

# Energy and Sustainability Statement

Aspect (Eastleigh) Ltd

237 Chamberlayne Road & Derby Road  
Eastleigh  
SO50 5HX  
Eastleigh Borough Council



| Version | Revision | Date       | Author          | Reviewer   | Project Manager |
|---------|----------|------------|-----------------|------------|-----------------|
| 1       | A        | 15.06.2023 | Alaister Coffey | Andy Frost | Alaister Coffey |
| 2       | B        | 19.06.2023 | Alaister Coffey | Andy Frost | Alaister Coffey |
| 2       | B        | 19.06.2023 | Alaister Coffey |            | Alaister Coffey |

The figures within this report may be based on indicative modelling and an assumed specification outlined within the relevant sections. Therefore, this modelling may not represent the as built emission or energy use of the Proposed Development and further modelling may need to be undertaken at detailed design stage to confirm precise performance figures. Please contact SRE should you have any questions, or should you wish further modelling to be undertaken post planning.

© Copyright SRE Ltd 2023

All rights reserved. No part of this publication may be reproduced, distributed, or transmitted in any form or by any means, including photocopying, recording, or other electronic or mechanical methods, without the prior written permission of the author, except in the case of brief quotations embodied in critical reviews and certain other non-commercial uses permitted by copyright law. For permission requests, write to the author, at the address below:

SRE Registered Office | Greenforde Farm

Stoner Hill Road | Froxfield

Petersfield | Hampshire | GU32 1DY

01730 710044

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

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

## Contents

|                                                  |    |
|--------------------------------------------------|----|
| Executive Summary .....                          | 1  |
| 1.0 Introduction.....                            | 4  |
| 1.1 Planning Policies.....                       | 4  |
| 1.2 Applicability to Proposed Development .....  | 7  |
| 2.0 Energy .....                                 | 9  |
| 2.1 Method .....                                 | 9  |
| 2.2 LEAN – Demand Reduction.....                 | 10 |
| 2.2.1 Passive Design Measures.....               | 11 |
| 2.2.2 Active Design Measures .....               | 11 |
| 2.2.3 Cooling.....                               | 12 |
| 2.3 CLEAN – Heating Infrastructure .....         | 12 |
| 2.4 GREEN – Low Carbon and Renewable Energy..... | 13 |
| 2.4.1 Air Source Heat Pumps.....                 | 14 |
| 2.4.2 Ground Source Heat Pump (GSHP).....        | 14 |
| 2.4.3 Photovoltaics (PV).....                    | 14 |
| 2.4.4 Energy Storage.....                        | 15 |
| 2.4.5 Energy Exporting.....                      | 15 |
| 2.5 SEEN – In-use monitoring .....               | 15 |
| 2.6 Conclusions.....                             | 15 |
| 3.0 Sustainability .....                         | 19 |
| 3.1 Pollution.....                               | 19 |
| 3.1.1 Air .....                                  | 19 |
| 3.1.2 Noise.....                                 | 20 |
| 3.1.3 Light.....                                 | 20 |
| 3.2 Flood Risk.....                              | 20 |
| 3.3 Transport .....                              | 21 |
| 3.3.1 Public Transport.....                      | 21 |
| 3.3.2 Parking.....                               | 21 |
| 3.3.3 Electric Vehicle Charging.....             | 21 |
| 3.3.4 Cycle Storage.....                         | 21 |
| 3.4 Resource efficiency .....                    | 22 |
| 3.4.1 Construction Phase Waste Management.....   | 22 |
| 3.4.2 Resource Management .....                  | 22 |
| 3.4.3 Materials .....                            | 23 |

|            |                                                              |    |
|------------|--------------------------------------------------------------|----|
| 3.4.4      | Water.....                                                   | 23 |
| 3.5        | Sustainability Conclusions.....                              | 23 |
| Appendix A | – Site Plan.....                                             | A  |
| Appendix B | – SAP Summary Building Performance Specification Sheets..... | B  |
| Appendix C | – Less feasible LZC Technologies .....                       | C  |
| Appendix D | – SAP10 Outputs – ASHP + PV option .....                     | D  |



## Executive Summary

## Executive Summary

This Energy and Sustainability Statement has been written to demonstrate the impact of the strategy and measures incorporated into the measures incorporated into the design of 237 Chamberlayne Road, Eastleigh (Proposed Development), which will consist of:

- 9 no. apartment dwellings
- 3 no. terraced houses.

