K          |          |             |                      |               |           |                                      | 178.4063 (35)   |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |          |             |                      |               |           |                                      | 4.0458 (36)     |
| Total fabric heat loss                                     |          |             |                      |               |           | (33) + (36) =                        | 39.1747 (37)    |

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)  
(38)m Jan 21.2316 Feb 20.9824 Mar 20.7331 Apr 19.4871 May 19.2379 Jun 17.9919 Jul 17.9919 Aug 17.7426 Sep 18.4903 Oct 19.2379 Nov 19.7363 Dec 20.2347 (38)  
Heat transfer coeff 60.4063 60.1571 59.9079 58.6618 58.4126 57.1666 57.1666 56.9174 57.6650 58.4126 58.9111 59.4095 (39)  
Average = Sum(39)m / 12 = 58.5995 (39)  
HLP (average) Jan 0.7063 Feb 0.7033 Mar 0.7004 Apr 0.6859 May 0.6829 Jun 0.6684 Jul 0.6684 Aug 0.6655 Sep 0.6742 Oct 0.6829 Nov 0.6888 Dec 0.6946 (40)  
Days in month 31 28 31 30 31 30 31 31 30 31 30 31 (41)

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

Assumed occupancy 2.5595 (42)  
Average daily hot water use (litres/day) 94.9873 (43)  
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

|                                                                 |          |          |          |          |          |          |          |          |          |          |          |               |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Daily hot water use                                             |          |          |          |          |          |          |          |          |          |          |          |               |
| Energy content (annual)                                         | 104.4860 | 100.6865 | 96.8871  | 93.0876  | 89.2881  | 85.4886  | 85.4886  | 89.2881  | 93.0876  | 96.8871  | 100.6865 | 104.4860 (44) |
| Distribution loss (46)m = 0.15 x (45)m                          | 23.2425  | 20.3280  | 20.9767  | 18.2880  | 17.5478  | 15.1424  | 14.0316  | 16.1015  | 16.2938  | 18.9889  | 20.7278  | 22.5091 (46)  |
| Water storage loss:                                             |          |          |          |          |          |          |          |          |          |          |          |               |
| Storage volume                                                  |          |          |          |          |          |          |          |          |          |          |          | 150.0000 (47) |
| b) If manufacturer declared loss factor is not known :          |          |          |          |          |          |          |          |          |          |          |          |               |
| Hot water storage loss factor from Table 2 (kWh/litre/day)      |          |          |          |          |          |          |          |          |          |          |          | 0.0191 (51)   |
| Volume factor from Table 2a                                     |          |          |          |          |          |          |          |          |          |          |          | 0.9283 (52)   |
| Temperature factor from Table 2b                                |          |          |          |          |          |          |          |          |          |          |          | 0.6000 (53)   |
| Enter (49) or (54) in (55)                                      |          |          |          |          |          |          |          |          |          |          |          | 1.5960 (55)   |
| Total storage loss                                              |          |          |          |          |          |          |          |          |          |          |          |               |
| If cylinder contains dedicated solar storage                    | 49.4758  | 44.6878  | 49.4758  | 47.8798  | 49.4758  | 47.8798  | 49.4758  | 49.4758  | 47.8798  | 49.4758  | 47.8798  | 49.4758 (56)  |
| Primary loss                                                    | 49.4758  | 44.6878  | 49.4758  | 47.8798  | 49.4758  | 47.8798  | 49.4758  | 49.4758  | 47.8798  | 49.4758  | 47.8798  | 49.4758 (57)  |
| Total heat required for water heating calculated for each month | 31.1612  | 28.1456  | 31.1612  | 30.1560  | 31.1612  | 22.5120  | 23.2624  | 22.5120  | 31.1612  | 30.1560  | 31.1612  | 31.1612 (59)  |
| 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 (63)   |
| Output from w/h                                                 | 235.5867 | 208.3535 | 220.4815 | 199.9557 | 197.6220 | 171.3410 | 166.2824 | 180.0816 | 179.0172 | 207.2294 | 216.2213 | 230.6976 (64) |
| Heat gains from water heating, kWh/month                        | 116.0304 | 103.3271 | 111.0079 | 102.9670 | 103.4071 | 89.8790  | 89.2940  | 93.8822  | 92.4314  | 106.6016 | 108.3753 | 114.4047 (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     | 127.9733  | 127.9733  | 127.9733  | 127.9733  | 127.9733  | 127.9733  | 127.9733  | 127.9733  | 127.9733  | 127.9733  | 127.9733  | 127.9733 (66)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 20.5590   | 18.2603   | 14.8503   | 11.2426   | 8.4040    | 7.0950    | 7.6664    | 9.9651    | 13.3751   | 16.9828   | 19.8214   | 21.1304 (67)   |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 230.6098  | 233.0028  | 226.9725  | 214.1347  | 197.9293  | 182.6985  | 172.5233  | 170.1303  | 176.1606  | 188.9984  | 205.2038  | 220.4347 (68)  |
| Pumps, fans                                                                         | 35.7973   | 35.7973   | 35.7973   | 35.7973   | 35.7973   | 35.7973   | 35.7973   | 35.7973   | 35.7973   | 35.7973   | 35.7973   | 35.7973 (69)   |
| Losses e.g. evaporation (negative values) (Table 5)                                 | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000 (70)    |
| Water heating gains (Table 5)                                                       | -102.3786 | -102.3786 | -102.3786 | -102.3786 | -102.3786 | -102.3786 | -102.3786 | -102.3786 | -102.3786 | -102.3786 | -102.3786 | -102.3786 (71) |
| Total internal gains                                                                | 155.9548  | 153.7606  | 149.2042  | 143.0097  | 136.9880  | 124.8320  | 120.0188  | 126.1858  | 128.3769  | 143.2817  | 150.5213  | 153.7698 (72)  |
| Total internal gains                                                                | 471.5156  | 469.4157  | 455.4189  | 432.7790  | 409.7133  | 379.0174  | 364.6006  | 370.6732  | 382.3047  | 413.6549  | 439.9386  | 459.7268 (73)  |

#### 6. Solar gains

|             |          |            |               |               |          |              |
|-------------|----------|------------|---------------|---------------|----------|--------------|
| [Jan]       | Area     | Solar flux | g             | FF            | Access   | Gains        |
|             | m2       | Table 5a   | Specific data | Specific data | factor   | W            |
|             |          | W/m2       | or Table 6b   | or Table 6c   | Table 6d |              |
| Northeast   | 11.1600  | 11.2829    | 0.4000        | 0.7000        | 0.7700   | 24.4331 (75) |
| Southeast   | 12.2100  | 36.7938    | 0.4000        | 0.7000        | 0.7700   | 87.1730 (77) |
| Solar gains | 111.6060 | 198.2221   | 292.7728      | 398.8919      | 479.7721 | 490.8094     |
| Total gains | 583.1216 | 667.6378   | 748.1917      | 831.6709      | 889.4854 | 869.8268     |

#### 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 5, Th1 (C) |         |         |         |         |         |         |         |         |         |         |         |              |
| Utilisation factor for gains for living area, nil/m (see Table 9a)          |         |         |         |         |         |         |         |         |         |         |         |              |
| tau                                                                         | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| alpha                                                                       | 70.1588 | 70.4595 | 70.7526 | 72.2554 | 72.5637 | 74.1453 | 74.1493 | 74.4700 | 73.5045 | 72.5637 | 71.9498 | 71.3461      |
| util living area                                                            | 5.6779  | 5.6973  | 5.7168  | 5.8170  | 5.8376  | 5.9430  | 5.9430  | 5.9647  | 5.9003  | 5.8376  | 5.7967  | 5.7564       |
| MIT                                                                         | 0.9807  | 0.9593  | 0.9067  | 0.7781  | 0.5969  | 0.4192  | 0.3022  | 0.3374  | 0.5511  | 0.8316  | 0.9578  | 0.9847 (86)  |
| Th 2                                                                        | 20.3075 | 20.4797 | 20.6980 | 20.9002 | 20.9804 | 20.9980 | 20.9998 | 20.9996 | 20.9907 | 20.8781 | 20.5732 | 20.2809 (87) |
| util rest of house                                                          | 20.3353 | 20.3379 | 20.3405 | 20.3533 | 20.3559 | 20.3688 | 20.3688 | 20.3714 | 20.3637 | 20.3559 | 20.3508 | 20.3456 (88) |
| MIT 2                                                                       | 0.9769  | 0.9518  | 0.8911  | 0.7493  | 0.5592  | 0.3784  | 0.2590  | 0.2914  | 0.5030  | 0.8011  | 0.9498  | 0.9816 (89)  |
| Living area fraction                                                        | 19.7029 | 19.8728 | 20.0826 | 20.2758 | 20.3428 | 20.3678 | 20.3688 | 20.3713 | 20.3584 | 20.2629 | 19.9766 | 19.6956 (90) |
| MIT                                                                         | 19.9941 | 20.1650 | 20.3790 | 20.5765 | 20.6498 | 20.6713 | 20.6726 | 20.6739 | 20.6629 | 20.5592 | 20.2639 | 19.9723 (92) |
| Temperature adjustment                                                      | 19.9941 | 20.1650 | 20.3790 | 20.5765 | 20.6498 | 20.6713 | 20.6726 | 20.6739 | 20.6629 | 20.5592 | 20.2639 | 19.9723 (93) |

#### 8. Space heating requirement

|                  |          |          |          |          |          |          |          |          |          |          |          |               |
|------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Utilisation      | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
| Useful gains     | 0.9746   | 0.9496   | 0.8921   | 0.7596   | 0.5766   | 0.3980   | 0.2798   | 0.3136   | 0.5258   | 0.8112   | 0.9474   | 0.9795 (94)   |
| Ext temp.        | 568.3308 | 634.0220 | 667.4682 | 631.7046 | 512.8359 | 346.1878 | 232.7327 | 243.0905 | 374.1231 | 517.9779 | 544.8653 | 542.9319 (95) |
| Heat loss rate W | 4.3000   | 4.9000   | 8.9000   | 11.7000  | 16.6000  | 16.6000  | 16.4000  | 14.1000  | 10.6000  | 10.6000  | 7.1000   | 4.2000 (96)   |
| Month fracti     | 1.0000   | 1.0000   | 1.0000   | 1.0000   | 1.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 1.0000   | 1.0000   | 1.0000 (97a)  |

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

|                      |          |          |          |         |        |        |        |        |        |         |          |                |
|----------------------|----------|----------|----------|---------|--------|--------|--------|--------|--------|---------|----------|----------------|
| Space heating kWh    | 282.4906 | 191.0354 | 122.0096 | 38.3460 | 7.4008 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 47.4392 | 166.0573 | 293.2046 (98)  |
| Space heating        |          |          |          |         |        |        |        |        |        |         |          | 1147.9835 (98) |
| Space heating per m2 |          |          |          |         |        |        |        |        |        |         |          | 13.4220 (99)   |

#### 9a. Space cooling requirement

Not applicable

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

|                                                                       |  |  |  |  |  |  |  |  |  |  |  |                 |
|-----------------------------------------------------------------------|--|--|--|--|--|--|--|--|--|--|--|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11) |  |  |  |  |  |  |  |  |  |  |  | 0.0000 (201)    |
| Fraction of space heat from main system(s)                            |  |  |  |  |  |  |  |  |  |  |  | 1.0000 (202)    |
| Efficiency of main space heating system 1 (in %)                      |  |  |  |  |  |  |  |  |  |  |  | 92.5000 (206)   |
| Efficiency of secondary/supplementary heating system, %               |  |  |  |  |  |  |  |  |  |  |  | 0.0000 (208)    |
| Space heating requirement                                             |  |  |  |  |  |  |  |  |  |  |  | 1241.0633 (211) |

|                                                  | Jan      | Feb      | Mar      | Apr     | May     | Jun    | Jul    | Aug    | Sep    | Oct     | Nov      | Dec            |
|--------------------------------------------------|----------|----------|----------|---------|---------|--------|--------|--------|--------|---------|----------|----------------|
| Space heating requirement                        | 282.4906 | 191.0354 | 122.0096 | 38.3460 | 7.4008  | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 47.4392 | 166.0573 | 293.2046 (98)  |
| Space heating efficiency (main heating system 1) | 92.5000  | 92.5000  | 92.5000  | 92.5000 | 92.5000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 92.5000 | 92.5000  | 92.5000 (210)  |
| Space heating fuel (main heating system)         | 305.3953 | 206.5248 | 131.9023 | 41.4551 | 8.0009  | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 51.2856 | 179.5214 | 316.9779 (211) |
| Water heating requirement                        | 0.0000   | 0.0000   | 0.0000   | 0.0000  | 0.0000  | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  | 0.0000   | 0.0000 (215)   |

|                                   |           |           |           |           |           |           |           |           |           |           |           |                 |
|-----------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------------|
| Water heating                     |           |           |           |           |           |           |           |           |           |           |           |                 |
| Water heating requirement         | 235.5867  | 208.3535  | 220.4815  | 199.9557  | 197.6220  | 171.3410  | 166.2824  | 180.0816  | 179.0172  | 207.2294  | 216.2213  | 230.6976 (64)   |
| Efficiency of water heater (217)m | 92.5000   | 92.5000   | 92.5000   | 92.5000   | 92.5000   | 92.5000   | 92.5000   | 92.5000   | 92.5000   | 92.5000   | 92.5000   | 92.5000 (216)   |
| Fuel for water heating, kWh/month | 254.6884  | 225.2470  | 238.3584  | 216.1683  | 213.6454  | 185.2335  | 179.7648  | 194.6828  | 193.5321  | 224.0318  | 233.7528  | 249.4028 (219)  |
| Annual totals kWh/year            | 2608.5080 | 2608.5080 | 2608.5080 | 2608.5080 | 2608.5080 | 2608.5080 | 2608.5080 | 2608.5080 | 2608.5080 | 2608.5080 | 2608.5080 | 2608.5080 (219) |
| Space heating fuel - main system  | 1241.0633 | 1241.0633 | 1241.0633 | 1241.0633 | 1241.0633 | 1241.0633 | 1241.0633 | 1241.0633 | 1241.0633 | 1241.0633 | 1241.0633 | 1241.0633 (211) |
| 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)    |

|                                                                            |  |  |  |  |  |  |  |  |  |  |  |                 |
|----------------------------------------------------------------------------|--|--|--|--|--|--|--|--|--|--|--|-----------------|
| Electricity for pumps and fans:                                            |  |  |  |  |  |  |  |  |  |  |  |                 |
| (BalancedWithHeatRecovery, Database: In-use factor = 1.2500, SFP = 0.6875) |  |  |  |  |  |  |  |  |  |  |  |                 |
| mechanical ventilation fans (SFP = 0.6875)                                 |  |  |  |  |  |  |  |  |  |  |  | 198.7151 (230a) |
| central heating pump                                                       |  |  |  |  |  |  |  |  |  |  |  | 30.0000 (230c)  |
| main heating flue fan                                                      |  |  |  |  |  |  |  |  |  |  |  | 45.0000 (230e)  |
| Total electricity for the above, kWh/year                                  |  |  |  |  |  |  |  |  |  |  |  | 273.7151 (231)  |
| Electricity for lighting (calculated in Appendix I)                        |  |  |  |  |  |  |  |  |  |  |  | 363.0789 (232)  |
| Total delivered energy for all uses                                        |  |  |  |  |  |  |  |  |  |  |  | 4486.3652 (238) |

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

| Energy                                      | Emission factor | Emissions       |
|---------------------------------------------|-----------------|-----------------|
| kWh/year                                    | kg CO2/kWh      | kg CO2/year     |
| Space heating - main system 1               | 0.2160          | 268.0697 (261)  |
| Space heating - secondary                   | 0.0000          | 0.0000 (263)    |
| Water heating (other fuel)                  | 0.2160          | 563.4377 (264)  |
| Space and water heating                     |                 | 831.5074 (265)  |
| Pumps and fans                              | 0.5190          | 142.0581 (267)  |
| Energy for lighting                         | 0.5190          | 188.4379 (268)  |
| Total CO2, kg/year                          |                 | 1162.0034 (272) |
| Dwelling Carbon Dioxide Emission Rate (DER) |                 | 13.5900 (273)   |

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)  
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

#### 1. Overall dwelling dimensions

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)            | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Ground floor                                           | 85.5300 (1b)              | 2.7700 (2b)                     | 236.9181 (1b) - (3b)        |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 85.5300                   |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | 236.9181 (5)                |

#### 2. Ventilation rate

|                                                                           | main<br>heating | secondary<br>heating | other | total | m <sup>3</sup> per hour                 |
|---------------------------------------------------------------------------|-----------------|----------------------|-------|-------|-----------------------------------------|
| Number of chimneys                                                        | 0               | +                    | 0     | =     | 0 * 40 = 0.0000 (6a)                    |
| Number of open flues                                                      | 0               | +                    | 0     | =     | 0 * 20 = 0.0000 (6b)                    |
| Number of intermittent fans                                               |                 |                      |       |       | 3 * 10 = 30.0000 (7a)                   |
| Number of passive vents                                                   |                 |                      |       |       | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                              |                 |                      |       |       | 0 * 40 = 0.0000 (7c)                    |
| Air changes per hour                                                      |                 |                      |       |       |                                         |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = |                 |                      |       |       | 30.0000 / (5) = 0.1266 (8)              |
| Pressure test                                                             |                 |                      |       |       | Yes                                     |
| Measured/design AP50                                                      |                 |                      |       |       | 5.0000                                  |
| Infiltration rate                                                         |                 |                      |       |       | 0.3766 (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) = 0.3201 (21)        |

|                 | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed      | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor     | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate |        |        |        |        |        |        |        |        |        |        |        |              |
| Effective ac    | 0.4082 | 0.4002 | 0.3922 | 0.3521 | 0.3441 | 0.3041 | 0.3041 | 0.2961 | 0.3201 | 0.3441 | 0.3601 | 0.3762 (22b) |
|                 | 0.5833 | 0.5801 | 0.5769 | 0.5620 | 0.5592 | 0.5462 | 0.5462 | 0.5438 | 0.5512 | 0.5592 | 0.5649 | 0.5707 (25)  |

#### 3. Heat losses and heat loss parameter

| Element                                                     | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K         | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K |
|-------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|----------------------|--------------------------------|---------------|
| TER Opaque door                                             |                         |                            | 2.1200                    | 1.0000                        | 2.1200               |                                | (26)          |
| TER Opening Type Curtain (Uw = 1.50)                        |                         |                            | 19.2600                   | 1.4151                        | 27.2547              |                                | (27)          |
| Unipanel column                                             | 10.9900                 |                            | 10.9900                   | 0.1800                        | 1.9782               |                                | (29a)         |
| Unipanel wall                                               | 17.1200                 | 2.1200                     | 15.0000                   | 0.1800                        | 2.7000               |                                | (29a)         |
| Curtain wall                                                | 23.7400                 | 19.2600                    | 4.4800                    | 0.1800                        | 0.8084               |                                | (29a)         |
| Total net area of external elements Aum(A, m <sup>2</sup> ) |                         |                            | 51.8500                   |                               |                      |                                | (31)          |
| Fabric heat loss, W/K = Sum (A x U)                         |                         |                            |                           |                               | (26)...(30) + (32) = |                                | 34.8593 (33)  |

Thermal mass parameter (TMP = Cm / TFA) in kJ/m<sup>2</sup>K 250.0000 (35)  
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.8103 (36)  
Total fabric heat loss (33) + (36) = 38.6696 (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                                                 | 45.6042 | 45.3513 | 45.1034 | 43.9391 | 43.7212 | 42.7071 | 42.7071 | 42.5194 | 43.0978 | 43.7212 | 44.1619 | 44.6226 (38) |
| Average = Sum(39)m / 12 =                                           | 84.2738 | 84.0209 | 83.7730 | 82.8087 | 82.3909 | 81.3768 | 81.3768 | 81.1890 | 81.7674 | 82.3909 | 82.8315 | 83.2923 (39) |
|                                                                     |         |         |         |         |         |         |         |         |         |         |         | 82.6077 (39) |

|               | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec         |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------------|
| HLP           | 0.9853 | 0.9824 | 0.9795 | 0.9658 | 0.9633 | 0.9514 | 0.9514 | 0.9492 | 0.9560 | 0.9633 | 0.9685 | 0.9738 (40) |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 0.9658 (40) |
| Days in month | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31 (41)     |

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

|                                          |  |  |  |  |  |  |  |  |  |  |  |              |
|------------------------------------------|--|--|--|--|--|--|--|--|--|--|--|--------------|
| Assumed occupancy                        |  |  |  |  |  |  |  |  |  |  |  | 2.5595 (42)  |
| Average daily hot water use (litres/day) |  |  |  |  |  |  |  |  |  |  |  | 94.9873 (43) |

|                                        | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul     | Aug      | Sep      | Oct      | Nov      | Dec                               |
|----------------------------------------|----------|----------|----------|----------|----------|----------|---------|----------|----------|----------|----------|-----------------------------------|
| Daily hot water use                    | 104.4860 | 100.6865 | 96.8871  | 93.0876  | 89.2881  | 85.4886  | 85.4886 | 89.2881  | 93.0876  | 96.8871  | 100.6865 | 104.4860 (44)                     |
| Energy cont                            | 154.9498 | 135.5201 | 139.8446 | 121.9199 | 116.9850 | 100.9492 | 93.5443 | 107.3434 | 108.6254 | 126.5925 | 138.1856 | 150.0606 (45)                     |
| Energy content (annual)                |          |          |          |          |          |          |         |          |          |          |          | Total = Sum(45)m = 1494.5202 (45) |
| Distribution loss (46)m = 0.15 x (45)m |          |          |          |          |          |          |         |          |          |          |          |                                   |
|                                        | 23.2425  | 20.3280  | 20.9787  | 18.2880  | 17.5478  | 15.1424  | 14.0316 | 16.1015  | 16.2938  | 18.9889  | 20.7278  | 22.5091 (46)                      |

|                                                             |  |  |  |  |  |  |  |  |  |  |  |               |
|-------------------------------------------------------------|--|--|--|--|--|--|--|--|--|--|--|---------------|
| Water storage loss:                                         |  |  |  |  |  |  |  |  |  |  |  |               |
| Store volume                                                |  |  |  |  |  |  |  |  |  |  |  | 150.0000 (47) |
| a) If manufacturer declared loss factor is known (kWh/day): |  |  |  |  |  |  |  |  |  |  |  | 1.3938 (48)   |
| Temperature factor from Table 20                            |  |  |  |  |  |  |  |  |  |  |  | 0.9400 (49)   |
| Enter (48) or (54) in (55)                                  |  |  |  |  |  |  |  |  |  |  |  | 0.7527 (55)   |

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

|                                                                 |          |          |          |          |          |          |          |          |          |          |          |                |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| Total storage loss                                              | 23.3325  | 21.0745  | 23.3325  | 22.5798  | 23.3325  | 22.5798  | 23.3325  | 23.3325  | 22.5798  | 23.3325  | 22.5798  | 23.3325 (56)   |
| If cylinder contains dedicated solar storage                    |          |          |          |          |          |          |          |          |          |          |          |                |
| Primary loss                                                    | 23.3325  | 21.0745  | 23.3325  | 22.5798  | 23.3325  | 22.5798  | 23.3325  | 23.3325  | 22.5798  | 23.3325  | 22.5798  | 23.3325 (57)   |
| Total heat required for water heating calculated for each month | 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)   |
| Solar input                                                     | 201.5447 | 177.6058 | 186.4395 | 167.0117 | 163.5799 | 146.0410 | 140.1392 | 153.9383 | 153.7173 | 173.1874 | 183.2774 | 196.6555 (62)  |
|                                                                 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63)    |
| Solar input (sum of months) = Sum(63)m =                        |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (63)    |
| Output from w/h                                                 | 201.5447 | 177.6058 | 186.4395 | 167.0117 | 163.5799 | 146.0410 | 140.1392 | 153.9383 | 153.7173 | 173.1874 | 183.2774 | 196.6555 (64)  |
| Heat gains from water heating, kWh/month                        | 88.7967  | 78.7290  | 83.7742  | 76.6118  | 76.1734  | 69.6391  | 68.3794  | 72.9676  | 72.1914  | 79.3679  | 82.0202  | 87.1711 (65)   |
| Total per year (kWh/year) = Sum(64)m =                          |          |          |          |          |          |          |          |          |          |          |          | 2043.1376 (64) |

#### 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                                                                               | 127.9733  | 127.9733  | 127.9733  | 127.9733  | 127.9733  | 127.9733  | 127.9733  | 127.9733  | 127.9733  | 127.9733  | 127.9733  | 127.9733 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 20.5559   | 18.2576   | 14.8481   | 11.2410   | 8.4027    | 7.0940    | 7.6653    | 9.9636    | 13.3731   | 16.9803   | 19.8185   | 21.1273 (67)   |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 230.6098  | 233.0028  | 226.9725  | 214.1347  | 197.9293  | 182.8985  | 172.5233  | 170.1303  | 176.1606  | 188.9984  | 205.2038  | 220.4347 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 35.7973   | 35.7973   | 35.7973   | 35.7973   | 35.7973   | 35.7973   | 35.7973   | 35.7973   | 35.7973   | 35.7973   | 35.7973   | 35.7973 (69)   |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000 (70)    |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -102.3786 | -102.3786 | -102.3786 | -102.3786 | -102.3786 | -102.3786 | -102.3786 | -102.3786 | -102.3786 | -102.3786 | -102.3786 | -102.3786 (71) |
| Water heating gains (Table 5)                                                       | 119.3504  | 117.1562  | 112.5998  | 106.4053  | 102.3837  | 96.7209   | 91.9078   | 98.0747   | 100.2659  | 106.6773  | 113.9169  | 117.1654 (72)  |
| Total internal gains                                                                | 434.9081  | 432.8066  | 418.8123  | 396.1729  | 373.1077  | 350.9053  | 336.4884  | 342.5607  | 354.1916  | 377.0480  | 403.3312  | 423.1193 (73)  |

#### 6. Solar gains

| [Jan]       |          |          | Area<br>m <sup>2</sup> | Solar flux<br>Table 6a<br>W/m <sup>2</sup> | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W    |          |          |          |               |
|-------------|----------|----------|------------------------|--------------------------------------------|-----------------------------------|------------------------------------|------------------------------|---------------|----------|----------|----------|---------------|
| Northeast   |          |          | 9.2000                 | 11.2829                                    | 0.6300                            | 0.7000                             | 0.7700                       | 31.7236 (75)  |          |          |          |               |
| Southeast   |          |          | 10.0600                | 36.7938                                    | 0.6300                            | 0.7000                             | 0.7700                       | 113.1214 (77) |          |          |          |               |
| Solar gains | 144.8450 | 257.2619 | 379.9858               | 517.7346                                   | 622.7265                          | 637.0587                           | 606.3541                     | 525.1458      | 427.2351 | 291.8757 | 175.4098 | 122.7154 (83) |
| Total gains | 579.7531 | 690.0705 | 798.7982               | 913.9075                                   | 995.8342                          | 987.9640                           | 942.8425                     | 867.7065      | 781.4267 | 668.9237 | 578.7411 | 545.8347 (84) |

#### 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Thl (C) |         |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |         |         |         |              |
| tau                                                                         | 70.4796 | 70.6917 | 70.9009 | 71.9002 | 72.0903 | 72.9887 | 72.9887 | 73.1575 | 72.6400 | 72.0903 | 71.7068 | 71.3101      |
| alpha                                                                       | 5.6986  | 5.7128  | 5.7267  | 5.7933  | 5.8060  | 5.8659  | 5.8659  | 5.8772  | 5.8427  | 5.8060  | 5.7805  | 5.7540       |
| util living area                                                            | 0.9962  | 0.9894  | 0.9670  | 0.8881  | 0.7229  | 0.5213  | 0.3790  | 0.4287  | 0.6885  | 0.9361  | 0.9906  | 0.9973 (86)  |
| MIT                                                                         | 20.0607 | 20.2412 | 20.4988 | 20.7865 | 20.9473 | 20.9934 | 20.9991 | 20.9983 | 20.9702 | 20.7377 | 20.3435 | 20.0301 (87) |
| Th 2                                                                        | 20.0956 | 20.0981 | 20.1005 | 20.1119 | 20.1140 | 20.1240 | 20.1240 | 20.1258 | 20.1202 | 20.1140 | 20.1097 | 20.1052 (88) |
| util rest of house                                                          | 0.9950  | 0.9861  | 0.9569  | 0.8584  | 0.6679  | 0.4525  | 0.3040  | 0.3482  | 0.6136  | 0.9115  | 0.9871  | 0.9964 (89)  |
| MIT 2                                                                       | 18.8450 | 19.1086 | 19.4781 | 19.8761 | 20.0672 | 20.1199 | 20.1237 | 20.1252 | 20.0988 | 19.8241 | 19.2675 | 18.8077 (90) |
| Living area fraction                                                        |         |         |         |         |         |         |         |         |         |         |         | 0.4816 (91)  |
| MIT                                                                         | 19.4304 | 19.6540 | 19.9697 | 20.3146 | 20.4911 | 20.5406 | 20.5453 | 20.5457 | 20.5185 | 20.2641 | 19.7857 | 19.3964 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT                                                                | 19.4304 | 19.6540 | 19.9697 | 20.3146 | 20.4911 | 20.5406 | 20.5453 | 20.5457 | 20.5185 | 20.2641 | 19.7857 | 19.3964 (93) |

#### 8. Space heating requirement

|                                  | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov       | Dec            |
|----------------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|-----------|----------------|
| Utilisation                      | 0.9939    | 0.9841    | 0.9552    | 0.8658   | 0.6921   | 0.4855   | 0.3401   | 0.3870   | 0.6486   | 0.9163   | 0.9855    | 0.9955 (94)    |
| Useful gains                     | 576.1930  | 679.0839  | 763.0245  | 791.2558 | 689.1791 | 479.6672 | 320.6733 | 335.7815 | 506.7987 | 612.9189 | 570.3205  | 543.3708 (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                 | 1275.1003 | 1239.6461 | 1128.3941 | 942.9429 | 724.3032 | 483.4242 | 321.0549 | 336.5811 | 524.8207 | 796.2331 | 1050.7775 | 1265.7404 (97) |
| Month fracti                     | 1.0000    | 1.0000    | 1.0000    | 1.0000   | 1.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 1.0000   | 1.0000    | 1.0000 (97a)   |
| Space heating kWh                | 519.9870  | 376.6978  | 271.8350  | 109.2147 | 26.1323  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 136.3872 | 345.9290  | 537.4430 (98)  |
| Space heating                    |           |           |           |          |          |          |          |          |          |          |           | 2323.6260 (98) |
| Space heating per m <sup>2</sup> |           |           |           |          |          |          |          |          |          |          |           | 27.1674 (99)   |

#### 9c. Space cooling requirement

Not applicable

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

#### 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 %)                      |          |          |          |          |          |          |          |          |          |          |          | 93.5000 (206)   |
| Efficiency of secondary/supplementary heating system, %               |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)    |
| Space heating requirement                                             |          |          |          |          |          |          |          |          |          |          |          | 2485.1615 (211) |
|                                                                       | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec             |
| Space heating requirement                                             | 519.9870 | 376.6978 | 271.8350 | 109.2147 | 26.1323  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 136.3872 | 345.9290 | 537.4430 (98)   |
| Space heating efficiency (main heating system 1)                      | 93.5000  | 93.5000  | 93.5000  | 93.5000  | 93.5000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 93.5000  | 93.5000  | 93.5000 (210)   |
| Space heating fuel (main heating system)                              | 556.1359 | 402.8853 | 290.7326 | 116.8072 | 27.9490  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 145.8687 | 369.9775 | 574.8054 (211)  |
| Water heating requirement                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)    |
| Water heating                                                         |          |          |          |          |          |          |          |          |          |          |          |                 |
| Water heating requirement                                             | 201.5447 | 177.6058 | 186.4395 | 167.0117 | 163.5799 | 146.0410 | 140.1392 | 153.9383 | 153.7173 | 173.1874 | 183.2774 | 196.5555 (64)   |
| Efficiency of water heater                                            |          |          |          |          |          |          |          |          |          |          |          | 79.8000 (216)   |
| (217)m                                                                | 87.2328  | 86.7720  | 85.8186  | 83.7133  | 81.1211  | 79.8000  | 79.8000  | 79.8000  | 79.8000  | 84.1851  | 86.4839  | 87.3620 (217)   |
| Fuel for water heating, kWh/month                                     | 231.0423 | 204.6809 | 217.2483 | 199.5044 | 201.6489 | 181.0088 | 175.6130 | 192.9052 | 192.6282 | 205.7221 | 211.9208 | 225.1042 (218)  |
| Water heating fuel used                                               |          |          |          |          |          |          |          |          |          |          |          | 2441.0270 (219) |
| Annual totals kWh/year                                                |          |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating fuel - main system                                      |          |          |          |          |          |          |          |          |          |          |          | 2485.1615 (211) |
| Space heating fuel - secondary                                        |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)    |
| Electricity for pumps and fans:                                       |          |          |          |          |          |          |          |          |          |          |          |                 |
| central heating pump                                                  |          |          |          |          |          |          |          |          |          |          |          | 50.0000 (230c)  |
| main heating flue fan                                                 |          |          |          |          |          |          |          |          |          |          |          | 45.0000 (230e)  |
| Total electricity for the above, kWh/year                             |          |          |          |          |          |          |          |          |          |          |          | 75.0000 (231)   |
| Electricity for lighting (calculated in Appendix L)                   |          |          |          |          |          |          |          |          |          |          |          | 363.0245 (232)  |
| Total delivered energy for all uses                                   |          |          |          |          |          |          |          |          |          |          |          | 5364.2130 (233) |

#### 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                                                                     | 2485.1615          | 0.2160                        | 536.7949                 | (261)  |
| Space heating - secondary                                                                         | 0.0000             | 0.0000                        | 0.0000                   | (263)  |
| Water heating (other fuel)                                                                        | 2441.0270          | 0.2160                        | 527.2618                 | (264)  |
| Space and water heating                                                                           |                    |                               | 1064.0567                | (265)  |
| Pumps and fans                                                                                    | 75.0000            | 0.5130                        | 38.9250                  | (267)  |
| Energy for lighting                                                                               | 363.0245           | 0.5130                        | 188.4097                 | (268)  |
| Total CO2, kg/m2/year                                                                             |                    |                               | 1291.3914                | (272)  |
| Emissions per m2 for space and water heating                                                      |                    |                               | 12.4407                  | (272a) |
| Fuel factor (mains gas)                                                                           |                    |                               | 1.0000                   | (272b) |
| Emissions per m2 for lighting                                                                     |                    |                               | 2.2028                   | (272c) |
| Emissions per m2 for pumps and fans                                                               |                    |                               | 0.4551                   | (272d) |
| Target Carbon Dioxide Emission Rate (TER) = (12.4407 * 1.00) + 2.2028 = 0.4551, rounded to 2 d.p. |                    |                               | 15.1000                  | (273)  |

# BASIC COMPLIANCE REPORT

## Calculation Type: New Build (As Designed)

|                      |              |                |            |
|----------------------|--------------|----------------|------------|
| Property Reference   | 116842       | Issued on Date | 17/12/2021 |
| Assessment Reference | Plot 54 / 58 | Prop Type Ref  | Mid Floor  |
| Property             |              |                |            |

|                                 |      |             |       |      |       |
|---------------------------------|------|-------------|-------|------|-------|
| SAP Rating                      | 86 B | DER         | 13.59 | TER  | 15.10 |
| Environmental                   | 89 B | % DER<TER   | 9.99  |      |       |
| CO2 Emissions (t/year)          | 1.01 | DFEE        | 34.88 | TFEE | 39.41 |
| General Requirements Compliance | Fail | % DFEE<TFEE | 11.50 |      |       |

|                  |                                                                                    |             |           |
|------------------|------------------------------------------------------------------------------------|-------------|-----------|
| Assessor Details | Mr. Richard Denteh, Meinhardt UK, Tel: 02078317969, richard.denteh@meinhardt.co.uk | Assessor ID | T596-0001 |
|------------------|------------------------------------------------------------------------------------|-------------|-----------|

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| Client |  |
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### SUMARY FOR INPUT DATA FOR New Build (As Designed)

#### Criterion 1 - Achieving the TER and TFEE rate

##### 1a TER and DER

|                                             |                  |                                   |      |
|---------------------------------------------|------------------|-----------------------------------|------|
| Fuel for main heating                       | Mains gas        |                                   |      |
| Fuel factor                                 | 1.00 (mains gas) |                                   |      |
| Target Carbon Dioxide Emission Rate (TER)   | 15.10            | kgCO <sub>2</sub> /m <sup>2</sup> |      |
| Dwelling Carbon Dioxide Emission Rate (DER) | 13.59            | kgCO <sub>2</sub> /m <sup>2</sup> | Pass |
|                                             | -1.51 (-10.0%)   | kgCO <sub>2</sub> /m <sup>2</sup> |      |

##### 1b TFEE and DFEE

|                                          |               |           |      |
|------------------------------------------|---------------|-----------|------|
| Target Fabric Energy Efficiency (TFEE)   | 39.41         | kWh/m²/yr |      |
| Dwelling Fabric Energy Efficiency (DFEE) | 34.88         | kWh/m²/yr |      |
|                                          | -4.5 (-11.4%) | kWh/m²/yr | Pass |

#### Criterion 2 - Limits on design flexibility

##### Limiting Fabric Standards

##### 2 Fabric U-values

| Element                   | Average          | Highest          |      |
|---------------------------|------------------|------------------|------|
| External wall             | 0.19 (max. 0.30) | 0.26 (max. 0.70) | Pass |
| Party wall                | 0.00 (max. 0.20) | -                | Pass |
| Openings and curtain wall | 1.22 (max. 2.00) | 1.40 (max. 3.30) | Pass |

##### 2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

##### 3 Air permeability

|                                |                     |      |
|--------------------------------|---------------------|------|
| Air permeability at 50 pascals | 3.00 (design value) |      |
| Maximum                        | 10.0                | Pass |

##### Limiting System Efficiencies

##### 4 Heating efficiency

|                     |                                                                                                                     |      |
|---------------------|---------------------------------------------------------------------------------------------------------------------|------|
| Main heating system | Boiler system with radiators or underfloor - Mains gas<br>Data from manufacturer<br>Efficiency: 93%<br>Minimum: 88% | Pass |
|---------------------|---------------------------------------------------------------------------------------------------------------------|------|

## BASIC COMPLIANCE REPORT

### Calculation Type: New Build (As Designed)

|                                                                             |                                                                |      |
|-----------------------------------------------------------------------------|----------------------------------------------------------------|------|
| Secondary heating system                                                    | None                                                           |      |
| <b>5 Cylinder insulation</b>                                                |                                                                |      |
| Hot water storage                                                           | Nominal cylinder loss: 2.66 kWh/day<br>Permitted by DBSCG 1.89 | Fail |
| Primary pipework insulated                                                  | Yes                                                            | Pass |
| <b>6 Controls</b>                                                           |                                                                |      |
| Space heating controls                                                      | Programmer, room thermostat and TRVs                           | Pass |
| Hot water controls                                                          | Cylinderstat                                                   | Pass |
|                                                                             | Not independent timer for DHW                                  | Fail |
| Boiler interlock                                                            | Yes                                                            | Pass |
| <b>7 Low energy lights</b>                                                  |                                                                |      |
| Percentage of fixed lights with low-energy fittings                         | 100 %                                                          |      |
| Minimum                                                                     | 75 %                                                           | Pass |
| <b>8 Mechanical ventilation</b>                                             |                                                                |      |
| Continuous supply and extract system                                        |                                                                |      |
| Specific fan power                                                          | 0.55                                                           |      |
| Maximum                                                                     | 1.5                                                            | Pass |
| MVHR efficiency                                                             | 92 %                                                           |      |
| Minimum                                                                     | 70 %                                                           | Pass |
| <b>Criterion 3 – Limiting the effects of heat gains in summer</b>           |                                                                |      |
| <b>9 Summertime temperature</b>                                             |                                                                |      |
| Overheating risk (Thames Valley)                                            | Slight                                                         | Pass |
| Based on:                                                                   |                                                                |      |
| Overshading                                                                 | Average                                                        |      |
| Windows facing North East                                                   | 11.16 m <sup>2</sup> , No overhang                             |      |
| Windows facing South East                                                   | 12.21 m <sup>2</sup> , No overhang                             |      |
| Air change rate                                                             | 6.00 ach                                                       |      |
| Blinds/curtains                                                             | None                                                           |      |
| <b>Criterion 4 – Building performance consistent with DER and DFEE rate</b> |                                                                |      |
| <b>Party Walls</b>                                                          |                                                                |      |
| Type                                                                        | U-value                                                        |      |
| Filled Cavity with Edge Sealing                                             | 0.00 W/m <sup>2</sup> K                                        | Pass |
| Solid Wall                                                                  | 0.00 W/m <sup>2</sup> K                                        | Pass |
| <b>Air permeability and pressure testing</b>                                |                                                                |      |
| <b>3 Air permeability</b>                                                   |                                                                |      |
| Air permeability at 50 pascals                                              | 3.00 (design value)                                            |      |
| Maximum                                                                     | 10.0                                                           | Pass |
| <b>10 Key features</b>                                                      |                                                                |      |
| External wall U-value                                                       | 0.14 W/m <sup>2</sup> K                                        |      |
| Party wall U-value                                                          | 0.00 W/m <sup>2</sup> K                                        |      |
| Party wall U-value                                                          | 0.00 W/m <sup>2</sup> K                                        |      |
| Air permeability                                                            | 3.0 m <sup>3</sup> /m <sup>2</sup> h                           |      |

## BASIC COMPLIANCE REPORT

### Calculation Type: New Build (As Designed)

*This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.*

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



|                      |            |                |            |
|----------------------|------------|----------------|------------|
| Property Reference   | 116845     | Issued on Date | 17/12/2021 |
| Assessment Reference | Plot 68/69 | Prop Type Ref  | Mid Floor  |
| Property             |            |                |            |

|                                    |      |             |       |      |       |
|------------------------------------|------|-------------|-------|------|-------|
| SAP Rating                         | 84 B | DER         | 15.77 | TER  | 17.49 |
| Environmental                      | 89 B | % DER<TER   | 9.83  |      |       |
| CO <sub>2</sub> Emissions (t/year) | 0.76 | DFEE        | 32.27 | TFEE | 38.71 |
| General Requirements Compliance    | Fail | % DFEE<TFEE | 16.63 |      |       |

|                  |                                                                                    |             |           |
|------------------|------------------------------------------------------------------------------------|-------------|-----------|
| Assessor Details | Mr. Richard Denteh, Meinhardt UK, Tel: 02078317969, richard.denteh@meinhardt.co.uk | Assessor ID | T596-0001 |
|------------------|------------------------------------------------------------------------------------|-------------|-----------|

|        |  |
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| Client |  |
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# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

#### DWELLING AS DESIGNED

Mid-floor flat, total floor area 53 m<sup>2</sup>

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

#### 1a TER and DER

Fuel for main heating: Mains gas  
Fuel factor: 1.00 (mains gas)  
Target Carbon Dioxide Emission Rate (TER) 17.49 kgCO<sub>2</sub>/m<sup>2</sup>yr  
Dwelling Carbon Dioxide Emission Rate (DER) 15.77 kgCO<sub>2</sub>/m<sup>2</sup>yr OK

#### 1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 38.7 kWh/m<sup>2</sup>/yr  
Dwelling Fabric Energy Efficiency (DFEE) 32.3 kWh/m<sup>2</sup>/yr OK

#### 2 Fabric U-values

| Element                   | Average          | Highest          |    |
|---------------------------|------------------|------------------|----|
| External wall             | 0.14 (max. 0.30) | 0.14 (max. 0.70) | OK |
| Party wall                | 0.00 (max. 0.20) | -                | OK |
| Floor (no floor)          |                  |                  |    |
| Roof (no roof)            |                  |                  |    |
| Openings and curtain wall | 1.23 (max. 2.00) | 1.40 (max. 3.30) | OK |

#### 2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

#### 3 Air permeability

|                                 |                     |    |
|---------------------------------|---------------------|----|
| Air permeability at 50 pascals: | 3.00 (design value) |    |
| Maximum                         | 10.0                | OK |

#### 4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas  
Data from manufacturer: . .

Efficiency: 93%

Minimum: 88% OK

Secondary heating system:

None

#### 5 Cylinder insulation

Hot water storage: Nominal cylinder loss: 2.66 kWh/day  
Permitted by DBSCG 1.89 Fail

Primary pipework insulated:

Yes

OK

#### 6 Controls

Space heating controls: Programmer, room thermostat and TRVs

OK

Hot water controls:

Cylinderstat

OK

Not independent timer for DHW

Fail

Boiler interlock

Yes

OK

#### 7 Low energy lights

Percentage of fixed lights with low-energy fittings: 100%

Minimum

75%

OK

#### 8 Mechanical ventilation

Continuous supply and extract system

Specific fan power:

0.52

Maximum

1.5

OK

MVHR efficiency:

92%

Minimum:

70%

OK

#### 9 Summertime temperature

Overheating risk (Thames Valley):

Slight

OK

Based on:

Overshading:

Average

Windows facing South West:

3.94 m<sup>2</sup>, No overhang

Windows facing North West:

7.30 m<sup>2</sup>, No overhang

Air change rate:

6.00 ach

Blinds/curtains:

None

#### 10 Key features

External wall U-value

0.14 W/m<sup>2</sup>K

Party wall U-value

0.00 W/m<sup>2</sup>K

Party wall U-value

0.00 W/m<sup>2</sup>K

Air permeability

3.0 m<sup>3</sup>/m<sup>2</sup>h

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)  
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

#### 1. Overall dwelling dimensions

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m) | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|----------------------|-----------------------------|
| Ground floor                                           | 53.2100                   | 2.7700               | 147.3917                    |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 53.2100                   |                      |                             |
| Dwelling volume                                        |                           |                      | 147.3917                    |

#### 2. Ventilation rate

|                              | main<br>heating | secondary<br>heating | other | total | m <sup>3</sup> per hour |
|------------------------------|-----------------|----------------------|-------|-------|-------------------------|
| Number of chimneys           | 0               | 0                    | 0     | 0     | 0.0000 (6a)             |
| Number of open flues         | 0               | 0                    | 0     | 0     | 0.0000 (6b)             |
| Number of intermittent fans  | 0               | 0                    | 0     | 0     | 0.0000 (7a)             |
| Number of passive vents      | 0               | 0                    | 0     | 0     | 0.0000 (7b)             |
| Number of flueless gas fires | 0               | 0                    | 0     | 0     | 0.0000 (7c)             |

|                                                      |                              |                |             |
|------------------------------------------------------|------------------------------|----------------|-------------|
| Infiltration due to chimneys, flues and fans         | = (6a)+(6b)+(7a)+(7b)+(7c) = | 0.0000 / (5) = | 0.0000 (8)  |
| Pressure test                                        |                              |                | Yes         |
| Measured/design AP50                                 |                              |                | 3.0000      |
| Infiltration rate                                    |                              |                | 0.1500 (18) |
| Number of sides sheltered                            |                              |                | 2 (19)      |
| Shelter factor                                       |                              |                | 0.8500 (20) |
| Infiltration rate adjusted to include shelter factor |                              |                | 0.1275 (21) |

|                                                                                              | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec           |
|----------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------------|
| Wind speed                                                                                   | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)   |
| Wind factor                                                                                  | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a)  |
| Adj infilt rate                                                                              | 0.1626 | 0.1594 | 0.1562 | 0.1403 | 0.1371 | 0.1211 | 0.1211 | 0.1179 | 0.1275 | 0.1371 | 0.1434 | 0.1498 (22b)  |
| Balanced mechanical ventilation with heat recovery                                           |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a)  |
| If mechanical ventilation:                                                                   |        |        |        |        |        |        |        |        |        |        |        | 78.2000 (23c) |
| If balanced with heat recovery; efficiency in % allowing for in-use factor (from Table 4h) = |        |        |        |        |        |        |        |        |        |        |        |               |
| Effective ac                                                                                 | 0.2716 | 0.2684 | 0.2652 | 0.2493 | 0.2461 | 0.2301 | 0.2301 | 0.2269 | 0.2365 | 0.2461 | 0.2524 | 0.2588 (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 | R-value<br>KJ/m <sup>2</sup> K | A x R<br>KJ/K   |
|-------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|-----------------|
| Windows (UW = 1.20)                                         |                         |                            | 11.2400                   | 1.1450                        | 12.8702      |                                | (27)            |
| Front Door                                                  |                         |                            | 2.2400                    | 1.4000                        | 3.1360       |                                | (26)            |
| Unipanel wall                                               | 15.4300                 | 2.2400                     | 13.1900                   | 0.1400                        | 1.8466       | 30.9500                        | 408.2305 (29a)  |
| Curtain wall                                                | 11.5200                 | 11.2400                    | 0.2800                    | 1.2000                        | 0.3360       | 14.0000                        | 3.9200 (29a)    |
| Total net area of external elements Sum(A, m <sup>2</sup> ) |                         |                            | 26.9500                   |                               |              |                                | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                         |                         |                            |                           |                               | 18.1888      |                                | (33)            |
| Party Wall 2                                                |                         |                            | 56.6900                   | 0.0000                        | 0.0000       | 20.0000                        | 1133.8000 (32)  |
| Party Wall column                                           |                         |                            | 4.8700                    | 0.0000                        | 0.0000       | 180.0000                       | 876.6000 (32)   |
| Party Floor 1                                               |                         |                            | 53.2100                   |                               |              | 40.0000                        | 2128.4000 (32d) |
| Party Ceilings 1                                            |                         |                            | 53.2100                   |                               |              | 40.0000                        | 2128.4000 (32b) |
| Internal Wall 1                                             |                         |                            | 85.5100                   |                               |              | 9.0000                         | 769.5900 (32c)  |

|                                                                |                                      |                |
|----------------------------------------------------------------|--------------------------------------|----------------|
| Heat capacity Cm = Sum(A x k)                                  | (28)...(30) + (32) + (32a)...(32e) = | 7448.9405 (34) |
| Thermal mass parameter (TMP = Cm / TFA) in KJ/m <sup>2</sup> K |                                      | 139.9914 (35)  |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)     |                                      | 2.6124 (36)    |
| Total fabric heat loss                                         | (33) + (36) =                        | 20.8012 (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                                                 | 13.2086 | 13.0536 | 12.8985 | 12.1233 | 11.9683 | 11.1931 | 11.1931 | 11.0381 | 11.5032 | 11.9683 | 12.2784 | 12.5884 (38) |
| Average = Sum(39)m / 12 =                                           | 34.0098 | 33.8548 | 33.6998 | 32.9246 | 32.7695 | 31.9943 | 31.9943 | 31.8393 | 32.3044 | 32.7695 | 33.0796 | 33.3897 (39) |
| HLP (average)                                                       | 0.6392  | 0.6362  | 0.6333  | 0.6188  | 0.6159  | 0.6013  | 0.6013  | 0.5984  | 0.6071  | 0.6159  | 0.6217  | 0.6275 (40)  |
| Days in month                                                       | 31      | 28      | 31      | 30      | 31      | 30      | 31      | 31      | 30      | 31      | 30      | 31 (41)      |

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

|                                          |         |         |         |         |         |         |         |         |         |         |         |              |
|------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Assumed occupancy                        |         |         |         |         |         |         |         |         |         |         |         |              |
| Average daily hot water use (litres/day) |         |         |         |         |         |         |         |         |         |         |         | 1.7847 (42)  |
| usually hot water use                    | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
|                                          | 84.2466 | 81.1831 | 78.1196 | 75.0560 | 71.9925 | 68.9290 | 68.9290 | 71.9925 | 75.0560 | 78.1196 | 81.1831 | 84.2466 (44) |

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

|                                                                 |          |          |          |          |          |          |          |          |          |          |          |                                   |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------------------------------|
| Energy conte                                                    | 124.9352 | 109.2692 | 112.7560 | 98.3034  | 94.3244  | 81.3948  | 75.4243  | 86.5505  | 87.5841  | 102.0709 | 111.4183 | 120.9931 (45)                     |
| Energy content (annual)                                         |          |          |          |          |          |          |          |          |          |          |          | Total = Sum(45)m = 1205.0242 (45) |
| Distribution loss (46)m = 0.15 x (45)m                          |          |          |          |          |          |          |          |          |          |          |          |                                   |
| Water storage loss:                                             | 18.7403  | 16.3904  | 16.9134  | 14.7455  | 14.1487  | 12.2092  | 11.3136  | 12.9826  | 13.1376  | 15.3106  | 16.7128  | 18.1490 (46)                      |
| Store volume                                                    |          |          |          |          |          |          |          |          |          |          |          | 150.0000 (47)                     |
| b) If manufacturer declared loss factor is not known :          |          |          |          |          |          |          |          |          |          |          |          |                                   |
| Hot water storage loss factor from Table 2 (kWh/litre/day)      |          |          |          |          |          |          |          |          |          |          |          | 0.0191 (51)                       |
| Volume factor from Table 2a                                     |          |          |          |          |          |          |          |          |          |          |          | 0.9283 (52)                       |
| Temperature factor from Table 2b                                |          |          |          |          |          |          |          |          |          |          |          | 0.6000 (53)                       |
| Enter (49) or (54) in (55)                                      |          |          |          |          |          |          |          |          |          |          |          | 1.5960 (55)                       |
| Total storage loss                                              | 49.4758  | 44.6878  | 49.4758  | 47.8798  | 49.4758  | 47.8798  | 49.4758  | 49.4758  | 47.8798  | 49.4758  | 47.8798  | 49.4758 (56)                      |
| If cylinder contains dedicated solar storage                    | 49.4758  | 44.6878  | 49.4758  | 47.8798  | 49.4758  | 47.8798  | 49.4758  | 49.4758  | 47.8798  | 49.4758  | 47.8798  | 49.4758 (57)                      |
| Primary loss                                                    | 31.1612  | 28.1456  | 31.1612  | 30.1560  | 31.1612  | 22.5120  | 23.2624  | 23.2624  | 31.1612  | 30.1560  | 31.1612  | 31.1612 (59)                      |
| Total heat required for water heating calculated for each month | 205.5722 | 182.1025 | 193.3929 | 176.3392 | 174.9614 | 151.7866 | 148.1624 | 159.2886 | 157.9759 | 182.7078 | 189.4541 | 201.6301 (62)                     |
| 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 (63)                       |
| Output from w/h                                                 | 205.5722 | 182.1025 | 193.3929 | 176.3392 | 174.9614 | 151.7866 | 148.1624 | 159.2886 | 157.9759 | 182.7078 | 189.4541 | 201.6301 (64)                     |
| Heat gains from water heating, kWh/month                        | 106.0505 | 94.5987  | 102.0009 | 95.1145  | 95.8725  | 83.3772  | 83.2691  | 86.9686  | 85.4351  | 98.4481  | 99.4752  | 104.7398 (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 L3 or L9a), also see Table 5     | 89.2375  | 89.2375  | 89.2375  | 89.2375  | 89.2375  | 89.2375  | 89.2375  | 89.2375  | 89.2375  | 89.2375  | 89.2375  | 89.2375 (66)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 13.9009  | 12.3467  | 10.0410  | 7.6017   | 5.6823   | 4.7973   | 5.1836   | 6.7379   | 9.0435   | 11.4829  | 13.4022  | 14.2873 (67)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 155.5615 | 157.1758 | 153.1079 | 144.4480 | 133.5164 | 123.2422 | 116.3784 | 114.7641 | 118.8320 | 127.4919 | 138.4236 | 148.6977 (68) |
| Pumps, fans                                                                         | 31.9237  | 31.9237  | 31.9237  | 31.9237  | 31.9237  | 31.9237  | 31.9237  | 31.9237  | 31.9237  | 31.9237  | 31.9237  | 31.9237 (69)  |
| Losses e.g. evaporation (negative values) (Table 5)                                 | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000 (70)   |
| Water heating gains (Table 5)                                                       | -71.3900 | -71.3900 | -71.3900 | -71.3900 | -71.3900 | -71.3900 | -71.3900 | -71.3900 | -71.3900 | -71.3900 | -71.3900 | -71.3900 (71) |
| Total internal gains                                                                | 142.5410 | 140.7719 | 137.0980 | 132.1035 | 128.8608 | 115.8017 | 111.9208 | 116.8932 | 118.6599 | 132.3228 | 138.1600 | 140.7793 (72) |

#### 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   |          |          |               |
|-------------|----------|----------|----------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|--------------|----------|----------|---------------|
| Southwest   |          |          |          | 3.9400     | 36.7938                        | 0.4000                            | 0.7000                             | 0.7700                       | 28.1295 (79) |          |          |               |
| Northwest   |          |          |          | 7.3000     | 11.2829                        | 0.4000                            | 0.7000                             | 0.7700                       | 15.9822 (81) |          |          |               |
| -----       |          |          |          |            |                                |                                   |                                    |                              |              |          |          |               |
| Solar gains | 44.1117  | 80.4472  | 124.1721 | 177.4902   | 220.3767                       | 228.2722                          | 216.1298                           | 182.6838                     | 142.4075     | 92.7132  | 53.8024  | 37.1249 (83)  |
| Total gains | 408.8865 | 443.5128 | 477.1903 | 514.4146   | 541.2074                       | 524.8845                          | 502.3839                           | 473.8503                     | 441.7142     | 416.7820 | 396.5594 | 393.6604 (84) |

#### 7. Mean internal temperature (heating season)

|                                                                                         |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, T <sub>hi</sub> (C) |         |         |         |         |         |         |         |         |         |         |         |              |
| Utilisation factor for gains for living area, n <sub>li</sub> ,m (see Table 9a)         |         |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| tau                                                                                     | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| alpha                                                                                   | 60.8398 | 61.1184 | 61.3996 | 62.8452 | 63.1425 | 64.6724 | 64.8724 | 64.9873 | 64.0516 | 63.1425 | 62.5506 | 61.9698      |
| util living area                                                                        | 0.9384  | 0.9084  | 0.8456  | 0.7161  | 0.5504  | 0.3885  | 0.2800  | 0.3087  | 0.4977  | 0.7445  | 0.8931  | 0.9453 (86)  |
| MIT                                                                                     | 20.4143 | 20.5507 | 20.7308 | 20.9046 | 20.9781 | 20.9973 | 20.9996 | 20.9994 | 20.9903 | 20.9029 | 20.6646 | 20.4017 (87) |
| Th 2                                                                                    | 20.3949 | 20.3975 | 20.4001 | 20.4131 | 20.4158 | 20.4288 | 20.4288 | 20.4315 | 20.4236 | 20.4158 | 20.4105 | 20.4053 (88) |
| util rest of house                                                                      | 0.9302  | 0.8963  | 0.8280  | 0.6901  | 0.5186  | 0.3544  | 0.2437  | 0.2707  | 0.4582  | 0.7147  | 0.8784  | 0.9379 (89)  |
| MIT 2                                                                                   | 19.8675 | 19.9966 | 20.1683 | 20.3366 | 20.4001 | 20.4273 | 20.4287 | 20.4312 | 20.4175 | 20.3400 | 20.1185 | 19.8606 (90) |
| Living area fraction                                                                    | 20.2329 | 20.3642 | 20.5414 | 20.7134 | 20.7836 | 20.8054 | 20.8074 | 20.8081 | 20.7975 | 20.7135 | 20.4808 | 20.2196 (92) |
| Temperature adjustment                                                                  | 20.2329 | 20.3642 | 20.5414 | 20.7134 | 20.7836 | 20.8054 | 20.8074 | 20.8081 | 20.7975 | 20.7135 | 20.4808 | 20.2196 (93) |

#### 8. Space heating requirement

|                   |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Utilisation       | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
| Useful gains      | 379.3554 | 397.4999 | 397.1893 | 361.9315 | 291.5673 | 197.8311 | 134.5242 | 140.2016 | 213.7628 | 304.3152 | 349.0746 | 368.2201 (95) |
| Ext temp.         | 4.3000   | 4.9000   | 6.5000   | 8.9000   | 11.7000  | 14.6000  | 16.8000  | 16.4000  | 14.1000  | 10.6000  | 7.1000   | 4.2000 (96)   |
| Heat loss rate W  | 541.8756 | 523.5370 | 473.1932 | 388.9514 | 297.6640 | 198.5387 | 134.6145 | 140.3518 | 216.3589 | 331.4130 | 442.6313 | 534.8877 (97) |
| Month fracti      | 1.0000   | 1.0000   | 1.0000   | 1.0000   | 1.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 1.0000   | 1.0000   | 1.0000 (97a)  |
| Space heating kwh | 120.9151 | 84.6969  | 56.5470  | 19.4543  | 4.5360   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 20.1608  | 67.3608  | 124.0007 (98) |

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|                      |              |               |
|----------------------|--------------|---------------|
| Space heating        |              | 497,6716 (98) |
| Space heating per m2 | (98) / (4) = | 9,3530 (99)   |

Not applicable

|                                                                       |          |       |
|-----------------------------------------------------------------------|----------|-------|
| 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 %)                      | 92.5000  | (206) |
| Efficiency of secondary/supplementary heating system, %               | 0.0000   | (208) |
| Space heating requirement                                             | 538.0233 | (211) |

[illegible]

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

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

|                                                                                 |         |     |
|---------------------------------------------------------------------------------|---------|-----|
| PER                                                                             | 15.7700 | EC1 |
| Total Floor Area                                                                | 53.2100 |     |
| Assumed number of occupants                                                     | 1.7847  |     |
| CO2 emission factor in Table 12 for electricity displaced from grid             | 0.5190  |     |
| CO2 emissions from appliances, equation (L14)                                   | 17.3243 | EC2 |
| CO2 emissions from cooking, equation (L16)                                      | 3.0414  | EC3 |
| Total CO2 emissions                                                             | 36.1357 | EC4 |
| Residual CO2 emissions offset from biofuel CHE                                  | 0.0000  | EC5 |
| Additional allowable electricity generation, kWh/m <sup>2</sup> /year           | 0.0000  | EC6 |
| Resulting CO2 emissions offset from additional allowable electricity generation | 0.0000  | EC7 |
| Net CO2 emissions                                                               | 36.1357 | EC8 |

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SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)  
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

|                                                        |         | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)              | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------|---------------------------|-----------------------------------|-----------------------------|
| Ground floor                                           |         | 53.2100 (1b)              | x 2.7700 (2b)                     | = 147.3917 (1b) - (3b)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 53.2100 |                           |                                   | (4)                         |
| Dwelling volume                                        |         |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 147.3917 (5)                |

|                              | main<br>heating | secondary<br>heating | other | total    | m3 per hour  |
|------------------------------|-----------------|----------------------|-------|----------|--------------|
| Number of chimneys           | 0               | 0                    | 0     | 0 * 40 = | 0.0000 (6a)  |
| Number of open flues         | 0               | 0                    | 0     | 0 * 20 = | 0.0000 (6b)  |
| Number of intermittent fans  |                 |                      |       | 2 * 10 = | 20.0000 (7a) |
| Number of passive vents      |                 |                      |       | 0 * 10 = | 0.0000 (7b)  |
| Number of flueless gas fires |                 |                      |       | 0 * 40 = | 0.0000 (7c)  |

|                 | 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 (22) |
| Adj infilt rate | 0.4180 | 0.4098 | 0.4016 | 0.3606 | 0.3524 | 0.3114 | 0.3114 | 0.3033 | 0.3278 | 0.3524 | 0.3688 | 0.3852 (22) |
| Effective ac    | 0.5874 | 0.5840 | 0.5806 | 0.5650 | 0.5621 | 0.5485 | 0.5485 | 0.5460 | 0.5537 | 0.5621 | 0.5680 | 0.5742 (25) |

| Element                                                     | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K |
|-------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|--------------|--------------------------------|---------------|
| TER Opaque door                                             |                         |                            | 2.2400                    | 1.0000                        | 2.2400       |                                | (26)          |
| TER Opening Type Curtain (Uw = 1.50)                        |                         |                            | 11.0600                   | 1.4151                        | 15.6509      |                                | (27)          |
| Unipanel wall                                               | 15.4300                 | 2.2400                     | 13.1900                   | 0.1800                        | 2.3742       |                                | (29)          |
| Curtain wall                                                | 11.5200                 | 11.0600                    | 0.4600                    | 0.1800                        | 0.0828       |                                | (29)          |
| Total net area of external elements Sum(A, m <sup>2</sup> ) |                         |                            | 26.9500                   |                               |              |                                | (31)          |
| Fabric heat loss, W/K = Sum (A x U)                         |                         |                            | (26) ... (30) + (32) =    |                               | 20.3479      |                                | (33)          |

[illegible]

|                                          |              |
|------------------------------------------|--------------|
| Assumed occupancy                        | 1.7847 (42)  |
| Average daily hot water use (litres/day) | 76.5878 (43) |

[illegible]

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

|                                                                 |          |          |          |          |          |          |          |          |          |          |          |      |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| 23.3325                                                         | 21.0745  | 23.3325  | 22.5798  | 23.3325  | 22.5798  | 23.3325  | 23.3325  | 22.5798  | 23.3325  | 22.5798  | 23.3325  | (56) |
| If cylinder contains dedicated solar storage                    |          |          |          |          |          |          |          |          |          |          |          |      |
| 23.3325                                                         | 21.0745  | 23.3325  | 22.5798  | 23.3325  | 22.5798  | 23.3325  | 23.3325  | 22.5798  | 23.3325  | 22.5798  | 23.3325  | (67) |
| 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 |          |          |          |          |          |          |          |          |          |          |          |      |
| 171.5301                                                        | 151.3549 | 159.3509 | 143.3952 | 140.9194 | 126.4867 | 122.0192 | 133.1454 | 132.6760 | 148.6658 | 156.5102 | 167.5880 | (62) |
| 0.0000                                                          | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (63) |
| Solar input (sum of months) = Sum(63)m =                        |          |          |          |          |          |          |          |          |          |          |          |      |
| 171.5301                                                        | 151.3549 | 159.3509 | 143.3952 | 140.9194 | 126.4867 | 122.0192 | 133.1454 | 132.6760 | 148.6658 | 156.5102 | 167.5880 | (64) |
| Total per year (kWh/year) = Sum(64)m =                          |          |          |          |          |          |          |          |          |          |          |          |      |
| 78.8169                                                         | 70.0006  | 74.7673  | 68.7594  | 68.6368  | 63.1373  | 62.3545  | 66.0539  | 65.1952  | 71.2145  | 73.1201  | 77.5061  | (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      |      |
| 89.2375                                                                             | 89.2375  | 89.2375  | 89.2375  | 89.2375  | 89.2375  | 89.2375  | 89.2375  | 89.2375  | 89.2375  | 89.2375  | 89.2375  | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     |          |          |          |          |          |          |          |          |          |          |          |      |
| 13.9170                                                                             | 12.3610  | 10.0526  | 7.6105   | 5.6889   | 4.8028   | 5.1896   | 6.7457   | 9.0540   | 11.4962  | 13.4177  | 14.3038  | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 |          |          |          |          |          |          |          |          |          |          |          |      |
| 155.5615                                                                            | 157.1758 | 153.1079 | 144.4480 | 133.5164 | 123.2422 | 116.3784 | 114.7641 | 118.8320 | 127.4919 | 138.4236 | 148.6977 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    |          |          |          |          |          |          |          |          |          |          |          |      |
| 31.9237                                                                             | 31.9237  | 31.9237  | 31.9237  | 31.9237  | 31.9237  | 31.9237  | 31.9237  | 31.9237  | 31.9237  | 31.9237  | 31.9237  | (69) |
| Pumps, fans                                                                         |          |          |          |          |          |          |          |          |          |          |          |      |
| 3.0000                                                                              | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 |          |          |          |          |          |          |          |          |          |          |          |      |
| -71.3900                                                                            | -71.3900 | -71.3900 | -71.3900 | -71.3900 | -71.3900 | -71.3900 | -71.3900 | -71.3900 | -71.3900 | -71.3900 | -71.3900 | (71) |
| Water heating gains (Table 5)                                                       |          |          |          |          |          |          |          |          |          |          |          |      |
| 105.9367                                                                            | 104.1675 | 100.4937 | 95.4991  | 92.2565  | 87.6906  | 83.8098  | 88.7822  | 90.5489  | 95.7184  | 101.5557 | 104.1749 | (72) |
| 328.1865                                                                            | 326.4755 | 316.4255 | 300.3288 | 284.2330 | 268.5069 | 258.1491 | 263.0633 | 271.2061 | 287.4777 | 306.1682 | 319.9477 | (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   |          |      |
|-------------|----------|----------|----------|------------|--------------------------------|-----------------------------------|----------|------------------------------------|----------|------------------------------|--------------|----------|------|
| Southwest   |          |          |          | 3.8800     | 36.7938                        | 0.6300                            |          | 0.7000                             |          | 0.7700                       | 43.6293 (79) |          |      |
| Northwest   |          |          |          | 7.1800     | 11.2829                        | 0.6300                            |          | 0.7000                             |          | 0.7700                       | 24.7582 (81) |          |      |
| <hr/>       |          |          |          |            |                                |                                   |          |                                    |          |                              |              |          |      |
| Solar gains | 68.3875  | 124.7129 | 192.4811 | 275.1065   | 341.5610                       | 353.7908                          | 334.9747 | 283.1494                           | 220.7401 | 143.7239                     | 83.4101      | 57.5564  | (83) |
| Total gains | 396.5740 | 451.1884 | 508.9066 | 575.4354   | 625.7940                       | 622.2977                          | 593.1237 | 546.2126                           | 491.9462 | 431.2016                     | 389.5783     | 377.5041 | (84) |

#### 7. Mean internal temperature (heating season)

|                                                                                          |         |         |         |         |         |         |         |         |                           |         |         |              |
|------------------------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 5, T <sub>hi</sub> (°C) |         |         |         |         |         |         |         |         |                           |         |         | 21,0000 (85) |
| Utilisation factor for gains for living area, n <sub>li,m</sub> (see Table 5a)           |         |         |         |         |         |         |         |         |                           |         |         |              |
|                                                                                          | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep                       | Oct     | Nov     | Dec          |
| tau                                                                                      | 72.0459 | 72.2784 | 72.5078 | 73.6050 | 73.8139 | 74.8026 | 74.8026 | 74.9886 | 74.4186                   | 73.8139 | 73.3924 | 72.9568      |
| alpha                                                                                    | 5.8031  | 5.8186  | 5.8339  | 5.9070  | 5.9209  | 5.9868  | 5.9868  | 5.9992  | 5.9612                    | 5.9209  | 5.8928  | 5.8638       |
| util living area                                                                         | 0.9938  | 0.9861  | 0.9617  | 0.8773  | 0.7060  | 0.5037  | 0.3659  | 0.4137  | 0.6698                    | 0.9228  | 0.9857  | 0.9952 (86)  |
| MIT                                                                                      | 20.1552 | 20.3087 | 20.5436 | 20.8118 | 20.9564 | 20.9950 | 20.9994 | 20.9988 | 20.9759                   | 20.7748 | 20.4211 | 20.1299 (87) |
| Th 2                                                                                     | 20.1135 | 20.1161 | 20.1187 | 20.1307 | 20.1330 | 20.1435 | 20.1435 | 20.1454 | 20.1394                   | 20.1330 | 20.1284 | 20.1236 (88) |
| util rest of house                                                                       | 0.9919  | 0.9819  | 0.9504  | 0.8463  | 0.6518  | 0.4382  | 0.2950  | 0.3376  | 0.5967                    | 0.8951  | 0.9806  | 0.9938 (89)  |
| MIT 2                                                                                    | 18.9959 | 19.2195 | 19.5551 | 19.9244 | 20.0945 | 20.1404 | 20.1432 | 20.1449 | 20.1224                   | 19.8877 | 19.3930 | 18.9668 (90) |
| Living area fraction                                                                     | 19.7650 | 19.9421 | 20.2109 | 20.5131 | 20.6663 | 20.7073 | 20.7112 | 20.7114 | fLA = Living area / (4) = | 20.6886 | 20.4762 | 0.6634 (91)  |
| MIT                                                                                      | 19.7650 | 19.9421 | 20.2109 | 20.5131 | 20.6663 | 20.7073 | 20.7112 | 20.7114 | 20.6886                   | 20.4762 | 20.0750 | 19.7384 (92) |
| Temperature adjustment                                                                   |         |         |         |         |         |         |         |         |                           |         |         | 0.0000       |
| adjusted MIT                                                                             | 19.7650 | 19.9421 | 20.2109 | 20.5131 | 20.6663 | 20.7073 | 20.7112 | 20.7114 | 20.6886                   | 20.4762 | 20.0750 | 19.7384 (93) |

#### 8. Space heating requirement

|                      |          |          |          |          |          |          |          |          |          |              |          |          |       |
|----------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------------|----------|----------|-------|
|                      | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct          | Nov      | Dec      |       |
| Utilisation          | 0.9910   | 0.9809   | 0.9517   | 0.8607   | 0.6857   | 0.4815   | 0.3420   | 0.3881   | 0.6442   | 0.9071       | 0.9802   | 0.9929   | (94)  |
| Useful gains         | 392.9912 | 442.5826 | 484.3381 | 495.3049 | 429.1382 | 299.6437 | 202.8693 | 211.9961 | 316.9215 | 391.1243     | 381.8837 | 374.8423 | (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     | 793.1791 | 769.0073 | 638.7322 | 583.0060 | 448.8553 | 301.6942 | 203.0877 | 212.4465 | 327.1487 | 494.4052     | 653.2630 | 786.9938 | (97)  |
| Month fracti         | 1.0000   | 1.0000   | 1.0000   | 1.0000   | 1.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 1.0000       | 1.0000   | 1.0000   | (97a) |
| Space heating kWh    | 297.7398 | 219.3574 | 159.5092 | 63.1448  | 14.6695  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 76.8410      | 195.3931 | 306.6407 | (98)  |
| Space heating        |          |          |          |          |          |          |          |          |          |              |          |          | (98)  |
| Space heating per m2 |          |          |          |          |          |          |          |          |          |              |          |          | (98)  |
|                      |          |          |          |          |          |          |          |          |          | (98) / (4) = |          |          | (99)  |

#### 8c. Space cooling requirement

Not applicable

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

#### 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 %)                      |          |          |          |          |          |          |          |          |          |          |          | 93.5000 (206)   |
| Efficiency of secondary/supplementary heating system, %               |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)    |
| Space heating requirement                                             |          |          |          |          |          |          |          |          |          |          |          | 1425.9845 (211) |
|                                                                       | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec             |
| Space heating requirement                                             | 297.7398 | 219.3574 | 159.5092 | 63.1448  | 14.6695  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 76.8410  | 195.3931 | 306.6407 (98)   |
| Space heating efficiency (main heating system 1)                      | 93.5000  | 93.5000  | 93.5000  | 93.5000  | 93.5000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 93.5000  | 93.5000  | 93.5000 (210)   |
| Space heating fuel (main heating system)                              | 318.4383 | 234.6069 | 170.5980 | 67.5345  | 15.6894  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 82.1829  | 208.9766 | 327.9580 (211)  |
| Water heating requirement                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (215)    |
| Water heating                                                         |          |          |          |          |          |          |          |          |          |          |          |                 |
| Water heating requirement                                             | 171.5301 | 151.3549 | 159.3509 | 143.3952 | 140.9194 | 126.4867 | 122.0192 | 133.1454 | 132.6760 | 148.6658 | 156.5102 | 167.5880 (64)   |
| Efficiency of water heater                                            |          |          |          |          |          |          |          |          |          |          |          | 79.8000 (216)   |
| (217)m                                                                | 86.2717  | 85.8028  | 84.8165  | 82.7927  | 80.6996  | 79.8000  | 79.8000  | 79.8000  | 79.8000  | 83.1499  | 85.4068  | 86.4057 (217)   |
| Fuel for water heating, kWh/month                                     | 198.8255 | 176.3986 | 187.8772 | 173.1980 | 174.6221 | 158.5046 | 152.9062 | 166.8488 | 166.2606 | 178.7925 | 183.2526 | 193.9548 (219)  |
| Water heating fuel used                                               |          |          |          |          |          |          |          |          |          |          |          | 2111.4417 (219) |
| Annual totals kWh/year                                                |          |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating fuel - main system                                      |          |          |          |          |          |          |          |          |          |          |          | 1425.9845 (211) |
| Space heating fuel - secondary                                        |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)    |
| Electricity for pumps and fans:                                       |          |          |          |          |          |          |          |          |          |          |          |                 |
| central heating pump                                                  |          |          |          |          |          |          |          |          |          |          |          | 30.0000 (230c)  |
| main heating flue fan                                                 |          |          |          |          |          |          |          |          |          |          |          | 45.0000 (230e)  |
| Total electricity for the above, kWh/year                             |          |          |          |          |          |          |          |          |          |          |          | 75.0000 (231)   |
| Electricity for lighting (calculated in Appendix I)                   |          |          |          |          |          |          |          |          |          |          |          | 245.7791 (232)  |
| Total delivered energy for all uses                                   |          |          |          |          |          |          |          |          |          |          |          | 3858.2052 (238) |

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

|  |  |  |  |                    |
|--|--|--|--|--------------------|
|  |  |  |  | Energy<br>kWh/year |
|--|--|--|--|--------------------|

# BASIC COMPLIANCE REPORT

## Calculation Type: New Build (As Designed)



|                      |            |                |            |
|----------------------|------------|----------------|------------|
| Property Reference   | 116845     | Issued on Date | 17/12/2021 |
| Assessment Reference | Plot 68/69 | Prop Type Ref  | Mid Floor  |
| Property             |            |                |            |

|                                    |      |             |       |      |       |
|------------------------------------|------|-------------|-------|------|-------|
| SAP Rating                         | 84 B | DER         | 15.77 | TER  | 17.49 |
| Environmental                      | 89 B | % DER<TER   | 9.83  |      |       |
| CO <sub>2</sub> Emissions (t/year) | 0.76 | DFEE        | 32.27 | TFEE | 38.71 |
| General Requirements Compliance    | Fail | % DFEE<TFEE | 16.63 |      |       |

|                  |                                                                                    |             |           |
|------------------|------------------------------------------------------------------------------------|-------------|-----------|
| Assessor Details | Mr. Richard Denteh, Meinhardt UK, Tel: 02078317969, richard.denteh@meinhardt.co.uk | Assessor ID | T596-0001 |
|------------------|------------------------------------------------------------------------------------|-------------|-----------|

|        |  |
|--------|--|
| Client |  |
|--------|--|

### SUMMARY FOR INPUT DATA FOR New Build (As Designed)

#### Criterion 1 – Achieving the TER and TFEE rate

##### 1a TER and DER

|                                             |                  |                                   |      |
|---------------------------------------------|------------------|-----------------------------------|------|
| Fuel for main heating                       | Mains gas        |                                   |      |
| Fuel factor                                 | 1.00 (mains gas) |                                   |      |
| Target Carbon Dioxide Emission Rate (TER)   | 17.49            | kgCO <sub>2</sub> /m <sup>2</sup> |      |
| Dwelling Carbon Dioxide Emission Rate (DER) | 15.77            | kgCO <sub>2</sub> /m <sup>2</sup> | Pass |
|                                             | -1.72 (-9.8%)    | kgCO <sub>2</sub> /m <sup>2</sup> |      |

##### 1b TFEE and DFEE

|                                          |               |                        |      |
|------------------------------------------|---------------|------------------------|------|
| Target Fabric Energy Efficiency (TFEE)   | 38.71         | kWh/m <sup>2</sup> /yr |      |
| Dwelling Fabric Energy Efficiency (DFEE) | 32.27         | kWh/m <sup>2</sup> /yr |      |
|                                          | -6.4 (-16.5%) | kWh/m <sup>2</sup> /yr | Pass |

#### Criterion 2 – Limits on design flexibility

##### Limiting Fabric Standards

##### 2 Fabric U-values

| Element                   | Average          | Highest          |      |
|---------------------------|------------------|------------------|------|
| External wall             | 0.14 (max. 0.30) | 0.14 (max. 0.70) | Pass |
| Party wall                | 0.00 (max. 0.20) | -                | Pass |
| Openings and curtain wall | 1.23 (max. 2.00) | 1.40 (max. 3.30) | Pass |

##### 2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

##### 3 Air permeability

|                                |                     |      |
|--------------------------------|---------------------|------|
| Air permeability at 50 pascals | 3.00 (design value) |      |
| Maximum                        | 10.0                | Pass |

##### Limiting System Efficiencies

##### 4 Heating efficiency

|                     |                                                                                                                     |      |
|---------------------|---------------------------------------------------------------------------------------------------------------------|------|
| Main heating system | Boiler system with radiators or underfloor - Mains gas<br>Data from manufacturer<br>Efficiency: 93%<br>Minimum: 88% | Pass |
|---------------------|---------------------------------------------------------------------------------------------------------------------|------|



# BASIC COMPLIANCE REPORT

## Calculation Type: New Build (As Designed)



|                          |      |  |
|--------------------------|------|--|
| Secondary heating system | None |  |
|--------------------------|------|--|

##### 5 Cylinder insulation

|                            |                                                                |      |
|----------------------------|----------------------------------------------------------------|------|
| Hot water storage          | Nominal cylinder loss: 2.66 kWh/day<br>Permitted by DBSCG 1.89 | Fail |
| Primary pipework insulated | Yes                                                            | Pass |

##### 6 Controls

|                        |                                      |      |
|------------------------|--------------------------------------|------|
| Space heating controls | Programmer, room thermostat and TRVs | Pass |
| Hot water controls     | Cylinderstat                         | Pass |
|                        | Not independent timer for DHW        | Fail |
| Boiler interlock       | Yes                                  | Pass |

##### 7 Low energy lights

|                                                     |     |   |      |
|-----------------------------------------------------|-----|---|------|
| Percentage of fixed lights with low-energy fittings | 100 | % |      |
| Minimum                                             | 75  | % | Pass |

##### 8 Mechanical ventilation

|                                      |      |   |      |
|--------------------------------------|------|---|------|
| Continuous supply and extract system |      |   |      |
| Specific fan power                   | 0.52 |   |      |
| Maximum                              | 1.5  |   | Pass |
| MVHR efficiency                      | 92   | % |      |
| Minimum                              | 70   | % | Pass |

#### Criterion 3 – Limiting the effects of heat gains in summer

##### 9 Summertime temperature

|                                  |                                   |      |
|----------------------------------|-----------------------------------|------|
| Overheating risk (Thames Valley) | Slight                            | Pass |
| Based on:                        |                                   |      |
| Overshading                      | Average                           |      |
| Windows facing South West        | 3.94 m <sup>2</sup> , No overhang |      |
| Windows facing North West        | 7.30 m <sup>2</sup> , No overhang |      |
| Air change rate                  | 6.00 ach                          |      |
| Blinds/curtains                  | None                              |      |

#### Criterion 4 – Building performance consistent with DER and DFEE rate

##### Party Walls

| Type                            | U-value |                    |      |
|---------------------------------|---------|--------------------|------|
| Filled Cavity with Edge Sealing | 0.00    | W/m <sup>2</sup> K | Pass |
| Solid Wall                      | 0.00    | W/m <sup>2</sup> K | Pass |

##### Air permeability and pressure testing

##### 3 Air permeability

|                                |                     |      |
|--------------------------------|---------------------|------|
| Air permeability at 50 pascals | 3.00 (design value) |      |
| Maximum                        | 10.0                | Pass |

##### 10 Key features

|                       |      |                                  |
|-----------------------|------|----------------------------------|
| External wall U-value | 0.14 | W/m <sup>2</sup> K               |
| Party wall U-value    | 0.00 | W/m <sup>2</sup> K               |
| Party wall U-value    | 0.00 | W/m <sup>2</sup> K               |
| Air permeability      | 3.0  | m <sup>3</sup> /m <sup>2</sup> h |



## BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Designed)



## FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



|                                    |                                                                                    |               |           |                |            |
|------------------------------------|------------------------------------------------------------------------------------|---------------|-----------|----------------|------------|
| Property Reference                 | 116862                                                                             |               |           | Issued on Date | 17/12/2021 |
| Assessment Reference               | Plot 47                                                                            | Prop Type Ref | Top Floor |                |            |
| Property                           |                                                                                    |               |           |                |            |
| SAP Rating                         | 83 B                                                                               | DER           | 17.94     | TER            | 19.41      |
| Environmental                      | 86 B                                                                               | % DER<TER     | 7.58      |                |            |
| CO <sub>2</sub> Emissions (t/year) | 1.23                                                                               | DFEE          | 52.00     | TFEE           | 59.79      |
| General Requirements Compliance    | Fail                                                                               | % DFEE<TFEE   | 13.04     |                |            |
| Assessor Details                   | Mr. Richard Denteh, Meinhardt UK, Tel: 02078317969, richard.denteh@meinhardt.co.uk |               |           | Assessor ID    | T596-0001  |
| Client                             |                                                                                    |               |           |                |            |

*This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.*



REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

Top-floor flat, total floor area 81 m<sup>2</sup>

This report covers items included within the SAP calculations.  
It is not a complete report of regulations compliance.