In delivering a new multi storey residential block, the scheme has sought to deliver lower energy and water use, lower carbon dioxide equivalent (CO<sub>2</sub>e) emissions and lower operational costs than equivalent Building Regulations 2021 compliant designs.

Aspect (Eastleigh) Ltd has sought to reduce their impact on the environment through the use of Low to Zero Carbon (LZC) technologies, in which several different technologies have been selected and assessed in order to produce the most beneficial outcome.

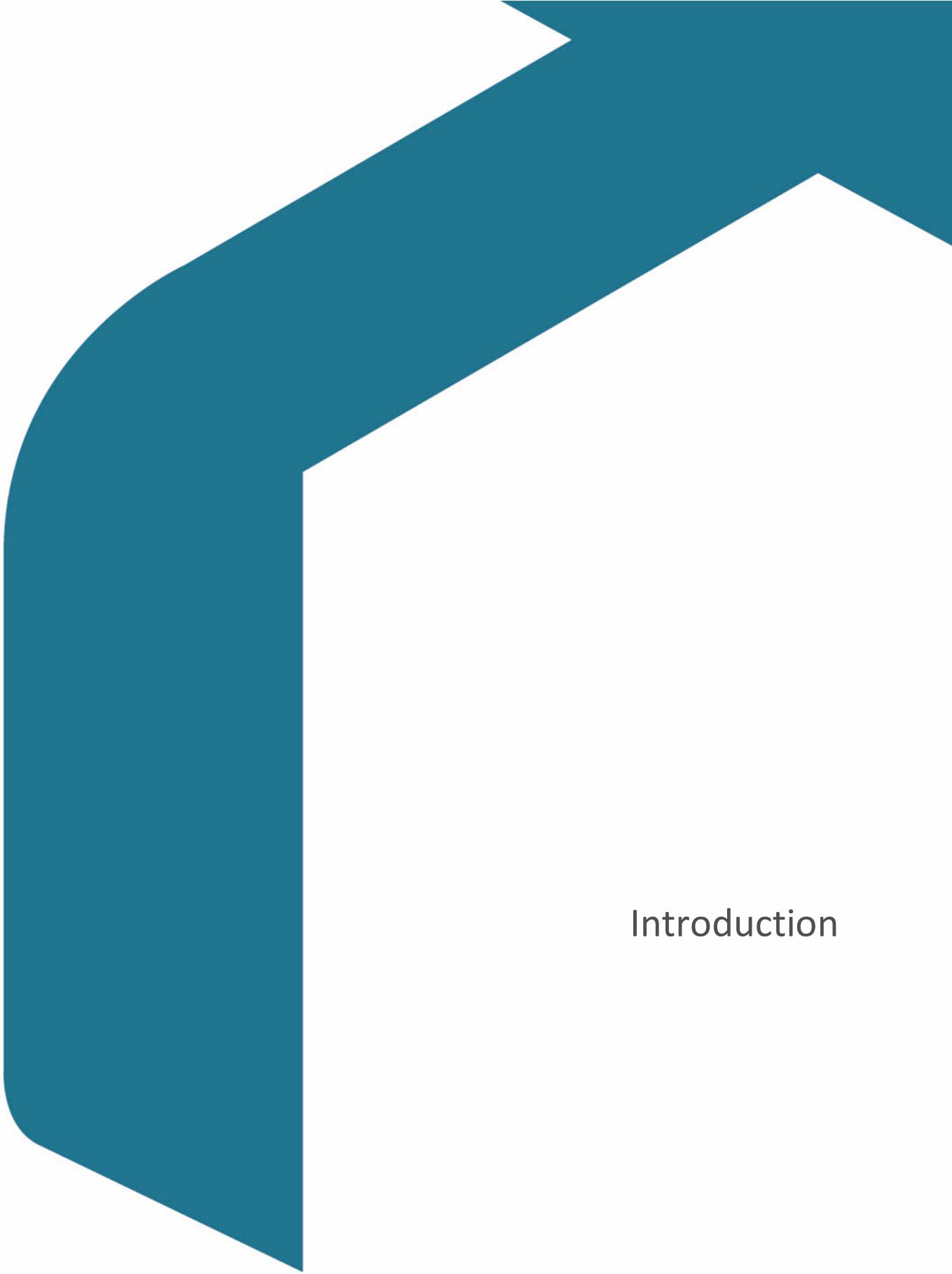
The energy strategy has been developed by following the nationally recognised Energy Hierarchy of: 'Lean, Clean, Green and Seen'. The chosen energy strategy includes both lean passive and active design measures to achieve Building Regulations 2021 Part L compliance, with LZC technology to maximise the CO<sub>2</sub>e offset of the overall site, as summarised in Table 1 below.