1a TER and DER  
Fuel for main heating:Mains gas  
Fuel factor:1.00 (mains gas)  
Target Carbon Dioxide Emission Rate (TER) 19.41 kgCO<sub>2</sub>/m<sup>2</sup>  
Dwelling Carbon Dioxide Emission Rate (DER) 17.94 kgCO<sub>2</sub>/m<sup>2</sup>OK

1b TFEE and DFEE  
Target Fabric Energy Efficiency (TFEE) 59.8 kWh/m<sup>2</sup>/yr  
Dwelling Fabric Energy Efficiency (DFEE) 52.0 kWh/m<sup>2</sup>/yrOK

| 2 Fabric U-values         |                  |                  |    |
|---------------------------|------------------|------------------|----|
| Element                   | Average          | Highest          |    |
| External wall             | 0.16 (max. 0.30) | 0.26 (max. 0.70) | OK |
| Party wall                | 0.00 (max. 0.20) | -                | OK |
| Floor                     | (no floor)       |                  |    |
| Roof                      | 0.11 (max. 0.20) | 0.11 (max. 0.35) | OK |
| Openings and curtain wall | 1.22 (max. 2.00) | 1.40 (max. 3.30) | OK |

2a Thermal bridging  
Thermal bridging calculated from linear thermal transmittances for each junction

|                                 |                     |    |
|---------------------------------|---------------------|----|
| 3 Air permeability              |                     |    |
| Air permeability at 50 pascals: | 3.00 (design value) |    |
| Maximum                         | 10.0                | OK |

4 Heating efficiency  
Main heating system: Boiler system with radiators or underfloor - Mains gas  
Data from manufacturer:

Efficiency: 93%  
Minimum: 88% OK

Secondary heating system: None

|                             |                                     |    |
|-----------------------------|-------------------------------------|----|
| 5 Cylinder insulation       |                                     |    |
| Hot water storage           | Nominal cylinder loss: 2.66 kWh/day |    |
| Permitted by DBSCG 1.89     | Fail                                |    |
| Primary pipework insulated: | Yes                                 | OK |

6 Controls  
Space heating controls: Programmer, room thermostat and TRVs OR

|                     |                               |      |
|---------------------|-------------------------------|------|
| Hot water controls: | Cylinderstat                  | OK   |
|                     | Not independent timer for DHW | Fail |

|                  |     |    |
|------------------|-----|----|
| Boiler interlock | Yes | OK |
|------------------|-----|----|

|                                                          |     |
|----------------------------------------------------------|-----|
| 7 Low energy lights                                      |     |
| Percentage of fixed lights with low-energy fittings:100% |     |
| Minimum                                                  | 75% |

|                                      |      |    |
|--------------------------------------|------|----|
| 8 Mechanical ventilation             |      |    |
| Continuous supply and extract system |      |    |
| Specific fan power:                  | 0.55 |    |
| Maximum                              | 1.5  | OK |
| MVHR efficiency:                     | 92%  |    |
| Minimum:                             | 70%  | OK |

9 Summertime temperature  
Overheating risk (Thames Valley): Slight OK

| Overshading:               | Average                            |
|----------------------------|------------------------------------|
| Windows facing North East: | 11.81 m <sup>2</sup> , No overhang |
| Windows facing South East: | 10.07 m <sup>2</sup> , No overhang |
| Air change rate:           | 6.00 ach                           |
| Blinds/curtains:           | None                               |

|                       |            |
|-----------------------|------------|
| 10 Key features       |            |
| External wall U-value | 0.14 W/m²K |
| Party wall U-value    | 0.00 W/m²K |
| Party wall U-value    | 0.00 W/m²K |
| Party wall U-value    | 0.00 W/m²K |
| Roof U-value          | 0.11 W/m²K |
| Air permeability      | 3.0 m³/m²h |



SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)  
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)            | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Ground floor                                           | 80.8800 (1b)              | x 2.7700 (2b)                   | = 224.0376 (1b) - (3b)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 80.8800                   |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 224.0376 (5)              |

## 2. Ventilation rate

|                              | main<br>heating | secondary<br>heating |   | other |   | total    | m3 per hour |
|------------------------------|-----------------|----------------------|---|-------|---|----------|-------------|
| Number of chimneys           | 0               | 0                    | + | 0     | = | 0 * 40 = | 0.0000 (6a) |
| Number of open flues         | 0               | 0                    | + | 0     | = | 0 * 20 = | 0.0000 (6b) |
| Number of intermittent 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 =  $(6a) + (6b) + (7a) + (7b) + (7c) =$  Air changes per hour  
0.0000 / (5) = 0.0000 (8)

|                           |             |
|---------------------------|-------------|
| Pressure test             | 188         |
| Measured/design AR50      | 3.0000      |
| Infiltration rate         | 0.1500 (18) |
| Number of sides sheltered | 2 (19)      |

|                                                      |                             |             |
|------------------------------------------------------|-----------------------------|-------------|
| Shelter factor                                       | (20) = 1 - [0.075 x (19)] = | 0.8500 (20) |
| Infiltration rate adjusted to include shelter factor | (21) = (18) x (20) =        | 0.1275 (21) |

[illegible]

|        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |       |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|
| 0.1306 | 0.1359 | 0.1402 | 0.1445 | 0.1488 | 0.1531 | 0.1574 | 0.1617 | 0.1660 | 0.1703 | 0.1746 | 0.1789 | 0.1832 | 0.1875 | 0.1918 | 0.1961 | 0.2004 | 0.2047 | 0.2090 | 0.2133 | 0.2176 | 0.2219 | 0.2262 | 0.2305 | 0.2348 | 0.2391 | 0.2434 | 0.2477 | 0.2520 | 0.2563 | 0.2606 | 0.2649 | 0.2692 | 0.2735 | 0.2778 | 0.2821 | 0.2864 | 0.2907 | 0.2950 | 0.2993 | 0.3036 | 0.3079 | 0.3122 | 0.3165 | 0.3208 | 0.3251 | 0.3294 | 0.3337 | 0.3380 | 0.3423 | 0.3466 | 0.3509 | 0.3552 | 0.3595 | 0.3638 | 0.3681 | 0.3724 | 0.3767 | 0.3810 | 0.3853 | 0.3896 | 0.3939 | 0.3982 | 0.4025 | 0.4068 | 0.4111 | 0.4154 | 0.4197 | 0.4240 | 0.4283 | 0.4326 | 0.4369 | 0.4412 | 0.4455 | 0.4498 | 0.4541 | 0.4584 | 0.4627 | 0.4670 | 0.4713 | 0.4756 | 0.4799 | 0.4842 | 0.4885 | 0.4928 | 0.4971 | 0.5014 | 0.5057 | 0.5100 | 0.5143 | 0.5186 | 0.5229 | 0.5272 | 0.5315 | 0.5358 | 0.5401 | 0.5444 | 0.5487 | 0.5530 | 0.5573 | 0.5616 | 0.5659 | 0.5702 | 0.5745 | 0.5788 | 0.5831 | 0.5874 | 0.5917 | 0.5960 | 0.6003 | 0.6046 | 0.6089 | 0.6132 | 0.6175 | 0.6218 | 0.6261 | 0.6304 | 0.6347 | 0.6390 | 0.6433 | 0.6476 | 0.6519 | 0.6562 | 0.6605 | 0.6648 | 0.6691 | 0.6734 | 0.6777 | 0.6820 | 0.6863 | 0.6906 | 0.6949 | 0.6992 | 0.7035 | 0.7078 | 0.7121 | 0.7164 | 0.7207 | 0.7250 | 0.7293 | 0.7336 | 0.7379 | 0.7422 | 0.7465 | 0.7508 | 0.7551 | 0.7594 | 0.7637 | 0.7680 | 0.7723 | 0.7766 | 0.7809 | 0.7852 | 0.7895 | 0.7938 | 0.7981 | 0.8024 | 0.8067 | 0.8110 | 0.8153 | 0.8196 | 0.8239 | 0.8282 | 0.8325 | 0.8368 | 0.8411 | 0.8454 | 0.8497 | 0.8540 | 0.8583 | 0.8626 | 0.8669 | 0.8712 | 0.8755 | 0.8798 | 0.8841 | 0.8884 | 0.8927 | 0.8970 | 0.9013 | 0.9056 | 0.9099 | 0.9142 | 0.9185 | 0.9228 | 0.9271 | 0.9314 | 0.9357 | 0.9400 | 0.9443 | 0.9486 | 0.9529 | 0.9572 | 0.9615 | 0.9658 | 0.9701 | 0.9744 | 0.9787 | 0.9830 | 0.9873 | 0.9916 | 0.9959 | 1.0002 | 1.0045 | 1.0088 | 1.0131 | 1.0174 | 1.0217 | 1.0260 | 1.0303 | 1.0346 | 1.0389 | 1.0432 | 1.0475 | 1.0518 | 1.0561 | 1.0604 | 1.0647 | 1.0690 | 1.0733 | 1.0776 | 1.0819 | 1.0862 | 1.0905 | 1.0948 | 1.0991 | 1.1034 | 1.1077 | 1.1120 | 1.1163 | 1.1206 | 1.1249 | 1.1292 | 1.1335 | 1.1378 | 1.1421 | 1.1464 | 1.1507 | 1.1550 | 1.1593 | 1.1636 | 1.1679 | 1.1722 | 1.1765 | 1.1808 | 1.1851 | 1.1894 | 1.1937 | 1.1980 | 1.2023 | 1.2066 | 1.2109 | 1.2152 | 1.2195 | 1.2238 | 1.2281 | 1.2324 | 1.2367 | 1.2410 | 1.2453 | 1.2496 | 1.2539 | 1.2582 | 1.2625 | 1.2668 | 1.2711 | 1.2754 | 1.2797 | 1.2840 | 1.2883 | 1.2926 | 1.2969 | 1.3012 | 1.3055 | 1.3098 | 1.3141 | 1.3184 | 1.3227 | 1.3270 | 1.3313 | 1.3356 | 1.3399 | 1.3442 | 1.3485 | 1.3528 | 1.3571 | 1.3614 | 1.3657 | 1.3700 | 1.3743 | 1.3786 | 1.3829 | 1.3872 | 1.3915 | 1.3958 | 1.4001 | 1.4044 | 1.4087 | 1.4130 | 1.4173 | 1.4216 | 1.4259 | 1.4302 | 1.4345 | 1.4388 | 1.4431 | 1.4474 | 1.4517 | 1.4560 | 1.4603 | 1.4646 | 1.4689 | 1.4732 | 1.4775 | 1.4818 | 1.4861 | 1.4904 | 1.4947 | 1.4990 | 1.5033 | 1.5076 | 1.5119 | 1.5162 | 1.5205 | 1.5248 | 1.5291 | 1.5334 | 1.5377 | 1.5420 | 1.5463 | 1.5506 | 1.5549 | 1.5592 | 1.5635 | 1.5678 | 1.5721 | 1.5764 | 1.5807 | 1.5850 | 1.5893 | 1.593 |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|

|              |        |        |        |        |        |        |        |        |        |        |        |             |
|--------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------------|
| Effective ac | 0.2716 | 0.2684 | 0.2652 | 0.2493 | 0.2461 | 0.2301 | 0.2301 | 0.2269 | 0.2365 | 0.2461 | 0.2524 | 0.2588 (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 |       |
|------------------------------------------------|-------------|----------------|---------------|----------------------|--------------|-------------------|---------------|-------|
| Windows (Uw = 1.20)                            |             |                | 21.8800       | 1.1450               | 25.0534      |                   |               | (27)  |
| Front Door                                     |             |                | 2.1200        | 1.4000               | 2.9680       |                   |               | (26)  |
| Unipanel column                                | 5.9800      |                | 5.9800        | 0.2600               | 1.5548       | 136.7400          | 817.7052      | (29a) |
| Unipanel wall                                  | 28.9100     | 2.1200         | 26.7900       | 0.1400               | 3.7506       | 30.9500           | 829.1505      | (29a) |
| Curtain wall                                   | 22.4800     | 21.8800        | 0.6000        | 1.2000               | 0.7200       | 14.0000           | 8.4000        | (29a) |
| External Roof 1                                | 80.8800     |                | 80.8800       | 0.1100               | 8.8968       | 9.0000            | 727.9200      | (30)  |
| Total net area of external elements Aum(A, m2) |             |                | 138.2500      |                      |              |                   |               | (31)  |
| Fabric heat loss, W/K = Sum (A x U)            |             |                |               | (26)...(30) + (32) = | 42.9436      |                   |               | (33)  |
| Party Wall 2 column                            |             |                | 2.4400        | 0.0000               | 0.0000       | 180.0000          | 439.2000      | (32)  |
| Party Wall 3                                   |             |                | 25.8500       | 0.0000               | 0.0000       | 20.0000           | 517.0000      | (32)  |
| Party Wall 4 stairs core /riser                |             |                | 26.9200       | 0.0000               | 0.0000       | 180.0000          | 4845.6000     | (32)  |
| Party Floor 1                                  |             |                | 80.8800       |                      |              | 40.0000           | 3235.2000     | (32d) |
| Internal Wall 1                                |             |                | 157.8000      |                      |              | 9.0000            | 1420.2000     | (32c) |

$$\text{Heat capacity } C_m = \text{Sum}(A \times k) \quad (28) \dots (30) + (32) + (32a) \dots (32e) = 12840.3757 \quad (34)$$

Thermal mass parameter (TMP =  $C_m$  / TFA) in kJ/m<sup>2</sup>K 158.7584 (35)

|                                                            |               |              |
|------------------------------------------------------------|---------------|--------------|
| Thermal bridges (Sum(L x Psi) calculated using Appendix K) |               | 18.5861 (36) |
| Total fabric heat loss                                     | (33) + (36) = | 61.5297 (37) |

[illegible]

Average =  $\text{Sum}(39)m / 12 = 79.8985 \quad (39)$

|               | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec         |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------------|
| HLP           | 1.0090 | 1.0061 | 1.0032 | 0.9886 | 0.9857 | 0.9711 | 0.9711 | 0.9682 | 0.9769 | 0.9857 | 0.9915 | 0.9973 (40) |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 0.9879 (40) |
| Days in month | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31 (41)     |

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

|                                          |              |
|------------------------------------------|--------------|
| Assumed occupancy                        | 2,4793 (42)  |
| Average daily hot water use (litres/day) | 93,0845 (43) |

[illegible]

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

|                                                                 |          |          |          |          |          |          |          |          |          |          |          |          |      |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------|
| Daily hot water use                                             |          |          |          |          |          |          |          |          |          |          |          |          |      |
| Energy conte                                                    | 102.3929 | 98.6695  | 94.9462  | 91.2228  | 87.4994  | 83.7760  | 83.7760  | 87.4994  | 91.2228  | 94.9462  | 98.6695  | 102.3929 | (44) |
| Energy content (annual)                                         | 151.8457 | 132.8053 | 137.0431 | 119.4775 | 114.6415 | 98.9269  | 91.6703  | 105.1930 | 106.4494 | 124.0565 | 135.4174 | 147.0545 | (45) |
| Distribution loss (46)m = 0.15 x (45)m                          |          |          |          |          |          |          |          |          |          |          |          |          | (45) |
| Distribution loss                                               | 22.7769  | 19.9208  | 20.5565  | 17.9216  | 17.1962  | 14.8390  | 13.7505  | 15.7790  | 15.9674  | 18.6085  | 20.3126  | 22.0582  | (46) |
| Water storage loss:                                             |          |          |          |          |          |          |          |          |          |          |          |          |      |
| Storage volume                                                  |          |          |          |          |          |          |          |          |          |          |          | 150.0000 | (47) |
| b) If manufacturer declared loss factor is not known:           |          |          |          |          |          |          |          |          |          |          |          |          |      |
| Hot water storage loss factor from Table 2 (kWh/litre/day)      |          |          |          |          |          |          |          |          |          |          |          | 0.0191   | (51) |
| Volume factor from Table 2a                                     |          |          |          |          |          |          |          |          |          |          |          | 0.9283   | (52) |
| Temperature factor from Table 2b                                |          |          |          |          |          |          |          |          |          |          |          | 0.6000   | (53) |
| Enter (49) or (54) ln (55)                                      |          |          |          |          |          |          |          |          |          |          |          | 1.5960   | (55) |
| Total storage loss                                              |          |          |          |          |          |          |          |          |          |          |          |          |      |
| 49.4758                                                         | 44.6878  | 49.4758  | 47.8798  | 49.4758  | 47.8798  | 49.4758  | 49.4758  | 47.8798  | 49.4758  | 47.8798  | 49.4758  | 49.4758  | (56) |
| If cylinder contains dedicated solar storage                    |          |          |          |          |          |          |          |          |          |          |          |          |      |
| 49.4758                                                         | 44.6878  | 49.4758  | 47.8798  | 49.4758  | 47.8798  | 49.4758  | 49.4758  | 47.8798  | 49.4758  | 47.8798  | 49.4758  | 49.4758  | (57) |
| Primary loss                                                    | 31.1612  | 28.1456  | 31.1612  | 30.1560  | 31.1612  | 22.5120  | 23.2624  | 22.5120  | 31.1612  | 30.1560  | 31.1612  | 31.1612  | (59) |
| Total heat required for water heating calculated for each month |          |          |          |          |          |          |          |          |          |          |          |          |      |
| 232.4827                                                        | 205.6386 | 217.6801 | 197.5133 | 195.2785 | 169.3187 | 164.4085 | 177.9312 | 176.8412 | 204.6935 | 213.4531 | 227.6915 | 227.6915 | (62) |
| 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   | (63) |
| Solar input (sum of month) = Sum(63)m =                         |          |          |          |          |          |          |          |          |          |          |          | 0.0000   | (63) |
| Output from w/h                                                 |          |          |          |          |          |          |          |          |          |          |          |          |      |
| 232.4827                                                        | 205.6386 | 217.6801 | 197.5133 | 195.2785 | 169.3187 | 164.4085 | 177.9312 | 176.8412 | 204.6935 | 213.4531 | 227.6915 | 227.6915 | (64) |
| Heat gains from water heating, kWh/month                        |          |          |          |          |          |          |          |          |          |          |          |          |      |
| 114.9983                                                        | 102.4245 | 110.0764 | 102.1549 | 102.6279 | 89.2066  | 88.6709  | 93.1672  | 91.7078  | 105.7584 | 107.4549 | 113.4052 | 113.4052 | (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      |          |      |
| 123.9673                                                                            | 123.9673 | 123.9673 | 123.9673 | 123.9673 | 123.9673 | 123.9673 | 123.9673 | 123.9673 | 123.9673 | 123.9673 | 123.9673 | 123.9673 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     |          |          |          |          |          |          |          |          |          |          |          |          |      |
| 19.7264                                                                             | 17.5208  | 14.2489  | 10.7873  | 8.0636   | 6.8077   | 7.3559   | 9.5615   | 12.8334  | 16.2950  | 19.0187  | 20.2748  | 20.2748  | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 |          |          |          |          |          |          |          |          |          |          |          |          |      |
| 221.2699                                                                            | 223.5660 | 217.7799 | 205.4621 | 189.9130 | 175.2990 | 165.5360 | 163.2399 | 169.0260 | 181.3438 | 196.8929 | 211.8069 | 211.8069 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    |          |          |          |          |          |          |          |          |          |          |          |          |      |
| 35.3967                                                                             | 35.3967  | 35.3967  | 35.3967  | 35.3967  | 35.3967  | 35.3967  | 35.3967  | 35.3967  | 35.3967  | 35.3967  | 35.3967  | 35.3967  | (69) |
| Pumps, fans                                                                         | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | (70) |
| Losses e.g. evaporation (negative values) (Table 5)                                 |          |          |          |          |          |          |          |          |          |          |          |          |      |
| -99.1738                                                                            | -99.1738 | -99.1738 | -99.1738 | -99.1738 | -99.1738 | -99.1738 | -99.1738 | -99.1738 | -99.1738 | -99.1738 | -99.1738 | -99.1738 | (71) |
| Water heating gains (Table 5)                                                       |          |          |          |          |          |          |          |          |          |          |          |          |      |
| 154.5676                                                                            | 152.4173 | 147.9522 | 141.8818 | 137.9407 | 123.8981 | 119.1813 | 125.2248 | 127.3720 | 142.1483 | 149.2429 | 152.4263 | 152.4263 | (72) |
| Total internal gains                                                                | 458.7540 | 456.6943 | 443.1711 | 421.3213 | 399.1075 | 369.1950 | 355.2635 | 361.2164 | 372.4216 | 402.9774 | 428.3447 | 447.3980 | (73) |

#### 6. Solar gains

|             |            |                                |                              |                              |                              |            |          |          |          |          |          |          |      |
|-------------|------------|--------------------------------|------------------------------|------------------------------|------------------------------|------------|----------|----------|----------|----------|----------|----------|------|
| [Jan]       | Area<br>m2 | Solar flux<br>Table 5a<br>W/m2 | Specific data<br>or Table 5b | Specific data<br>or Table 5c | Access<br>factor<br>Table 5d | Gains<br>W |          |          |          |          |          |          |      |
| Northeast   | 11.8100    | 11.2829                        | 0.4000                       | 0.7000                       | 0.7700                       | 25.8561    | (75)     |          |          |          |          |          |      |
| Southeast   | 10.0700    | 36.7938                        | 0.4000                       | 0.7000                       | 0.7700                       | 71.8945    | (77)     |          |          |          |          |          |      |
| Solar gains | 97.7505    | 175.0939                       | 262.3833                     | 363.3424                     | 441.8745                     | 454.0308   | 431.3455 | 370.4100 | 296.9758 | 199.6668 | 118.6468 | 82.6421  | (83) |
| Total gains | 556.5047   | 631.7882                       | 705.5544                     | 784.6637                     | 840.9820                     | 823.2257   | 786.6089 | 731.6264 | 669.3974 | 602.6441 | 546.9914 | 530.0402 | (84) |

#### 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |         |         |         |         |         |      |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| Temperature during heating periods in the living area from Table 5, Th1 (C) |         |         |         |         |         |         |         |         |         |         |         |         | 21.0000 | (85) |
| Utilisation factor for gains for living area, nil/m (see Table 5a)          |         |         |         |         |         |         |         |         |         |         |         |         |         |      |
| Jan                                                                         | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |         |         |      |
| tau                                                                         | 43.7067 | 43.8333 | 43.9606 | 44.6084 | 44.7403 | 45.4114 | 45.4114 | 45.5481 | 45.1406 | 44.7403 | 44.4773 | 44.2174 |         |      |
| alpha                                                                       | 3.9138  | 3.9222  | 3.9307  | 3.9739  | 3.9827  | 4.0274  | 4.0274  | 4.0365  | 4.0094  | 3.9827  | 3.9652  | 3.9478  |         |      |
| util living area                                                            | 0.9820  | 0.9695  | 0.9417  | 0.8730  | 0.7461  | 0.5750  | 0.4302  | 0.4776  | 0.7111  | 0.9037  | 0.9688  | 0.9849  | (86)    |      |
| MIT                                                                         | 19.6178 | 19.8180 | 20.1316 | 20.5191 | 20.8058 | 20.9499 | 20.9877 | 20.9816 | 20.8819 | 20.5153 | 20.0053 | 19.5850 | (87)    |      |
| Th 2                                                                        | 20.0758 | 20.0783 | 20.0807 | 20.0929 | 20.0953 | 20.1075 | 20.1075 | 20.1099 | 20.1026 | 20.0953 | 20.0904 | 20.0856 | (88)    |      |
| util rest of house                                                          | 0.9783  | 0.9634  | 0.9299  | 0.8478  | 0.6995  | 0.5060  | 0.3469  | 0.3913  | 0.6454  | 0.8789  | 0.9615  | 0.9818  | (89)    |      |
| MIT 2                                                                       | 18.8179 | 19.0168 | 19.3247 | 19.7018 | 19.9573 | 20.0801 | 20.1030 | 20.1026 | 20.0304 | 19.7080 | 19.2130 | 18.7930 | (90)    |      |
| Living area fraction                                                        | 19.2310 | 19.4306 | 19.7414 | 20.1239 | 20.3955 | 20.5293 | 20.5599 | 20.5566 | 20.4702 | 20.1249 | 19.6222 | 19.2020 | (92)    |      |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         |         |         |      |
| adjusted MIT                                                                | 19.2310 | 19.4306 | 19.7414 | 20.1239 | 20.3955 | 20.5293 | 20.5599 | 20.5566 | 20.4702 | 20.1249 | 19.6222 | 19.2020 | (93)    |      |

#### 8. Space heating requirement

|                  |           |           |           |          |          |          |          |          |          |          |           |           |       |  |
|------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|-----------|-----------|-------|--|
| Utilisation      | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov       | Dec       |       |  |
| 0.9742           | 0.9582    | 0.9248    | 0.8487    | 0.7158   | 0.5394   | 0.3896   | 0.4353   | 0.6737   | 0.8798   | 0.9570   | 0.9780    | 0.9780    | (94)  |  |
| Useful gains     | 542.1239  | 605.3999  | 652.4982  | 665.9785 | 601.9499 | 444.0806 | 306.5011 | 318.5005 | 450.9759 | 530.2105 | 523.4447  | 518.3982  | (95)  |  |
| Ext temp.        | 4.3000    | 4.9000    | 6.5000    | 8.9000   | 11.7000  | 16.6000  | 16.4000  | 14.1000  | 10.6000  | 7.1000   | 4.2000    | 4.2000    | (96)  |  |
| Heat loss rate W | 1218.9724 | 1182.5744 | 1074.3517 | 897.4515 | 693.2216 | 465.7075 | 311.0245 | 325.9904 | 503.3570 | 759.4424 | 1004.1915 | 1210.1291 | (97)  |  |
| Month fracti     | 1.0000    | 1.0000    | 1.0000    | 1.0000   | 1.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 1.0000   | 1.0000    | 1.0000    | (97a) |  |

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

|                      |          |          |          |          |         |        |        |        |        |          |          |           |      |
|----------------------|----------|----------|----------|----------|---------|--------|--------|--------|--------|----------|----------|-----------|------|
| Space heating kWh    | 503.2032 | 387.7268 | 313.8590 | 166.6461 | 67.9062 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 170.4741 | 346.1375 | 514.6478  | (98) |
| Space heating        |          |          |          |          |         |        |        |        |        |          |          | 2470.6008 | (98) |
| Space heating per m2 |          |          |          |          |         |        |        |        |        |          |          | 30.5465   | (99) |

#### 8c. Space cooling requirement

Not applicable

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

|                                                                            |          |          |          |          |          |          |          |          |          |          |          |           |        |
|----------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|--------|
| Fraction of space heat from secondary/supplementary system (Table 11)      |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (201)  |
| Fraction of space heat from main system(s)                                 |          |          |          |          |          |          |          |          |          |          |          | 1.0000    | (202)  |
| Efficiency of main space heating system 1 (in %)                           |          |          |          |          |          |          |          |          |          |          |          | 92.5000   | (206)  |
| Efficiency of secondary/supplementary heating system, %                    |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (208)  |
| Space heating requirement                                                  |          |          |          |          |          |          |          |          |          |          |          | 2670.9197 | (211)  |
| Jan                                                                        | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |           |        |
| Space heating requirement                                                  | 503.2032 | 387.7268 | 313.8590 | 166.6461 | 67.9062  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 170.4741 | 346.1375 | 514.6478  | (98)   |
| Space heating efficiency (main heating system 1)                           | 92.5000  | 92.5000  | 92.5000  | 92.5000  | 92.5000  | 92.5000  | 92.5000  | 92.5000  | 92.5000  | 92.5000  | 92.5000  | 92.5000   | (210)  |
| Space heating fuel (main heating system)                                   | 544.0035 | 419.1642 | 339.3070 | 180.1580 | 73.4121  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 184.2963 | 374.2027 | 556.3760  | (211)  |
| Water heating requirement                                                  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (215)  |
| Water heating                                                              |          |          |          |          |          |          |          |          |          |          |          |           |        |
| Water heating requirement                                                  | 232.4827 | 205.6386 | 217.6801 | 197.5133 | 195.2785 | 169.3187 | 164.4085 | 177.9312 | 176.8412 | 204.6935 | 213.4531 | 227.6915  | (64)   |
| Efficiency of water heater (217)m                                          | 92.5000  | 92.5000  | 92.5000  | 92.5000  | 92.5000  | 92.5000  | 92.5000  | 92.5000  | 92.5000  | 92.5000  | 92.5000  | 92.5000   | (216)  |
| Fuel for water heating, kWh/month                                          | 251.3327 | 222.3120 | 235.3298 | 213.5279 | 211.1119 | 183.0472 | 177.7389 | 192.3583 | 191.1796 | 221.2902 | 230.7601 | 246.1529  | (219)  |
| Water heating fuel used                                                    |          |          |          |          |          |          |          |          |          |          |          | 2576.1414 | (219)  |
| Annual totals kWh/year                                                     |          |          |          |          |          |          |          |          |          |          |          |           |        |
| Space heating fuel - main system                                           |          |          |          |          |          |          |          |          |          |          |          | 2670.9197 | (211)  |
| Space heating fuel - secondary                                             |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (215)  |
| Electricity for pumps and fans:                                            |          |          |          |          |          |          |          |          |          |          |          |           |        |
| (BalancedWithHeatRecovery, Database: In-use factor = 1.2500, SFP = 0.6875) |          |          |          |          |          |          |          |          |          |          |          |           |        |
| mechanical ventilation fans (SFP = 0.6875)                                 |          |          |          |          |          |          |          |          |          |          |          | 187.9115  | (230a) |
| central heating pump                                                       |          |          |          |          |          |          |          |          |          |          |          | 30.0000   | (230c) |
| main heating blue fan                                                      |          |          |          |          |          |          |          |          |          |          |          | 45.0000   | (230e) |
| Total electricity for the above, kWh/year                                  |          |          |          |          |          |          |          |          |          |          |          | 262.9115  | (231)  |
| Electricity for lighting (calculated in Appendix E)                        |          |          |          |          |          |          |          |          |          |          |          | 348.3739  | (232)  |
| Total delivered energy for all uses                                        |          |          |          |          |          |          |          |          |          |          |          | 5858.3466 | (238)  |

 **Design SAP**  
elmhurst energy

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

### 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 %)                      |          |          |          |          |          |          |          |          |          |          |          | 93.5000   | (206)  |
| Efficiency of secondary/supplementary heating system, %               |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (208)  |
| Space heating requirement                                             |          |          |          |          |          |          |          |          |          |          |          | 3872.4688 | (211)  |
|                                                                       | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec       |        |
| Space heating requirement                                             | 724.9645 | 563.1168 | 461.4412 | 248.7608 | 97.9077  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 267.1508 | 515.4562 | 741.9603  | (98)   |
| Space heating efficiency (main heating system 1)                      | 93.5000  | 93.5000  | 93.5000  | 93.5000  | 93.5000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 93.5000  | 93.5000  | 93.5000   | (210)  |
| Space heating fuel (main heating system)                              | 775.3631 | 602.2639 | 493.5200 | 266.0543 | 104.7142 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 285.7228 | 551.2901 | 793.5405  | (211)  |
| Water heating requirement                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (215)  |
| Water heating                                                         |          |          |          |          |          |          |          |          |          |          |          |           |        |
| Water heating requirement                                             | 198.4406 | 174.8910 | 183.6380 | 164.5694 | 161.2364 | 144.0188 | 138.2652 | 151.7879 | 151.5412 | 170.6514 | 180.5092 | 193.6494  | (64)   |
| Efficiency of water heater                                            | 87.9653  | 87.7129  | 87.1726  | 85.9134  | 83.5313  | 79.8000  | 79.8000  | 79.8000  | 79.8000  | 86.0049  | 87.4585  | 88.0562   | (216)  |
| Fuel for water heating, kWh/month                                     | 225.5897 | 199.3902 | 210.6604 | 191.5527 | 193.0252 | 180.4746 | 173.2647 | 190.2105 | 189.9013 | 198.4205 | 206.3942 | 219.9156  | (219)  |
| Water heating fuel used                                               |          |          |          |          |          |          |          |          |          |          |          | 2378.7996 | (219)  |
| Annual totals kWh/year                                                |          |          |          |          |          |          |          |          |          |          |          |           |        |
| Space heating fuel - main system                                      |          |          |          |          |          |          |          |          |          |          |          | 3872.4688 | (211)  |
| Space heating fuel - secondary                                        |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (215)  |
| Electricity for pumps and fans:                                       |          |          |          |          |          |          |          |          |          |          |          |           |        |
| central heating pump                                                  |          |          |          |          |          |          |          |          |          |          |          | 30.0000   | (230c) |
| main heating flue fan                                                 |          |          |          |          |          |          |          |          |          |          |          | 45.0000   | (230e) |
| Total electricity for the above, kWh/year                             |          |          |          |          |          |          |          |          |          |          |          | 75.0000   | (231)  |
| Electricity for lighting (calculated in Appendix B)                   |          |          |          |          |          |          |          |          |          |          |          | 348.3505  | (232)  |
| Total delivered energy for all uses                                   |          |          |          |          |          |          |          |          |          |          |          | 6674.6189 | (238)  |

### 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                                                                     | 0.2160                     | 836.4533 (261)        |
| Space heating - secondary                                                                         | 0.0000                     | 0.0000 (263)          |
| Water heating (other fuel)                                                                        | 0.2160                     | 513.8207 (264)        |
| Space and water heating                                                                           |                            | 1350.2740 (265)       |
| Pumps and fans                                                                                    | 0.5190                     | 38.9250 (267)         |
| Energy for lighting                                                                               | 0.5190                     | 180.7939 (268)        |
| Total CO2, kg/m2/year                                                                             |                            | 1569.9929 (272)       |
| Emissions per m2 for space and water heating                                                      |                            | 16.6948 (272a)        |
| Fuel factor (mains gas)                                                                           |                            | 1.0000                |
| Emissions per m2 for lighting                                                                     |                            | 2.2353 (272b)         |
| Emissions per m2 for pumps and fans                                                               |                            | 0.4813 (272c)         |
| Target Carbon Dioxide Emission Rate (TER) = (16.6948 * 1.00) + 2.2353 + 0.4813, rounded to 2 d.p. |                            | 19.4100 (273)         |

# BASIC COMPLIANCE REPORT

## Calculation Type: New Build (As Designed)

|                      |         |                |            |
|----------------------|---------|----------------|------------|
| Property Reference   | 116862  | Issued on Date | 17/12/2021 |
| Assessment Reference | Plot 47 | Prop Type Ref  | Top Floor  |
| Property             |         |                |            |

|                                 |      |             |       |      |       |
|---------------------------------|------|-------------|-------|------|-------|
| SAP Rating                      | 83 B | DER         | 17.94 | TER  | 19.41 |
| Environmental                   | 86 B | % DER<TER   | 7.58  |      |       |
| CO2 Emissions (t/year)          | 1.23 | DFEE        | 52.00 | TFEE | 59.79 |
| General Requirements Compliance | Fail | % DFEE<TFEE | 13.04 |      |       |

|                  |                                                                                    |             |           |
|------------------|------------------------------------------------------------------------------------|-------------|-----------|
| Assessor Details | Mr. Richard Denteh, Meinhardt UK, Tel: 02078317969, richard.denteh@meinhardt.co.uk | Assessor ID | T596-0001 |
|------------------|------------------------------------------------------------------------------------|-------------|-----------|

|        |  |
|--------|--|
| Client |  |
|--------|--|

### SUMMARY FOR INPUT DATA FOR New Build (As Designed)

#### Criterion 1 - Achieving the TER and TFEE rate

##### 1a TER and DER

|                                             |                  |                                   |      |
|---------------------------------------------|------------------|-----------------------------------|------|
| Fuel for main heating                       | Mains gas        |                                   |      |
| Fuel factor                                 | 1.00 (mains gas) |                                   |      |
| Target Carbon Dioxide Emission Rate (TER)   | 19.41            | kgCO <sub>2</sub> /m <sup>2</sup> |      |
| Dwelling Carbon Dioxide Emission Rate (DER) | 17.94            | kgCO <sub>2</sub> /m <sup>2</sup> | Pass |
|                                             | -1.47 (-7.6%)    | kgCO <sub>2</sub> /m <sup>2</sup> |      |

##### 1b TFEE and DFEE

|                                          |               |           |      |
|------------------------------------------|---------------|-----------|------|
| Target Fabric Energy Efficiency (TFEE)   | 59.79         | kWh/m²/yr |      |
| Dwelling Fabric Energy Efficiency (DFEE) | 52.00         | kWh/m²/yr |      |
|                                          | -7.8 (-13.0%) | kWh/m²/yr | Pass |

#### Criterion 2 - Limits on design flexibility

##### Limiting Fabric Standards

##### 2 Fabric U-values

| Element                   | Average          | Highest          |      |
|---------------------------|------------------|------------------|------|
| External wall             | 0.16 (max. 0.30) | 0.26 (max. 0.70) | Pass |
| Party wall                | 0.00 (max. 0.20) | -                | Pass |
| Roof                      | 0.11 (max. 0.20) | 0.11 (max. 0.35) | Pass |
| Openings and curtain wall | 1.22 (max. 2.00) | 1.40 (max. 3.30) | Pass |

##### 2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

##### 3 Air permeability

|                                |                     |      |
|--------------------------------|---------------------|------|
| Air permeability at 50 pascals | 3.00 (design value) |      |
| Maximum                        | 10.0                | Pass |

##### Limiting System Efficiencies

##### 4 Heating efficiency

## BASIC COMPLIANCE REPORT

### Calculation Type: New Build (As Designed)

|                          |                                                                                                                     |      |
|--------------------------|---------------------------------------------------------------------------------------------------------------------|------|
| Main heating system      | Boiler system with radiators or underfloor - Mains gas<br>Data from manufacturer<br>Efficiency: 93%<br>Minimum: 88% | Pass |
| Secondary heating system | None                                                                                                                |      |

#### 5 Cylinder insulation

|                            |                                                                |      |
|----------------------------|----------------------------------------------------------------|------|
| Hot water storage          | Nominal cylinder loss: 2.66 kWh/day<br>Permitted by DBSCG 1.89 | Fail |
| Primary pipework insulated | Yes                                                            | Pass |

#### 6 Controls

|                        |                                      |      |
|------------------------|--------------------------------------|------|
| Space heating controls | Programmer, room thermostat and TRVs | Pass |
| Hot water controls     | Cylinderstat                         | Pass |
|                        | Not independent timer for DHW        | Fail |
| Boiler interlock       | Yes                                  | Pass |

#### 7 Low energy lights

|                                                     |     |   |      |
|-----------------------------------------------------|-----|---|------|
| Percentage of fixed lights with low-energy fittings | 100 | % |      |
| Minimum                                             | 75  | % | Pass |

#### 8 Mechanical ventilation

|                                      |      |   |      |
|--------------------------------------|------|---|------|
| Continuous supply and extract system |      |   |      |
| Specific fan power                   | 0.55 |   |      |
| Maximum                              | 1.5  |   | Pass |
| MVHR efficiency                      | 92   | % |      |
| Minimum                              | 70   | % | Pass |

### Criterion 3 – Limiting the effects of heat gains in summer

#### 9 Summertime temperature

|                                  |                                    |      |
|----------------------------------|------------------------------------|------|
| Overheating risk (Thames Valley) | Slight                             | Pass |
| Based on:                        |                                    |      |
| Overshading                      | Average                            |      |
| Windows facing North East        | 11.81 m <sup>2</sup> , No overhang |      |
| Windows facing South East        | 10.07 m <sup>2</sup> , No overhang |      |
| Air change rate                  | 6.00 ach                           |      |
| Blinds/curtains                  | None                               |      |

### Criterion 4 – Building performance consistent with DER and DFEE rate

#### Party Walls

| Type                            | U-value |                    |      |
|---------------------------------|---------|--------------------|------|
| Solid Wall                      | 0.00    | W/m <sup>2</sup> K | Pass |
| Filled Cavity with Edge Sealing | 0.00    | W/m <sup>2</sup> K | Pass |
| Solid Wall                      | 0.00    | W/m <sup>2</sup> K | Pass |

#### Air permeability and pressure testing

##### 3 Air permeability

|                                |                     |      |
|--------------------------------|---------------------|------|
| Air permeability at 50 pascals | 3.00 (design value) |      |
| Maximum                        | 10.0                | Pass |

## BASIC COMPLIANCE REPORT

### Calculation Type: New Build (As Designed)

#### 10 Key features

|                       |      |                                  |
|-----------------------|------|----------------------------------|
| External wall U-value | 0.14 | W/m <sup>2</sup> K               |
| Party wall U-value    | 0.00 | W/m <sup>2</sup> K               |
| Party wall U-value    | 0.00 | W/m <sup>2</sup> K               |
| Party wall U-value    | 0.00 | W/m <sup>2</sup> K               |
| Roof U-value          | 0.11 | W/m <sup>2</sup> K               |
| Air permeability      | 3.0  | m <sup>3</sup> /m <sup>2</sup> h |

*This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.*

## Appendix A.2 – SAP Calculations (Be Green)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



|                      |        |                |            |
|----------------------|--------|----------------|------------|
| Property Reference   | 116542 | Issued on Date | 17/12/2021 |
| Assessment Reference | Plot 5 | Prop Type Ref  | FF         |
| Property             |        |                |            |

|                                    |      |             |       |      |       |
|------------------------------------|------|-------------|-------|------|-------|
| SAP Rating                         | 84 B | DER         | 4.23  | TER  | 23.00 |
| Environmental                      | 97 A | % DER<TER   | 81.61 |      |       |
| CO <sub>2</sub> Emissions (t/year) | 0.20 | DFEE        | 52.18 | TFEE | 69.12 |
| General Requirements Compliance    | Pass | % DFEE<TFEE | 24.51 |      |       |

|                  |                                                                                    |             |           |
|------------------|------------------------------------------------------------------------------------|-------------|-----------|
| Assessor Details | Mr. Richard Denteh, Meinhardt UK, Tel: 02078317969, richard.denteh@meinhardt.co.uk | Assessor ID | T596-0001 |
|------------------|------------------------------------------------------------------------------------|-------------|-----------|

|        |  |
|--------|--|
| Client |  |
|--------|--|

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

#### DWELLING AS DESIGNED

Ground-floor flat, total floor area 58 m<sup>2</sup>

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

#### 1a TER and DER

Fuel for main heating: Waste Heat  
Fuel factor: 1.00 (waste heat)  
Target Carbon Dioxide Emission Rate (TER) 23.00 kgCO<sub>2</sub>/m<sup>2</sup>  
Dwelling Carbon Dioxide Emission Rate (DER) 4.23 kgCO<sub>2</sub>/m<sup>2</sup>OK

#### 1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 69.1 kWh/m<sup>2</sup>/yr  
Dwelling Fabric Energy Efficiency (DFEE) 52.2 kWh/m<sup>2</sup>/yrOK

#### 2 Fabric U-values

| Element                   | Average          | Highest          |    |
|---------------------------|------------------|------------------|----|
| External wall             | 0.17 (max. 0.30) | 0.26 (max. 0.70) | OK |
| Party wall                | 0.00 (max. 0.20) | -                | OK |
| Floor                     | 0.09 (max. 0.25) | 0.09 (max. 0.70) | OK |
| Roof                      | (no roof)        |                  |    |
| Openings and curtain wall | 1.23 (max. 2.00) | 1.40 (max. 3.30) | OK |

#### 2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

#### 3 Air permeability

|                                 |                     |    |
|---------------------------------|---------------------|----|
| Air permeability at 50 pascals: | 3.00 (design value) |    |
| Maximum                         | 10.0                | OK |

#### 4 Heating efficiency

|                           |                          |   |
|---------------------------|--------------------------|---|
| Main heating system:      | Community heating scheme | - |
| Secondary heating system: | None                     |   |

#### 5 Cylinder insulation

|                             |                                      |    |
|-----------------------------|--------------------------------------|----|
| Hot water storage           | Measured cylinder loss: 1.18 kWh/day |    |
| Permitted by DBSCG 1.85     | OK                                   |    |
| Primary pipework insulated: | Yes (assumed)                        | OK |

#### 6 Controls

Space heating controls: Charging system linked to use of community heating, programmer and TRVsOK

#### Hot water controls:

Cylinderstat OK

#### 7 Low energy lights

|                                                          |     |    |
|----------------------------------------------------------|-----|----|
| Percentage of fixed lights with low-energy fittings:100% |     |    |
| Minimum                                                  | 75% | OK |

#### 8 Mechanical ventilation

|                                      |      |    |
|--------------------------------------|------|----|
| 8 Mechanical ventilation             |      |    |
| Continuous supply and extract system |      |    |
| Specific fan power:                  | 0.25 |    |
| Maximum:                             | 1.5  | OK |
| MVHR efficiency:                     | 91%  |    |
| Minimum:                             | 70%  | OK |

#### 9 Summertime temperature

|                                   |                                    |    |
|-----------------------------------|------------------------------------|----|
| Overheating risk (Thames Valley): | Slight                             | OK |
| Based on:                         |                                    |    |
| Overshading:                      | Average                            |    |
| Windows facing North West:        | 11.40 m <sup>2</sup> , No overhang |    |
| Air change rate:                  | 6.00 ach                           |    |
| Blinds/curtains:                  | None                               |    |

#### 10 Key features

|                               |                                      |
|-------------------------------|--------------------------------------|
| External wall U-value         | 0.14 W/m <sup>2</sup> K              |
| Party wall U-value            | 0.00 W/m <sup>2</sup> K              |
| Party wall U-value            | 0.00 W/m <sup>2</sup> K              |
| Party wall U-value            | 0.00 W/m <sup>2</sup> K              |
| Exposed floor U-value         | 0.09 W/m <sup>2</sup> K              |
| Air permeability              | 3.0 m <sup>3</sup> /m <sup>2</sup> h |
| Community heating, Waste Heat |                                      |
| Photovoltaic array            | 368.33 kWh/Year                      |



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

9b. Energy requirements

|                                                                                         |                  |
|-----------------------------------------------------------------------------------------|------------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                   | 0.0000 (301)     |
| Fraction of space heat from community system                                            | 1.0000 (302)     |
| Fraction of heat from community Waste Heat                                              | 1.0000 (303a)    |
| Fraction of total space heat from community Waste Heat                                  | 1.0000 (304a)    |
| Factor for control and charging method (Table 4c(3)) for community space heating        | 1.0000 (305)     |
| Factor for control and charging method (Table 4c(3)) for community water heating        | 1.0000 (305a)    |
| Distribution loss factor (Table 12c) for community heating system                       | 1.0000 (306)     |
| Space heating:                                                                          |                  |
| Annual space heating requirement                                                        | 2035.7037 (98)   |
| Space heat from Waste Heat = (98) x 1.00 x 1.00 x 1.10                                  | 2239.2740 (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 9a or Appendix B) | 0.0000 (308)     |
| Space heating fuel for secondary/supplementary system                                   | 0.0000 (309)     |
| Water heating                                                                           |                  |
| Annual water heating requirement                                                        | 1784.1966 (64)   |
| Water heat from Waste Heat = (64) x 1.00 x 1.00 x 1.10                                  | 1962.6163 (310a) |
| Electricity used for heat distribution                                                  | 42.0189 (313)    |
| Annual totals kWh/year                                                                  |                  |
| Electricity for pumps and fans:                                                         |                  |
| (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.3125)              |                  |
| mechanical ventilation fans (SFP = 0.3125)                                              | 60.7236 (330a)   |
| Total electricity for the above, kWh/year                                               | 60.7236 (331)    |
| Electricity for lighting (calculated in Appendix L)                                     | 264.3961 (332)   |
| Energy saving/generation technologies (Appendices M, N and Q)                           |                  |
| Total delivered energy for all uses                                                     | 4527.0101 (338)  |

12b. Carbon dioxide emissions - Community heating scheme

| Energy kWh/year                                                                         | Emission factor kg CO2/kWh | Emissions kg CO2/year |
|-----------------------------------------------------------------------------------------|----------------------------|-----------------------|
| Efficiency of heat source Waste Heat                                                    |                            | 100.0000 (367a)       |
| Space heating from Waste Heat                                                           | 0.0580                     | 243.7096 (367)        |
| Electrical energy for heat distribution                                                 | 0.5190                     | 21.8078 (372)         |
| Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE) |                            | 265.5174 (373)        |
| Space and water heating                                                                 |                            | 265.5174 (376)        |
| Pumps and fans                                                                          | 0.5190                     | 31.5155 (378)         |
| Energy for lighting                                                                     | 0.5190                     | 137.2216 (379)        |

|                                             |           |                 |
|---------------------------------------------|-----------|-----------------|
| Energy saving/generation technologies       |           |                 |
| PV Unit                                     | -368.3300 | 0.5190          |
| Total CO2, kg/year                          |           | -191.1633 (380) |
| Dwelling Carbon Dioxide Emission Rate (DER) |           | 243.0913 (383)  |
|                                             |           | 4.2300 (384)    |

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

|                                                                                 |     |             |
|---------------------------------------------------------------------------------|-----|-------------|
| DER                                                                             |     | 4.2300 ZC1  |
| Total Floor Area                                                                | TFA | 57.5000     |
| Assumed number of occupants                                                     | N   | 1.9101      |
| CO2 emission factor in Table 12 for electricity displaced from grid             | EF  | 0.5190      |
| CO2 emissions from appliances, equation (L14)                                   |     | 17.1694 ZC2 |
| CO2 emissions from cooking, equation (L16)                                      |     | 2.8668 ZC3  |
| Total CO2 emissions                                                             |     | 24.2663 ZC4 |
| Residual CO2 emissions offset from biofuel CHP                                  |     | 0.0000 ZC5  |
| Additional allowable electricity generation, kWh/m <sup>2</sup> /year           |     | 0.0000 ZC6  |
| Resulting CO2 emissions offset from additional allowable electricity generation |     | 0.0000 ZC7  |
| Net CO2 emissions                                                               |     | 24.2663 ZC8 |

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)  
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

|                                                        | Area (m <sup>2</sup> ) | Storey height (m) | Volume (m <sup>3</sup> )                       |
|--------------------------------------------------------|------------------------|-------------------|------------------------------------------------|
| Ground floor                                           | 57.5000 (1b)           | 2.7700 (2b)       | 158.2750 (1b) - (3b)                           |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 57.5000                |                   | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 158.2750 (5) |
| Dwelling volume                                        |                        |                   |                                                |

2. Ventilation rate

|                                                                        | main heating | secondary heating | other | total                       | m <sup>3</sup> per hour |
|------------------------------------------------------------------------|--------------|-------------------|-------|-----------------------------|-------------------------|
| Number of chimneys                                                     | 0            | 0                 | 0     | 0 * 40 =                    | 0.0000 (6a)             |
| Number of open flues                                                   | 0            | 0                 | 0     | 0 * 20 =                    | 0.0000 (6b)             |
| Number of intermittent fans                                            |              |                   |       | 2 * 10 =                    | 20.0000 (7a)            |
| Number of passive vents                                                |              |                   |       | 0 * 10 =                    | 0.0000 (7b)             |
| Number of flueless gas fires                                           |              |                   |       | 0 * 40 =                    | 0.0000 (7c)             |
| Infiltation due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) |              |                   |       | 20.0000 / (5) =             | 0.1256 (8)              |
| Pressure test                                                          |              |                   |       | Yes                         |                         |
| Measured/design AP50                                                   |              |                   |       | 5.0000                      |                         |
| Infiltration rate                                                      |              |                   |       | 0.3756 (18)                 |                         |
| Number of sides sheltered                                              |              |                   |       | 3 (19)                      |                         |
| Shelter factor                                                         |              |                   |       | (20) = 1 - [0.075 x (19)] = | 0.7750 (20)             |
| Infiltration rate adjusted to include shelter factor                   |              |                   |       | (21) = (18) x (20) =        | 0.2911 (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 | 0.3711 | 0.3638 | 0.3566 | 0.3202 | 0.3129 | 0.2765 | 0.2765 | 0.2692 | 0.2911 | 0.3129 | 0.3274 | 0.3420 (22b) |
| Effective ac    | 0.5689 | 0.5662 | 0.5636 | 0.5513 | 0.5490 | 0.5382 | 0.5382 | 0.5362 | 0.5424 | 0.5490 | 0.5536 | 0.5585 (25)  |

3. Heat losses and heat loss parameter

| Element                                                             | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K         | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K  |                |                |                |                |                     |
|---------------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|----------------------|--------------------------------|----------------|----------------|----------------|----------------|----------------|---------------------|
| TER Opaque door                                                     |                         |                            | 2.1600                    | 1.0000                        | 2.1600               |                                | (26)           |                |                |                |                |                     |
| TER Opening Type Curtain (Uw = 1.50)                                |                         |                            | 11.4000                   | 1.4151                        | 16.1321              |                                | (27)           |                |                |                |                |                     |
| Exposed Floor to commercial                                         |                         |                            | 57.5000                   | 0.1300                        | 7.4750               |                                | (28b)          |                |                |                |                |                     |
| Unipanel column                                                     | 12.2000                 |                            | 12.2000                   | 0.1800                        | 2.1960               |                                | (29a)          |                |                |                |                |                     |
| Unipanel wall                                                       | 45.6300                 | 2.1600                     | 43.4700                   | 0.1800                        | 7.8246               |                                | (29a)          |                |                |                |                |                     |
| Curtain wall                                                        | 11.5200                 | 11.4000                    | 0.1200                    | 0.1800                        | 0.0216               |                                | (29a)          |                |                |                |                |                     |
| Total net area of external elements Aum(A, m <sup>2</sup> )         |                         |                            | 126.8500                  |                               |                      |                                | (31)           |                |                |                |                |                     |
| Fabric heat loss, W/K = Sum (A x U)                                 |                         |                            |                           |                               | (26)...(30) + (32) = | 35.8093                        | (33)           |                |                |                |                |                     |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K      |                         |                            |                           |                               |                      |                                | 250.0000 (35)  |                |                |                |                |                     |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)          |                         |                            |                           |                               |                      |                                | 12.4572 (36)   |                |                |                |                |                     |
| Total fabric heat loss                                              |                         |                            |                           |                               |                      | (33) + (36) =                  | 48.2665 (37)   |                |                |                |                |                     |
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5) |                         |                            |                           |                               |                      |                                |                |                |                |                |                |                     |
| (38)m                                                               | Jan<br>29.8998          | Feb<br>29.7592             | Mar<br>29.6215            | Apr<br>28.9744                | May<br>28.8533       | Jun<br>28.2898                 | Jul<br>28.2898 | Aug<br>28.1854 | Sep<br>28.5068 | Oct<br>28.8533 | Nov<br>29.0982 | Dec<br>29.3543 (38) |
| Heat transfer coeff                                                 | 78.1662                 | 78.0257                    | 77.8879                   | 77.2409                       | 77.1198              | 76.5562                        | 76.5562        | 76.4519        | 76.7733        | 77.1198        | 77.3647        | 77.6208 (39)        |
| Average = Sum(38)m / 12 =                                           |                         |                            |                           |                               |                      |                                |                |                |                |                |                | 77.2403 (39)        |
| HLP                                                                 | Jan<br>1.3594           | Feb<br>1.3570              | Mar<br>1.3546             | Apr<br>1.3433                 | May<br>1.3412        | Jun<br>1.3314                  | Jul<br>1.3314  | Aug<br>1.3296  | Sep<br>1.3352  | Oct<br>1.3412  | Nov<br>1.3455  | Dec<br>1.3499 (40)  |
| HLP (average)                                                       |                         |                            |                           |                               |                      |                                |                |                |                |                |                | 1.3433 (40)         |
| Days in month                                                       | 31                      | 28                         | 31                        | 30                            | 31                   | 30                             | 31             | 31             | 30             | 31             | 30             | 31 (41)             |

4. Water heating energy requirements (kWh/year)

|                                                             |          |          |          |          |         |         |         |         |         |                    |          |               |                |
|-------------------------------------------------------------|----------|----------|----------|----------|---------|---------|---------|---------|---------|--------------------|----------|---------------|----------------|
| Assumed occupancy                                           |          |          |          |          |         |         |         |         |         |                    |          |               | 1.9101 (42)    |
| Average daily hot water use (litres/day)                    |          |          |          |          |         |         |         |         |         |                    |          |               | 79.5658 (43)   |
|                                                             | Jan      | Feb      | Mar      | Apr      | May     | Jun     | Jul     | Aug     | Sep     | Oct                | Nov      | Dec           |                |
| Daily hot water use                                         | 87.5224  | 84.3398  | 81.1572  | 77.9745  | 74.7919 | 71.6093 | 71.6093 | 74.7919 | 77.9745 | 81.1572            | 84.3398  | 87.5224 (44)  |                |
| Energy content                                              | 129.7932 | 113.5180 | 117.1404 | 102.1258 | 97.9922 | 84.5598 | 78.3571 | 89.9159 | 90.9898 | 106.0398           | 115.7508 | 125.6978 (45) |                |
| Energy content (annual)                                     |          |          |          |          |         |         |         |         |         |                    |          |               | 1251.8806 (45) |
| Distribution loss (46)m = 0.15 x (45)m                      |          |          |          |          |         |         |         |         |         | Total = Sum(45)m = |          |               |                |
|                                                             | 19.4690  | 17.0277  | 17.5711  | 15.3189  | 14.6988 | 12.6840 | 11.7536 | 13.4874 | 13.6885 | 15.9060            | 17.3626  | 18.8547 (46)  |                |
| Water storage loss:                                         |          |          |          |          |         |         |         |         |         |                    |          |               |                |
| Store volume                                                |          |          |          |          |         |         |         |         |         |                    |          |               | 145.0000 (47)  |
| a) If manufacturer declared loss factor is known (kWh/day): |          |          |          |          |         |         |         |         |         |                    |          |               | 1.5665 (48)    |
| Temperature factor from Table 2b                            |          |          |          |          |         |         |         |         |         |                    |          |               | 0.5400 (49)    |

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

|                                                                 |             |          |          |          |          |          |          |          |          |          |          |               |
|-----------------------------------------------------------------|-------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Enter (49) or (54) in (55)                                      | 0.7379 (55) |          |          |          |          |          |          |          |          |          |          |               |
| Total storage loss                                              | 22.8747     | 20.6610  | 22.8747  | 22.1368  | 22.8747  | 22.1368  | 22.8747  | 22.8747  | 22.1368  | 22.8747  | 22.1368  | 22.8747 (56)  |
| If cylinder contains dedicated solar storage                    | 22.8747     | 20.6610  | 22.8747  | 22.1368  | 22.8747  | 22.1368  | 22.8747  | 22.8747  | 22.1368  | 22.8747  | 22.1368  | 22.8747 (57)  |
| Primary loss                                                    | 23.2624     | 21.0112  | 23.2624  | 22.5120  | 23.2624  | 22.5120  | 23.2624  | 23.2624  | 22.5120  | 23.2624  | 23.2624  | (59)          |
| Total heat required for water heating calculated for each month | 175.9303    | 155.1902 | 163.2775 | 146.7746 | 144.1293 | 129.2086 | 124.4942 | 136.0530 | 135.6386 | 152.1769 | 160.3995 | 171.8349 (62) |
| Solar input                                                     | 0.0000      | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (63)          |
| Outout from w/h                                                 | 175.9303    | 155.1902 | 163.2775 | 146.7746 | 144.1293 | 129.2086 | 124.4942 | 136.0530 | 135.6386 | 152.1769 | 160.3995 | 171.8349 (64) |
| Heat gains from water heating, kWh/month                        | 80.0659     | 71.0825  | 75.8588  | 69.8759  | 69.4921  | 63.8352  | 62.9634  | 66.8067  | 65.9731  | 72.1679  | 74.2062  | 78.7042 (85)  |

### 3. 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                                                                               | 95.5071  | 95.5071  | 95.5071  | 95.5071  | 95.5071  | 95.5071  | 95.5071  | 95.5071  | 95.5071  | 95.5071  | 95.5071  | 95.5071 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 14.9712  | 13.2973  | 10.8141  | 8.1870   | 6.1198   | 5.1666   | 5.5827   | 7.2566   | 9.7398   | 12.3670  | 14.4341  | 15.3873 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 166.6008 | 168.3296 | 163.9731 | 154.6986 | 142.9912 | 131.9880 | 124.6371 | 122.9083 | 127.2648 | 136.5393 | 148.2467 | 159.2500 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 32.5507  | 32.5507  | 32.5507  | 32.5507  | 32.5507  | 32.5507  | 32.5507  | 32.5507  | 32.5507  | 32.5507  | 32.5507  | 32.5507 (69)  |
| Pumps, fans                                                                         | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000 (70)   |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -76.4056 | -76.4056 | -76.4056 | -76.4056 | -76.4056 | -76.4056 | -76.4056 | -76.4056 | -76.4056 | -76.4056 | -76.4056 | -76.4056 (71) |
| Water heating gains (Table 5)                                                       | 107.6155 | 105.7775 | 101.9608 | 96.7720  | 93.4033  | 88.6599  | 84.6282  | 89.7939  | 91.6293  | 96.9999  | 103.0641 | 105.7852 (72) |
| Total internal gains                                                                | 343.8396 | 342.0565 | 331.4001 | 314.3097 | 297.1665 | 280.4666 | 269.5001 | 274.6110 | 283.2861 | 300.5582 | 320.3970 | 335.0746 (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 |               |
|-------------|----------|----------|----------|------------|--------------------------------|-----------------------------------|------------------------------------|----------|----------|------------------------------|------------|---------------|
| Northwest   |          |          |          | 11.4000    | 11.2829                        | 0.6300                            | 0.7000                             | 0.7700   |          | 39.3096 (81)                 |            |               |
| Solar gains | 39.3096  | 80.0159  | 144.1632 | 236.7574   | 318.2484                       | 339.2865                          | 317.3955                           | 253.0314 | 175.6651 | 97.7858                      | 49.4617    | 32.1022 (83)  |
| Total gains | 383.1492 | 422.0724 | 475.5633 | 551.0671   | 615.4149                       | 619.7531                          | 586.8957                           | 527.6424 | 458.9512 | 398.3440                     | 369.8587   | 367.1768 (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                                                                         | 51.0841      | 51.1762 | 51.2667 | 51.6962 | 51.7773 | 52.1585 | 52.1585 | 52.2297 | 52.0110 | 51.7773 | 51.6134 | 51.4431      |
| alpha                                                                       | 4.4056       | 4.4117  | 4.4178  | 4.4464  | 4.4518  | 4.4772  | 4.4772  | 4.4820  | 4.4674  | 4.4518  | 4.4409  | 4.4295       |
| util living area                                                            | 0.9968       | 0.9946  | 0.9872  | 0.9585  | 0.8731  | 0.7107  | 0.5526  | 0.6261  | 0.8705  | 0.9772  | 0.9942  | 0.9974 (86)  |
| MIT                                                                         | 19.5471      | 19.6835 | 19.9609 | 20.3588 | 20.7161 | 20.9217 | 20.9802 | 20.9662 | 20.7942 | 20.3485 | 19.8839 | 19.5221 (87) |
| Th 2                                                                        | 19.7946      | 19.7965 | 19.7983 | 19.8071 | 19.8087 | 19.8163 | 19.8163 | 19.8177 | 19.8134 | 19.8087 | 19.8054 | 19.8019 (88) |
| util rest of house                                                          | 0.9957       | 0.9927  | 0.9824  | 0.9418  | 0.8230  | 0.6092  | 0.4145  | 0.4843  | 0.7981  | 0.9650  | 0.9918  | 0.9965 (89)  |
| MIT 2                                                                       | 17.8828      | 18.0829 | 18.4870 | 19.0596 | 19.5340 | 19.7658 | 19.8095 | 19.8043 | 19.6460 | 19.0556 | 18.3822 | 17.8512 (90) |
| Living area fraction                                                        | 18.8348      | 18.9984 | 19.3301 | 19.8027 | 20.2102 | 20.4270 | 20.4791 | 20.4690 | 20.3028 | 19.7951 | 19.2412 | 18.8069 (92) |
| Temperature adjustment                                                      | 18.8348      | 18.9984 | 19.3301 | 19.8027 | 20.2102 | 20.4270 | 20.4791 | 20.4690 | 20.3028 | 19.7951 | 19.2412 | 18.8069 (93) |

### 8. Space heating requirement

|                      |           |           |          |          |          |          |          |          |          |              |          |                |
|----------------------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|--------------|----------|----------------|
| Utilisation          | Jan       | Feb       | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct          | Nov      | Dec            |
| Useful gains         | 0.9945    | 0.9909    | 0.9799   | 0.9418   | 0.8418   | 0.6644   | 0.4939   | 0.5656   | 0.8318   | 0.9649       | 0.9903   | 0.9954 (94)    |
| Ext temp.            | 381.0297  | 418.2508  | 466.0182 | 518.9821 | 518.0737 | 411.7366 | 283.8513 | 298.4225 | 381.7779 | 384.3450     | 366.2621 | 365.4906 (95)  |
| Heat loss rate W     | 4.3000    | 4.9000    | 6.5000   | 8.3000   | 11.7000  | 14.6000  | 18.6000  | 16.4000  | 14.1000  | 10.6000      | 7.1000   | 4.2000 (96)    |
| Month fracti         | 1136.1295 | 1100.0382 | 999.3064 | 842.1356 | 656.3013 | 446.0929 | 296.9698 | 311.0789 | 476.2079 | 709.1267     | 939.2990 | 1133.7999 (97) |
| Space heating kWh    | 1.0000    | 1.0000    | 1.0000   | 1.0000   | 1.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 1.0000       | 1.0000   | 1.0000 (97a)   |
| Space heating        | 561.7942  | 458.1612  | 396.7664 | 232.6705 | 102.8414 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 241.6376     | 412.5865 | 571.6221 (98)  |
| Space heating per m2 |           |           |          |          |          |          |          |          |          |              |          | 2978.0799 (98) |
|                      |           |           |          |          |          |          |          |          |          | (98) / (4) = |          | 51.7927 (99)   |

### 8c. Space cooling requirement

Not applicable

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

### 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 %)                      | 93.5000 (206)   |          |          |          |          |          |          |          |          |          |          |                 |
| Efficiency of secondary/supplementary heating system, %               | 0.0000 (208)    |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating requirement                                             | 3185.1122 (211) |          |          |          |          |          |          |          |          |          |          |                 |
| Jan                                                                   | Feb             | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |                 |
| Space heating requirement                                             | 561.7942        | 458.1612 | 396.7664 | 232.6705 | 102.8414 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 241.6376 | 412.5865 | 571.6221 (98)   |
| Space heating efficiency (main heating system 1)                      | 93.5000         | 93.5000  | 93.5000  | 93.5000  | 93.5000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 93.5000  | 93.5000  | 93.5000 (210)   |
| Space heating fuel (main heating system)                              | 600.8494        | 490.0119 | 424.3493 | 248.8455 | 109.9908 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 258.4359 | 441.2690 | 611.3605 (211)  |
| Water heating requirement                                             | 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                                                         | 175.9303        | 155.1902 | 163.2775 | 146.7746 | 144.1293 | 129.2086 | 124.4942 | 136.0530 | 135.6386 | 152.1769 | 160.3995 | 171.8349 (64)   |
| Water heating requirement                                             | 87.6958         | 87.5304  | 87.0953  | 86.0376  | 83.9323  | 79.8000  | 79.8000  | 79.8000  | 79.8000  | 86.0418  | 87.2259  | 79.8000 (216)   |
| Efficiency of water heater                                            | 200.6143        | 177.2986 | 187.4699 | 170.9996 | 171.7209 | 161.9155 | 156.0077 | 170.4924 | 169.9731 | 176.9637 | 183.8897 | 195.7572 (219)  |
| Fuel for water heating, kWh/month                                     | 200.6143        | 177.2986 | 187.4699 | 170.9996 | 171.7209 | 161.9155 | 156.0077 | 170.4924 | 169.9731 | 176.9637 | 183.8897 | 195.7572 (219)  |
| Water heating fuel used                                               | 200.6143        | 177.2986 | 187.4699 | 170.9996 | 171.7209 | 161.9155 | 156.0077 | 170.4924 | 169.9731 | 176.9637 | 183.8897 | 195.7572 (219)  |
| Annual totals kWh/year                                                | 200.6143        | 177.2986 | 187.4699 | 170.9996 | 171.7209 | 161.9155 | 156.0077 | 170.4924 | 169.9731 | 176.9637 | 183.8897 | 195.7572 (219)  |
| Space heating fuel - main system                                      | 3185.1122       |          |          |          |          |          |          |          |          |          |          | (211)           |
| Space heating fuel - secondary                                        | 0.0000          |          |          |          |          |          |          |          |          |          |          | (215)           |
| Electricity for pumps and fans:                                       |                 |          |          |          |          |          |          |          |          |          |          |                 |
| central heating pump                                                  |                 |          |          |          |          |          |          |          |          |          |          | 30.0000 (230c)  |
| main heating flue fan                                                 |                 |          |          |          |          |          |          |          |          |          |          | 45.0000 (230e)  |
| Total electricity for the above, kWh/year                             |                 |          |          |          |          |          |          |          |          |          |          | 75.0000 (231)   |
| Electricity for lighting (calculated in Appendix L)                   |                 |          |          |          |          |          |          |          |          |          |          | 264.3961 (232)  |
| Total delivered energy for all uses                                   |                 |          |          |          |          |          |          |          |          |          |          | 5647.1050 (238) |

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

|                                                                                                   |                 |                 |
|---------------------------------------------------------------------------------------------------|-----------------|-----------------|
| Energy                                                                                            | Emission factor | Emissions       |
| kWh/year                                                                                          | kg CO2/kWh      | kg CO2/year     |
| Space heating - main system 1                                                                     | 0.2160          | 687.9842 (261)  |
| Space heating - secondary                                                                         | 0.0000          | 0.0000 (263)    |
| Water heating (other fuel)                                                                        | 0.2160          | 458.4809 (264)  |
| Space and water heating                                                                           |                 | 1146.4651 (265) |
| Pumps and fans                                                                                    | 0.3190          | 38.9250 (267)   |
| Energy for lighting                                                                               | 0.3190          | 137.2216 (268)  |
| Total CO2, kg/m2/year                                                                             |                 | 1322.6117 (272) |
| Emissions per m2 for space and water heating                                                      |                 | 19.9385 (272a)  |
| Fuel factor (waste heat)                                                                          |                 | 1.0000          |
| Emissions per m2 for lighting                                                                     |                 | 2.3865 (272b)   |
| Emissions per m2 for pumps and fans                                                               |                 | 0.6770 (272c)   |
| Target Carbon Dioxide Emission Rate (TER) = (19.9385 + 1.00) + 2.3865 + 0.6770, rounded to 2 d.p. |                 | 23.0000 (273)   |

# BASIC COMPLIANCE REPORT

## Calculation Type: New Build (As Designed)



|                      |        |                |            |
|----------------------|--------|----------------|------------|
| Property Reference   | 116542 | Issued on Date | 17/12/2021 |
| Assessment Reference | Plot 5 | Prop Type Ref  | FF         |
| Property             |        |                |            |

|                                    |      |             |       |      |       |
|------------------------------------|------|-------------|-------|------|-------|
| SAP Rating                         | 84 B | DER         | 4.23  | TER  | 23.00 |
| Environmental                      | 97 A | % DER<TER   | 81.61 |      |       |
| CO <sub>2</sub> Emissions (t/year) | 0.20 | DFEE        | 52.18 | TFEE | 69.12 |
| General Requirements Compliance    | Pass | % DFEE<TFEE | 24.51 |      |       |

|                  |                                                                                    |             |           |
|------------------|------------------------------------------------------------------------------------|-------------|-----------|
| Assessor Details | Mr. Richard Denteh, Meinhardt UK, Tel: 02078317969, richard.denteh@meinhardt.co.uk | Assessor ID | T596-0001 |
|------------------|------------------------------------------------------------------------------------|-------------|-----------|

|        |  |
|--------|--|
| Client |  |
|--------|--|

### SUMMARY FOR INPUT DATA FOR New Build (As Designed)

#### Criterion 1 – Achieving the TER and TFEE rate

##### 1a TER and DER

|                                             |                   |                                   |      |
|---------------------------------------------|-------------------|-----------------------------------|------|
| Fuel for main heating                       | Waste Heat        |                                   |      |
| Fuel factor                                 | 1.00 (waste heat) |                                   |      |
| Target Carbon Dioxide Emission Rate (TER)   | 23.00             | kgCO <sub>2</sub> /m <sup>2</sup> |      |
| Dwelling Carbon Dioxide Emission Rate (DER) | 4.23              | kgCO <sub>2</sub> /m <sup>2</sup> | Pass |
|                                             | -18.77 (-81.6%)   | kgCO <sub>2</sub> /m <sup>2</sup> |      |

##### 1b TFEE and DFEE

|                                          |                |                        |      |
|------------------------------------------|----------------|------------------------|------|
| Target Fabric Energy Efficiency (TFEE)   | 69.12          | kWh/m <sup>2</sup> /yr |      |
| Dwelling Fabric Energy Efficiency (DFEE) | 52.18          | kWh/m <sup>2</sup> /yr |      |
|                                          | -16.9 (-24.5%) | kWh/m <sup>2</sup> /yr | Pass |

#### Criterion 2 – Limits on design flexibility

##### Limiting Fabric Standards

##### 2 Fabric U-values

| Element                   | Average          | Highest          |      |
|---------------------------|------------------|------------------|------|
| External wall             | 0.17 (max. 0.30) | 0.26 (max. 0.70) | Pass |
| Party wall                | 0.00 (max. 0.20) | -                | Pass |
| Floor                     | 0.09 (max. 0.25) | 0.09 (max. 0.70) | Pass |
| Openings and curtain wall | 1.23 (max. 2.00) | 1.40 (max. 3.30) | Pass |

##### 2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

##### 3 Air permeability

|                                |                     |      |
|--------------------------------|---------------------|------|
| Air permeability at 50 pascals | 3.00 (design value) |      |
| Maximum                        | 10.0                | Pass |

##### Limiting System Efficiencies

##### 4 Heating efficiency

|                          |                          |   |
|--------------------------|--------------------------|---|
| Main heating system      | Community heating scheme | - |
| Secondary heating system | None                     |   |

##### 5 Cylinder insulation

# BASIC COMPLIANCE REPORT

## Calculation Type: New Build (As Designed)



|                            |                                                                 |      |
|----------------------------|-----------------------------------------------------------------|------|
| Hot water storage          | Measured cylinder loss: 1.18 kWh/day<br>Permitted by DBSCG 1.85 | Pass |
| Primary pipework insulated | Yes (assumed)                                                   | Pass |

##### 6 Controls

|                        |                                                                         |      |
|------------------------|-------------------------------------------------------------------------|------|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | Pass |
| Hot water controls     | Cylinderstat                                                            | Pass |

##### 7 Low energy lights

|                                                     |     |   |      |
|-----------------------------------------------------|-----|---|------|
| Percentage of fixed lights with low-energy fittings | 100 | % |      |
| Minimum                                             | 75  | % | Pass |

##### 8 Mechanical ventilation

|                                      |      |   |      |
|--------------------------------------|------|---|------|
| Continuous supply and extract system |      |   |      |
| Specific fan power                   | 0.25 |   |      |
| Maximum                              | 1.5  |   | Pass |
| MVHR efficiency                      | 91   | % |      |
| Minimum                              | 70   | % | Pass |

#### Criterion 3 – Limiting the effects of heat gains in summer

##### 9 Summertime temperature

|                                  |                                    |      |
|----------------------------------|------------------------------------|------|
| Overheating risk (Thames Valley) | Slight                             | Pass |
| Based on:                        |                                    |      |
| Overshading                      | Average                            |      |
| Windows facing North West        | 11.40 m <sup>2</sup> , No overhang |      |
| Air change rate                  | 6.00 ach                           |      |
| Blinds/curtains                  | None                               |      |

#### Criterion 4 – Building performance consistent with DER and DFEE rate

##### Party Walls

| Type | U-value |                    |      |
|------|---------|--------------------|------|
|      |         | W/m <sup>2</sup> K | Pass |
|      |         | W/m <sup>2</sup> K | Pass |
|      |         | W/m <sup>2</sup> K | Pass |

##### Air permeability and pressure testing

##### 3 Air permeability

|                                |                     |      |
|--------------------------------|---------------------|------|
| Air permeability at 50 pascals | 3.00 (design value) |      |
| Maximum                        | 10.0                | Pass |

##### 10 Key features

|                               |        |                                  |
|-------------------------------|--------|----------------------------------|
| External wall U-value         | 0.14   | W/m <sup>2</sup> K               |
| Party wall U-value            | 0.00   | W/m <sup>2</sup> K               |
| Party wall U-value            | 0.00   | W/m <sup>2</sup> K               |
| Party wall U-value            | 0.00   | W/m <sup>2</sup> K               |
| Exposed floor U-value         | 0.09   | W/m <sup>2</sup> K               |
| Air permeability              | 3.0    | m <sup>3</sup> /m <sup>2</sup> h |
| Community heating, Waste Heat | N/A    |                                  |
| Photovoltaic array            | 368.33 | kWh/Year                         |

## BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Designed)



## FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



|                                    |                                                                                    |               |           |                |            |
|------------------------------------|------------------------------------------------------------------------------------|---------------|-----------|----------------|------------|
| Property Reference                 | 116561                                                                             |               |           | Issued on Date | 17/12/2021 |
| Assessment Reference               | Plot 54 / 58                                                                       | Prop Type Ref | Mid Floor |                |            |
| Property                           |                                                                                    |               |           |                |            |
| SAP Rating                         | 87 B                                                                               | DER           | 3.83      | TER            | 15.09      |
| Environmental                      | 97 A                                                                               | % DER<TER     | 74.61     |                |            |
| CO <sub>2</sub> Emissions (t/year) | 0.28                                                                               | DFEE          | 34.88     | TFEE           | 39.41      |
| General Requirements Compliance    | Pass                                                                               | % DFEE<TFEE   | 11.50     |                |            |
| Assessor Details                   | Mr. Richard Denteh, Meinhardt UK, Tel: 02078317969, richard.denteh@meinhardt.co.uk |               |           | Assessor ID    | T596-0001  |
| Client                             |                                                                                    |               |           |                |            |

*This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.*

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

#### DWELLING AS DESIGNED

Mid-floor flat, total floor area 86 m<sup>2</sup>

This report covers items included within the SAP calculations.  
It is not a complete report of regulations compliance.

1a TER and DER  
Fuel for main heating: Waste Heat  
Fuel factor: 1.00 (waste heat)  
Target Carbon Dioxide Emission Rate (TER) 15.09 kgCO<sub>2</sub>/m<sup>2</sup>  
Dwelling Carbon Dioxide Emission Rate (DER) 3.83 kgCO<sub>2</sub>/m<sup>2</sup>OK

1b TFEE and DFEE  
Target Fabric Energy Efficiency (TFEE) 39.4 kWh/m<sup>2</sup>/yr  
Dwelling Fabric Energy Efficiency (DFEE) 34.9 kWh/m<sup>2</sup>/yrOK

#### 2 Fabric U-values

| Element                   | Average          | Highest          |    |
|---------------------------|------------------|------------------|----|
| External wall             | 0.19 (max. 0.30) | 0.26 (max. 0.70) | OK |
| Party wall                | 0.00 (max. 0.20) | -                | OK |
| Floor (no floor)          |                  |                  |    |
| Roof (no roof)            |                  |                  |    |
| Openings and curtain wall | 1.22 (max. 2.00) | 1.40 (max. 3.30) | OK |

#### 2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

#### 3 Air permeability

Air permeability at 50 pascals:  
Maximum 3.00 (design value)  
10.0 OK

#### 4 Heating efficiency

Main heating system: Community heating scheme -

#### Secondary heating system:

None

#### 5 Cylinder insulation

Hot water storage Measured cylinder loss: 1.18 kWh/day

Permitted by DBSCG 1.85 OK

Primary pipework insulated: Yes (assumed) OK

#### 6 Controls

Space heating controls: Charging system linked to use of community heating, programmer and TRVsOK

#### Hot water controls:

Cylinderstat OK

#### 7 Low energy lights

Percentage of fixed lights with low-energy fittings: 100%

Minimum 75% OK

#### 8 Mechanical ventilation

Continuous supply and extract system

Specific fan power: 0.55

Maximum 1.5 OK

MVHR efficiency: 92%

Minimum: 70% OK

#### 9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

Overshading: Average

Windows facing North East: 11.16 m<sup>2</sup>, No overhang

Windows facing South East: 12.21 m<sup>2</sup>, No overhang

Air change rate: 6.00 ach

Blinds/curtains: None

#### 10 Key features

External wall U-value 0.14 W/m<sup>2</sup>K

Party wall U-value 0.00 W/m<sup>2</sup>K

Party wall U-value 0.00 W/m<sup>2</sup>K

Air permeability 3.0 m<sup>3</sup>/m<sup>2</sup>h

Community heating, Waste Heat

Photovoltaic array 368.33 kWh/Year



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)  
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

#### 1. Overall dwelling dimensions

|                                                        | Area (m <sup>2</sup> ) | Storey height (m)               | Volume (m <sup>3</sup> ) |
|--------------------------------------------------------|------------------------|---------------------------------|--------------------------|
| Ground floor                                           | 85.5300 (1b)           | x 2.7700 (2b)                   | = 236.9181 (1b) - (3b)   |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 85.5300                |                                 | (4)                      |
| Dwelling volume                                        |                        | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 236.9181 (5)           |

#### 2. Ventilation rate

|                              | main heating | secondary heating | other | total    | m <sup>3</sup> per hour |
|------------------------------|--------------|-------------------|-------|----------|-------------------------|
| Number of chimneys           | 0            | 0                 | 0     | 0 * 40 = | 0.0000 (6a)             |
| Number of open flues         | 0            | 0                 | 0     | 0 * 20 = | 0.0000 (6b)             |
| Number of intermittent fans  | 0            | 0                 | 0     | 0 * 10 = | 0.0000 (7a)             |
| Number of passive vents      | 0            | 0                 | 0     | 0 * 10 = | 0.0000 (7b)             |
| Number of flueless gas fires | 0            | 0                 | 0     | 0 * 40 = | 0.0000 (7c)             |

Air changes per hour  
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 0.0000 / (5) = 0.0000 (8)

Pressure test Yes

Measured/design AP50 3.0000

Infiltration rate 0.1500 (18)

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)

Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1275 (21)

|  | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|

Wind speed 5.1000 5.0000 4.9000 4.4000 4.3000 3.8000 3.8000 3.7000 4.0000 4.3000 4.5000 4.7000 (22)

Wind factor 1.2750 1.2500 1.2250 1.1000 1.0750 0.9500 0.9500 0.9250 1.0000 1.0750 1.1250 1.1750 (22a)

Adj infilt rate 0.1626 0.1594 0.1562 0.1403 0.1371 0.1211 0.1211 0.1179 0.1275 0.1371 0.1434 0.1498 (22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation: 0.5000 (23a)

If balanced with heat recovery; efficiency in % allowing for in-use factor (from Table 4b) = 78.2000 (23c)

Effective ac 0.2716 0.2684 0.2652 0.2493 0.2461 0.2301 0.2301 0.2269 0.2365 0.2461 0.2524 0.2588 (25)

#### 3. Heat losses and heat loss parameter

| Element                                                     | Gross m <sup>2</sup> | Openings m <sup>2</sup> | NetArea m <sup>2</sup> | U-value W/m <sup>2</sup> K | A x U W/K | K-value kJ/m <sup>2</sup> K | A x K kJ/K      |
|-------------------------------------------------------------|----------------------|-------------------------|------------------------|----------------------------|-----------|-----------------------------|-----------------|
| Windows (UW = 1.20)                                         |                      |                         | 23.3700                | 1.1450                     | 26.7595   |                             | (27)            |
| Front Door                                                  |                      |                         | 2.1200                 | 1.4000                     | 2.9680    |                             | (26)            |
| Unipanel column                                             | 10.9900              |                         | 10.9900                | 0.2600                     | 2.8574    | 136.7400                    | 1502.7726 (29a) |
| Unipanel wall                                               | 17.1200              | 2.1200                  | 15.0000                | 0.1400                     | 2.1000    | 30.9500                     | 464.2500 (29a)  |
| Curtain wall                                                | 23.7400              | 23.3700                 | 0.3700                 | 1.2000                     | 0.4440    | 14.0000                     | 5.1800 (29a)    |
| Total net area of external elements Aum(A, m <sup>2</sup> ) |                      |                         | 51.8500                |                            |           |                             | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                         |                      |                         | (26)...(30) + (32) =   |                            | 35.1289   |                             | (33)            |
| Party Wall 2                                                |                      |                         | 39.1400                | 0.0000                     | 0.0000    | 20.0000                     | 782.8000 (32)   |
| Party Wall 1 lift & staircore                               |                      |                         | 21.1300                | 0.0000                     | 0.0000    | 180.0000                    | 3803.4000 (32)  |
| Party Floor 1                                               |                      |                         | 85.5300                | 0.0000                     | 0.0000    | 40.0000                     | 3421.2000 (32d) |
| Party Ceilings 1                                            |                      |                         | 85.5300                | 0.0000                     | 0.0000    | 40.0000                     | 3421.2000 (32b) |
| Internal Wall 1                                             |                      |                         | 165.8100               | 0.0000                     | 0.0000    | 1492.2900                   | (32c)           |
| Internal Wall 2                                             |                      |                         | 4.8800                 | 0.0000                     | 0.0000    | 75.0000                     | 366.0000 (32c)  |

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 13259.0926 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m<sup>2</sup>K 178.4063 (35)

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 4.0458 (36)

Total fabric heat loss (33) + (36) = 39.1747 (37)

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

(38)m 21.2316 20.9824 20.7331 19.4871 19.2379 17.9919 17.9919 17.7426 18.4903 19.2379 19.7363 20.2347 (38)

Heat transfer coeff 60.4063 60.1571 59.9079 58.6618 58.4126 57.1666 57.1666 56.9174 57.6650 58.4126 58.9111 59.4095 (39)

Average = Sum(39)m / 12 = 58.5995 (39)

|  | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|

HLP (average) 0.7063 0.7033 0.7004 0.6859 0.6829 0.6684 0.6684 0.6655 0.6742 0.6829 0.6888 0.6946 (40)

Days in month 31 28 31 30 31 30 31 31 30 31 30 31 (41)

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

Assumed occupancy 2.5595 (42)

Average daily hot water use (litres/day) 94.9873 (43)

|  | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

|                                                                 |          |          |          |          |          |          |          |                                          |          |                    |                |                |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|------------------------------------------|----------|--------------------|----------------|----------------|
| Daily hot water use                                             | 104.4860 | 100.6865 | 96.8871  | 93.0876  | 89.2881  | 85.4886  | 85.4886  | 89.2881                                  | 93.0876  | 96.8871            | 100.6865       | 104.4860 (44)  |
| Energy content (annual)                                         | 154.9498 | 135.5201 | 139.8446 | 121.9199 | 116.9850 | 100.9492 | 93.5443  | 107.3434                                 | 108.6254 | 126.5925           | 138.1856       | 150.0606 (45)  |
| Distribution loss (46)m = 0.15 x (45)m                          |          |          |          |          |          |          |          |                                          |          | Total = Sum(45)m = | 1494.5202 (45) |                |
|                                                                 | 23.2425  | 20.3280  | 20.9767  | 18.2880  | 17.5478  | 15.1424  | 14.0316  | 16.1015                                  | 16.2938  | 18.9889            | 20.7278        | 22.5091 (46)   |
| Water storage loss:                                             |          |          |          |          |          |          |          |                                          |          |                    |                |                |
| Store volume                                                    |          |          |          |          |          |          |          |                                          |          |                    |                | 145.0000 (47)  |
| a) If manufacturer declared loss factor is known (kWh/day):     |          |          |          |          |          |          |          |                                          |          |                    |                | 1.1800 (48)    |
| Temperature factor from Table 2b                                |          |          |          |          |          |          |          |                                          |          |                    |                | 0.6000 (49)    |
| Enter (49) or (54) in (55)                                      |          |          |          |          |          |          |          |                                          |          |                    |                | 0.7080 (55)    |
| Total storage loss                                              |          |          |          |          |          |          |          |                                          |          |                    |                |                |
|                                                                 | 21.9480  | 19.8240  | 21.9480  | 21.2400  | 21.9480  | 21.2400  | 21.9480  | 21.9480                                  | 21.2400  | 21.9480            | 21.2400        | 21.9480 (56)   |
| If cylinder contains dedicated solar storage                    |          |          |          |          |          |          |          |                                          |          |                    |                |                |
|                                                                 | 21.9480  | 19.8240  | 21.9480  | 21.2400  | 21.9480  | 21.2400  | 21.9480  | 21.9480                                  | 21.2400  | 21.9480            | 21.2400        | 21.9480 (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)   |
| Total heat required for water heating calculated for each month |          |          |          |          |          |          |          |                                          |          |                    |                |                |
|                                                                 | 200.1602 | 176.3553 | 185.0550 | 165.6719 | 162.1954 | 144.7012 | 138.7547 | 152.5538                                 | 152.3774 | 171.8029           | 181.9376       | 195.2710 (62)  |
| 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 (63)    |
|                                                                 |          |          |          |          |          |          |          | Solar input (sum of months) = Sum(63)m = |          |                    |                | 0.0000 (63)    |
| Output from w/h                                                 |          |          |          |          |          |          |          |                                          |          |                    |                |                |
|                                                                 | 200.1602 | 176.3553 | 185.0550 | 165.6719 | 162.1954 | 144.7012 | 138.7547 | 152.5538                                 | 152.3774 | 171.8029           | 181.9376       | 195.2710 (64)  |
|                                                                 |          |          |          |          |          |          |          | Total per year (kWh/year) = Sum(64)m =   |          |                    |                | 2026.8362 (64) |
| Heat gains from water heating, kWh/month                        |          |          |          |          |          |          |          |                                          |          |                    |                |                |
|                                                                 | 87.8891  | 77.7288  | 82.6666  | 75.5400  | 75.0658  | 68.5672  | 67.2718  | 71.8600                                  | 71.1196  | 78.2603            | 80.9483        | 86.0635 (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                                                                               | 127.9733  | 127.9733  | 127.9733  | 127.9733  | 127.9733  | 127.9733  | 127.9733  | 127.9733  | 127.9733  | 127.9733  | 127.9733  | 127.9733 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 20.5590   | 18.2603   | 14.8503   | 11.2426   | 8.4040    | 7.0950    | 7.6664    | 9.9651    | 13.3751   | 16.9828   | 19.8214   | 21.1304 (67)   |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 230.6098  | 233.0028  | 226.9725  | 214.1347  | 197.9293  | 182.6985  | 172.5233  | 170.1303  | 176.1606  | 188.9984  | 205.2038  | 220.4347 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 35.7973   | 35.7973   | 35.7973   | 35.7973   | 35.7973   | 35.7973   | 35.7973   | 35.7973   | 35.7973   | 35.7973   | 35.7973   | 35.7973 (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)                                 | -102.3786 | -102.3786 | -102.3786 | -102.3786 | -102.3786 | -102.3786 | -102.3786 | -102.3786 | -102.3786 | -102.3786 | -102.3786 | -102.3786 (71) |
| Water heating gains (Table 5)                                                       | 117.8617  | 115.6675  | 111.1111  | 104.9166  | 100.8950  | 95.2322   | 90.4191   | 96.5860   | 98.7772   | 105.1886  | 112.4282  | 115.6767 (72)  |
| Total internal gains                                                                | 430.4225  | 428.3226  | 414.3258  | 391.6859  | 368.6202  | 346.4177  | 332.0008  | 338.0734  | 349.7049  | 372.5616  | 398.8455  | 418.6338 (73)  |

#### 6. Solar gains

|             |          |          |             |             |               |          |               |
|-------------|----------|----------|-------------|-------------|---------------|----------|---------------|
| [Jan]       |          | Area     | Solar flux  | g           | FF            | Access   | Gains         |
|             |          | m2       | Table 6a    | W/m2        | Specific data | factor   | W             |
|             |          |          | or Table 6b | or Table 6b | or Table 6c   | Table 6d |               |
| Northeast   |          | 11.1600  | 11.2829     | 0.4000      | 0.7000        | 0.7700   | 24.4331 (75)  |
| Southeast   |          | 12.2100  | 36.7938     | 0.4000      | 0.7000        | 0.7700   | 87.1730 (77)  |
| Solar gains | 111.6060 | 198.2221 | 292.7728    | 398.8919    | 479.7721      | 490.8094 | 457.1556 (83) |
| Total gains | 542.0286 | 626.5447 | 707.0986    | 790.5778    | 848.3923      | 837.2271 | 799.1564 (84) |

#### 7. Mean internal temperature (heating season)

|                                                                                         |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, T <sub>hi</sub> (C) |         |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, n <sub>li</sub> (see Table 9a)            |         |         |         |         |         |         |         |         |         |         |         |              |
| Jan                                                                                     | 70.1688 | 70.4595 | 70.7526 | 72.2554 | 72.5637 | 74.1453 | 74.1453 | 74.4700 | 73.5045 | 72.5637 | 71.9498 | 71.3461      |
| Feb                                                                                     | 5.6779  | 5.6973  | 5.7168  | 5.8170  | 5.8376  | 5.9430  | 5.9430  | 5.9647  | 5.9003  | 5.8376  | 5.7967  | 5.7564       |
| util living area                                                                        | 0.9862  | 0.9888  | 0.9234  | 0.8037  | 0.6224  | 0.4352  | 0.3145  | 0.3521  | 0.5755  | 0.8608  | 0.9691  | 0.9893 (86)  |
| MIT                                                                                     | 20.2483 | 20.4265 | 20.6576 | 20.8814 | 20.9758 | 20.9976 | 20.9997 | 20.9995 | 20.9885 | 20.8513 | 20.5202 | 20.2204 (87) |
| T <sub>hi</sub> 2                                                                       | 20.3353 | 20.3379 | 20.3405 | 20.3535 | 20.3559 | 20.3688 | 20.3688 | 20.3714 | 20.3637 | 20.3559 | 20.3508 | 20.3456 (88) |
| util rest of house                                                                      | 0.9834  | 0.9628  | 0.9098  | 0.7759  | 0.5839  | 0.3930  | 0.2695  | 0.3042  | 0.5260  | 0.8328  | 0.9622  | 0.9871 (89)  |
| MIT 2                                                                                   | 19.3240 | 19.5817 | 19.9084 | 20.2170 | 20.3320 | 20.3670 | 20.3687 | 20.3711 | 20.3540 | 20.1871 | 19.7285 | 19.2916 (90) |
| Living area fraction                                                                    | 19.7892 | 19.9886 | 20.2692 | 20.5369 | 20.6420 | 20.6707 | 20.6726 | 20.6737 | 20.6595 | 20.5070 | 20.1098 | 19.7389 (92) |
| Temperature adjustment                                                                  |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT                                                                            | 13.7692 | 13.9886 | 20.2692 | 20.5369 | 20.6420 | 20.6707 | 20.6726 | 20.6737 | 20.6595 | 20.5070 | 20.1098 | 19.7389 (93) |

#### 8. Space heating requirement

|                   |          |          |          |          |          |          |          |          |          |          |          |               |
|-------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Utilisation       | 0.9804   | 0.9591   | 0.9082   | 0.7841   | 0.6012   | 0.4132   | 0.2912   | 0.3273   | 0.5492   | 0.8398   | 0.9592   | 0.9646 (94)   |
| Useful gains      | 531.4150 | 600.9203 | 642.1949 | 619.8959 | 510.0524 | 345.9540 | 232.7075 | 243.0391 | 372.8478 | 501.7324 | 512.1910 | 505.2790 (95) |
| Ext temp.         | 4.3000   | 4.3000   | 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  | 934.4348 | 907.6847 | 824.8839 | 682.6435 | 522.3264 | 347.0401 | 232.8158 | 243.2492 | 378.2559 | 578.6917 | 766.4182 | 923.1584 (97) |
| Month fracti      | 1.0000   | 1.0000   | 1.0000   | 1.0000   | 1.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 1.0000   | 1.0000   | 1.0000 (97a)  |
| Space heating kWh | 299.8460 | 206.1457 | 135.9207 | 45.1783  | 9.1318   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 57.2577  | 183.0436 | 310.9023 (98) |

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

|                      |  |  |  |  |  |  |  |  |  |  |  |                           |
|----------------------|--|--|--|--|--|--|--|--|--|--|--|---------------------------|
| Space heating        |  |  |  |  |  |  |  |  |  |  |  | 1247.4261 (98)            |
| Space heating per m2 |  |  |  |  |  |  |  |  |  |  |  | (98) / (4) = 14.5847 (99) |

#### 8c. Space cooling requirement

Not applicable

#### 9b. Energy requirements

|                                                                                         |                  |
|-----------------------------------------------------------------------------------------|------------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                   | 0.0000 (301)     |
| Fraction of space heat from community system                                            | 1.0000 (302)     |
| Fraction of heat from community Waste Heat                                              | 1.0000 (303a)    |
| Fraction of total space heat from community Waste Heat                                  | 1.0000 (304a)    |
| Factor for control and charging method (Table 4c(3)) for community space heating        | 1.0000 (305)     |
| Factor for control and charging method (Table 4c(3)) for community water heating        | 1.0000 (305a)    |
| Distribution loss factor (Table 12c) for community heating system                       | 1.1000 (306)     |
| Space heating:                                                                          |                  |
| Annual space heating requirement                                                        | 1247.4261 (98)   |
| Space heat from Waste Heat = (98) x 1.00 x 1.00 x 1.10                                  | 1372.1687 (307a) |
| Efficiency of secondary/supplementary heating system in 3 (from Table 4a or Appendix 5) | 0.0000 (308)     |
| Space heating fuel for secondary/supplementary system                                   | 0.0000 (309)     |

|                                                        |                  |
|--------------------------------------------------------|------------------|
| Water heating                                          |                  |
| Annual water heating requirement                       | 2026.8362 (64)   |
| Water heat from Waste Heat = (64) x 1.00 x 1.00 x 1.10 | 2229.5193 (310a) |
| Electricity used for heat distribution                 | 36.0169 (313)    |
| Annual totals kWh/year                                 |                  |

|                                                                           |                 |
|---------------------------------------------------------------------------|-----------------|
| Electricity for pumps and fans:                                           |                 |
| (BalancedWithHeatRecovery, Database in-use factor = 1.2500, SFP = 0.6875) |                 |
| mechanical ventilation fans (SFP = 0.6875)                                | 198.7151 (330a) |
| Total electricity for the above, kWh/year                                 | 198.7151 (331)  |
| Electricity for lighting (calculated in Appendix L)                       | 363.0789 (332)  |

|                                                               |                 |
|---------------------------------------------------------------|-----------------|
| Energy saving/generation technologies (Appendices M, N and O) |                 |
| Total delivered energy for all uses                           | 4163.4825 (338) |

#### 12b. Carbon dioxide emissions - Community heating scheme

|                                                                                         |           |        |                 |
|-----------------------------------------------------------------------------------------|-----------|--------|-----------------|
| Efficiency of heat source Waste Heat                                                    |           |        |                 |
| Space heating from Waste Heat                                                           | 3601.6885 | 0.0580 | 208.8979 (367)  |
| Electrical energy for heat distribution                                                 | 36.0169   | 0.5190 | 18.6928 (372)   |
| Total CO2 associated with community systems (negative value allowed since DFEE <= TFEE) |           |        | 227.5907 (373)  |
| Space and water heating                                                                 |           |        | 227.5907 (376)  |
| Pumps and fans                                                                          | 198.7151  | 0.5190 | 103.1331 (378)  |
| Energy for lighting                                                                     | 363.0789  | 0.5190 | 188.4379 (379)  |
| Energy saving/generation technologies                                                   |           |        |                 |
| PV Unit                                                                                 | -168.3300 | 0.5190 | -191.1633 (380) |
| Total CO2, kg/year                                                                      |           |        | 327.9985 (383)  |
| Dwelling Carbon Dioxide Emission Rate (DER)                                             |           |        | 3.8300 (384)    |

#### 16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

|                                                                                 |     |  |             |
|---------------------------------------------------------------------------------|-----|--|-------------|
| DER                                                                             |     |  | 3.8300 ZC1  |
| Total Floor Area                                                                | TFA |  | 85.5300     |
| Assumed number of occupants                                                     | N   |  | 2.5595      |
| CO2 emission factor in Table 12 for electricity displaced from grid             | EF  |  | 0.5190      |
| CO2 emissions from appliances, equation (L14)                                   |     |  | 15.9774 ZC2 |
| CO2 emissions from cooking, equation (L16)                                      |     |  | 2.1095 ZC3  |
| Total CO2 emissions                                                             |     |  | 21.9169 ZC4 |
| Residual CO2 emissions offset from biofuel CHP                                  |     |  | 0.0000 ZC5  |
| Additional allowable electricity generation, kWh/m²/year                        |     |  | 0.0000 ZC6  |
| Resulting CO2 emissions offset from additional allowable electricity generation |     |  | 0.0000 ZC7  |
| Net CO2 emissions                                                               |     |  | 21.9169 ZC8 |

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)  
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

#### 1. Overall dwelling dimensions

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)            | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|---------------------------------|-----------------------------|
| Ground floor                                           | 85.5300 (1b)              | x 2.7700 (2b)                   | = 236.9181 (1b) - (3b)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 85.5300                   |                                 | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 236.9181 (5)              |

#### 2. Ventilation rate

|                                                                           | main<br>heating | secondary<br>heating | other | total | m <sup>3</sup> per hour                 |
|---------------------------------------------------------------------------|-----------------|----------------------|-------|-------|-----------------------------------------|
| Number of chimneys                                                        | 0               | +                    | 0     | =     | 0 * 40 = 0.0000 (6a)                    |
| Number of open flues                                                      | 0               | +                    | 0     | =     | 0 * 20 = 0.0000 (6b)                    |
| Number of intermittent fans                                               |                 |                      |       |       | 3 * 10 = 30.0000 (7a)                   |
| Number of passive vents                                                   |                 |                      |       |       | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                              |                 |                      |       |       | 0 * 40 = 0.0000 (7c)                    |
| Air changes per hour                                                      |                 |                      |       |       |                                         |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = |                 |                      |       |       | 30.0000 / (5) = 0.1266 (8)              |
| Pressure test                                                             |                 |                      |       |       | Yes                                     |
| Measured/design AP50                                                      |                 |                      |       |       | 5.0000                                  |
| Infiltration rate                                                         |                 |                      |       |       | 0.3766 (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) = 0.3201 (21)        |

|                 | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed      | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor     | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate |        |        |        |        |        |        |        |        |        |        |        |              |
| Effective ac    | 0.4082 | 0.4002 | 0.3922 | 0.3521 | 0.3441 | 0.3041 | 0.3041 | 0.2961 | 0.3201 | 0.3441 | 0.3601 | 0.3762 (22b) |
|                 | 0.5833 | 0.5801 | 0.5769 | 0.5620 | 0.5592 | 0.5462 | 0.5462 | 0.5438 | 0.5512 | 0.5592 | 0.5649 | 0.5707 (25)  |

#### 3. Heat losses and heat loss parameter

| Element                                                     | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K         | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K |
|-------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|----------------------|--------------------------------|---------------|
| TER Opaque door                                             |                         |                            | 2.1200                    | 1.0000                        | 2.1200               |                                | (26)          |
| TER Opening Type Curtain (Uw = 1.50)                        |                         |                            | 19.2600                   | 1.4151                        | 27.2547              |                                | (27)          |
| Unipanel column                                             | 10.9900                 |                            | 10.9900                   | 0.1800                        | 1.9782               |                                | (29a)         |
| Unipanel wall                                               | 17.1200                 | 2.1200                     | 15.0000                   | 0.1800                        | 2.7000               |                                | (29a)         |
| Curtain wall                                                | 23.7400                 | 19.2600                    | 4.4800                    | 0.1800                        | 0.8084               |                                | (29a)         |
| Total net area of external elements Aum(A, m <sup>2</sup> ) |                         |                            | 51.8500                   |                               |                      |                                | (31)          |
| Fabric heat loss, W/K = Sum (A x U)                         |                         |                            |                           |                               | (26)...(30) + (32) = | 34.8593                        | (33)          |

Thermal mass parameter (TMP = Cm / TFA) in kJ/m<sup>2</sup>K 250.0000 (35)  
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 3.8103 (36)  
Total fabric heat loss (33) + (36) = 38.6696 (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                                                 | 45.6042 | 45.3513 | 45.1034 | 43.9391 | 43.7212 | 42.7071 | 42.7071 | 42.5194 | 43.0978 | 43.7212 | 44.1619 | 44.6226 (38) |
| Average = Sum(39)m / 12 =                                           | 84.2738 | 84.0209 | 83.7730 | 82.8087 | 82.3909 | 81.3768 | 81.3768 | 81.1890 | 81.7674 | 82.3909 | 82.8315 | 83.2923 (39) |
|                                                                     |         |         |         |         |         |         |         |         |         |         |         | 82.6077 (39) |

|               | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec         |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------------|
| HLP           | 0.9853 | 0.9824 | 0.9795 | 0.9658 | 0.9633 | 0.9514 | 0.9514 | 0.9492 | 0.9560 | 0.9633 | 0.9685 | 0.9738 (40) |
| HLP (average) |        |        |        |        |        |        |        |        |        |        |        | 0.9658 (40) |
| Days in month | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31 (41)     |

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

|                                                             |          |          |          |          |          |          |         |          |          |          |          |                                   |
|-------------------------------------------------------------|----------|----------|----------|----------|----------|----------|---------|----------|----------|----------|----------|-----------------------------------|
| Assumed occupancy                                           |          |          |          |          |          |          |         |          |          |          |          | 2.5595 (42)                       |
| Average daily hot water use (litres/day)                    |          |          |          |          |          |          |         |          |          |          |          | 94.9873 (43)                      |
|                                                             | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul     | Aug      | Sep      | Oct      | Nov      | Dec                               |
| Daily hot water use                                         | 104.4860 | 100.6865 | 96.8871  | 93.0876  | 89.2881  | 85.4886  | 85.4886 | 89.2881  | 93.0876  | 96.8871  | 100.6865 | 104.4860 (44)                     |
| Energy cont                                                 | 154.9498 | 135.5201 | 139.8446 | 121.9199 | 116.9850 | 100.9492 | 93.5443 | 107.3434 | 108.6254 | 126.5925 | 138.1856 | 150.0606 (45)                     |
| Energy content (annual)                                     |          |          |          |          |          |          |         |          |          |          |          | Total = Sum(45)m = 1494.5202 (45) |
| Distribution loss (46)m = 0.15 x (45)m                      |          |          |          |          |          |          |         |          |          |          |          |                                   |
|                                                             | 23.2425  | 20.3280  | 20.9787  | 18.2880  | 17.5478  | 15.1424  | 14.0316 | 16.1015  | 16.2938  | 18.9889  | 20.7278  | 22.5091 (46)                      |
| Water storage loss:                                         |          |          |          |          |          |          |         |          |          |          |          |                                   |
| Store volume                                                |          |          |          |          |          |          |         |          |          |          |          | 145.0000 (47)                     |
| a) If manufacturer declared loss factor is known (kWh/day): |          |          |          |          |          |          |         |          |          |          |          | 1.3665 (48)                       |
| Temperature factor from Table 20                            |          |          |          |          |          |          |         |          |          |          |          | 0.9400 (49)                       |
| Enter (49) or (54) in (55)                                  |          |          |          |          |          |          |         |          |          |          |          | 0.7379 (55)                       |

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

|                                                                 |          |          |          |          |          |          |          |          |          |          |          |               |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Total storage loss                                              | 22.8747  | 20.6610  | 22.8747  | 22.1368  | 22.8747  | 22.1368  | 22.8747  | 22.8747  | 22.1368  | 22.8747  | 22.1368  | 22.8747 (56)  |
| If cylinder contains dedicated solar storage                    | 22.8747  | 20.6610  | 22.8747  | 22.1368  | 22.8747  | 22.1368  | 22.8747  | 22.8747  | 22.1368  | 22.8747  | 22.1368  | 22.8747 (57)  |
| Primary loss                                                    | 23.2624  | 21.0112  | 23.2624  | 22.8120  | 23.2624  | 22.8120  | 23.2624  | 23.2624  | 22.8120  | 23.2624  | 22.8120  | 23.2624 (59)  |
| Total heat required for water heating calculated for each month | 201.0869 | 177.1923 | 185.9816 | 166.5687 | 163.1221 | 145.5980 | 139.6813 | 153.4805 | 153.2742 | 172.7295 | 182.8344 | 196.1977 (62) |
| 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 (63)   |
| Output from w/h                                                 | 201.0869 | 177.1923 | 185.9816 | 166.5687 | 163.1221 | 145.5980 | 139.6813 | 153.4805 | 153.2742 | 172.7295 | 182.8344 | 196.1977 (64) |
| Heat gains from water heating, kWh/month                        | 88.4305  | 78.3982  | 83.4080  | 76.2574  | 75.8072  | 69.2846  | 68.0131  | 72.6013  | 71.8370  | 79.0017  | 81.6657  | 86.8048 (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                                                                               | 127.9733  | 127.9733  | 127.9733  | 127.9733  | 127.9733  | 127.9733  | 127.9733  | 127.9733  | 127.9733  | 127.9733  | 127.9733  | 127.9733 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 20.5559   | 18.2576   | 14.8481   | 11.2410   | 8.4027    | 7.0940    | 7.6653    | 9.9636    | 13.3731   | 16.9803   | 19.8185   | 21.1273 (67)   |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 230.6098  | 233.0028  | 226.9725  | 214.1347  | 197.9293  | 182.8985  | 172.5233  | 170.1303  | 176.1606  | 188.9984  | 205.2038  | 220.4347 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 35.7973   | 35.7973   | 35.7973   | 35.7973   | 35.7973   | 35.7973   | 35.7973   | 35.7973   | 35.7973   | 35.7973   | 35.7973   | 35.7973 (69)   |
| Pumps, fans                                                                         | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000    | 3.0000 (70)    |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -102.3786 | -102.3786 | -102.3786 | -102.3786 | -102.3786 | -102.3786 | -102.3786 | -102.3786 | -102.3786 | -102.3786 | -102.3786 | -102.3786 (71) |
| Water heating gains (Table 5)                                                       | 118.8581  | 116.6640  | 112.1075  | 105.9130  | 101.8914  | 96.2287   | 91.4155   | 97.5825   | 99.7736   | 106.1850  | 113.4246  | 116.6731 (72)  |
| Total internal gains                                                                | 434.4158  | 432.3163  | 418.3200  | 395.6807  | 372.6154  | 350.4130  | 335.9961  | 342.0684  | 353.6993  | 376.5557  | 402.8389  | 422.6270 (73)  |

#### 6. Solar gains

| [Jan]       | Area<br>m <sup>2</sup> |          | Solar flux<br>Table 6a<br>W/m <sup>2</sup> |          | q<br>Specific data<br>or Table 6b |          | FF<br>Specific data<br>or Table 6c |          | Access<br>factor<br>Table 6d |          | Gains<br>W    |               |
|-------------|------------------------|----------|--------------------------------------------|----------|-----------------------------------|----------|------------------------------------|----------|------------------------------|----------|---------------|---------------|
| Northeast   | 9.2000                 |          | 11.2829                                    |          | 0.6300                            |          | 0.7000                             |          | 0.7700                       |          | 31.7236 (75)  |               |
| Southeast   | 10.0600                |          | 36.7938                                    |          | 0.6300                            |          | 0.7000                             |          | 0.7700                       |          | 113.1214 (77) |               |
| Solar gains | 144.8450               | 257.2619 | 379.9858                                   | 517.7346 | 622.7265                          | 637.0587 | 606.3541                           | 525.1458 | 427.2351                     | 291.8757 | 175.4098      | 122.7154 (83) |
| Total gains | 579.2608               | 689.5782 | 798.3059                                   | 913.4152 | 995.3419                          | 987.4717 | 942.3502                           | 867.2142 | 780.9344                     | 668.4314 | 578.2488      | 545.3424 (84) |

#### 7. Mean internal temperature (heating season)

|                                                                             |         |         |         |         |         |         |         |         |         |         |         |              |
|-----------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, Thl (C) |         |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, nil,m (see Table 9a)          |         |         |         |         |         |         |         |         |         |         |         |              |
| tau                                                                         | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| alpha                                                                       | 70.4796 | 70.6917 | 70.9009 | 71.9002 | 72.0903 | 72.9887 | 72.9887 | 73.1575 | 72.6400 | 72.0903 | 71.7068 | 71.3101      |
| util living area                                                            | 5.6986  | 5.7128  | 5.7267  | 5.7933  | 5.8060  | 5.8659  | 5.8659  | 5.8772  | 5.8427  | 5.8060  | 5.7805  | 5.7540       |
| MIT                                                                         | 0.9963  | 0.9894  | 0.9671  | 0.8883  | 0.7232  | 0.5215  | 0.3792  | 0.4289  | 0.6888  | 0.9362  | 0.9906  | 0.9973 (86)  |
| MIT 2                                                                       | 20.0601 | 20.2406 | 20.4983 | 20.7862 | 20.9472 | 20.9933 | 20.9991 | 20.9983 | 20.9701 | 20.7374 | 20.3430 | 20.0295 (87) |
| Living area fraction                                                        | 20.0956 | 20.0981 | 20.1005 | 20.1119 | 20.1140 | 20.1240 | 20.1240 | 20.1258 | 20.1202 | 20.1140 | 20.1097 | 20.1052 (88) |
| MIT 2                                                                       | 0.9951  | 0.9862  | 0.9570  | 0.8587  | 0.6682  | 0.4528  | 0.3041  | 0.3483  | 0.6139  | 0.9118  | 0.9871  | 0.9964 (89)  |
| Living area fraction                                                        | 18.8442 | 19.1078 | 19.4775 | 19.8758 | 20.0671 | 20.1199 | 20.1237 | 20.1252 | 20.0988 | 19.8236 | 19.2668 | 18.8069 (90) |
| MIT 2                                                                       | 19.4298 | 19.6534 | 19.9691 | 20.3142 | 20.4910 | 20.5406 | 20.5453 | 20.5456 | 20.5184 | 20.2637 | 19.7851 | 19.3957 (92) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         | 0.0000       |
| adjusted MIT                                                                | 19.4298 | 19.6534 | 19.9691 | 20.3142 | 20.4910 | 20.5406 | 20.5453 | 20.5456 | 20.5184 | 20.2637 | 19.7851 | 19.3957 (93) |

#### 8. Space heating requirement

|                                  | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov       | Dec                       |
|----------------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|-----------|---------------------------|
| Utilisation                      | 0.9939    | 0.9841    | 0.9553    | 0.8660   | 0.6923   | 0.4857   | 0.3403   | 0.3872   | 0.6489   | 0.9165   | 0.9855    | 0.9955 (94)               |
| Useful gains                     | 575.7177  | 678.6332  | 762.6371  | 791.0190 | 689.6569 | 479.6569 | 320.6721 | 335.7889 | 506.7455 | 612.6047 | 569.8668  | 542.8913 (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                 | 1275.0436 | 1239.5921 | 1128.3477 | 942.9157 | 724.2951 | 483.4232 | 321.0548 | 336.5808 | 524.8152 | 796.1986 | 1050.7238 | 1265.6839 (97)            |
| Month fracti                     | 1.0000    | 1.0000    | 1.0000    | 1.0000   | 1.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 1.0000   | 1.0000    | 1.0000 (97a)              |
| Space heating kWh                | 520.2984  | 376.9644  | 272.0887  | 109.3664 | 26.1828  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 136.5938 | 346.2170  | 537.7577 (98)             |
| Space heating                    |           |           |           |          |          |          |          |          |          |          |           | 2325.4692 (98)            |
| Space heating per m <sup>2</sup> |           |           |           |          |          |          |          |          |          |          |           | (98) / (4) = 27.1889 (99) |

#### 9c. Space cooling requirement

Not applicable

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

Design SAP  
elmhurst energy

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

### 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 %)                      |          |          |          |          |          |          |          |          |          |          |          | 93.5000   | (206)  |
| Efficiency of secondary/supplementary heating system, %               |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (208)  |
| Space heating requirement                                             |          |          |          |          |          |          |          |          |          |          |          | 2487.1328 | (211)  |
|                                                                       | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec       |        |
| Space heating requirement                                             | 520.2984 | 376.9644 | 272.0887 | 109.3664 | 26.1828  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 136.5938 | 346.2170 | 537.7577  | (98)   |
| Space heating efficiency (main heating system 1)                      | 93.5000  | 93.5000  | 93.5000  | 93.5000  | 93.5000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 93.5000  | 93.5000  | 93.5000   | (210)  |
| Space heating fuel (main heating system)                              | 556.4689 | 403.1705 | 291.0039 | 116.9694 | 28.0030  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 146.0897 | 370.2856 | 575.1419  | (213)  |
| Water heating requirement                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (215)  |
| Water heating requirement                                             | 201.0869 | 177.1923 | 185.9816 | 166.5687 | 163.1221 | 145.5980 | 139.6813 | 153.4805 | 153.2742 | 172.7295 | 182.8344 | 196.1977  | (64)   |
| Efficiency of water heater (217)m                                     | 87.2393  | 86.7794  | 85.8275  | 83.7234  | 81.1266  | 79.8000  | 79.8000  | 79.8000  | 79.8000  | 84.1959  | 86.4921  | 87.3684   | (216)  |
| Fuel for water heating, kWh/month                                     | 230.5003 | 204.1869 | 216.6923 | 198.9512 | 201.0710 | 182.4536 | 175.0399 | 192.3314 | 192.0729 | 205.1520 | 211.3885 | 224.5635  | (219)  |
| Water heating fuel used                                               | 230.5003 | 204.1869 | 216.6923 | 198.9512 | 201.0710 | 182.4536 | 175.0399 | 192.3314 | 192.0729 | 205.1520 | 211.3885 | 224.5635  | (219)  |
| Annual totals kWh/year                                                |          |          |          |          |          |          |          |          |          |          |          |           |        |
| Space heating fuel - main system                                      |          |          |          |          |          |          |          |          |          |          |          | 2487.1328 | (211)  |
| Space heating fuel - secondary                                        |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (215)  |
| Electricity for pumps and fans:                                       |          |          |          |          |          |          |          |          |          |          |          |           |        |
| central heating pump                                                  |          |          |          |          |          |          |          |          |          |          |          | 50.0000   | (230c) |
| main heating flue fan                                                 |          |          |          |          |          |          |          |          |          |          |          | 45.0000   | (230e) |
| Total electricity for the above, kWh/year                             |          |          |          |          |          |          |          |          |          |          |          | 75.0000   | (231)  |
| Electricity for lighting (calculated in Appendix L)                   |          |          |          |          |          |          |          |          |          |          |          | 363.0245  | (232)  |
| Total delivered energy for all uses                                   |          |          |          |          |          |          |          |          |          |          |          | 5359.5603 | (238)  |

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

|                                                                                                   | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |        |
|---------------------------------------------------------------------------------------------------|--------------------|-------------------------------|--------------------------|--------|
| Space heating - main system 1                                                                     | 2487.1328          | 0.2160                        | 537.2207                 | (261)  |
| Space heating - secondary                                                                         | 0.0000             | 0.0000                        | 0.0000                   | (263)  |
| Water heating (other fuel)                                                                        | 2434.4030          | 0.2160                        | 525.8310                 | (264)  |
| Space and water heating                                                                           |                    |                               | 1063.0517                | (265)  |
| Pumps and fans                                                                                    | 75.0000            | 0.5150                        | 38.6250                  | (267)  |
| Energy for lighting                                                                               | 363.0245           | 0.5150                        | 188.4097                 | (268)  |
| Total CO2, kg/m2/year                                                                             |                    |                               | 1290.3664                | (272)  |
| Emissions per m2 for space and water heating                                                      |                    |                               | 12.4290                  | (272a) |
| Fuel factor (waste heat)                                                                          |                    |                               | 1.0000                   |        |
| Emissions per m2 for lighting                                                                     |                    |                               | 2.2028                   | (272b) |
| Emissions per m2 for pumps and fans                                                               |                    |                               | 0.4551                   | (272c) |
| Target Carbon Dioxide Emission Rate (TER) = (12.4290 * 1.00) + 2.2028 + 0.4551, rounded to 2 d.p. |                    |                               | 15.0900                  | (273)  |

# BASIC COMPLIANCE REPORT

## Calculation Type: New Build (As Designed)

Design SAP  
elmhurst energy

|                      |              |                |            |
|----------------------|--------------|----------------|------------|
| Property Reference   | 116561       | Issued on Date | 17/12/2021 |
| Assessment Reference | Plot 54 / 58 | Prop Type Ref  | Mid Floor  |
| Property             |              |                |            |

|                                 |      |             |       |      |       |
|---------------------------------|------|-------------|-------|------|-------|
| SAP Rating                      | 87 B | DER         | 3.83  | TER  | 15.09 |
| Environmental                   | 97 A | % DER<TER   | 74.61 |      |       |
| CO2 Emissions (t/year)          | 0.28 | DFEE        | 34.88 | TFEE | 39.41 |
| General Requirements Compliance | Pass | % DFEE<TFEE | 11.50 |      |       |

|                  |                                                                                    |             |           |
|------------------|------------------------------------------------------------------------------------|-------------|-----------|
| Assessor Details | Mr. Richard Denteh, Meinhardt UK, Tel: 02078317969, richard.denteh@meinhardt.co.uk | Assessor ID | T596-0001 |
|------------------|------------------------------------------------------------------------------------|-------------|-----------|

|        |  |
|--------|--|
| Client |  |
|--------|--|

### SUMARY FOR INPUT DATA FOR New Build (As Designed)

#### Criterion 1 - Achieving the TER and TFEE rate

##### 1a TER and DER

|                                             |                   |          |
|---------------------------------------------|-------------------|----------|
| Fuel for main heating                       | Waste Heat        |          |
| Fuel factor                                 | 1.00 (waste heat) |          |
| Target Carbon Dioxide Emission Rate (TER)   | 15.09             | kgCO2/m2 |
| Dwelling Carbon Dioxide Emission Rate (DER) | 3.83              | kgCO2/m2 |
|                                             | -11.26 (-74.6%)   | kgCO2/m2 |
|                                             |                   | Pass     |

##### 1b TFEE and DFEE

|                                          |               |           |
|------------------------------------------|---------------|-----------|
| Target Fabric Energy Efficiency (TFEE)   | 39.41         | kWh/m2/yr |
| Dwelling Fabric Energy Efficiency (DFEE) | 34.88         | kWh/m2/yr |
|                                          | -4.5 (-11.4%) | kWh/m2/yr |
|                                          |               | Pass      |

#### Criterion 2 - Limits on design flexibility

##### Limiting Fabric Standards

##### 2 Fabric U-values

| Element                   | Average          | Highest          |      |
|---------------------------|------------------|------------------|------|
| External wall             | 0.19 (max. 0.30) | 0.26 (max. 0.70) | Pass |
| Party wall                | 0.00 (max. 0.20) | -                | Pass |
| Openings and curtain wall | 1.22 (max. 2.00) | 1.40 (max. 3.30) | Pass |

##### 2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

##### 3 Air permeability

|                                |                     |      |
|--------------------------------|---------------------|------|
| Air permeability at 50 pascals | 3.00 (design value) |      |
| Maximum                        | 10.0                | Pass |

##### Limiting System Efficiencies

##### 4 Heating efficiency

|                          |                          |   |
|--------------------------|--------------------------|---|
| Main heating system      | Community heating scheme | - |
| Secondary heating system | None                     |   |

##### 5 Cylinder insulation

|                   |                                                                 |      |
|-------------------|-----------------------------------------------------------------|------|
| Hot water storage | Measured cylinder loss: 1.18 kWh/day<br>Permitted by DB5CG 1.85 | Pass |
|-------------------|-----------------------------------------------------------------|------|

## BASIC COMPLIANCE REPORT

### Calculation Type: New Build (As Designed)

Primary pipework insulated Yes (assumed) Pass

#### 6 Controls

Space heating controls Charging system linked to use of community heating, programmer and TRVs Pass

Hot water controls Cylinderstat Pass

#### 7 Low energy lights

Percentage of fixed lights with low-energy fittings 100 %

Minimum 75 % Pass

#### 8 Mechanical ventilation

Continuous supply and extract system

Specific fan power 0.55

Maximum 1.5 Pass

MVHR efficiency 92 %

Minimum 70 % Pass

#### Criterion 3 – Limiting the effects of heat gains in summer

##### 9 Summertime temperature

Overheating risk (Thames Valley) Slight Pass

Based on:

Overshading Average

Windows facing North East 11.16 m<sup>2</sup>, No overhang

Windows facing South East 12.21 m<sup>2</sup>, No overhang

Air change rate 6.00 ach

Blinds/curtains None

#### Criterion 4 – Building performance consistent with DER and DFEE rate

##### Party Walls

Type U-value

Filled Cavity with Edge Sealing 0.00 W/m<sup>2</sup>K Pass

Solid Wall 0.00 W/m<sup>2</sup>K Pass

##### Air permeability and pressure testing

##### 3 Air permeability

Air permeability at 50 pascals 3.00 (design value)

Maximum 10.0 Pass

#### 10 Key features

External wall U-value 0.14 W/m<sup>2</sup>K

Party wall U-value 0.00 W/m<sup>2</sup>K

Party wall U-value 0.00 W/m<sup>2</sup>K

Air permeability 3.0 m<sup>3</sup>/m<sup>2</sup>h

Community heating, Waste Heat N/A

Photovoltaic array 368.33 kWh/Year

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

## FULL SAP CALCULATION PRINTOUT

### Calculation Type: New Build (As Designed)

|                      |            |                |            |
|----------------------|------------|----------------|------------|
| Property Reference   | 116564     | Issued on Date | 17/12/2021 |
| Assessment Reference | Plot 68/69 | Prop Type Ref  | Mid Floor  |
| Property             |            |                |            |

|                                    |      |             |       |      |       |
|------------------------------------|------|-------------|-------|------|-------|
| SAP Rating                         | 86 B | DER         | 2.98  | TER  | 17.47 |
| Environmental                      | 98 A | % DER<TER   | 82.94 |      |       |
| CO <sub>2</sub> Emissions (t/year) | 0.13 | DFEE        | 32.27 | TFEE | 38.71 |
| General Requirements Compliance    | Pass | % DFEE<TFEE | 16.63 |      |       |

|                  |                                                                                    |             |           |
|------------------|------------------------------------------------------------------------------------|-------------|-----------|
| Assessor Details | Mr. Richard Denteh, Meinhardt UK, Tel: 02078317969, richard.denteh@meinhardt.co.uk | Assessor ID | T596-0001 |
|------------------|------------------------------------------------------------------------------------|-------------|-----------|

|        |  |
|--------|--|
| Client |  |
|--------|--|

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

#### DWELLING AS DESIGNED

Mid-floor flat, total floor area 53 m<sup>2</sup>

This report covers items included within the SAP calculations.  
It is not a complete report of regulations compliance.

1a TER and DER  
Fuel for main heating: Waste Heat  
Fuel factor: 1.00 (waste heat)  
Target Carbon Dioxide Emission Rate (TER) 17.47 kgCO<sub>2</sub>/m<sup>2</sup>  
Dwelling Carbon Dioxide Emission Rate (DER) 2.98 kgCO<sub>2</sub>/m<sup>2</sup>OK

1b TFEE and DFEE  
Target Fabric Energy Efficiency (TFEE) 38.7 kWh/m<sup>2</sup>/yr  
Dwelling Fabric Energy Efficiency (DFEE) 32.3 kWh/m<sup>2</sup>/yrOK

#### 2 Fabric U-values

| Element                   | Average          | Highest          |    |
|---------------------------|------------------|------------------|----|
| External wall             | 0.14 (max. 0.30) | 0.14 (max. 0.70) | OK |
| Party wall                | 0.00 (max. 0.20) | -                | OK |
| Floor (no floor)          |                  |                  |    |
| Roof (no roof)            |                  |                  |    |
| Openings and curtain wall | 1.23 (max. 2.00) | 1.40 (max. 3.30) | OK |

2a Thermal bridging  
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability  
Air permeability at 50 pascals: 3.00 (design value)  
Maximum 10.0 OK

4 Heating efficiency  
Main heating system: Community heating scheme -

Secondary heating system: None

5 Cylinder insulation  
Hot water storage: Measured cylinder loss: 1.18 kWh/day  
Permitted by DBSCG 1.85 OK  
Primary pipework insulated: Yes (assumed) OK

6 Controls  
Space heating controls: Charging system linked to use of community heating, programmer and TRVsOK

Hot water controls: Cylinderstat OK

7 Low energy lights  
Percentage of fixed lights with low-energy fittings: 100%  
Minimum 75% OK

8 Mechanical ventilation  
Continuous supply and extract system  
Specific fan power: 0.52  
Maximum 1.5 OK  
MVHR efficiency: 92%  
Minimum 70% OK

9 Summertime temperature  
Overheating risk (Thames Valley): Slight OK  
Based on:  
Overshading: Average  
Windows facing South West: 3.94 m<sup>2</sup>, No overhang  
Windows facing North West: 7.30 m<sup>2</sup>, No overhang  
Air change rate: 6.00 ach  
Blinds/curtains: None

10 Key features  
External wall U-value: 0.14 W/m<sup>2</sup>K  
Party wall U-value: 0.00 W/m<sup>2</sup>K  
Party wall U-value: 0.00 W/m<sup>2</sup>K  
Air permeability: 3.0 m<sup>3</sup>/m<sup>2</sup>h  
Community heating, Waste Heat  
Photovoltaic array: 368.33 kWh/Year

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)  
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

#### 1. Overall dwelling dimensions

|                                                        | Area (m <sup>2</sup> ) | Storey height (m)               | Volume (m <sup>3</sup> ) |
|--------------------------------------------------------|------------------------|---------------------------------|--------------------------|
| Ground floor                                           | 53.2100 (1b)           | x 2.7700 (2b)                   | = 147.3917 (1b) - (3b)   |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 53.2100                |                                 | (4)                      |
| Dwelling volume                                        |                        | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 147.3917 (5)           |

#### 2. Ventilation rate

|                              | main heating | secondary heating | other | total    | m <sup>3</sup> per hour |
|------------------------------|--------------|-------------------|-------|----------|-------------------------|
| Number of chimneys           | 0            | 0                 | 0     | 0 * 40 = | 0.0000 (6a)             |
| Number of open flues         | 0            | 0                 | 0     | 0 * 20 = | 0.0000 (6b)             |
| Number of intermittent fans  | +            | +                 |       | 0 * 10 = | 0.0000 (7a)             |
| Number of passive vents      |              |                   |       | 0 * 10 = | 0.0000 (7b)             |
| Number of flueless gas fires |              |                   |       | 0 * 40 = | 0.0000 (7c)             |

Air changes per hour  
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 0.0000 / (5) = 0.0000 (8)  
Pressure test Yes  
Measured/design AP50 3.0000  
Infiltration rate 0.1500 (18)  
Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)  
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1275 (21)

|                                                                                              | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec           |
|----------------------------------------------------------------------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------------|
| Wind speed                                                                                   | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)   |
| Wind factor                                                                                  | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a)  |
| Adj infilt rate                                                                              | 0.1626 | 0.1594 | 0.1562 | 0.1403 | 0.1371 | 0.1211 | 0.1211 | 0.1179 | 0.1275 | 0.1371 | 0.1434 | 0.1498 (22b)  |
| Balanced mechanical ventilation with heat recovery                                           |        |        |        |        |        |        |        |        |        |        |        |               |
| If mechanical ventilation:                                                                   |        |        |        |        |        |        |        |        |        |        |        | 0.5000 (23a)  |
| If balanced with heat recovery; efficiency in % allowing for in-use factor (from Table 4b) = |        |        |        |        |        |        |        |        |        |        |        | 78.2000 (23c) |
| Effective ac                                                                                 | 0.2716 | 0.2684 | 0.2652 | 0.2493 | 0.2461 | 0.2301 | 0.2301 | 0.2269 | 0.2365 | 0.2461 | 0.2524 | 0.2588 (25)   |

#### 3. Heat losses and heat loss parameter

| Element                                                     | Gross m <sup>2</sup> | Openings m <sup>2</sup> | NetArea m <sup>2</sup> | U-value W/m <sup>2</sup> K | A x U W/K            | K-value kJ/m <sup>2</sup> K | A x K kJ/K      |
|-------------------------------------------------------------|----------------------|-------------------------|------------------------|----------------------------|----------------------|-----------------------------|-----------------|
| Windows (UW = 1.20)                                         |                      |                         | 11.2400                | 1.1450                     | 12.8702              |                             | (27)            |
| Front Door                                                  |                      |                         | 2.2400                 | 1.4000                     | 3.1360               |                             | (26)            |
| Unipanel wall                                               | 15.4300              | 2.2400                  | 13.1900                | 0.1400                     | 1.8466               | 30.9500                     | 408.2305 (29a)  |
| Curtain wall                                                | 11.5200              | 11.2400                 | 0.2800                 | 1.2000                     | 0.3360               | 14.0000                     | 3.9200 (29a)    |
| Total net area of external elements Aum(A, m <sup>2</sup> ) |                      |                         | 26.9500                |                            |                      |                             | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                         |                      |                         |                        |                            | (26)...(30) + (32) = | 18.1888                     | (33)            |
| Party Wall 2                                                |                      |                         | 56.6900                | 0.0000                     | 0.0000               | 20.0000                     | 1133.8000 (32)  |
| Party Wall column                                           |                      |                         | 4.8700                 | 0.0000                     | 0.0000               | 180.0000                    | 876.6000 (32)   |
| Party Floor 1                                               |                      |                         | 53.2100                |                            |                      | 40.0000                     | 2128.4000 (32d) |
| Party Ceilings 1                                            |                      |                         | 53.2100                |                            |                      | 40.0000                     | 2128.4000 (32b) |
| Internal Wall 1                                             |                      |                         | 85.5100                |                            |                      | 9.0000                      | 769.5900 (32c)  |

Heat capacity Cm = Sum(A x K) (28)...(30) + (32) + (32a)...(32e) = 7448.9405 (34)  
Thermal mass parameter (TMP = Cm / TFA) in kJ/m<sup>2</sup>K 139.9914 (35)  
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 2.6124 (36)  
Total fabric heat loss (33) + (36) = 20.8012 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)  
(38)m Jan 13.2086 Feb 13.0536 Mar 12.8985 Apr 12.1233 May 11.9683 Jun 11.1931 Jul 11.1931 Aug 11.0381 Sep 11.5032 Oct 11.9683 Nov 12.2784 Dec 12.5884 (38)  
Heat transfer coeff 34.0098 33.8548 33.6998 32.9246 32.7695 31.9943 31.9943 31.8393 32.3044 32.7695 33.0796 33.3897 (39)  
Average = Sum(39)m / 12 = 32.8858 (39)  
HLP Jan 0.6392 Feb 0.6362 Mar 0.6333 Apr 0.6188 May 0.6159 Jun 0.6013 Jul 0.6013 Aug 0.5984 Sep 0.6071 Oct 0.6159 Nov 0.6217 Dec 0.6275 (40)  
HLP (average) 0.6180 (40)  
Days in month 31 28 31 30 31 30 31 31 30 31 30 31 (41)

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

Assumed occupancy 1.7847 (42)  
Average daily hot water use (litres/day) 76.5878 (43)

|                     | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
|---------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| daily hot water use | 84.2466 | 81.1831 | 78.1196 | 75.0560 | 71.9925 | 68.9290 | 68.9290 | 71.9925 | 75.0560 | 78.1196 | 81.1831 | 84.2466 (44) |

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

|                                                                 |          |          |          |          |          |          |          |          |          |          |               |                                   |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|-----------------------------------|
| Energy conte                                                    | 124.9352 | 109.2692 | 112.7560 | 98.3034  | 94.3244  | 81.3948  | 75.4243  | 86.5505  | 87.5841  | 102.0709 | 111.4183      | 120.9931 (45)                     |
| Energy content (annual)                                         |          |          |          |          |          |          |          |          |          |          |               | Total = Sum(45)m = 1205.0242 (45) |
| Distribution loss (46)m = 0.15 x (45)m                          |          |          |          |          |          |          |          |          |          |          |               |                                   |
| 18.7403                                                         | 16.3904  | 16.9134  | 14.7455  | 14.1487  | 12.2092  | 11.3136  | 12.9826  | 13.1376  | 13.3106  | 16.7128  | 18.1490 (46)  |                                   |
| Water storage loss:                                             |          |          |          |          |          |          |          |          |          |          |               |                                   |
| Store volume                                                    |          |          |          |          |          |          |          |          |          |          |               | 145.0000 (47)                     |
| a) If manufacturer declared loss factor is known (kWh/day):     |          |          |          |          |          |          |          |          |          |          |               | 1.1800 (48)                       |
| Temperature factor from Table 2b                                |          |          |          |          |          |          |          |          |          |          |               | 0.6000 (49)                       |
| Enter (49) or (54) in (55)                                      |          |          |          |          |          |          |          |          |          |          |               | 0.7080 (55)                       |
| Total storage loss                                              |          |          |          |          |          |          |          |          |          |          |               |                                   |
| 21.9480                                                         | 19.8240  | 21.9480  | 21.2400  | 21.9480  | 21.2400  | 21.9480  | 21.9480  | 21.2400  | 21.9480  | 21.2400  | 21.9480 (56)  |                                   |
| If cylinder contains dedicated solar storage                    |          |          |          |          |          |          |          |          |          |          |               |                                   |
| 21.9480                                                         | 19.8240  | 21.9480  | 21.2400  | 21.9480  | 21.2400  | 21.9480  | 21.9480  | 21.2400  | 21.9480  | 21.2400  | 21.9480 (57)  |                                   |
| Primary loss                                                    | 23.2624  | 21.0112  | 23.2624  | 22.5120  | 23.2624  | 22.5120  | 23.2624  | 22.5120  | 23.2624  | 22.5120  | 23.2624 (59)  |                                   |
| Total heat required for water heating calculated for each month |          |          |          |          |          |          |          |          |          |          |               |                                   |
| 170.1456                                                        | 150.1044 | 157.9664 | 142.0554 | 139.5348 | 125.1468 | 120.6347 | 131.7609 | 131.3361 | 147.2813 | 155.1703 | 166.2035 (62) |                                   |
| Solar input                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000 (63)   |                                   |
| Output from w/h                                                 |          |          |          |          |          |          |          |          |          |          |               |                                   |
| 170.1456                                                        | 150.1044 | 157.9664 | 142.0554 | 139.5348 | 125.1468 | 120.6347 | 131.7609 | 131.3361 | 147.2813 | 155.1703 | 166.2035 (64) |                                   |
| Heat gains from water heating, kWh/month                        |          |          |          |          |          |          |          |          |          |          |               |                                   |
| 77.7093                                                         | 69.0002  | 73.6597  | 67.6875  | 67.5312  | 62.0654  | 61.2469  | 64.9463  | 64.1233  | 70.1069  | 72.0482  | 76.3985 (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                                                                               | 89.2375  | 89.2375  | 89.2375  | 89.2375  | 89.2375  | 89.2375  | 89.2375  | 89.2375  | 89.2375  | 89.2375  | 89.2375  | 89.2375 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 13.9009  | 12.3467  | 10.0410  | 7.6017   | 5.6823   | 4.7973   | 5.1836   | 6.7379   | 9.0435   | 11.4829  | 13.4022  | 14.2873 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 155.5615 | 157.1758 | 153.1079 | 144.4480 | 133.5164 | 123.2422 | 116.3784 | 114.7641 | 118.8320 | 127.4919 | 138.4236 | 148.6977 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 31.9237  | 31.9237  | 31.9237  | 31.9237  | 31.9237  | 31.9237  | 31.9237  | 31.9237  | 31.9237  | 31.9237  | 31.9237  | 31.9237 (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)                                 | -71.3900 | -71.3900 | -71.3900 | -71.3900 | -71.3900 | -71.3900 | -71.3900 | -71.3900 | -71.3900 | -71.3900 | -71.3900 | -71.3900 (71) |
| Water heating gains (Table 5)                                                       | 104.4480 | 102.6788 | 99.0050  | 94.0104  | 90.7677  | 86.2019  | 82.3211  | 87.2935  | 89.0602  | 94.2297  | 100.0669 | 102.6862 (72) |
| Total internal gains                                                                | 323.6816 | 321.9725 | 311.9251 | 295.8313 | 279.7377 | 264.0126 | 253.6543 | 258.5667 | 266.7069 | 282.9757 | 301.6639 | 315.4424 (73) |

#### 6. Solar gains

| [Jan]       |          |          |          |            |          |             |          |             |          |          |          |               |
|-------------|----------|----------|----------|------------|----------|-------------|----------|-------------|----------|----------|----------|---------------|
|             | Area     |          |          | Solar flux |          | g           |          | FF          |          | Access   |          | Gains         |
|             | m2       |          |          | Table 6a   |          | or Table 6b |          | or Table 6c |          | factor   |          | W             |
|             |          |          |          | W/m2       |          |             |          |             |          | Table 6d |          |               |
| Southwest   | 3.9400   |          |          | 36.7938    |          | 0.4000      |          | 0.7000      |          | 0.7700   |          | 28.1295 (79)  |
| Northwest   | 7.3000   |          |          | 11.2829    |          | 0.4000      |          | 0.7000      |          | 0.7700   |          | 15.9822 (81)  |
| -----       |          |          |          |            |          |             |          |             |          |          |          |               |
| Solar gains | 44.1117  | 80.4472  | 124.1721 | 177.4902   | 220.3767 | 228.2722    | 216.1298 | 182.6838    | 142.4075 | 92.7132  | 53.8024  | 37.1249 (83)  |
| Total gains | 367.7934 | 402.4197 | 436.0972 | 473.3215   | 500.1143 | 492.2848    | 469.7841 | 441.2506    | 409.1144 | 375.6889 | 355.4664 | 352.5673 (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, n1,m (see Table 9a)           | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| tau                                                                         | 60.8398 | 61.1184 | 61.3996 | 62.8452 | 63.1425 | 64.6724 | 64.6724 | 64.9873 | 64.0516 | 63.1425 | 62.5506 | 61.9698      |
| alpha                                                                       | 5.0560  | 5.0746  | 5.0933  | 5.1897  | 5.2095  | 5.3115  | 5.3115  | 5.3325  | 5.2701  | 5.2095  | 5.1700  | 5.1313       |
| util: living area                                                           | 0.9578  | 0.9333  | 0.8795  | 0.7586  | 0.5905  | 0.4136  | 0.2993  | 0.3313  | 0.5345  | 0.7955  | 0.9246  | 0.9636 (86)  |
| MIT                                                                         | 20.3191 | 20.4645 | 20.6676 | 20.8751 | 20.9699 | 20.9964 | 20.9995 | 20.9991 | 20.9865 | 20.8665 | 20.5836 | 20.2990 (87) |
| Th 2                                                                        | 20.3949 | 20.3975 | 20.4001 | 20.4131 | 20.4158 | 20.4288 | 20.4288 | 20.4315 | 20.4236 | 20.4158 | 20.4105 | 20.4053 (88) |
| util: rest of house                                                         | 0.9517  | 0.9242  | 0.8643  | 0.7334  | 0.5574  | 0.3775  | 0.2606  | 0.2906  | 0.4928  | 0.7675  | 0.9131  | 0.9583 (89)  |
| MIT 2                                                                       | 19.4824 | 19.6906 | 19.9761 | 20.2646 | 20.3839 | 20.4257 | 20.4285 | 20.4309 | 20.4111 | 20.2606 | 19.8723 | 19.4621 (90) |
| Living area fraction                                                        | 20.0374 | 20.2040 | 20.4349 | 20.6696 | 20.7727 | 20.8043 | 20.8073 | 20.8079 | 20.7928 | 20.6626 | 20.3442 | 20.0173 (91) |
| MIT                                                                         | 20.0374 | 20.2040 | 20.4349 | 20.6696 | 20.7727 | 20.8043 | 20.8073 | 20.8079 | 20.7928 | 20.6626 | 20.3442 | 20.0173 (92) |
| Temperature adjustment                                                      | 20.0374 | 20.2040 | 20.4349 | 20.6696 | 20.7727 | 20.8043 | 20.8073 | 20.8079 | 20.7928 | 20.6626 | 20.3442 | 20.0173 (93) |
| adjusted MIT                                                                | 20.0374 | 20.2040 | 20.4349 | 20.6696 | 20.7727 | 20.8043 | 20.8073 | 20.8079 | 20.7928 | 20.6626 | 20.3442 | 20.0173 (93) |

#### 8. Space heating requirement

|                      | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec           |
|----------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| Utilisation          | 0.9477   | 0.9210   | 0.8652   | 0.7447   | 0.5778   | 0.4013   | 0.2863   | 0.3176   | 0.5197   | 0.7797   | 0.9117   | 0.9544 (94)   |
| Useful gains         | 348.5460 | 370.6486 | 377.3089 | 352.4723 | 288.9493 | 197.5474 | 134.4839 | 140.1301 | 212.6050 | 292.9276 | 324.0675 | 336.4810 (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     | 535.2279 | 518.1136 | 469.6011 | 387.5082 | 297.3077 | 198.5021 | 134.6096 | 140.3431 | 216.2086 | 329.7464 | 438.1135 | 528.1343 (97) |
| Month fracti         | 1.0000   | 1.0000   | 1.0000   | 1.0000   | 1.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 1.0000   | 1.0000   | 1.0000 (97a)  |
| Space heating kWh    | 138.8914 | 99.0965  | 68.6654  | 25.2259  | 6.2187   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 27.3932  | 82.1131  | 142.5900 (98) |
| Space heating        |          |          |          |          |          |          |          |          |          |          |          | 290.1340 (98) |
| Space heating per m2 |          |          |          |          |          |          |          |          |          |          |          | 11.0918 (99)  |



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

#### 8c. Space cooling requirement

Not applicable

#### 9B. Energy requirements

|                                                                                         |                 |
|-----------------------------------------------------------------------------------------|-----------------|
| Fraction of space heat from secondary/supplementary system (Table 11)                   | 0.0000 (301)    |
| Fraction of space heat from community system                                            | 1.0000 (302)    |
| Fraction of heat from community Waste Heat                                              | 1.0000 (303a)   |
| Fraction of total space heat from community Waste Heat                                  | 1.0000 (304a)   |
| Factor for control and charging method (Table 4c(3)) for community space heating        | 1.0000 (305)    |
| Factor for control and charging method (Table 4c(3)) for community water heating        | 1.0000 (305a)   |
| Distribution loss factor (Table 12c) for community heating system                       | 1.1000 (306)    |
| Space heating:                                                                          |                 |
| Annual space heating requirement                                                        | 590.1940 (98)   |
| Space heat from Waste Heat = (98) x 1.00 x 1.00 x 1.10                                  | 649.2134 (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | 0.0000 (308)    |
| Space heating fuel for secondary/supplementary system                                   | 0.0000 (309)    |

#### Water heating

|                                                        |                  |
|--------------------------------------------------------|------------------|
| Annual water heating requirement                       | 1737.3402 (64)   |
| Water heat from Waste Heat = (64) x 1.00 x 1.00 x 1.10 | 1911.0743 (310a) |
| Electricity used for heat distribution                 | 25.6029 (313)    |
| Annual totals kWh/year                                 |                  |

#### Electricity for pumps and fans:

|                                                                            |                 |
|----------------------------------------------------------------------------|-----------------|
| (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SEP = 0.6500) |                 |
| mechanical ventilation fans (SEP = 0.6500)                                 | 116.8816 (330a) |
| Total electricity for the above, kWh/year                                  | 116.8816 (331)  |
| Electricity for lighting (calculated in Appendix L)                        | 245.4944 (332)  |

#### Energy saving/generation technologies (Appendices M, N and Q)

|                                     |                 |
|-------------------------------------|-----------------|
| Total delivered energy for all uses | 2922.6637 (338) |
|-------------------------------------|-----------------|

#### 12b. Carbon dioxide emissions - Community heating scheme

|                                                                                            |                    |                               |                          |
|--------------------------------------------------------------------------------------------|--------------------|-------------------------------|--------------------------|
|                                                                                            | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
| Efficiency of heat source Waste Heat                                                       |                    |                               | 100.0000 (367a)          |
| Space heating from Waste Heat                                                              | 2560.2876          | 0.0580                        | 148.4967 (367)           |
| Electrical energy for heat distribution                                                    | 25.6029            | 0.5190                        | 13.2879 (372)            |
| Total CO2 associated with community systems<br>(negative value allowed since DFEE <= TFEE) |                    |                               | 161.7846 (373)           |
| Space and water heating                                                                    |                    |                               | 161.7846 (376)           |
| Pumps and fans                                                                             | 116.8816           | 0.5190                        | 60.6616 (378)            |
| Energy for lighting                                                                        | 245.4944           | 0.5190                        | 127.4116 (379)           |
| Energy saving/generation technologies                                                      |                    |                               |                          |
| PV Unit                                                                                    | -368.3300          | 0.5190                        | -191.1633 (380)          |
| Total CO2, kg/year                                                                         |                    |                               | 158.6945 (383)           |
| Dwelling Carbon Dioxide Emission Rate (DER)                                                |                    |                               | 2.9800 (384)             |

#### 16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

|                                                                                 |     |             |
|---------------------------------------------------------------------------------|-----|-------------|
| DER                                                                             |     | 2.9800 2C1  |
| Total Floor Area                                                                | TFA | 53.2100     |
| Assumed number of occupants                                                     | N   | 1.7847      |
| CO2 emission factor in Table 12 for electricity displaced from grid             | EF  | 0.5190      |
| CO2 emissions from appliances, equation (L14)                                   |     | 17.3243 2C2 |
| CO2 emissions from cooking, equation (L16)                                      |     | 3.0414 2C3  |
| Total CO2 emissions                                                             |     | 23.3457 2C4 |
| Residual CO2 emissions offset from biofuel CHP                                  |     | 0.0000 2C5  |
| Additional allowable electricity generation, kWh/m²/year                        |     | 0.0000 2C6  |
| Resulting CO2 emissions offset from additional allowable electricity generation |     | 0.0000 2C7  |
| Net CO2 emissions                                                               |     | 23.3457 2C8 |



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)  
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

#### 1. Overall dwelling dimensions

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m) | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|----------------------|-----------------------------|
| Ground floor                                           | 53.2100                   | 2.7700               | 147.3917                    |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 53.2100                   |                      |                             |
| Dwelling volume                                        |                           |                      | 147.3917                    |

#### 2. Ventilation rate

|                                                      | main<br>heating | secondary<br>heating | other | total                       | m <sup>3</sup> per hour |
|------------------------------------------------------|-----------------|----------------------|-------|-----------------------------|-------------------------|
| Number of chimneys                                   | 0               | +                    | 0     | 0 * 40 =                    | 0.0000 (6a)             |
| Number of open flues                                 | 0               | +                    | 0     | 0 * 20 =                    | 0.0000 (6b)             |
| Number of intermittent fans                          |                 |                      |       | 2 * 10 =                    | 20.0000 (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         |                 |                      |       | 20.0000 / (5) =             | 0.1357 (8)              |
| Pressure test                                        |                 |                      |       | Yes                         |                         |
| Measured/design AP50                                 |                 |                      |       | 5.0000                      |                         |
| Infiltration rate                                    |                 |                      |       | 0.3857                      | (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) =        | 0.3278 (21)             |

|                 | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed      | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor     | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate |        |        |        |        |        |        |        |        |        |        |        |              |
| Effective ac    | 0.4180 | 0.4098 | 0.4016 | 0.3606 | 0.3524 | 0.3114 | 0.3114 | 0.3033 | 0.3278 | 0.3524 | 0.3688 | 0.3852 (22b) |
|                 | 0.5874 | 0.5840 | 0.5806 | 0.5650 | 0.5621 | 0.5485 | 0.5485 | 0.5460 | 0.5537 | 0.5621 | 0.5680 | 0.5742 (25)  |

#### 3. Heat losses and heat loss parameter

| Element                                                             | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K           | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K |         |         |         |         |              |
|---------------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|------------------------|--------------------------------|---------------|---------|---------|---------|---------|--------------|
| TER Opaque door                                                     |                         |                            | 2.2400                    | 1.0000                        | 2.2400                 |                                | (26)          |         |         |         |         |              |
| TER Opening Type Curtain (Uw = 1.50)                                |                         |                            | 11.0600                   | 1.4151                        | 15.6509                |                                | (27)          |         |         |         |         |              |
| Unipanel wall                                                       | 15.4300                 | 2.2400                     | 13.1900                   | 0.1800                        | 2.3742                 |                                | (29a)         |         |         |         |         |              |
| Curtain wall                                                        | 11.5200                 | 11.0600                    | 0.4600                    | 0.1800                        | 0.0828                 |                                | (29a)         |         |         |         |         |              |
| Total net area of external elements Sum(A, m <sup>2</sup> )         |                         |                            | 26.9500                   |                               |                        |                                | (31)          |         |         |         |         |              |
| Fabric heat loss, W/K = Sum (A x U)                                 |                         |                            |                           |                               | (26) ... (30) + (32) = | 20.3479                        | (33)          |         |         |         |         |              |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K      |                         |                            |                           |                               |                        |                                | 250.0000 (35) |         |         |         |         |              |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)          |                         |                            |                           |                               |                        |                                | 2.3720 (36)   |         |         |         |         |              |
| Total fabric heat loss                                              |                         |                            |                           |                               |                        | (33) + (36) =                  | 27.7199 (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                                                 | 28.5687                 | 28.4037                    | 28.2420                   | 27.4824                       | 27.3402                | 26.6786                        | 26.6786       | 26.5561 | 26.9335 | 27.3402 | 27.6278 | 27.9284 (38) |
| Average = Sum(39)m / 12 =                                           | 51.2887                 | 51.1237                    | 50.9620                   | 50.2023                       | 50.0602                | 49.3986                        | 49.3986       | 49.2760 | 49.6534 | 50.0602 | 50.3477 | 50.6483 (39) |
|                                                                     |                         |                            |                           |                               |                        |                                |               |         |         |         |         | 50.2016 (39) |
| HLP                                                                 | Jan                     | Feb                        | Mar                       | Apr                           | May                    | Jun                            | Jul           | Aug     | Sep     | Oct     | Nov     | Dec          |
| HLP (average)                                                       | 0.9639                  | 0.9608                     | 0.9578                    | 0.9435                        | 0.9408                 | 0.9284                         | 0.9284        | 0.9261  | 0.9332  | 0.9408  | 0.9462  | 0.9519 (40)  |
| Days in month                                                       | 31                      | 28                         | 31                        | 30                            | 31                     | 30                             | 31            | 31      | 30      | 31      | 30      | 31 (41)      |

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

|                                                             |          |          |          |         |         |         |         |         |         |          |          |               |
|-------------------------------------------------------------|----------|----------|----------|---------|---------|---------|---------|---------|---------|----------|----------|---------------|
| Assumed occupancy                                           |          |          |          |         |         |         |         |         |         |          |          | 1.7847 (42)   |
| Average daily hot water use (litres/day)                    |          |          |          |         |         |         |         |         |         |          |          | 76.5878 (43)  |
| Daily hot water use                                         | Jan      | Feb      | Mar      | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct      | Nov      | Dec           |
| Energy cont                                                 | 84.2466  | 81.1831  | 78.1196  | 75.0560 | 71.9925 | 68.9290 | 68.9290 | 71.9925 | 75.0560 | 78.1196  | 81.1831  | 84.2466 (44)  |
| Energy content (annual)                                     | 124.9352 | 109.2692 | 112.7560 | 98.3034 | 94.3244 | 81.3948 | 75.4243 | 86.5505 | 87.5841 | 102.0709 | 111.4183 | 120.9931 (45) |
| Distribution loss (46)m = 0.15 x (45)m                      | 18.7403  | 16.3904  | 16.9134  | 14.7455 | 14.1487 | 12.2092 | 11.3136 | 12.9826 | 13.1376 | 15.3106  | 16.7128  | 18.1490 (46)  |
| Water storage loss:                                         |          |          |          |         |         |         |         |         |         |          |          |               |
| Store volume                                                |          |          |          |         |         |         |         |         |         |          |          | 145.0000 (47) |
| a) If manufacturer declared loss factor is known (kWh/day): |          |          |          |         |         |         |         |         |         |          |          | 1.3665 (48)   |
| Temperature factor from Table 2b                            |          |          |          |         |         |         |         |         |         |          |          | 0.5400 (49)   |
| enter (48) or (54) in (53)                                  |          |          |          |         |         |         |         |         |         |          |          | 0.5479 (50)   |
| Total storage loss                                          |          |          |          |         |         |         |         |         |         |          |          |               |

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

|                                                                 |          |          |          |          |          |          |          |          |          |          |          |               |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------------|
| If cylinder contains dedicated solar storage                    | 22.8747  | 20.6610  | 22.8747  | 22.1368  | 22.8747  | 22.1368  | 22.8747  | 22.1368  | 22.8747  | 22.1368  | 22.8747  | (56)          |
| Primary loss                                                    | 22.8747  | 20.6610  | 22.8747  | 22.1368  | 22.8747  | 22.1368  | 22.8747  | 22.1368  | 22.8747  | 22.1368  | 22.8747  | (57)          |
| Total heat required for water heating calculated for each month | 23.2624  | 21.0112  | 23.2624  | 22.5120  | 23.2624  | 22.5120  | 23.2624  | 22.5120  | 23.2624  | 22.5120  | 23.2624  | (59)          |
| Solar input                                                     | 171.0723 | 150.9414 | 158.8931 | 142.9522 | 140.4615 | 126.0436 | 121.5613 | 132.6875 | 132.2329 | 148.2080 | 156.0671 | 167.1302 (62) |
| Output from w/h                                                 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (63)          |
| Heat gains from water heating, kWh/month                        | 171.0723 | 150.9414 | 158.8931 | 142.9522 | 140.4615 | 126.0436 | 121.5613 | 132.6875 | 132.2329 | 148.2080 | 156.0671 | 167.1302 (64) |
|                                                                 | 78.4506  | 69.6698  | 74.4010  | 68.4049  | 68.2728  | 62.7828  | 61.9882  | 65.6877  | 64.8408  | 70.8482  | 72.7656  | 77.1399 (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                                                                               | 89.2375  | 89.2375  | 89.2375  | 89.2375  | 89.2375  | 89.2375  | 89.2375  | 89.2375  | 89.2375  | 89.2375  | 89.2375  | 89.2375 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 13.9170  | 12.3610  | 10.0526  | 7.6105   | 5.6889   | 4.8028   | 5.1896   | 6.7457   | 9.0540   | 11.4962  | 13.4177  | 14.3038 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 155.5615 | 157.1758 | 153.1079 | 144.4480 | 133.5164 | 123.2422 | 116.3784 | 114.7641 | 118.8320 | 127.4919 | 138.4236 | 148.6977 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 31.9237  | 31.9237  | 31.9237  | 31.9237  | 31.9237  | 31.9237  | 31.9237  | 31.9237  | 31.9237  | 31.9237  | 31.9237  | 31.9237 (69)  |
| Pumps, fans                                                                         | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000 (70)   |
| Losses e.g. evaporation (negative values) (Table 5)                                 | -71.3900 | -71.3900 | -71.3900 | -71.3900 | -71.3900 | -71.3900 | -71.3900 | -71.3900 | -71.3900 | -71.3900 | -71.3900 | -71.3900 (71) |
| Water heating gains (Table 5)                                                       | 105.4444 | 103.6752 | 100.0014 | 95.0068  | 91.7642  | 87.1983  | 83.3175  | 88.2899  | 90.0566  | 95.2261  | 101.0634 | 103.6826 (72) |
| Total internal gains                                                                | 327.6942 | 325.9832 | 315.9332 | 299.8365 | 283.7407 | 268.0146 | 257.8568 | 262.5710 | 270.7139 | 286.9855 | 305.6759 | 319.4554 (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   |
|-------------|----------|----------|------------|----------|--------------------------------|----------|-----------------------------------|----------|------------------------------------|----------|------------------------------|---------------|--------------|
| Southwest   |          |          | 3.8800     |          | 36.7938                        |          | 0.6300                            |          | 0.7000                             |          | 0.7700                       |               | 43.6293 (79) |
| Northwest   |          |          | 7.1800     |          | 11.2829                        |          | 0.6300                            |          | 0.7000                             |          | 0.7700                       |               | 24.7582 (81) |
| Solar gains | 68.3875  | 124.7129 | 192.4811   | 275.1065 | 341.5610                       | 353.7908 | 334.9747                          | 285.1494 | 220.7401                           | 143.7239 | 83.4101                      | 57.5564 (83)  |              |
| Total gains | 396.0817 | 450.6961 | 508.4143   | 574.9431 | 625.3017                       | 621.8054 | 592.6315                          | 545.7203 | 491.4539                           | 430.7093 | 389.0860                     | 377.0118 (84) |              |

#### 7. Mean internal temperature (heating season)

|                                                                                          |         |         |         |         |         |         |         |         |         |         |         |              |
|------------------------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------------|
| Temperature during heating periods in the living area from Table 9, T <sub>hi</sub> (°C) |         |         |         |         |         |         |         |         |         |         |         | 21.0000 (85) |
| Utilisation factor for gains for living area, n <sub>li</sub> ,m (see Table 9a)          |         |         |         |         |         |         |         |         |         |         |         |              |
| Jan                                                                                      | 72.0459 | 72.2784 | 72.5078 | 73.8050 | 73.8139 | 74.8026 | 74.8026 | 74.9886 | 74.4186 | 73.8139 | 73.3924 | 72.9568      |
| alpha                                                                                    | 5.8031  | 5.8186  | 5.8339  | 5.9070  | 5.9209  | 5.9868  | 5.9868  | 5.9992  | 5.9612  | 5.9209  | 5.8928  | 5.8638       |
| util living area                                                                         | 0.9938  | 0.9862  | 0.9618  | 0.8776  | 0.7064  | 0.5040  | 0.3662  | 0.4141  | 0.6704  | 0.9231  | 0.9858  | 0.9953 (86)  |
| MIT                                                                                      | 20.1544 | 20.3079 | 20.5428 | 20.8114 | 20.9563 | 20.9950 | 20.9994 | 20.9987 | 20.9758 | 20.7742 | 20.4202 | 20.1290 (87) |
| Th 2                                                                                     | 20.1135 | 20.1161 | 20.1187 | 20.1307 | 20.1330 | 20.1435 | 20.1435 | 20.1454 | 20.1394 | 20.1330 | 20.1284 | 20.1236 (88) |
| util rest of house                                                                       | 0.9919  | 0.9820  | 0.9506  | 0.8467  | 0.6522  | 0.4386  | 0.2952  | 0.3379  | 0.5973  | 0.8955  | 0.9807  | 0.9938 (89)  |
| MIT 2                                                                                    | 18.9946 | 19.2184 | 19.5541 | 19.9239 | 20.0944 | 20.1404 | 20.1432 | 20.1449 | 20.1223 | 19.8870 | 19.3918 | 18.9655 (90) |
| Living area fraction                                                                     | 19.7640 | 19.9411 | 20.2100 | 20.5127 | 20.6662 | 20.7073 | 20.7112 | 20.7114 | 20.6886 | 20.4756 | 20.0741 | 18.7374 (92) |
| MIT                                                                                      | 19.7640 | 19.9411 | 20.2100 | 20.5127 | 20.6662 | 20.7073 | 20.7112 | 20.7114 | 20.6886 | 20.4756 | 20.0741 | 18.7374 (93) |

#### 8. Space heating requirement

|                                  |          |          |          |          |          |          |          |          |          |          |          |                |
|----------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| Utilisation                      | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec            |
| Useful gains                     | 392.5238 | 442.1401 | 481.9595 | 495.0771 | 429.0684 | 299.6346 | 202.8682 | 211.9937 | 316.8723 | 390.4282 | 381.4433 | 374.3699 (95)  |
| Ext temp.                        | 4.3000   | 4.9000   | 6.5000   | 8.9000   | 11.7000  | 14.6000  | 16.8000  | 16.4000  | 14.1000  | 10.6000  | 7.1000   | 4.2000 (96)    |
| Heat loss rate W                 | 793.1279 | 768.9588 | 698.6908 | 582.9822 | 448.8485 | 301.6934 | 203.0876 | 212.4462 | 327.1440 | 494.3739 | 653.2154 | 786.9427 (97)  |
| Month fracti                     | 1.0000   | 1.0000   | 1.0000   | 1.0000   | 1.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 1.0000   | 1.0000   | 1.0000 (97a)   |
| Space heating kWh                | 298.0495 | 219.6222 | 159.7601 | 63.2917  | 14.7164  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 77.0380  | 195.6759 | 306.9542 (98)  |
| Space heating                    |          |          |          |          |          |          |          |          |          |          |          | 1335.1079 (98) |
| Space heating per m <sup>2</sup> |          |          |          |          |          |          |          |          |          |          |          | 25.0913 (99)   |

#### 8c. Space cooling requirement

Not applicable

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

#### 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 %)                      |          |          |          |          |          |          |          |          |          |          |          | 93.5000   | (206)  |
| Efficiency of secondary/supplementary heating system, %               |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (208)  |
| Space heating requirement                                             |          |          |          |          |          |          |          |          |          |          |          | 1427.9229 | (211)  |
|                                                                       | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec       |        |
| Space heating requirement                                             | 298.0495 | 219.6222 | 159.7601 | 63.2917  | 14.7164  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 77.0380  | 195.6759 | 306.9542  | (98)   |
| Space heating efficiency (main heating system 1)                      | 93.5000  | 93.5000  | 93.5000  | 93.5000  | 93.5000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 93.5000  | 93.5000  | 93.5000   | (210)  |
| Space heating fuel (main heating system)                              | 318.7695 | 234.8900 | 170.8664 | 67.6916  | 15.7395  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 82.3936  | 209.2791 | 328.2932  | (211)  |
| Water heating requirement                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | (215)  |
| Water heating requirement                                             | 171.0723 | 150.9414 | 158.8931 | 142.9522 | 140.4615 | 126.0436 | 121.5613 | 132.6875 | 132.2329 | 148.2080 | 156.0671 | 167.1302  | (64)   |
| Efficiency of water heater (217)m                                     | 86.2812  | 85.8132  | 84.8284  | 82.8044  | 80.7049  | 79.8000  | 79.8000  | 79.8000  | 79.8000  | 83.1629  | 85.4182  | 86.4152   | (216)  |
| Fuel for water heating, kWh/month                                     | 198.2730 | 175.8953 | 187.3112 | 172.6384 | 174.0433 | 157.9494 | 152.3325 | 166.2751 | 165.7054 | 178.2140 | 182.7094 | 193.4037  | (219)  |
| Water heating fuel used                                               | 198.2730 | 175.8953 | 187.3112 | 172.6384 | 174.0433 | 157.9494 | 152.3325 | 166.2751 | 165.7054 | 178.2140 | 182.7094 | 193.4037  | (219)  |
| Annual totals kWh/year                                                |          |          |          |          |          |          |          |          |          |          |          |           |        |
| Space heating fuel - main system                                      |          |          |          |          |          |          |          |          |          |          |          | 1427.9229 | (211)  |
| Space heating fuel - secondary                                        |          |          |          |          |          |          |          |          |          |          |          | 0.0000    | (215)  |
| Electricity for pumps and fans:                                       |          |          |          |          |          |          |          |          |          |          |          |           |        |
| central heating pump                                                  |          |          |          |          |          |          |          |          |          |          |          | 30.0000   | (230c) |
| main heating flue fan                                                 |          |          |          |          |          |          |          |          |          |          |          | 45.0000   | (230e) |
| Total electricity for the above, kWh/year                             |          |          |          |          |          |          |          |          |          |          |          | 75.0000   | (231)  |
| Electricity for lighting (calculated in Appendix b)                   |          |          |          |          |          |          |          |          |          |          |          | 245.7791  | (232)  |
| Total delivered energy for all uses                                   |          |          |          |          |          |          |          |          |          |          |          | 3853.8530 | (238)  |

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

|                                                                                                   | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |        |
|---------------------------------------------------------------------------------------------------|--------------------|-------------------------------|--------------------------|--------|
| Space heating - main system 1                                                                     | 1427.9229          | 0.2160                        | 308.4314                 | (261)  |
| Space heating - secondary                                                                         | 0.0000             | 0.0000                        | 0.0000                   | (263)  |
| Water heating (other fuel)                                                                        | 2104.7510          | 0.2160                        | 454.6262                 | (264)  |
| Space and water heating                                                                           |                    |                               | 763.0576                 | (265)  |
| Pumps and fans                                                                                    | 75.0000            | 0.5190                        | 38.9250                  | (267)  |
| Energy for lighting                                                                               | 245.7791           | 0.5190                        | 127.5593                 | (268)  |
| Total CO2, kg/m2/year                                                                             |                    |                               | 929.5419                 | (272)  |
| Emissions per m2 for space and water heating                                                      |                    |                               | 14.3405                  | (272a) |
| Fuel factor (waste heat)                                                                          |                    |                               | 1.0000                   |        |
| Emissions per m2 for lighting                                                                     |                    |                               | 2.3973                   | (272b) |
| Emissions per m2 for pumps and fans                                                               |                    |                               | 0.7315                   | (272c) |
| Target Carbon Dioxide Emission Rate (TER) = (14.3405 * 1.00) + 2.3973 + 0.7315, rounded to 2 d.p. |                    |                               | 17.4700                  | (273)  |

# BASIC COMPLIANCE REPORT

## Calculation Type: New Build (As Designed)



|                      |            |                |            |
|----------------------|------------|----------------|------------|
| Property Reference   | 116564     | Issued on Date | 17/12/2021 |
| Assessment Reference | Plot 68/69 | Prop Type Ref  | Mid Floor  |
| Property             |            |                |            |

|                                 |      |             |       |      |       |
|---------------------------------|------|-------------|-------|------|-------|
| SAP Rating                      | 86 B | DER         | 2.98  | TER  | 17.47 |
| Environmental                   | 98 A | % DER<TER   | 82.94 |      |       |
| CO2 Emissions (t/year)          | 0.13 | DFEE        | 32.27 | TFEE | 38.71 |
| General Requirements Compliance | Pass | % DFEE<TFEE | 16.63 |      |       |

|                  |                                                                                    |             |           |
|------------------|------------------------------------------------------------------------------------|-------------|-----------|
| Assessor Details | Mr. Richard Denteh, Meinhardt UK, Tel: 02078317969, richard.denteh@meinhardt.co.uk | Assessor ID | T596-0001 |
|------------------|------------------------------------------------------------------------------------|-------------|-----------|

|        |  |
|--------|--|
| Client |  |
|--------|--|

### SUMMARY FOR INPUT DATA FOR New Build (As Designed)

#### Criterion 1 - Achieving the TER and TFEE rate

##### 1a TER and DER

|                                             |                   |          |
|---------------------------------------------|-------------------|----------|
| Fuel for main heating                       | Waste Heat        |          |
| Fuel factor                                 | 1.00 (waste heat) |          |
| Target Carbon Dioxide Emission Rate (TER)   | 17.47             | kgCO2/m2 |
| Dwelling Carbon Dioxide Emission Rate (DER) | 2.98              | kgCO2/m2 |
|                                             | -14.49 (-82.9%)   | kgCO2/m2 |
|                                             |                   | Pass     |

##### 1b TFEE and DFEE

|                                          |               |           |
|------------------------------------------|---------------|-----------|
| Target Fabric Energy Efficiency (TFEE)   | 38.71         | kWh/m2/yr |
| Dwelling Fabric Energy Efficiency (DFEE) | 32.27         | kWh/m2/yr |
|                                          | -6.4 (-16.5%) | kWh/m2/yr |
|                                          |               | Pass      |

#### Criterion 2 - Limits on design flexibility

##### Limiting Fabric Standards

##### 2 Fabric U-values

| Element                   | Average          | Highest          |      |
|---------------------------|------------------|------------------|------|
| External wall             | 0.14 (max. 0.30) | 0.14 (max. 0.70) | Pass |
| Party wall                | 0.00 (max. 0.20) | -                | Pass |
| Openings and curtain wall | 1.23 (max. 2.00) | 1.40 (max. 3.30) | Pass |

##### 2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

##### 3 Air permeability

|                                |                     |      |
|--------------------------------|---------------------|------|
| Air permeability at 50 pascals | 3.00 (design value) |      |
| Maximum                        | 10.0                | Pass |

##### Limiting System Efficiencies

##### 4 Heating efficiency

|                          |                          |   |
|--------------------------|--------------------------|---|
| Main heating system      | Community heating scheme | - |
| Secondary heating system | None                     |   |

##### 5 Cylinder insulation

|                   |                                                                 |      |
|-------------------|-----------------------------------------------------------------|------|
| Hot water storage | Measured cylinder loss: 1.18 kWh/day<br>Permitted by DB5CG 1.85 | Pass |
|-------------------|-----------------------------------------------------------------|------|

## BASIC COMPLIANCE REPORT

### Calculation Type: New Build (As Designed)

Primary pipework insulated Yes (assumed) Pass

#### 6 Controls

Space heating controls Charging system linked to use of community heating, programmer and TRVs Pass

Hot water controls Cylinderstat Pass

#### 7 Low energy lights

Percentage of fixed lights with low-energy fittings 100 %

Minimum 75 % Pass

#### 8 Mechanical ventilation

Continuous supply and extract system

Specific fan power 0.52

Maximum 1.5 Pass

MVHR efficiency 92 %

Minimum 70 % Pass

#### Criterion 3 – Limiting the effects of heat gains in summer

##### 9 Summertime temperature

Overheating risk (Thames Valley) Slight Pass

Based on:

Overshading Average

Windows facing South West 3.94 m<sup>2</sup>, No overhang

Windows facing North West 7.30 m<sup>2</sup>, No overhang

Air change rate 6.00 ach

Blinds/curtains None

#### Criterion 4 – Building performance consistent with DER and DFEE rate

##### Party Walls

Type U-value

Filled Cavity with Edge Sealing 0.00 W/m<sup>2</sup>K Pass

Solid Wall 0.00 W/m<sup>2</sup>K Pass

##### Air permeability and pressure testing

##### 3 Air permeability

Air permeability at 50 pascals 3.00 (design value)

Maximum 10.0 Pass

#### 10 Key features

External wall U-value 0.14 W/m<sup>2</sup>K

Party wall U-value 0.00 W/m<sup>2</sup>K

Party wall U-value 0.00 W/m<sup>2</sup>K

Air permeability 3.0 m<sup>3</sup>/m<sup>2</sup>h

Community heating, Waste Heat N/A

Photovoltaic array 368.33 kWh/Year

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

## FULL SAP CALCULATION PRINTOUT

### Calculation Type: New Build (As Designed)

|                      |         |                |            |
|----------------------|---------|----------------|------------|
| Property Reference   | 116581  | Issued on Date | 17/12/2021 |
| Assessment Reference | Plot 47 | Prop Type Ref  | Top Floor  |
| Property             |         |                |            |

|                                    |      |             |       |      |       |
|------------------------------------|------|-------------|-------|------|-------|
| SAP Rating                         | 85 B | DER         | 4.98  | TER  | 19.40 |
| Environmental                      | 96 A | % DER<TER   | 74.33 |      |       |
| CO <sub>2</sub> Emissions (t/year) | 0.34 | DFEE        | 52.00 | TFEE | 59.79 |
| General Requirements Compliance    | Pass | % DFEE<TFEE | 13.04 |      |       |

|                  |                                                                                    |             |           |
|------------------|------------------------------------------------------------------------------------|-------------|-----------|
| Assessor Details | Mr. Richard Denteh, Meinhardt UK, Tel: 02078317969, richard.denteh@meinhardt.co.uk | Assessor ID | T596-0001 |
|------------------|------------------------------------------------------------------------------------|-------------|-----------|

|        |  |
|--------|--|
| Client |  |
|--------|--|

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

#### DWELLING AS DESIGNED

Top-floor flat, total floor area 81 m<sup>2</sup>

This report covers items included within the SAP calculations.  
It is not a complete report of regulations compliance.

1a TER and DER  
Fuel for main heating:Waste Heat  
Fuel factor:1.00 (waste heat)  
Target Carbon Dioxide Emission Rate (TER) 19.40 kgCO<sub>2</sub>/m<sup>2</sup>  
Dwelling Carbon Dioxide Emission Rate (DER) 4.98 kgCO<sub>2</sub>/m<sup>2</sup>OK

1b TFEE and DFEE  
Target Fabric Energy Efficiency (TFEE)59.8 kWh/m<sup>2</sup>/yr  
Dwelling Fabric Energy Efficiency (DFEE)52.0 kWh/m<sup>2</sup>/yrOK

#### 2 Fabric U-values

| Element                   | Average          | Highest          |    |
|---------------------------|------------------|------------------|----|
| External wall             | 0.16 (max. 0.30) | 0.26 (max. 0.70) | OK |
| Party wall                | 0.00 (max. 0.20) | -                | OK |
| Floor (no floor)          |                  |                  |    |
| Roof                      | 0.11 (max. 0.20) | 0.11 (max. 0.35) | OK |
| Openings and curtain wall | 1.22 (max. 2.00) | 1.40 (max. 3.30) | OK |

#### 2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

#### 3 Air permeability

|                                 |                     |    |
|---------------------------------|---------------------|----|
| Air permeability at 50 pascals: | 3.00 (design value) |    |
| Maximum                         | 10.0                | OK |

#### 4 Heating efficiency

|                      |                          |   |
|----------------------|--------------------------|---|
| Main heating system: | Community heating scheme | - |
|----------------------|--------------------------|---|

#### Secondary heating system:

|  |      |  |
|--|------|--|
|  | None |  |
|--|------|--|

#### 5 Cylinder insulation

|                         |                                      |  |
|-------------------------|--------------------------------------|--|
| Hot water storage       | Measured cylinder loss: 1.18 kWh/day |  |
| Permitted by DBSCG 1.85 | OK                                   |  |

|                             |               |    |
|-----------------------------|---------------|----|
| Primary pipework insulated: | Yes (assumed) | OK |
|-----------------------------|---------------|----|

#### 6 Controls

|                         |                                                                           |  |
|-------------------------|---------------------------------------------------------------------------|--|
| Space heating controls: | Charging system linked to use of community heating, programmer and TRVsOK |  |
|-------------------------|---------------------------------------------------------------------------|--|

|                     |              |    |
|---------------------|--------------|----|
| Hot water controls: | Cylinderstat | OK |
|---------------------|--------------|----|

#### 7 Low energy lights

|                                                          |     |    |
|----------------------------------------------------------|-----|----|
| Percentage of fixed lights with low-energy fittings:100% |     |    |
| Minimum                                                  | 75% | OK |

#### 8 Mechanical ventilation

Continuous supply and extract system

|                     |      |    |
|---------------------|------|----|
| Specific fan power: | 0.55 |    |
| Maximum             | 1.5  | OK |
| MVHR efficiency:    | 92%  |    |
| Minimum:            | 70%  | OK |

#### 9 Summertime temperature

|                                   |        |    |
|-----------------------------------|--------|----|
| Overheating risk (Thames Valley): | Slight | OK |
|-----------------------------------|--------|----|

Based on:

|                            |                                    |  |
|----------------------------|------------------------------------|--|
| Overshading:               | Average                            |  |
| Windows facing North East: | 11.81 m <sup>2</sup> , No overhang |  |
| Windows facing South East: | 10.07 m <sup>2</sup> , No overhang |  |
| Air change rate:           | 6.00 ach                           |  |
| Blinds/curtains:           | None                               |  |

#### 10 Key features

|                               |                                      |  |
|-------------------------------|--------------------------------------|--|
| External wall U-value         | 0.14 W/m <sup>2</sup> K              |  |
| Party wall U-value            | 0.00 W/m <sup>2</sup> K              |  |
| Party wall U-value            | 0.00 W/m <sup>2</sup> K              |  |
| Party wall U-value            | 0.00 W/m <sup>2</sup> K              |  |
| Roof U-value                  | 0.11 W/m <sup>2</sup> K              |  |
| Air permeability              | 3.0 m <sup>3</sup> /m <sup>2</sup> h |  |
| Community heating, Waste Heat |                                      |  |
| Photovoltaic array            | 368.33 kWh/Year                      |  |



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)  
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

#### 1. Overall dwelling dimensions

|                                                        | Area (m <sup>2</sup> ) | Storey height (m) | Volume (m <sup>3</sup> )                       |
|--------------------------------------------------------|------------------------|-------------------|------------------------------------------------|
| Ground floor                                           | 80.8800 (1b)           | 2.7700 (2b)       | 224.0376 (1b) - (3b)                           |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 80.8800                |                   | (4)                                            |
| Dwelling volume                                        |                        |                   | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 224.0376 (5) |

#### 2. Ventilation rate

|                              | main heating | secondary heating | other | total    | m <sup>3</sup> per hour |
|------------------------------|--------------|-------------------|-------|----------|-------------------------|
| Number of chimneys           | 0            | 0                 | 0     | 0 * 40 = | 0.0000 (6a)             |
| Number of open flues         | 0            | 0                 | 0     | 0 * 20 = | 0.0000 (6b)             |
| Number of intermittent fans  | 0            | 0                 | 0     | 0 * 10 = | 0.0000 (7a)             |
| Number of passive vents      | 0            | 0                 | 0     | 0 * 10 = | 0.0000 (7b)             |
| Number of flueless gas fires | 0            | 0                 | 0     | 0 * 40 = | 0.0000 (7c)             |

Air changes per hour  
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 0.0000 / (5) = 0.0000 (8)

Pressure test  
Measured/design AP50  
Infiltration rate  
Number of sides sheltered

Shelter factor  
Infiltration rate adjusted to include shelter factor

|                 | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed      | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor     | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate | 0.1626 | 0.1594 | 0.1562 | 0.1403 | 0.1371 | 0.1211 | 0.1211 | 0.1179 | 0.1275 | 0.1371 | 0.1434 | 0.1498 (22b) |

Balanced mechanical ventilation with heat recovery  
If mechanical ventilation:  
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4b) =

|              |        |        |        |        |        |        |        |        |        |        |        |             |
|--------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------------|
| Effective ac | 0.2716 | 0.2684 | 0.2652 | 0.2493 | 0.2461 | 0.2301 | 0.2301 | 0.2269 | 0.2365 | 0.2461 | 0.2524 | 0.2588 (25) |
|--------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------------|

#### 3. Heat losses and heat loss parameter

| Element                                                     | Gross m <sup>2</sup> | Openings m <sup>2</sup> | NetArea m <sup>2</sup> | U-value W/m <sup>2</sup> K | A x U W/K            | K-value kJ/m <sup>2</sup> K | A x K kJ/K      |
|-------------------------------------------------------------|----------------------|-------------------------|------------------------|----------------------------|----------------------|-----------------------------|-----------------|
| Windows (UW = 1.20)                                         |                      |                         | 21.8800                | 1.1450                     | 25.0534              |                             | (27)            |
| Front Door                                                  |                      |                         | 2.1200                 | 1.4000                     | 2.9680               |                             | (26)            |
| Unipanel column                                             | 5.9800               |                         | 5.9800                 | 0.2600                     | 1.5548               | 136.7400                    | 817.7052 (29a)  |
| Unipanel wall                                               | 28.9100              | 2.1200                  | 26.7900                | 0.1400                     | 3.7506               | 30.9500                     | 829.1505 (29a)  |
| Curtain wall                                                | 22.4800              | 21.8800                 | 0.6000                 | 1.2000                     | 0.7200               | 14.0000                     | 8.4000 (29a)    |
| External Roof 1                                             | 80.8800              |                         | 80.8800                | 0.1100                     | 8.8968               | 9.0000                      | 727.9200 (30)   |
| Total net area of external elements Aum(A, m <sup>2</sup> ) |                      |                         | 138.2500               |                            |                      |                             | (31)            |
| Fabric heat loss, W/K = Sum (A x U)                         |                      |                         |                        |                            | (26)...(30) + (32) = | 42.9436                     | (33)            |
| Party Wall 2 column                                         |                      |                         | 2.4400                 | 0.0000                     | 0.0000               | 180.0000                    | 435.2000 (32)   |
| Party Wall 3                                                |                      |                         | 25.8500                | 0.0000                     | 0.0000               | 20.0000                     | 517.0000 (32)   |
| Party Wall 4 stair core /riser                              |                      |                         | 26.9200                | 0.0000                     | 0.0000               | 180.0000                    | 4845.6000 (32)  |
| Party Floor 1                                               |                      |                         | 80.8800                |                            |                      | 40.0000                     | 3235.2000 (32d) |
| Internal Wall 1                                             |                      |                         | 157.8000               |                            |                      | 9.0000                      | 1420.2000 (32e) |

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12840.3757 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m<sup>2</sup>K 158.7584 (35)

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 18.5861 (36)

Total fabric heat loss (33) + (36) = 61.5297 (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          |
|                           | 20.0773 | 19.8416 | 19.6060 | 18.4277 | 18.1920 | 17.0137 | 17.0137 | 16.7780 | 17.4850 | 18.1920 | 18.6633 | 19.1346 (38) |
| Heat transfer coeff       | 81.6070 | 81.3713 | 81.1357 | 79.9574 | 79.7217 | 78.5434 | 78.5434 | 78.3078 | 79.0147 | 79.7217 | 80.1930 | 80.6644 (39) |
| Average = Sum(39)m / 12 = |         |         |         |         |         |         |         |         |         |         |         | 79.6985 (39) |

|               |        |        |        |        |        |        |        |        |        |        |        |             |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------------|
| HLP           | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec         |
| HLP (average) | 1.0090 | 1.0061 | 1.0032 | 0.9886 | 0.9857 | 0.9711 | 0.9711 | 0.9682 | 0.9769 | 0.9857 | 0.9915 | 0.9973 (40) |
| Days in month | 31     | 28     | 31     | 30     | 31     | 30     | 31     | 31     | 30     | 31     | 30     | 31 (41)     |

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

|                                          |  |  |  |  |  |  |  |  |  |  |  |              |
|------------------------------------------|--|--|--|--|--|--|--|--|--|--|--|--------------|
| Assumed occupancy                        |  |  |  |  |  |  |  |  |  |  |  | 2.4793 (42)  |
| Average daily hot water use (litres/day) |  |  |  |  |  |  |  |  |  |  |  | 93.0845 (43) |

|  |     |     |     |     |     |     |     |     |     |     |     |     |
|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|  | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

|                                                                 |          |          |          |          |          |          |          |          |          |                    |          |           |      |
|-----------------------------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|--------------------|----------|-----------|------|
| Daily hot water use                                             | 102.3929 | 98.6695  | 94.9462  | 91.2228  | 87.4994  | 83.7760  | 83.7760  | 87.4994  | 91.2228  | 94.9462            | 98.6695  | 102.3929  | (44) |
| Energy content (annual)                                         | 151.8457 | 132.8053 | 137.0431 | 119.4775 | 114.6415 | 98.9269  | 91.6703  | 105.1930 | 106.4494 | 124.0565           | 135.4174 | 147.0545  | (45) |
| Distribution loss (46)m = 0.15 x (45)m                          |          |          |          |          |          |          |          |          |          | Total = Sum(45)m = |          | 1464.5812 | (45) |
|                                                                 | 22.7769  | 19.9208  | 20.5565  | 17.9216  | 17.1962  | 14.8390  | 13.7505  | 15.7790  | 15.9674  | 18.6085            | 20.3126  | 22.0582   | (46) |
| Water storage loss:                                             |          |          |          |          |          |          |          |          |          |                    |          |           |      |
| Store volume                                                    |          |          |          |          |          |          |          |          |          |                    |          | 145.0000  | (47) |
| a) If manufacturer declared loss factor is known (kWh/day):     |          |          |          |          |          |          |          |          |          |                    |          | 1.1800    | (48) |
| Temperature factor from Table 2b                                |          |          |          |          |          |          |          |          |          |                    |          | 0.6000    | (49) |
| Enter (49) or (54) in (55)                                      |          |          |          |          |          |          |          |          |          |                    |          | 0.7080    | (55) |
| Total storage loss                                              |          |          |          |          |          |          |          |          |          |                    |          |           |      |
|                                                                 | 21.9480  | 19.8240  | 21.9480  | 21.2400  | 21.9480  | 21.2400  | 21.9480  | 21.9480  | 21.2400  | 21.9480            | 21.2400  | 21.9480   | (56) |
| If cylinder contains dedicated solar storage                    |          |          |          |          |          |          |          |          |          |                    |          |           |      |
|                                                                 | 21.9480  | 19.8240  | 21.9480  | 21.2400  | 21.9480  | 21.2400  | 21.9480  | 21.9480  | 21.2400  | 21.9480            | 21.2400  | 21.9480   | (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) |
| Total heat required for water heating calculated for each month |          |          |          |          |          |          |          |          |          |                    |          |           |      |
|                                                                 | 197.0561 | 173.6405 | 182.2535 | 163.2295 | 159.8519 | 142.6789 | 136.8807 | 150.4034 | 150.2014 | 169.2669           | 179.1694 | 192.2649  | (62) |
| 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    | (63) |
| Solar input (sum of months) = Sum(63)m =                        |          |          |          |          |          |          |          |          |          |                    |          | 0.0000    | (63) |
| Output from w/h                                                 |          |          |          |          |          |          |          |          |          |                    |          |           |      |
|                                                                 | 197.0561 | 173.6405 | 182.2535 | 163.2295 | 159.8519 | 142.6789 | 136.8807 | 150.4034 | 150.2014 | 169.2669           | 179.1694 | 192.2649  | (64) |
| Total per year (kWh/year) = Sum(64)m =                          |          |          |          |          |          |          |          |          |          |                    |          | 1996.8972 | (64) |
| Heat gains from water heating, kWh/month                        |          |          |          |          |          |          |          |          |          |                    |          |           |      |
|                                                                 | 86.6570  | 76.8259  | 81.7352  | 74.7279  | 74.2866  | 67.8948  | 66.6487  | 71.1450  | 70.3960  | 77.4171            | 80.0279  | 85.0639   | (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                                                                               | 123.9673 | 123.9673 | 123.9673 | 123.9673 | 123.9673 | 123.9673 | 123.9673 | 123.9673 | 123.9673 | 123.9673 | 123.9673 | 123.9673 (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 19.7264  | 17.5208  | 14.2489  | 10.7873  | 8.0636   | 6.8077   | 7.3559   | 9.5615   | 12.8334  | 16.2950  | 19.0187  | 20.2746 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 221.2699 | 223.5660 | 217.7799 | 205.4621 | 189.9130 | 175.2990 | 165.5360 | 163.2399 | 169.0260 | 181.3438 | 196.8929 | 211.5069 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 35.3967  | 35.3967  | 35.3967  | 35.3967  | 35.3967  | 35.3967  | 35.3967  | 35.3967  | 35.3967  | 35.3967  | 35.3967  | 35.3967 (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)                                 | -99.1738 | -99.1738 | -99.1738 | -99.1738 | -99.1738 | -99.1738 | -99.1738 | -99.1738 | -99.1738 | -99.1738 | -99.1738 | -99.1738 (71) |
| Water heating gains (Table 5)                                                       | 116.4745 | 114.3243 | 109.8591 | 103.7887 | 99.8476  | 94.2983  | 89.5816  | 95.6250  | 97.7722  | 104.0552 | 111.1498 | 114.3332 (72) |
| Total internal gains                                                                | 417.6610 | 415.6012 | 402.0780 | 380.2283 | 358.0144 | 336.5352 | 322.6637 | 328.6166 | 339.8219 | 361.8843 | 387.2516 | 406.3049 (73) |

#### 6. Solar gains

| [Jan]       |          |          |          |          | Area<br>m2 | Solar flux<br>Table 6a<br>W/m2 | g<br>Specific data<br>or Table 6b | FF<br>Specific data<br>or Table 6c | Access<br>factor<br>Table 6d | Gains<br>W   |          |               |
|-------------|----------|----------|----------|----------|------------|--------------------------------|-----------------------------------|------------------------------------|------------------------------|--------------|----------|---------------|
| Northeast   |          |          |          |          | 11.8100    | 11.2829                        | 0.4000                            | 0.7000                             | 0.7700                       | 25.8561 (75) |          |               |
| Southeast   |          |          |          |          | 10.0700    | 36.7938                        | 0.4000                            | 0.7000                             | 0.7700                       | 71.8945 (77) |          |               |
| Solar gains | 97.7506  | 175.0939 | 262.3833 | 363.3424 | 441.8745   | 454.0308                       | 431.3455                          | 370.4100                           | 296.9758                     | 199.6668     | 116.6468 | 82.6421 (83)  |
| Total gains | 515.4116 | 590.6951 | 664.4613 | 743.5707 | 799.8889   | 790.6260                       | 754.0092                          | 699.0266                           | 636.7977                     | 561.5511     | 505.8984 | 488.9471 (84) |

#### 7. Mean internal temperature (heating season)

|                                                                                         |         |         |         |         |         |         |         |         |         |         |         |         |         |      |
|-----------------------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| Temperature during heating periods in the living area from Table 9, T <sub>hi</sub> (C) |         |         |         |         |         |         |         |         |         |         |         |         | 21.0000 | (85) |
| Utilisation factor for gains for living area, n <sub>li</sub> (see Table 9a)            |         |         |         |         |         |         |         |         |         |         |         |         |         |      |
| Jan                                                                                     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec     |         |         |      |
| tau                                                                                     | 43.7057 | 43.8333 | 43.9606 | 44.6084 | 44.7403 | 45.4114 | 45.4114 | 45.5481 | 45.1406 | 44.7403 | 44.4773 | 44.2174 |         |      |
| alpha                                                                                   | 3.9138  | 3.9222  | 3.9307  | 3.9739  | 3.9827  | 4.0274  | 4.0274  | 4.0365  | 4.0094  | 3.9827  | 3.9652  | 3.9478  |         |      |
| util living area                                                                        | 0.9860  | 0.9754  | 0.9510  | 0.8886  | 0.7679  | 0.5942  | 0.4474  | 0.4975  | 0.7340  | 0.9202  | 0.9757  | 0.9885  | (86)    |      |
| MIT                                                                                     | 19.5530 | 19.7564 | 20.0765 | 20.4778 | 20.7833 | 20.9437 | 20.9859 | 20.9787 | 20.6671 | 20.4678 | 19.9435 | 19.5192 | (87)    |      |
| T <sub>hi</sub> 2                                                                       | 20.0758 | 20.0783 | 20.0807 | 20.0929 | 20.0953 | 20.1075 | 20.1075 | 20.1099 | 20.1026 | 20.0953 | 20.0904 | 20.0856 | (88)    |      |
| util rest of house                                                                      | 0.9831  | 0.9703  | 0.9407  | 0.8655  | 0.7226  | 0.5242  | 0.3613  | 0.4085  | 0.6692  | 0.8985  | 0.9698  | 0.9861  | (89)    |      |
| MIT 2                                                                                   | 18.1398 | 18.4355 | 18.8965 | 19.4660 | 19.8673 | 20.0620 | 20.0998 | 20.0975 | 19.9822 | 19.4654 | 18.7173 | 18.0973 | (90)    |      |
| Living area fraction                                                                    | 18.8696 | 19.1176 | 19.5059 | 19.9885 | 20.3405 | 20.5174 | 20.5574 | 20.5526 | 20.4392 | 19.9831 | 19.3506 | 18.8317 | (92)    |      |
| Temperature adjustment                                                                  |         |         |         |         |         |         |         |         |         |         |         |         |         |      |
| adjusted MIT                                                                            | 18.8696 | 19.1176 | 19.5059 | 19.9885 | 20.3405 | 20.5174 | 20.5574 | 20.5526 | 20.4392 | 19.9831 | 19.3506 | 18.8317 | (93)    |      |

#### 8. Space heating requirement

|                   |           |           |          |          |          |          |          |          |          |          |           |          |       |  |
|-------------------|-----------|-----------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|----------|-------|--|
| Utilisation       | Jan       | Feb       | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov       | Dec      |       |  |
|                   | 0.9781    | 0.9636    | 0.9330   | 0.8625   | 0.7356   | 0.5572   | 0.4053   | 0.4536   | 0.6949   | 0.8954   | 0.9638    | 0.9817   | (94)  |  |
| Useful gains      | 504.1453  | 569.2076  | 619.9707 | 641.3379 | 588.4189 | 440.5499 | 305.6205 | 317.0874 | 442.5269 | 502.7892 | 487.5597  | 480.0006 | (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  |           |           |          |          |          |          |          |          |          |          |           |          |       |  |
| 1188.9834         | 1156.9087 | 1055.2422 | 886.6115 | 688.8326 | 464.7694 | 310.8304 | 325.1781 | 500.8889 | 748.0340 | 982.4116 | 1180.2542 | (97)     |       |  |
| Month fracti      | 1.0000    | 1.0000    | 1.0000   | 1.0000   | 1.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 1.0000   | 1.0000    | 1.0000   | (97a) |  |
| Space heating kwh | 509.5195  | 394.9351  | 323.8420 | 176.5970 | 74.7078  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 182.4622 | 356.2934  | 520.9897 | (98)  |  |



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

|                      |              |           |      |
|----------------------|--------------|-----------|------|
| Space heating        |              | 2539.3456 | (98) |
| Space heating per m2 | (98) / (4) = | 31.3965   | (99) |

#### 8c. Space cooling requirement

Not applicable

#### 9b. Energy requirements

|                                                                                         |           |        |
|-----------------------------------------------------------------------------------------|-----------|--------|
| Fraction of space heat from secondary/supplementary system (Table 11)                   | 0.0000    | (301)  |
| Fraction of space heat from community system                                            | 1.0000    | (302)  |
| Fraction of heat from community Waste Heat                                              | 1.0000    | (303a) |
| Fraction of total space heat from community Waste Heat                                  | 1.0000    | (304a) |
| Factor for control and charging method (Table 4c(3)) for community space heating        | 1.0000    | (305)  |
| Factor for control and charging method (Table 4c(3)) for community water heating        | 1.0000    | (305a) |
| Distribution loss factor (Table 12c) for community heating system                       | 1.1000    | (306)  |
| Space heating:                                                                          |           |        |
| Annual space heating requirement                                                        | 2539.3456 | (98)   |
| Space heat from Waste Heat = (98) x 1.00 x 1.00 x 1.10                                  | 2793.2802 | (307a) |
| Efficiency of secondary/supplementary heating system in 3 (from Table 4a or Appendix 5) | 0.0000    | (308)  |
| Space heating fuel for secondary/supplementary system                                   | 0.0000    | (309)  |

|                                                        |           |        |  |
|--------------------------------------------------------|-----------|--------|--|
| Water heating                                          |           |        |  |
| Annual water heating requirement                       | 1996.8972 | (64)   |  |
| Water heat from Waste Heat = (64) x 1.00 x 1.00 x 1.10 | 2196.5869 | (310a) |  |
| Electricity used for heat distribution                 | 40.8987   | (313)  |  |
| Annual totals kWh/year                                 |           |        |  |

|                                                                           |          |        |  |
|---------------------------------------------------------------------------|----------|--------|--|
| Electricity for pumps and fans:                                           |          |        |  |
| (BalancedWithHeatRecovery, Database in-use factor = 1.2500, SFP = 0.6875) |          |        |  |
| mechanical ventilation fans (SFP = 0.6875)                                | 187.9115 | (330a) |  |
| Total electricity for the above, kWh/year                                 | 187.9115 | (331)  |  |
| Electricity for lighting (calculated in Appendix L)                       | 348.3739 | (332)  |  |

|                                                               |           |       |  |
|---------------------------------------------------------------|-----------|-------|--|
| Energy saving/generation technologies (Appendices M, N and O) |           |       |  |
| Total delivered energy for all uses                           | 5526.1525 | (338) |  |

#### 12b. Carbon dioxide emissions - Community heating scheme

|                                                                                            | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |        |
|--------------------------------------------------------------------------------------------|--------------------|-------------------------------|--------------------------|--------|
| Efficiency of heat source Waste Heat                                                       |                    |                               | 100.0000                 | (366a) |
| Space heating from Waste Heat                                                              | 4989.8671          | 0.0580                        | 289.4123                 | (367)  |
| Electrical energy for heat distribution                                                    | 49.8987            | 0.5190                        | 25.8974                  | (372)  |
| Total CO2 associated with community systems<br>(negative value allowed since DFEE <= TFEE) |                    |                               | 315.3097                 | (373)  |
| Space and water heating                                                                    |                    |                               | 315.3097                 | (376)  |
| Pumps and fans                                                                             | 187.9115           | 0.5190                        | 97.5261                  | (378)  |
| Energy for lighting                                                                        | 348.3739           | 0.5190                        | 180.8060                 | (379)  |
| Energy saving/generation technologies                                                      |                    |                               |                          |        |
| PV Unit                                                                                    | -368.3300          | 0.5190                        | -191.1633                | (380)  |
| Total CO2, kg/year                                                                         |                    |                               | 402.4786                 | (383)  |
| Dwelling Carbon Dioxide Emission Rate (DER)                                                |                    |                               | 4.9800                   | (384)  |

#### 16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

|                                                                                 |     |         |     |
|---------------------------------------------------------------------------------|-----|---------|-----|
| DER                                                                             |     | 4.9800  | ZC1 |
| Total Floor Area                                                                | TFA | 80.8800 |     |
| Assumed number of occupants                                                     | N   | 2.4793  |     |
| CO2 emission factor in Table 12 for electricity displaced from grid             | EF  | 0.5190  |     |
| CO2 emissions from appliances, equation (L14)                                   |     | 16.2117 | ZC2 |
| CO2 emissions from cooking, equation (L16)                                      |     | 2.2070  | ZC3 |
| Total CO2 emissions                                                             |     | 23.3987 | ZC4 |
| Residual CO2 emissions offset from biofuel CHP                                  |     | 0.0000  | ZC5 |
| Additional allowable electricity generation, kWh/m²/year                        |     | 0.0000  | ZC6 |
| Resulting CO2 emissions offset from additional allowable electricity generation |     | 0.0000  | ZC7 |
| Net CO2 emissions                                                               |     | 23.3987 | ZC8 |



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)  
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

#### 1. Overall dwelling dimensions

|                                                        | Area<br>(m <sup>2</sup> ) | Storey height<br>(m)              | Volume<br>(m <sup>3</sup> ) |
|--------------------------------------------------------|---------------------------|-----------------------------------|-----------------------------|
| Ground floor                                           | 80.8800 (1b)              | x 2.7700 (2b)                     | = 224.0376 (1b) - (3b)      |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 80.8800                   |                                   | (4)                         |
| Dwelling volume                                        |                           | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = | 224.0376 (5)                |

#### 2. Ventilation rate

|                                                                           | main<br>heating | secondary<br>heating | other | total | m <sup>3</sup> per hour                 |
|---------------------------------------------------------------------------|-----------------|----------------------|-------|-------|-----------------------------------------|
| Number of chimneys                                                        | 0               | +                    | 0     | =     | 0 * 40 = 0.0000 (6a)                    |
| Number of open flues                                                      | 0               | +                    | 0     | =     | 0 * 20 = 0.0000 (6b)                    |
| Number of intermittent fans                                               |                 |                      |       |       | 3 * 10 = 30.0000 (7a)                   |
| Number of passive vents                                                   |                 |                      |       |       | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                              |                 |                      |       |       | 0 * 40 = 0.0000 (7c)                    |
| Air changes per hour                                                      |                 |                      |       |       |                                         |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = |                 |                      |       |       | 30.0000 / (5) = 0.1339 (8)              |
| Pressure test                                                             |                 |                      |       |       | Yes                                     |
| Measured/design AP50                                                      |                 |                      |       |       | 5.0000                                  |
| Infiltration rate                                                         |                 |                      |       |       | 0.3839 (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) = 0.3263 (21)        |

|                 | Jan    | Feb    | Mar    | Apr    | May    | Jun    | Jul    | Aug    | Sep    | Oct    | Nov    | Dec          |
|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Wind speed      | 5.1000 | 5.0000 | 4.9000 | 4.4000 | 4.3000 | 3.8000 | 3.8000 | 3.7000 | 4.0000 | 4.3000 | 4.5000 | 4.7000 (22)  |
| Wind factor     | 1.2750 | 1.2500 | 1.2250 | 1.1000 | 1.0750 | 0.9500 | 0.9500 | 0.9250 | 1.0000 | 1.0750 | 1.1250 | 1.1750 (22a) |
| Adj infilt rate |        |        |        |        |        |        |        |        |        |        |        |              |
| Effective ac    | 0.4161 | 0.4079 | 0.3997 | 0.3590 | 0.3508 | 0.3100 | 0.3100 | 0.3018 | 0.3263 | 0.3508 | 0.3671 | 0.3834 (22b) |
|                 | 0.5866 | 0.5832 | 0.5799 | 0.5644 | 0.5613 | 0.5481 | 0.5481 | 0.5456 | 0.5532 | 0.5615 | 0.5674 | 0.5735 (23)  |

#### 3. Heat losses and heat loss parameter

| Element                                                             | Gross<br>m <sup>2</sup> | Openings<br>m <sup>2</sup> | NetArea<br>m <sup>2</sup> | U-value<br>W/m <sup>2</sup> K | A x U<br>W/K         | K-value<br>kJ/m <sup>2</sup> K | A x K<br>kJ/K |          |          |          |          |               |
|---------------------------------------------------------------------|-------------------------|----------------------------|---------------------------|-------------------------------|----------------------|--------------------------------|---------------|----------|----------|----------|----------|---------------|
| TER Opaque door                                                     |                         |                            | 2.1200                    | 1.0000                        | 2.1200               |                                | (26)          |          |          |          |          |               |
| TER Opening Type Curtain (Uw = 1.50)                                |                         |                            | 18.1000                   | 1.4151                        | 25.6132              |                                | (27)          |          |          |          |          |               |
| Unipanel column                                                     | 5.9800                  |                            | 5.9800                    | 0.1800                        | 1.0764               |                                | (29a)         |          |          |          |          |               |
| Unipanel wall                                                       | 28.9100                 | 2.1200                     | 26.7900                   | 0.1800                        | 4.8222               |                                | (29a)         |          |          |          |          |               |
| Curtain wall                                                        | 22.4800                 | 18.1000                    | 4.3800                    | 0.1800                        | 0.7884               |                                | (29a)         |          |          |          |          |               |
| External Roof 1                                                     | 80.8800                 |                            | 80.8800                   | 0.1300                        | 10.5144              |                                | (30)          |          |          |          |          |               |
| Total net area of external elements Aum(A, m <sup>2</sup> )         |                         |                            | 138.2500                  |                               |                      |                                | (31)          |          |          |          |          |               |
| Fabric heat loss, W/K = Sum (A x U)                                 |                         |                            |                           |                               | (26)...(30) + (32) = | 44.9346                        | (33)          |          |          |          |          |               |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K      |                         |                            |                           |                               |                      |                                | 250.0000 (35) |          |          |          |          |               |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)          |                         |                            |                           |                               |                      |                                | 15.9688 (36)  |          |          |          |          |               |
| Total fabric heat loss                                              |                         |                            |                           |                               |                      | (33) + (36) =                  | 60.9034 (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                                                 | 43.3652                 | 43.1167                    | 42.8732                   | 41.7292                       | 41.5151              | 40.5188                        | 40.5188       | 40.3342  | 40.9025  | 41.5151  | 41.9481  | 42.4008 (38)  |
| Average = Sum(39)m / 12 =                                           | 104.2686                | 104.0201                   | 103.7766                  | 102.6326                      | 102.4185             | 101.4222                       | 101.4222      | 101.2376 | 101.8060 | 102.4185 | 102.8515 | 103.3042 (39) |
|                                                                     |                         |                            |                           |                               |                      |                                |               |          |          |          |          | 102.6316 (39) |
| HLP                                                                 | Jan                     | Feb                        | Mar                       | Apr                           | May                  | Jun                            | Jul           | Aug      | Sep      | Oct      | Nov      | Dec           |
| HLP (average)                                                       | 1.2892                  | 1.2861                     | 1.2831                    | 1.2689                        | 1.2663               | 1.2540                         | 1.2540        | 1.2517   | 1.2587   | 1.2663   | 1.2717   | 1.2773 (40)   |
| Days in month                                                       | 31                      | 28                         | 31                        | 30                            | 31                   | 30                             | 31            | 31       | 30       | 31       | 30       | 31 (41)       |

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

|                                                             |          |          |          |          |          |         |         |          |          |          |          |                                   |
|-------------------------------------------------------------|----------|----------|----------|----------|----------|---------|---------|----------|----------|----------|----------|-----------------------------------|
| Assumed occupancy                                           |          |          |          |          |          |         |         |          |          |          |          | 2.4793 (42)                       |
| Average daily hot water use (litres/day)                    |          |          |          |          |          |         |         |          |          |          |          | 93.0845 (43)                      |
| Daily hot water use                                         | Jan      | Feb      | Mar      | Apr      | May      | Jun     | Jul     | Aug      | Sep      | Oct      | Nov      | Dec                               |
| Energy conte                                                | 102.3929 | 98.6695  | 94.9462  | 91.2228  | 87.4994  | 83.7760 | 83.7760 | 87.4994  | 91.2228  | 94.9462  | 98.6695  | 102.3929 (44)                     |
| Energy content (annual)                                     | 151.8457 | 132.8053 | 137.0431 | 119.4775 | 114.6415 | 98.9269 | 91.6703 | 105.1930 | 106.4494 | 124.0565 | 135.4174 | 147.0545 (45)                     |
| Distribution loss (46)m = 0.15 x (45)m                      |          |          |          |          |          |         |         |          |          |          |          | Total = Sum(45)m = 1464.5812 (45) |
| Water storage loss:                                         | 22.7769  | 19.9209  | 20.5565  | 17.9216  | 17.1962  | 14.8390 | 13.7505 | 19.7790  | 15.9674  | 18.6085  | 20.3126  | 22.0582 (46)                      |
| Store volume                                                |          |          |          |          |          |         |         |          |          |          |          | 145.0000 (47)                     |
| a) if manufacturer declared loss factor is known (kWh/day): |          |          |          |          |          |         |         |          |          |          |          | 1.3665 (48)                       |
| Temperature factor from Table 2b                            |          |          |          |          |          |         |         |          |          |          |          | 0.5400 (49)                       |

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF TARGET EMISSIONS 09 Jan 2014

|                                                                 |                                          |          |          |          |          |          |          |          |          |          |          |                |
|-----------------------------------------------------------------|------------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------------|
| Enter (49) or (54) in (55)                                      |                                          |          |          |          |          |          |          |          |          |          |          | 0.7379 (55)    |
| Total storage loss                                              | 22.8747                                  | 20.6610  | 22.8747  | 22.1368  | 22.8747  | 22.1368  | 22.8747  | 22.8747  | 22.1368  | 22.8747  | 22.1368  | 22.8747 (56)   |
| If cylinder contains dedicated solar storage                    | 22.8747                                  | 20.6610  | 22.8747  | 22.1368  | 22.8747  | 22.1368  | 22.8747  | 22.8747  | 22.1368  | 22.8747  | 22.1368  | 22.8747 (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)   |
| Total heat required for water heating calculated for each month | 197.9828                                 | 174.4774 | 183.1802 | 164.1263 | 160.7786 | 143.5757 | 137.8074 | 151.3301 | 151.0982 | 170.1936 | 180.0661 | 193.1916 (62)  |
| 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 (63)    |
|                                                                 | Solar input (sum of months) = Sum(63)m = |          |          |          |          |          |          |          |          |          |          | 0.0000 (63)    |
| Output from w/h                                                 | 197.9828                                 | 174.4774 | 183.1802 | 164.1263 | 160.7786 | 143.5757 | 137.8074 | 151.3301 | 151.0982 | 170.1936 | 180.0661 | 193.1916 (64)  |
|                                                                 | Total per year (kWh/year) = Sum(64)m =   |          |          |          |          |          |          |          |          |          |          | 2007.8080 (64) |
| Heat gains from water heating, kWh/month                        | 87.3984                                  | 77.4955  | 82.4765  | 75.4453  | 75.0280  | 68.8122  | 67.3900  | 71.8863  | 71.1134  | 78.1584  | 80.7453  | 85.8053 (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                                                                               | 123.9673 | 123.9673 | 123.9673 | 123.9673 | 123.9673 | 123.9673 | 123.9673 | 123.9673 | 123.9673 | 123.9673 | 123.9673 | 123.9673 (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 19.7250  | 17.5196  | 14.2479  | 10.7866  | 8.0631   | 6.8072   | 7.3554   | 9.5609   | 12.8326  | 16.2939  | 19.0174  | 20.2733 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 221.2699 | 223.5660 | 217.7799 | 205.4621 | 189.9130 | 175.2990 | 165.5360 | 163.2399 | 169.0260 | 181.3438 | 196.8929 | 211.5069 (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 35.3967  | 35.3967  | 35.3967  | 35.3967  | 35.3967  | 35.3967  | 35.3967  | 35.3967  | 35.3967  | 35.3967  | 35.3967  | 35.3967 (69)  |
| Pumps, fans                                                                         | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000   | 3.0000 (70)   |
| Looses e.g. evaporation (negative values) (Table 5)                                 | -99.1738 | -99.1738 | -99.1738 | -99.1738 | -99.1738 | -99.1738 | -99.1738 | -99.1738 | -99.1738 | -99.1738 | -99.1738 | -99.1738 (71) |
| Water heating gains (Table 5)                                                       | 117.4709 | 115.3207 | 110.8555 | 104.7851 | 100.8440 | 95.2948  | 90.5780  | 96.6214  | 98.7687  | 105.0517 | 112.1462 | 115.3297 (72) |
| Total internal gains                                                                | 421.6561 | 419.5965 | 406.0735 | 384.2240 | 362.0103 | 340.5912 | 326.6596 | 332.6124 | 343.8174 | 365.8796 | 391.2467 | 410.3000 (73) |

#### 6. Solar gains

| [Jan]       |          |          | Area<br>m2 |          | Solar flux<br>Table 6a<br>W/m2 |          | g<br>Specific data<br>or Table 6b |          | FF<br>Specific data<br>or Table 6c |          | Access<br>factor<br>Table 6d |          | Gains<br>W   |
|-------------|----------|----------|------------|----------|--------------------------------|----------|-----------------------------------|----------|------------------------------------|----------|------------------------------|----------|--------------|
| Northeast   |          |          | 9.7700     |          | 11.2829                        |          | 0.6300                            |          | 0.7000                             |          | 0.7700                       |          | 33.6890 (75) |
| Southseast  |          |          | 8.3300     |          | 36.7938                        |          | 0.6300                            |          | 0.7000                             |          | 0.7700                       |          | 93.6681 (77) |
| Solar gains | 127.3572 | 228.1265 | 341.8557   | 473.3961 | 575.7167                       | 591.5558 | 561.9988                          | 482.6050 | 386.9265                           | 260.1425 | 154.5824                     | 107.6726 | (83)         |
| Total gains | 549.0132 | 647.7230 | 747.9292   | 857.6200 | 937.7270                       | 932.1470 | 888.6585                          | 815.2175 | 730.7440                           | 626.0221 | 545.8291                     | 517.9726 | (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, nll,m (see Table 9a)          | Jan     | Feb     | Mar     | Apr     | May     | Jun     | Jul     | Aug     | Sep     | Oct     | Nov     | Dec          |
| tau                                                                         | 53.8673 | 53.9960 | 54.1227 | 54.7260 | 54.8403 | 55.3791 | 55.3791 | 55.4800 | 55.1703 | 54.8403 | 54.6095 | 54.3702      |
| alpha                                                                       | 4.5912  | 4.5997  | 4.6082  | 4.6484  | 4.6560  | 4.6919  | 4.6919  | 4.6987  | 4.6780  | 4.6560  | 4.6406  | 4.6247       |
| util living area                                                            | 0.9966  | 0.9922  | 0.9795  | 0.9368  | 0.8296  | 0.6520  | 0.4921  | 0.5529  | 0.8072  | 0.9635  | 0.9929  | 0.9974 (86)  |
| MIT                                                                         | 19.6477 | 19.8306 | 20.1246 | 20.5017 | 20.8015 | 20.9529 | 20.9898 | 20.9829 | 20.8718 | 20.4747 | 19.9916 | 19.6167 (87) |
| Th 2                                                                        | 19.8493 | 19.8517 | 19.8541 | 19.8652 | 19.8673 | 19.8771 | 19.8771 | 19.8789 | 19.8733 | 19.8673 | 19.8631 | 19.8587 (88) |
| util rest of house                                                          | 0.9954  | 0.9895  | 0.9723  | 0.9142  | 0.7732  | 0.5553  | 0.3717  | 0.4272  | 0.7242  | 0.9458  | 0.9900  | 0.9965 (89)  |
| MIT 2                                                                       | 18.0666 | 18.3343 | 18.7605 | 19.2971 | 19.6817 | 19.8476 | 19.8736 | 19.8723 | 19.7757 | 19.2727 | 18.5780 | 18.0279 (90) |
| Living area fraction                                                        | 18.8831 | 19.1071 | 19.4650 | 19.9192 | 20.2600 | 20.4184 | 20.4501 | 20.4459 | 20.3418 | 19.8934 | 19.3081 | 18.8484 (92) |
| MIT                                                                         | 18.8831 | 19.1071 | 19.4650 | 19.9192 | 20.2600 | 20.4184 | 20.4501 | 20.4459 | 20.3418 | 19.8934 | 19.3081 | 18.8484 (93) |
| Temperature adjustment                                                      |         |         |         |         |         |         |         |         |         |         |         |              |
| adjusted MIT                                                                | 18.8831 | 19.1071 | 19.4650 | 19.9192 | 20.2600 | 20.4184 | 20.4501 | 20.4459 | 20.3418 | 19.8934 | 19.3081 | 18.8484 (93) |

#### 8. Space heating requirement

|                                  | Jan       | Feb       | Mar       | Apr       | May      | Jun      | Jul      | Aug      | Sep      | Oct          | Nov       | Dec            |
|----------------------------------|-----------|-----------|-----------|-----------|----------|----------|----------|----------|----------|--------------|-----------|----------------|
| Utilisation                      | 0.9940    | 0.9872    | 0.9692    | 0.9155    | 0.7944   | 0.6037   | 0.4342   | 0.4924   | 0.7619   | 0.9463       | 0.9881    | 0.9954 (94)    |
| Useful gains                     | 545.7377  | 639.4545  | 724.8801  | 785.1417  | 744.9463 | 562.7407 | 385.8184 | 401.4039 | 556.7520 | 592.4191     | 539.3081  | 515.5731 (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                 | 1520.5605 | 1477.8211 | 1345.4607 | 1130.9291 | 876.7024 | 590.1183 | 390.4811 | 409.5955 | 635.4508 | 951.8216     | 1255.6168 | 1513.2431 (97) |
| Month fracti                     | 1.0000    | 1.0000    | 1.0000    | 1.0000    | 1.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 1.0000       | 1.0000    | 1.0000 (97a)   |
| Space heating kWh                | 725.2683  | 563.3824  | 461.7120  | 248.9659  | 98.0265  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 267.3955     | 515.7423  | 742.2655 (98)  |
| Space heating                    |           |           |           |           |          |          |          |          |          |              |           | 3622.7603 (98) |
| Space heating per m <sup>2</sup> |           |           |           |           |          |          |          |          |          | (98) / (4) = |           | 44.7918 (99)   |

#### 9. Space cooling requirement

Not applicable

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

### 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 %)                      |          |          |          |          |          |          |          |          |          |          |          |          | 93.5000 (206)   |
| Efficiency of secondary/supplementary heating system, %               |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (208)    |
| Space heating requirement                                             |          |          |          |          |          |          |          |          |          |          |          |          | 3874.6100 (211) |
|                                                                       | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct      | Nov      | Dec      |                 |
| Space heating requirement                                             | 725.2683 | 563.3824 | 461.7120 | 248.9669 | 98.0265  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 267.3955 | 515.7423 | 742.2665 | (98)            |
| Space heating efficiency (main heating system 1)                      | 93.5000  | 93.5000  | 93.5000  | 93.5000  | 93.5000  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 93.5000  | 93.5000  | 93.5000  | (210)           |
| Space heating fuel (main heating system)                              | 775.6880 | 602.5480 | 493.8096 | 266.2748 | 104.8412 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 285.9844 | 551.5960 | 793.8679 | (213)           |
| Water heating requirement                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (215)           |
| Water heating requirement                                             | 197.9828 | 174.4774 | 183.1802 | 164.1263 | 160.7786 | 143.5757 | 137.8074 | 151.3301 | 151.0982 | 170.1936 | 180.0661 | 193.1916 | (64)            |
| Efficiency of water heater (217)m                                     | 87.9706  | 87.7188  | 87.1796  | 85.9226  | 83.5412  | 79.8000  | 79.8000  | 79.8000  | 79.8000  | 86.0143  | 87.4650  | 88.0615  | (216)           |
| Fuel for water heating, kWh/month                                     | 225.0558 | 198.9055 | 210.1181 | 191.0164 | 192.4543 | 179.9194 | 172.6910 | 189.6367 | 189.3461 | 197.8666 | 205.8722 | 219.3827 | (219)           |
| Water heating fuel used                                               |          |          |          |          |          |          |          |          |          |          |          |          | 2372.2649 (219) |
| Annual totals kWh/year                                                |          |          |          |          |          |          |          |          |          |          |          |          |                 |
| Space heating fuel - main system                                      |          |          |          |          |          |          |          |          |          |          |          |          | 3874.6100 (211) |
| Space heating fuel - secondary                                        |          |          |          |          |          |          |          |          |          |          |          |          | 0.0000 (215)    |
| Electricity for pumps and fans:                                       |          |          |          |          |          |          |          |          |          |          |          |          |                 |
| central heating pump                                                  |          |          |          |          |          |          |          |          |          |          |          |          | 30.0000 (230c)  |
| main heating flue fan                                                 |          |          |          |          |          |          |          |          |          |          |          |          | 45.0000 (230e)  |
| Total electricity for the above, kWh/year                             |          |          |          |          |          |          |          |          |          |          |          |          | 75.0000 (231)   |
| Electricity for lighting (calculated in Appendix B)                   |          |          |          |          |          |          |          |          |          |          |          |          | 348.3505 (232)  |
| Total delivered energy for all uses                                   |          |          |          |          |          |          |          |          |          |          |          |          | 6670.2254 (238) |

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

|                                                                                                   | Energy<br>kWh/year | Emission factor<br>kg CO2/kWh | Emissions<br>kg CO2/year |
|---------------------------------------------------------------------------------------------------|--------------------|-------------------------------|--------------------------|
| Space heating - main system 1                                                                     | 3874.6100          | 0.2160                        | 836.9158 (261)           |
| Space heating - secondary                                                                         | 0.0000             | 0.0000                        | 0.0000 (263)             |
| Water heating (other fuel)                                                                        | 2372.2649          | 0.2160                        | 512.4092 (264)           |
| Space and water heating                                                                           |                    |                               | 1349.3250 (265)          |
| Pumps and fans                                                                                    | 75.0000            | 0.5190                        | 38.9250 (267)            |
| Energy for lighting                                                                               | 348.3505           | 0.5190                        | 180.7939 (268)           |
| Total CO2, kg/m2/year                                                                             |                    |                               | 1569.0439 (272)          |
| Emissions per m2 for space and water heating                                                      |                    |                               | 16.6830 (272a)           |
| Fuel factor (waste heat)                                                                          |                    |                               | 1.0000                   |
| Emissions per m2 for lighting                                                                     |                    |                               | 2.2353 (272b)            |
| Emissions per m2 for pumps and fans                                                               |                    |                               | 0.4813 (272c)            |
| Target Carbon Dioxide Emission Rate (TER) = (16.6830 * 1.00) + 2.2353 + 0.4813, rounded to 2 d.p. |                    |                               | 19.4000 (273)            |

# BASIC COMPLIANCE REPORT

## Calculation Type: New Build (As Designed)

|                      |         |                |            |
|----------------------|---------|----------------|------------|
| Property Reference   | 116581  | Issued on Date | 17/12/2021 |
| Assessment Reference | Plot 47 | Prop Type Ref  | Top Floor  |
| Property             |         |                |            |

|                                 |      |             |       |      |       |
|---------------------------------|------|-------------|-------|------|-------|
| SAP Rating                      | 85 B | DER         | 4.98  | TER  | 19.40 |
| Environmental                   | 96 A | % DER<TER   | 74.33 |      |       |
| CO2 Emissions (t/year)          | 0.34 | DFEE        | 52.00 | TFEE | 59.79 |
| General Requirements Compliance | Pass | % DFEE<TFEE | 13.04 |      |       |

|                  |                                                                                    |             |           |
|------------------|------------------------------------------------------------------------------------|-------------|-----------|
| Assessor Details | Mr. Richard Denteh, Meinhardt UK, Tel: 02078317969, richard.denteh@meinhardt.co.uk | Assessor ID | T596-0001 |
|------------------|------------------------------------------------------------------------------------|-------------|-----------|

|        |  |
|--------|--|
| Client |  |
|--------|--|

### SUMMARY FOR INPUT DATA FOR New Build (As Designed)

#### Criterion 1 - Achieving the TER and TFEE rate

##### 1a TER and DER

|                                             |                   |          |      |
|---------------------------------------------|-------------------|----------|------|
| Fuel for main heating                       | Waste Heat        |          |      |
| Fuel factor                                 | 1.00 (waste heat) |          |      |
| Target Carbon Dioxide Emission Rate (TER)   | 19.40             | kgCO2/m2 |      |
| Dwelling Carbon Dioxide Emission Rate (DER) | 4.98              | kgCO2/m2 | Pass |
|                                             | -14.42 (-74.3%)   | kgCO2/m2 |      |

##### 1b TFEE and DFEE

|                                          |               |           |      |
|------------------------------------------|---------------|-----------|------|
| Target Fabric Energy Efficiency (TFEE)   | 59.79         | kWh/m2/yr |      |
| Dwelling Fabric Energy Efficiency (DFEE) | 52.00         | kWh/m2/yr |      |
|                                          | -7.8 (-13.0%) | kWh/m2/yr | Pass |

#### Criterion 2 - Limits on design flexibility

##### Limiting Fabric Standards

##### 2 Fabric U-values

| Element                   | Average          | Highest          |      |
|---------------------------|------------------|------------------|------|
| External wall             | 0.16 (max. 0.30) | 0.26 (max. 0.70) | Pass |
| Party wall                | 0.00 (max. 0.20) | -                | Pass |
| Roof                      | 0.11 (max. 0.20) | 0.11 (max. 0.35) | Pass |
| Openings and curtain wall | 1.22 (max. 2.00) | 1.40 (max. 3.30) | Pass |

##### 2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

##### 3 Air permeability

|                                |                     |      |
|--------------------------------|---------------------|------|
| Air permeability at 50 pascals | 3.00 (design value) |      |
| Maximum                        | 10.0                | Pass |

##### Limiting System Efficiencies

##### 4 Heating efficiency

|                          |                          |   |
|--------------------------|--------------------------|---|
| Main heating system      | Community heating scheme | - |
| Secondary heating system | None                     |   |

##### 5 Cylinder insulation

## BASIC COMPLIANCE REPORT

### Calculation Type: New Build (As Designed)

|                            |                                                                 |      |
|----------------------------|-----------------------------------------------------------------|------|
| Hot water storage          | Measured cylinder loss: 1.18 kWh/day<br>Permitted by DBSCG 1.85 | Pass |
| Primary pipework insulated | Yes (assumed)                                                   | Pass |

#### 6 Controls

|                        |                                                                         |      |
|------------------------|-------------------------------------------------------------------------|------|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | Pass |
| Hot water controls     | Cylinderstat                                                            | Pass |

#### 7 Low energy lights

|                                                     |     |   |      |
|-----------------------------------------------------|-----|---|------|
| Percentage of fixed lights with low-energy fittings | 100 | % |      |
| Minimum                                             | 75  | % | Pass |

#### 8 Mechanical ventilation

|                                      |      |   |      |
|--------------------------------------|------|---|------|
| Continuous supply and extract system |      |   |      |
| Specific fan power                   | 0.55 |   |      |
| Maximum                              | 1.5  |   | Pass |
| MVHR efficiency                      | 92   | % |      |
| Minimum                              | 70   | % | Pass |

#### Criterion 3 – Limiting the effects of heat gains in summer

##### 9 Summertime temperature

|                                  |                                    |      |
|----------------------------------|------------------------------------|------|
| Overheating risk (Thames Valley) | Slight                             | Pass |
| Based on:                        |                                    |      |
| Overshading                      | Average                            |      |
| Windows facing North East        | 11.81 m <sup>2</sup> , No overhang |      |
| Windows facing South East        | 10.07 m <sup>2</sup> , No overhang |      |
| Air change rate                  | 6.00 ach                           |      |
| Blinds/curtains                  | None                               |      |

#### Criterion 4 – Building performance consistent with DER and DFEE rate

##### Party Walls

| Type                            | U-value |                    |      |
|---------------------------------|---------|--------------------|------|
| Solid Wall                      | 0.00    | W/m <sup>2</sup> K | Pass |
| Filled Cavity with Edge Sealing | 0.00    | W/m <sup>2</sup> K | Pass |
| Solid Wall                      | 0.00    | W/m <sup>2</sup> K | Pass |

##### Air permeability and pressure testing

##### 3 Air permeability

|                                |                     |      |
|--------------------------------|---------------------|------|
| Air permeability at 50 pascals | 3.00 (design value) |      |
| Maximum                        | 10.0                | Pass |

## BASIC COMPLIANCE REPORT

### Calculation Type: New Build (As Designed)

#### 10 Key features

|                               |        |                                  |
|-------------------------------|--------|----------------------------------|
| External wall U-value         | 0.14   | W/m <sup>2</sup> K               |
| Party wall U-value            | 0.00   | W/m <sup>2</sup> K               |
| Party wall U-value            | 0.00   | W/m <sup>2</sup> K               |
| Party wall U-value            | 0.00   | W/m <sup>2</sup> K               |
| Roof U-value                  | 0.11   | W/m <sup>2</sup> K               |
| Air permeability              | 3.0    | m <sup>3</sup> /m <sup>2</sup> h |
| Community heating, Waste Heat | N/A    |                                  |
| Photovoltaic array            | 368.33 | kWh/Year                         |

*This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.*

## Appendix A.3 - BRUKL Reports

BRUKL Output Document

 HM Government

Compliance with England Building Regulations Part L 2013

Project name

Woodgreen Be Lean

As designed

Date: Thu Dec 16 13:58:04 2021

Administrative information

Building Details

Address: Caxton Road, London, N22

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.13

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.13

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: Ross Mercer Meinhardt (UK) Ltd

Telephone number: : 020 7831 7969

Address: 10 Aldersgate Street, London, EC1A 4HJ

Criterion 1: The calculated CO<sub>2</sub> emission rate for the building must not exceed the target

|                                                                                                    |                     |
|----------------------------------------------------------------------------------------------------|---------------------|
| CO <sub>2</sub> emission rate from the notional building, kgCO <sub>2</sub> /m <sup>2</sup> .annum | 37.1                |
| Target CO <sub>2</sub> emission rate (TER), kgCO <sub>2</sub> /m <sup>2</sup> .annum               | 37.1                |
| Building CO <sub>2</sub> emission rate (BER), kgCO <sub>2</sub> /m <sup>2</sup> .annum             | 25.8                |
| Are emissions from the building less than or equal to the target?                                  | BER =< TER          |
| Are as built details the same as used in the BER calculations?                                     | Separate submission |

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

| Element                                                                                                                                                                                                                                                                                                                                                                                                                                      | U <sub>a</sub> -Limit | U <sub>a</sub> -Calc | U <sub>i</sub> -Calc | Surface where the maximum value occurs*  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|----------------------|----------------------|------------------------------------------|
| Wall**                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.35                  | 0.13                 | 0.13                 | GF000002:Surf[2]                         |
| Floor                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.25                  | 0.15                 | 0.15                 | GF000002:Surf[0]                         |
| Roof                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.25                  | 0.18                 | 0.18                 | GF000002:Surf[1]                         |
| Windows***, roof windows, and rooflights                                                                                                                                                                                                                                                                                                                                                                                                     | 2.2                   | 1.5                  | 1.5                  | GF000002:Surf[3]                         |
| Personnel doors                                                                                                                                                                                                                                                                                                                                                                                                                              | 2.2                   | 1                    | 1                    | GF000002:Surf[10]                        |
| Vehicle access & similar large doors                                                                                                                                                                                                                                                                                                                                                                                                         | 1.5                   | -                    | -                    | No Vehicle access doors in building      |
| High usage entrance doors                                                                                                                                                                                                                                                                                                                                                                                                                    | 3.5                   | -                    | -                    | No High usage entrance doors in building |
| U <sub>a</sub> -Limit = Limiting area-weighted average U-values [W/(m²K)]<br>U <sub>a</sub> -Calc = Calculated area-weighted average U-values [W/(m²K)]<br>U <sub>i</sub> -Calc = Calculated maximum individual element U-values [W/(m²K)]                                                                                                                                                                                                   |                       |                      |                      |                                          |
| * There might be more than one surface where the maximum U-value occurs.<br>** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.<br>*** Display windows and similar glazing are excluded from the U-value check.<br>N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool. |                       |                      |                      |                                          |

| Air Permeability   | Worst acceptable standard | This building |
|--------------------|---------------------------|---------------|
| m³/(h.m²) at 50 Pa | 10                        | 5             |

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

|                                                                                              |      |
|----------------------------------------------------------------------------------------------|------|
| Whole building lighting automatic monitoring & targeting with alarms for out-of-range values | YES  |
| Whole building electric power factor achieved by power factor correction                     | <0.9 |

1- Be Lean

|                                                                                                                                                                                                                                                   | Heating efficiency | Cooling efficiency | Radiant efficiency | SFP [W/(l/s)] | HR efficiency |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|--------------------|--------------------|---------------|---------------|
| This system                                                                                                                                                                                                                                       | 0.91               | 4.4                | 0                  | 0             | 0.9           |
| Standard value                                                                                                                                                                                                                                    | 0.91*              | 2.6                | N/A                | N/A           | 0.5           |
| Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system                                                                                                                                                         |                    |                    |                    |               | YES           |
| * Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82. |                    |                    |                    |               |               |

1- Be Lean Hot Water

|                                                                                                             | Water heating efficiency | Storage loss factor [kWh/litre per day] |
|-------------------------------------------------------------------------------------------------------------|--------------------------|-----------------------------------------|
| This building                                                                                               | 0.91                     | -                                       |
| Standard value                                                                                              | 0.9*                     | N/A                                     |
| * Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73. |                          |                                         |

Local mechanical ventilation, exhaust, and terminal units

| ID | System type in Non-domestic Building Services Compliance Guide                                          |
|----|---------------------------------------------------------------------------------------------------------|
| A  | Local supply or extract ventilation units serving a single area                                         |
| B  | Zonal supply system where the fan is remote from the zone                                               |
| C  | Zonal extract system where the fan is remote from the zone                                              |
| D  | Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery |
| E  | Local supply and extract ventilation system serving a single area with heating and heat recovery        |
| F  | Other local ventilation units                                                                           |
| G  | Fan-assisted terminal VAV unit                                                                          |
| H  | Fan coil units                                                                                          |
| I  | Zonal extract system where the fan is remote from the zone with grease filter                           |

| Zone name             | SFP [W/(l/s)]     |     |     |     |     |     |     |     |     |   | HR efficiency |          |
|-----------------------|-------------------|-----|-----|-----|-----|-----|-----|-----|-----|---|---------------|----------|
|                       | ID of system type | A   | B   | C   | D   | E   | F   | G   | H   | I |               |          |
|                       | Standard value    | 0.3 | 1.1 | 0.5 | 1.9 | 1.6 | 0.5 | 1.1 | 0.5 | 1 | Zone          | Standard |
| GF Commercial Space 1 |                   | -   | -   | -   | 1.5 | -   | -   | -   | -   | - | -             | N/A      |
| GF Commercial Space 3 |                   | -   | -   | -   | 1.5 | -   | -   | -   | -   | - | -             | N/A      |
| GF Commercial Space 4 |                   | -   | -   | -   | 1.5 | -   | -   | -   | -   | - | -             | N/A      |
| GF Commercial Space 5 |                   | -   | -   | -   | 1.5 | -   | -   | -   | -   | - | -             | N/A      |
| GF Commercial Space 2 |                   | -   | -   | -   | 1.5 | -   | -   | -   | -   | - | -             | N/A      |
| GF Commercial Space 7 |                   | -   | -   | -   | 1.5 | -   | -   | -   | -   | - | -             | N/A      |
| GF Commercial Space 6 |                   | -   | -   | -   | 1.5 | -   | -   | -   | -   | - | -             | N/A      |

General lighting and display lighting

| Zone name             | Luminous efficacy [lm/W] |      |              | General lighting [W] |
|-----------------------|--------------------------|------|--------------|----------------------|
|                       | Luminaire                | Lamp | Display lamp |                      |
|                       | Standard value           | 60   | 60           | 22                   |
| GF Commercial Space 1 | -                        | 80   | 80           | 1318                 |
| GF Commercial Space 3 | -                        | 80   | 80           | 1571                 |
| GF Commercial Space 4 | -                        | 80   | 80           | 1575                 |

| General lighting and display lighting | Luminous efficacy [lm/W] |      |              |                      |
|---------------------------------------|--------------------------|------|--------------|----------------------|
| Zone name                             | Luminaire                | Lamp | Display lamp | General lighting [W] |
| Standard value                        | 60                       | 60   | 22           |                      |
| GF Commercial Space 5                 | -                        | 80   | 80           | 1246                 |
| GF Commercial Space 2                 | -                        | 80   | 80           | 1427                 |
| GF Commercial Space 7                 | -                        | 80   | 80           | 1542                 |
| GF Commercial Space 6                 | -                        | 80   | 80           | 1880                 |

**Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains**

| Zone                  | Solar gain limit exceeded? (%) | Internal blinds used? |
|-----------------------|--------------------------------|-----------------------|
| GF Commercial Space 1 | NO (-57.6%)                    | NO                    |
| GF Commercial Space 3 | NO (-43.2%)                    | NO                    |
| GF Commercial Space 4 | NO (-57.8%)                    | NO                    |
| GF Commercial Space 5 | NO (-43.2%)                    | NO                    |
| GF Commercial Space 2 | NO (-65.8%)                    | NO                    |
| GF Commercial Space 7 | NO (-66.3%)                    | NO                    |
| GF Commercial Space 6 | NO (-66.2%)                    | NO                    |

**Criterion 4: The performance of the building, as built, should be consistent with the calculated BER**

Separate submission

**Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place**

Separate submission

## EPBD (Recast): Consideration of alternative energy systems

|                                                                                               |     |
|-----------------------------------------------------------------------------------------------|-----|
| <b>Were alternative energy systems considered and analysed as part of the design process?</b> | YES |
| Is evidence of such assessment available as a separate submission?                            | YES |
| Are any such measures included in the proposed design?                                        | YES |

### Technical Data Sheet (Actual vs. Notional Building)

| Building Global Parameters  |        |          | Building Use |                                                           |
|-----------------------------|--------|----------|--------------|-----------------------------------------------------------|
|                             | Actual | Notional | % Area       | Building Type                                             |
| Area [m²]                   | 898.9  | 898.9    | 100          | A1/A2 Retail/Financial and Professional services          |
| External area [m²]          | 1445.6 | 1445.6   |              | A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways    |
| Weather                     | LON    | LON      |              | B1 Offices and Workshop businesses                        |
| Infiltration [m³/hm²@ 50Pa] | 5      | 3        |              | B2 to B7 General Industrial and Special Industrial Groups |
| Average conductance [W/K]   | 424.18 | 588.25   |              | B8 Storage or Distribution                                |
| Average U-value [W/m²K]     | 0.29   | 0.41     |              | C1 Hotels                                                 |
| Alpha value* [%]            | 10     | 10       |              | C2 Residential Institutions: Hospitals and Care Homes     |
|                             |        |          |              | C2 Residential Institutions: Residential schools          |
|                             |        |          |              | C2 Residential Institutions: Universities and colleges    |

\* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

### Energy Consumption by End Use [kWh/m<sup>2</sup>]

|                | Actual       | Notional     |
|----------------|--------------|--------------|
| Heating        | 11.76        | 9.75         |
| Cooling        | 4.49         | 9.41         |
| Auxiliary      | 6.69         | 3.06         |
| Lighting       | 32.78        | 55.93        |
| Hot water      | 2.05         | 1.86         |
| Equipment*     | 20.26        | 20.26        |
| <b>TOTAL**</b> | <b>57.77</b> | <b>80.02</b> |

\* Energy used by equipment does not count towards the total for consumption or calculating emissions.

\*\* Total is net of any electrical energy displaced by CHP generators, if applicable

### Energy Production by Technology [kWh/m<sup>2</sup>]

|                       | Actual | Notional |
|-----------------------|--------|----------|
| Photovoltaic systems  | 0      | 0        |
| Wind turbines         | 0      | 0        |
| CHP generators        | 0      | 0        |
| Solar thermal systems | 0      | 0        |

## Energy & CO<sub>2</sub> Emissions Summary

|                                               | Actual | Notional |
|-----------------------------------------------|--------|----------|
| Heating + cooling demand [MJ/m <sup>2</sup> ] | 99.44  | 158.65   |
| Primary energy* [kWh/m <sup>2</sup> ]         | 151.81 | 218.92   |
| Total emissions [kg/m <sup>2</sup> ]          | 25.8   | 37.1     |

\* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

| HVAC Systems Performance                                                                 |                   |                   |                    |                    |                   |              |               |                  |                  |      |
|------------------------------------------------------------------------------------------|-------------------|-------------------|--------------------|--------------------|-------------------|--------------|---------------|------------------|------------------|------|
| System Type                                                                              | Heat dem<br>MJ/m2 | Cool dem<br>MJ/m2 | Heat con<br>kWh/m2 | Cool con<br>kWh/m2 | Aux con<br>kWh/m2 | Heat<br>SSEF | Cool<br>SSEER | Heat gen<br>SEFF | Cool gen<br>SEER |      |
| [ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity |                   |                   |                    |                    |                   |              |               |                  |                  |      |
|                                                                                          | Actual            | 37.8              | 61.6               | 11.8               | 4.5               | 6.7          | 0.89          | 3.81             | 0.91             | 5.1  |
|                                                                                          | Notional          | 30.3              | 128.4              | 9.8                | 9.4               | 3.1          | 0.86          | 3.79             | ----             | ---- |

| Key to terms      |                                                                                                       |
|-------------------|-------------------------------------------------------------------------------------------------------|
| Heat dem [MJ/m2]  | = Heating energy demand                                                                               |
| Cool dem [MJ/m2]  | = Cooling energy demand                                                                               |
| Heat con [kWh/m2] | = Heating energy consumption                                                                          |
| Cool con [kWh/m2] | = Cooling energy consumption                                                                          |
| Aux con [kWh/m2]  | = Auxiliary energy consumption                                                                        |
| Heat SSEFF        | = Heating system seasonal efficiency (for notional building, value depends on activity glazing class) |
| Cool SSEER        | = Cooling system seasonal energy efficiency ratio                                                     |
| Heat gen SSEFF    | = Heating generator seasonal efficiency                                                               |
| Cool gen SSEER    | = Cooling generator seasonal energy efficiency ratio                                                  |
| ST                | = System type                                                                                         |
| HS                | = Heat source                                                                                         |
| HFT               | = Heating fuel type                                                                                   |
| CFT               | = Cooling fuel type                                                                                   |

## Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

| Building fabric                                                          |                    |                    |                                                                    |
|--------------------------------------------------------------------------|--------------------|--------------------|--------------------------------------------------------------------|
| Element                                                                  | U <sub>i-Typ</sub> | U <sub>i-Min</sub> | Surface where the minimum value occurs*                            |
| Wall                                                                     | 0.23               | 0.13               | GF000002:Surf[2]                                                   |
| Floor                                                                    | 0.2                | 0.15               | GF000002:Surf[0]                                                   |
| Roof                                                                     | 0.15               | 0.18               | GF000002:Surf[1]                                                   |
| Windows, roof windows, and rooflights                                    | 1.5                | 1.5                | GF000002:Surf[3]                                                   |
| Personnel doors                                                          | 1.5                | 1                  | GF000002:Surf[10]                                                  |
| Vehicle access & similar large doors                                     | 1.5                | -                  | No Vehicle access doors in building                                |
| High usage entrance doors                                                | 1.5                | -                  | No High usage entrance doors in building                           |
| U <sub>i-Typ</sub> = Typical individual element U-values [W/(m²K)]       |                    |                    | U <sub>i-Min</sub> = Minimum individual element U-values [W/(m²K)] |
| * There might be more than one surface where the minimum U-value occurs. |                    |                    |                                                                    |

| Air Permeability   | Typical value | This building |
|--------------------|---------------|---------------|
| m³/(h.m²) at 50 Pa | 5             | 5             |

BRUKL Output Document

 HM Government

Compliance with England Building Regulations Part L 2013

Project name

Woodgreen Be Green

As designed

Date: Thu Dec 16 14:01:01 2021

Administrative information

Building Details

Address: Caxton Road, London, N22

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.13

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.13

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: Ross Mercer Meinhardt (UK) Ltd

Telephone number: : 020 7831 7969

Address: 10 Aldersgate Street, London, EC1A 4HJ

Criterion 1: The calculated CO<sub>2</sub> emission rate for the building must not exceed the target

|                                                                                                    |                     |
|----------------------------------------------------------------------------------------------------|---------------------|
| CO <sub>2</sub> emission rate from the notional building, kgCO <sub>2</sub> /m <sup>2</sup> .annum | 34.6                |
| Target CO <sub>2</sub> emission rate (TER), kgCO <sub>2</sub> /m <sup>2</sup> .annum               | 34.6                |
| Building CO <sub>2</sub> emission rate (BER), kgCO <sub>2</sub> /m <sup>2</sup> .annum             | 23.6                |
| Are emissions from the building less than or equal to the target?                                  | BER =< TER          |
| Are as built details the same as used in the BER calculations?                                     | Separate submission |

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

| Element                                                                                                                                                                                                                                                                                                                                                                                                                                      | U <sub>a</sub> -Limit | U <sub>a</sub> -Calc | U <sub>i</sub> -Calc | Surface where the maximum value occurs*  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|----------------------|----------------------|------------------------------------------|
| Wall**                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.35                  | 0.13                 | 0.13                 | GF000002:Surf[2]                         |
| Floor                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.25                  | 0.15                 | 0.15                 | GF000002:Surf[0]                         |
| Roof                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.25                  | 0.18                 | 0.18                 | GF000002:Surf[1]                         |
| Windows***, roof windows, and rooflights                                                                                                                                                                                                                                                                                                                                                                                                     | 2.2                   | 1.5                  | 1.5                  | GF000002:Surf[3]                         |
| Personnel doors                                                                                                                                                                                                                                                                                                                                                                                                                              | 2.2                   | 1                    | 1                    | GF000002:Surf[10]                        |
| Vehicle access & similar large doors                                                                                                                                                                                                                                                                                                                                                                                                         | 1.5                   | -                    | -                    | No Vehicle access doors in building      |
| High usage entrance doors                                                                                                                                                                                                                                                                                                                                                                                                                    | 3.5                   | -                    | -                    | No High usage entrance doors in building |
| U <sub>a</sub> -Limit = Limiting area-weighted average U-values [W/(m²K)]<br>U <sub>a</sub> -Calc = Calculated area-weighted average U-values [W/(m²K)]<br>U <sub>i</sub> -Calc = Calculated maximum individual element U-values [W/(m²K)]                                                                                                                                                                                                   |                       |                      |                      |                                          |
| * There might be more than one surface where the maximum U-value occurs.<br>** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.<br>*** Display windows and similar glazing are excluded from the U-value check.<br>N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool. |                       |                      |                      |                                          |

| Air Permeability   | Worst acceptable standard | This building |
|--------------------|---------------------------|---------------|
| m³/(h.m²) at 50 Pa | 10                        | 5             |

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

|                                                                                              |      |
|----------------------------------------------------------------------------------------------|------|
| Whole building lighting automatic monitoring & targeting with alarms for out-of-range values | YES  |
| Whole building electric power factor achieved by power factor correction                     | <0.9 |

1- ASHP

|                                                                                                                                                                   | Heating efficiency | Cooling efficiency | Radiant efficiency | SFP [W/(l/s)] | HR efficiency |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|--------------------|--------------------|---------------|---------------|
| This system                                                                                                                                                       | 3.4                | 4.4                | 0                  | 0             | 0.9           |
| Standard value                                                                                                                                                    | 2.5*               | 2.6                | N/A                | N/A           | 0.5           |
| Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system                                                                         |                    |                    |                    |               | YES           |
| * Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards. |                    |                    |                    |               |               |

1- Be Green Hot Water

|                | Water heating efficiency | Storage loss factor [kWh/litre per day] |
|----------------|--------------------------|-----------------------------------------|
| This building  | 1                        | -                                       |
| Standard value | 1                        | N/A                                     |

Local mechanical ventilation, exhaust, and terminal units

| ID | System type in Non-domestic Building Services Compliance Guide                                          |
|----|---------------------------------------------------------------------------------------------------------|
| A  | Local supply or extract ventilation units serving a single area                                         |
| B  | Zonal supply system where the fan is remote from the zone                                               |
| C  | Zonal extract system where the fan is remote from the zone                                              |
| D  | Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery |
| E  | Local supply and extract ventilation system serving a single area with heating and heat recovery        |
| F  | Other local ventilation units                                                                           |
| G  | Fan-assisted terminal VAV unit                                                                          |
| H  | Fan coil units                                                                                          |
| I  | Zonal extract system where the fan is remote from the zone with grease filter                           |

| Zone name             | SFP [W/(l/s)]     |     |     |     |     |     |     |     |     |   | HR efficiency |          |
|-----------------------|-------------------|-----|-----|-----|-----|-----|-----|-----|-----|---|---------------|----------|
|                       | ID of system type | A   | B   | C   | D   | E   | F   | G   | H   | I |               |          |
|                       | Standard value    | 0.3 | 1.1 | 0.5 | 1.9 | 1.6 | 0.5 | 1.1 | 0.5 | 1 | Zone          | Standard |
| GF Commercial Space 1 |                   | -   | -   | -   | 1.5 | -   | -   | -   | -   | - | -             | N/A      |
| GF Commercial Space 3 |                   | -   | -   | -   | 1.5 | -   | -   | -   | -   | - | -             | N/A      |
| GF Commercial Space 4 |                   | -   | -   | -   | 1.5 | -   | -   | -   | -   | - | -             | N/A      |
| GF Commercial Space 5 |                   | -   | -   | -   | 1.5 | -   | -   | -   | -   | - | -             | N/A      |
| GF Commercial Space 2 |                   | -   | -   | -   | 1.5 | -   | -   | -   | -   | - | -             | N/A      |
| GF Commercial Space 7 |                   | -   | -   | -   | 1.5 | -   | -   | -   | -   | - | -             | N/A      |
| GF Commercial Space 6 |                   | -   | -   | -   | 1.5 | -   | -   | -   | -   | - | -             | N/A      |

General lighting and display lighting

| Zone name             | Luminous efficacy [lm/W] |      |              | General lighting [W] |
|-----------------------|--------------------------|------|--------------|----------------------|
|                       | Luminaire                | Lamp | Display lamp |                      |
|                       | Standard value           | 60   | 60           | 22                   |
| GF Commercial Space 1 |                          | -    | 80           | 80                   |
| GF Commercial Space 3 |                          | -    | 80           | 80                   |
| GF Commercial Space 4 |                          | -    | 80           | 80                   |
| GF Commercial Space 5 |                          | -    | 80           | 80                   |

| General lighting and display lighting |  | Luminous efficacy [lm/W] |      |                      |
|---------------------------------------|--|--------------------------|------|----------------------|
| Zone name                             |  | Luminaire                | Lamp | Display lamp         |
| Standard value                        |  | 60                       | 60   | 22                   |
| GF Commercial Space 2                 |  | -                        | 80   | 80                   |
| GF Commercial Space 7                 |  | -                        | 80   | 80                   |
| GF Commercial Space 6                 |  | -                        | 80   | 80                   |
|                                       |  |                          |      | General lighting [W] |
|                                       |  |                          |      | 1427                 |
|                                       |  |                          |      | 1542                 |
|                                       |  |                          |      | 1880                 |

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

| Zone                  | Solar gain limit exceeded? (%) | Internal blinds used? |
|-----------------------|--------------------------------|-----------------------|
| GF Commercial Space 1 | NO (-57.6%)                    | NO                    |
| GF Commercial Space 3 | NO (-43.2%)                    | NO                    |
| GF Commercial Space 4 | NO (-57.8%)                    | NO                    |
| GF Commercial Space 5 | NO (-43.2%)                    | NO                    |
| GF Commercial Space 2 | NO (-65.8%)                    | NO                    |
| GF Commercial Space 7 | NO (-66.3%)                    | NO                    |
| GF Commercial Space 6 | NO (-66.2%)                    | NO                    |

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

|                                                                                        |     |
|----------------------------------------------------------------------------------------|-----|
| Were alternative energy systems considered and analysed as part of the design process? | YES |
| Is evidence of such assessment available as a separate submission?                     | YES |
| Are any such measures included in the proposed design?                                 | YES |

Technical Data Sheet (Actual vs. Notional Building)

| Building Global Parameters                                                                        |        |          | Building Use |                                                                    |
|---------------------------------------------------------------------------------------------------|--------|----------|--------------|--------------------------------------------------------------------|
|                                                                                                   | Actual | Notional | % Area       | Building Type                                                      |
| Area [m²]                                                                                         | 898.9  | 898.9    | 100          | A1/A2 Retail/Financial and Professional services                   |
| External area [m²]                                                                                | 1445.6 | 1445.6   |              | A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways             |
| Weather                                                                                           | LON    | LON      |              | B1 Offices and Workshop businesses                                 |
| Infiltration [m³/hm²@ 50Pa]                                                                       | 5      | 3        |              | B2 to B7 General Industrial and Special Industrial Groups          |
| Average conductance [W/K]                                                                         | 424.18 | 588.25   |              | B8 Storage or Distribution                                         |
| Average U-value [W/m²K]                                                                           | 0.29   | 0.41     |              | C1 Hotels                                                          |
| Alpha value* [%]                                                                                  | 10     | 10       |              | C2 Residential Institutions: Hospitals and Care Homes              |
| * Percentage of the building's average heat transfer coefficient which is due to thermal bridging |        |          |              | C2 Residential Institutions: Residential schools                   |
|                                                                                                   |        |          |              | C2 Residential Institutions: Universities and colleges             |
|                                                                                                   |        |          |              | C2A Secure Residential Institutions                                |
|                                                                                                   |        |          |              | Residential spaces                                                 |
|                                                                                                   |        |          |              | D1 Non-residential Institutions: Community/Day Centre              |
|                                                                                                   |        |          |              | D1 Non-residential Institutions: Libraries, Museums, and Galleries |
|                                                                                                   |        |          |              | D1 Non-residential Institutions: Education                         |
|                                                                                                   |        |          |              | D1 Non-residential Institutions: Primary Health Care Building      |
|                                                                                                   |        |          |              | D1 Non-residential Institutions: Crown and County Courts           |
|                                                                                                   |        |          |              | D2 General Assembly and Leisure, Night Clubs, and Theatres         |
|                                                                                                   |        |          |              | Others: Passenger terminals                                        |
|                                                                                                   |        |          |              | Others: Emergency services                                         |
|                                                                                                   |        |          |              | Others: Miscellaneous 24hr activities                              |
|                                                                                                   |        |          |              | Others: Car Parks 24 hrs                                           |
|                                                                                                   |        |          |              | Others: Stand alone utility block                                  |

Energy Consumption by End Use [kWh/m²]

|            |        |          |
|------------|--------|----------|
|            | Actual | Notional |
| Heating    | 3.1    | 3.02     |
| Cooling    | 1.27   | 5.81     |
| Auxiliary  | 6.69   | 3.06     |
| Lighting   | 32.78  | 55.93    |
| Hot water  | 1.7    | 0.63     |
| Equipment* | 20.26  | 20.26    |
| TOTAL**    | 45.53  | 68.45    |

\* Energy used by equipment does not count towards the total for consumption or calculating emissions.  
\*\* Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

|                       |        |          |
|-----------------------|--------|----------|
|                       | Actual | Notional |
| Photovoltaic systems  | 0      | 0        |
| Wind turbines         | 0      | 0        |
| CHP generators        | 0      | 0        |
| Solar thermal systems | 0      | 0        |

Energy & CO<sub>2</sub> Emissions Summary

|                                  |        |          |
|----------------------------------|--------|----------|
|                                  | Actual | Notional |
| Heating + cooling demand [MJ/m²] | 54.57  | 87.3     |
| Primary energy* [kWh/m²]         | 139.77 | 204.9    |
| Total emissions [kg/m²]          | 23.6   | 34.6     |

\* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

| HVAC Systems Performance                                                                                      |                   |                   |                    |                    |                   |              |               |                  |                  |      |
|---------------------------------------------------------------------------------------------------------------|-------------------|-------------------|--------------------|--------------------|-------------------|--------------|---------------|------------------|------------------|------|
| System Type                                                                                                   | Heat dem<br>MJ/m2 | Cool dem<br>MJ/m2 | Heat con<br>kWh/m2 | Cool con<br>kWh/m2 | Aux con<br>kWh/m2 | Heat<br>SSEF | Cool<br>SSEER | Heat gen<br>SEFF | Cool gen<br>SEER |      |
| [ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity |                   |                   |                    |                    |                   |              |               |                  |                  |      |
|                                                                                                               | Actual            | 37.2              | 17.4               | 3.1                | 1.3               | 6.7          | 3.33          | 3.81             | 3.4              | 5.1  |
|                                                                                                               | Notional          | 27.8              | 59.5               | 3                  | 5.8               | 3.1          | 2.56          | 2.84             | ----             | ---- |

Key to terms

- Heat dem [MJ/m2]
- = Heating energy demand
- Cool dem [MJ/m2]
- = Cooling energy demand
- Heat con [kWh/m2]
- = Heating energy consumption
- Cool con [kWh/m2]
- = Cooling energy consumption
- Aux con [kWh/m2]
- = Auxiliary energy consumption
- Heat SSEFF
- = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
- Cool SSEER
- = Cooling system seasonal energy efficiency ratio
- Heat gen SSEFF
- = Heating generator seasonal efficiency
- Cool gen SSEER
- = Cooling generator seasonal energy efficiency ratio
- ST
- = System type
- HS
- = Heat source
- HFT
- = Heating fuel type
- CFT
- = Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

| Element                                                                  | U <sub>i-Typ</sub> | U <sub>i-Min</sub> | Surface where the minimum value occurs*                            |
|--------------------------------------------------------------------------|--------------------|--------------------|--------------------------------------------------------------------|
| Wall                                                                     | 0.23               | 0.13               | GF000002:Surf[2]                                                   |
| Floor                                                                    | 0.2                | 0.15               | GF000002:Surf[0]                                                   |
| Roof                                                                     | 0.15               | 0.18               | GF000002:Surf[1]                                                   |
| Windows, roof windows, and rooflights                                    | 1.5                | 1.5                | GF000002:Surf[3]                                                   |
| Personnel doors                                                          | 1.5                | 1                  | GF000002:Surf[10]                                                  |
| Vehicle access & similar large doors                                     | 1.5                | -                  | No Vehicle access doors in building                                |
| High usage entrance doors                                                | 1.5                | -                  | No High usage entrance doors in building                           |
| U <sub>i-Typ</sub> = Typical individual element U-values [W/(m²K)]       |                    |                    | U <sub>i-Min</sub> = Minimum individual element U-values [W/(m²K)] |
| * There might be more than one surface where the minimum U-value occurs. |                    |                    |                                                                    |

| Air Permeability   | Typical value | This building |
|--------------------|---------------|---------------|
| m³/(h.m²) at 50 Pa | 5             | 5             |

## Appendix A.4 – Assessment Results Using SAP2012 Emissions Factors

## A.4 Assessment Results Using SAP2012 Emissions Factors

### A.4.1 Consented Energy Strategy

Below are summarised the carbon emissions and savings for the consented development as detailed in Table 6-03 of the Energy Strategy Report by JAW Sustainability dated 24<sup>th</sup> April 2020 based on a connection to the Haringey District Energy Scheme using SAP2012 carbon emissions factors.

|                            | Residential                      |                                |          | Commercial                       |                                |          |
|----------------------------|----------------------------------|--------------------------------|----------|----------------------------------|--------------------------------|----------|
|                            | CO <sub>2</sub> Emissions (T/yr) | CO <sub>2</sub> Savings (T/yr) | % Saving | CO <sub>2</sub> Emissions (T/yr) | CO <sub>2</sub> Savings (T/yr) | % Saving |
| Baseline                   | 87.21                            |                                |          | 16.25                            |                                |          |
| Be lean                    | 74.80                            | 12.40                          | 14.22%   | 11.70                            | 4.55                           | 28%      |
| Be clean                   | 39.56                            | 35.24                          | 40.4%    | 11.70                            | 0.00                           | 0.0%     |
| Be green                   | 27.62                            | 11.94                          | 13.69%   | 11.33                            | 0.37                           | 2%       |
| Cumulative on site savings |                                  | 59.58                          | 68.33%   |                                  | 4.92                           | 30%      |

**Table A.4.1: Regulated carbon dioxide emissions and savings from each stage of the energy hierarchy for consented scheme (SAP2012 emissions factors)**

### A.4.2 ‘As Designed’ Energy Strategy

Below are summarised the carbon emissions and savings for the final ‘as designed’ scheme proposed by Weston Homes based on a connection to the Haringey District Energy Scheme using SAP2012 carbon emissions factors.

|                            | Residential                      |                                |          | Commercial                       |                                |          |
|----------------------------|----------------------------------|--------------------------------|----------|----------------------------------|--------------------------------|----------|
|                            | CO <sub>2</sub> Emissions (T/yr) | CO <sub>2</sub> Savings (T/yr) | % Saving | CO <sub>2</sub> Emissions (T/yr) | CO <sub>2</sub> Savings (T/yr) | % Saving |
| Baseline                   | 88.28                            |                                |          | 33.37                            |                                |          |
| Be lean                    | 82.26                            | 6.03                           | 6.83%    | 23.19                            | 10.18                          | 30.50%   |
| Be clean                   | 34.00                            | 48.26                          | 54.66%   | 23.19                            | 0.00                           | 0.0%     |
| Be green                   | 19.66                            | 14.34                          | 16.24%   | 21.25                            | 1.94                           | 5.83%    |
| Cumulative on site savings |                                  | 68.62                          | 77.73%   |                                  | 12.12                          | 36.33%   |

**Table A.4.2: Regulated carbon dioxide emissions and savings from each stage of the energy hierarchy for as designed scheme (SAP2012 emissions factors)**

## Appendix A.5 – Interim Gas Boiler Scenario

A.5 Interim Gas Boiler Scenario

A.5.1 Consented Energy Strategy

Below are summarised the carbon emissions and savings for the consented development as detailed in Table 5-03 of the Energy Strategy Report by JAW Sustainability dated 24<sup>th</sup> April 2020 based on communal boilers using SAP10 carbon emissions factors.

|                            | Residential                      |                                |          | Commercial                       |                                |          |
|----------------------------|----------------------------------|--------------------------------|----------|----------------------------------|--------------------------------|----------|
|                            | CO <sub>2</sub> Emissions (T/yr) | CO <sub>2</sub> Savings (T/yr) | % Saving | CO <sub>2</sub> Emissions (T/yr) | CO <sub>2</sub> Savings (T/yr) | % Saving |
| Baseline                   | 77.16                            |                                |          | 8.39                             |                                |          |
| Be lean                    | 63.09                            | 14.07                          | 18.20%   | 6.97                             | 1.42                           | 17%      |
| Be clean                   | 63.09                            | 0.00                           | 0.0%     | 6.97                             | 0.00                           | 0%       |
| Be green                   | 57.73                            | 5.36                           | 6.95%    | 5.09                             | 1.84                           | 22%      |
| Cumulative on site savings |                                  | 19.43                          | 25.18%   |                                  | 3.30                           | 39%      |

Table A.5.1: Regulated carbon dioxide emissions and savings from each stage of the energy hierarchy for consented scheme in gas boiler scenario (SAP10 emissions factors)

Below are summarised the carbon emissions and savings for the consented development as detailed in Table 6-06 of the Energy Strategy Report by JAW Sustainability dated 24<sup>th</sup> April 2020 based on communal boilers using SAP2012 carbon emissions factors.

|                            | Residential                      |                                |          | Commercial                       |                                |          |
|----------------------------|----------------------------------|--------------------------------|----------|----------------------------------|--------------------------------|----------|
|                            | CO <sub>2</sub> Emissions (T/yr) | CO <sub>2</sub> Savings (T/yr) | % Saving | CO <sub>2</sub> Emissions (T/yr) | CO <sub>2</sub> Savings (T/yr) | % Saving |
| Baseline                   | 87.21                            |                                |          | 16.25                            |                                |          |
| Be lean                    | 74.80                            | 12.40                          | 14.2%    | 11.70                            | 4.55                           | 28%      |
| Be clean                   | 74.80                            | 0.00                           | 0.0%     | 0.00                             | 0.00                           | 0%       |
| Be green                   | 62.87                            | 11.94                          | 13.69%   | 11.33                            | 0.37                           | 2%       |
| Cumulative on site savings |                                  | 24.34                          | 27.91%   |                                  | 4.92                           | 30%      |

Table A.5.2: Regulated carbon dioxide emissions and savings from each stage of the energy hierarchy for consented scheme in gas boiler scenario (SAP2012 emissions factors)

A.5.2 ‘As Designed’ Energy Strategy

Below are summarised the carbon emissions and savings for the final ‘as designed’ scheme proposed by Weston Homes based on communal boilers using SAP10 carbon emissions factors.

|                            | Residential                      |                                |          | Commercial                       |                                |          |
|----------------------------|----------------------------------|--------------------------------|----------|----------------------------------|--------------------------------|----------|
|                            | CO <sub>2</sub> Emissions (T/yr) | CO <sub>2</sub> Savings (T/yr) | % Saving | CO <sub>2</sub> Emissions (T/yr) | CO <sub>2</sub> Savings (T/yr) | % Saving |
| Baseline                   | 76.30                            |                                |          | 16.16                            |                                |          |
| Be lean                    | 67.72                            | 8.58                           | 11.24%   | 11.81                            | 4.35                           | 26.89%   |
| Be clean                   | 67.72                            | 0.00                           | 0.00%    | 11.81                            | 0.00                           | 0.0%     |
| Be green                   | 61.29                            | 6.44                           | 8.44%    | 9.54                             | 2.28                           | 14.08%   |
| Cumulative on site savings |                                  | 15.01                          | 19.68%   |                                  | 6.62                           | 40.98%   |

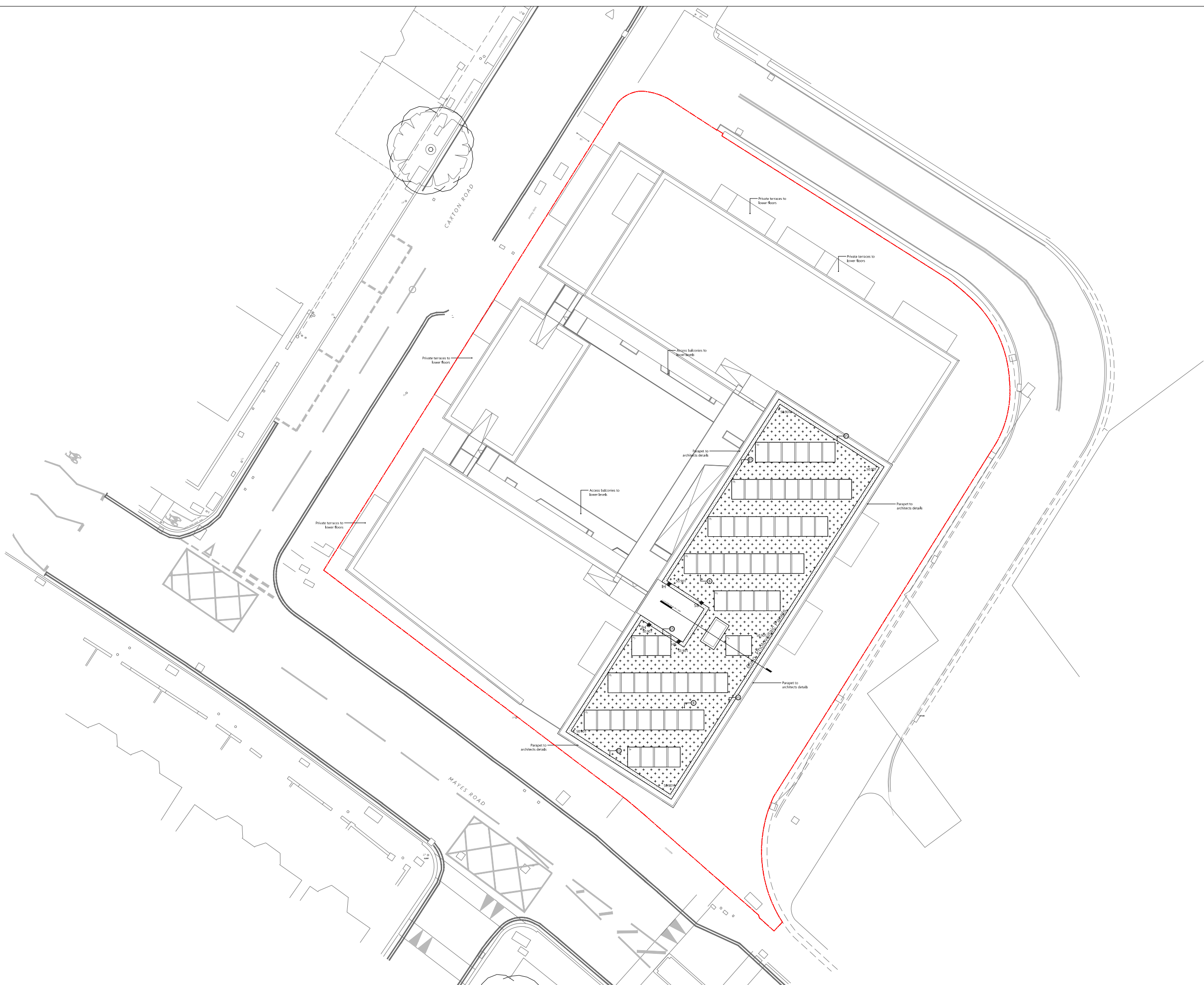
Table A.5.3: Regulated carbon dioxide emissions and savings from each stage of the energy hierarchy for as designed scheme in gas boiler scenario (SAP10 emissions factors)

Below are summarised the carbon emissions and savings for the final ‘as designed’ scheme proposed by Weston Homes based on communal boilers using SAP2012 carbon emissions factors.

|                            | Residential                      |                                |          | Commercial                       |                                |          |
|----------------------------|----------------------------------|--------------------------------|----------|----------------------------------|--------------------------------|----------|
|                            | CO <sub>2</sub> Emissions (T/yr) | CO <sub>2</sub> Savings (T/yr) | % Saving | CO <sub>2</sub> Emissions (T/yr) | CO <sub>2</sub> Savings (T/yr) | % Saving |
| Baseline                   | 86.35                            |                                |          | 33.37                            |                                |          |
| Be lean                    | 79.57                            | 6.78                           | 7.85%    | 23.19                            | 10.18                          | 30.50%   |
| Be clean                   | 79.57                            | 0.00                           | 0.00%    | 23.19                            | 0.00                           | 0.0%     |
| Be green                   | 65.23                            | 14.34                          | 16.6%    | 21.25                            | 1.94                           | 5.83%    |
| Cumulative on site savings |                                  | 21.11                          | 24.45%   |                                  | 12.12                          | 36.33%   |

Table A.4.2: Regulated carbon dioxide emissions and savings from each stage of the energy hierarchy for as designed scheme in gas boiler scenario (SAP2012 emissions factors)

Appendix A.6 - Drawings



- KEY**
- HARDWORKS**
- SITE BOUNDARY
- SURFACE FINISHES**
- PROPOSED TERRACES**  
To architects details
- POURCELAN PAVING ARGENTO  
Laid on rails and pedestals, butt jointed, 600 x 600 x 20mm  
Manufacturer: Ryms, Colour: Argento
  - POURCELAN PAVING ARGENTO  
Laid on rails and pedestals, butt jointed, 1300 x 600 x 20mm  
Manufacturer: Ryms, Colour: Argento
  - FEATURI POURCELAN PAVING NERO  
Laid on rails and pedestals, butt jointed, 600 x 600 x 20mm  
Manufacturer: Ryms, Colour: NERO
  - FERRON BELLEVE ARACHAIR  
Or similar approved. Size: As manufactured. Colour: Anthracite Grey. Fixing: Roof fixed
  - FERRON BELLEVE LOW TABLE  
Or similar approved. Size: As manufactured. Colour: Anthracite Grey. Material: As fabricated. Fixing: Fixed
  - VESTRE BLOC BENCH NO BACK  
Or similar approved. Size: As manufactured. Colour: Anthracite Grey. Material: As fabricated. Fixing: Fixed
  - VESTRE BLOC SEATS WITH BACK AND BLOC TABLE  
Or similar approved. Size: As manufactured. Colour: Anthracite Grey. Material: As fabricated. Fixing: Fixed
  - FERRON BELLEVE 2 SEATER SOFA  
Or similar approved. Size: As manufactured. Colour: Anthracite Grey. Material: As fabricated. Fixing: Fixed
- EDGING AND BOUNDARIES**
- METAL EDGING  
Manufacturer: Kinley or similar. Size: 100mm x 6mm x 3000mm. Colour: PGL to match window colour
  - RABED METAL PLANTERS  
Manufacturer: Kinley systems or similar. 500mm rolled top. Varying heights
  - 1.1m VERTICAL METAL RAB RIGS  
To architects details for private terraces
- LIGHTING:**
- INGROUND UPLIGHTER LED  
Ligman. Kiss. X1-60/331-11-W30
- SPOT HEIGHTS:**
- EXISTING LEVELS  
+0.000
  - FINISHED FLOOR LEVELS  
+0.000
- ECOLOGICAL:**
- SWIFT NEST BOX  
Internal swift boxes Woodstone built in visible swift box or similar approved
  - HOLE SPARKER NEST TREES  
Sparsen fence internal box quarter brick, supplied form bird brick houses or similar approved
  - INSECT HOTEL  
Free standing insect hotel to ecologists specification
- PLAY EQUIPMENT:**
- GRANITE BOULDERS  
Manufacturer: CED or similar. Installation: base set into ground. Size up to 800mm. Colour: Pink granite
  - OAK LOG PILE  
Manufacturer: Sunway Oak Frames or similar. Materials: Green Oak. Installation: peg and roof fixed to ground. Size: as shown
  - PLAY SCREENS  
Manufacturer: Playdate. Installation: roof fixed
- SOFT LANDSCAPE:**
- SPECIMEN CLIMBER  
Trained along metal wires attached to the building facade
  - PROPOSED SMALL SCALE TREE  
Up to 10m refer to planting plan for further details
  - EXISTING VEGETATION RETAINED  
With Root Protection Zone as per BS5837
  - PROPOSED WEDGE 1.0m  
Refer to planting plan for further details
  - PROPOSED ORNAMENTAL SHRUB BED  
Refer to planting plan for further details
  - PROPOSED GENERAL AMENITY TURF  
Refer to planting plan for further details
  - PROPOSED AREAS OF BIODIVERSE ROOF  
Areas of bio-diverse brown roof plug planted and seeded. See ecologists plans for further details





Meinhardt (UK) Ltd  
10 Aldersgate Street  
London  
EC1A 4HJ  
T: +44 (0) 20 7831 7969

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