|                            | Apartment Dwellings                                                             |                                             | Terrace House                                                                   |                                             |
|----------------------------|---------------------------------------------------------------------------------|---------------------------------------------|---------------------------------------------------------------------------------|---------------------------------------------|
|                            | Average CO <sub>2</sub> e Emissions<br>(kgCO <sub>2</sub> e/yr/m <sup>2</sup> ) | Percentage Improvement over Baseline<br>(%) | Average CO <sub>2</sub> e Emissions<br>(kgCO <sub>2</sub> e/yr/m <sup>2</sup> ) | Percentage Improvement over Baseline<br>(%) |
| Baseline                   | 11.67                                                                           | -                                           | 9.11                                                                            | -                                           |
| Lean                       | 11.17                                                                           | 4.28                                        | 8.17                                                                            | 10.32                                       |
| Clean                      | 11.17                                                                           | 4.28                                        | 8.17                                                                            | 10.32                                       |
| Green - ASHP               | 4.79                                                                            | 58.95                                       | 3.50                                                                            | 61.58                                       |
| Green – Communal ASHP      | 3.51                                                                            | 69.92                                       | -                                                                               | -                                           |
| Green – Communal GSHP      | 3.91                                                                            | 66.50                                       | -                                                                               | -                                           |
| Green – Shoebox GSHP       | 5.99                                                                            | 48.67                                       | 4.44                                                                            | 51.26                                       |
| Green – EASHP              | 4.44                                                                            | 61.95                                       | 3.02                                                                            | 66.85                                       |
| Green – ASHP + PV          | 1.15                                                                            | 90.14                                       | 1.62                                                                            | 82.22                                       |
| Green – Communal GSHP + PV | 0.27                                                                            | 97.73                                       | -                                                                               | -                                           |
| Shoebox + PV               | 2.35                                                                            | 79.84                                       | 2.55                                                                            | 72.01                                       |

Table 1 - Summary of regulated CO<sub>2</sub>e savings

### **Proposed Energy & Sustainability Strategy**

- Passive and active design measures
  - Improved External wall, roof & floor U-values
  - Triple glazed windows with low g-values (0.4)
  - Low energy lighting
  - Air tightness of <3m<sup>3</sup>/hr/m<sup>2</sup>
  - Mechanical ventilation with heat recovery (MVHR)
  - Enhanced thermal bridge values
- The Use of various LZC technologies scenarios including air source heat pumps (ASHP), ground source heat pump (GSHP) and solar photovoltaic (PV)
- Implementation of Export Cable Meters where solar PV has been applied.



## Introduction

## 1.0 Introduction

This Energy and Sustainability Statement has been written by SRE for Aspect (Eastleigh) Ltd, the Client, to demonstrate the measures incorporated into the design of 237 Chamberlayne Road, Eastleigh (the Proposed Development). This scheme will deliver lower energy and water use, lower carbon dioxide equivalent (CO<sub>2</sub>e) emissions and lower operational costs than a new Building Regulations Compliant design.

The statement compares the predicted actual building energy requirement with a Building Regulations compliant design, outlines passive and active design measures, and assesses the suitability of low and zero carbon (LZC) technologies specific to this site to address the relevant planning policy requirements.

The statement analyses how the Proposed Development will integrate with its surrounding environment within the context of sustainability to ensure it benefits the surrounding area socially, environmentally and economically.

The Proposed Development seeks to construct a block of 9 no. apartments and 3 no. terrace houses on the site of 237 Chamberlayne Road. The proposed elevations are shown in Figure 1. Currently the site is in a post demolition brownfield site, surrounded by Derby Road and Chamberlayne Road, located in Eastleigh, Hampshire.



Figure 1 –Front Elevation Proposed Development at Chamberlayne Road (Fairhurst Design Group)

The general site plan is shown in Appendix A.

### 1.1 Planning Policies

The Proposed Development is located in Hampshire within the jurisdiction of Eastleigh Borough Council (EBC), therefore the following Planning Policies, shown in

| Planning Authority | Requirements                                        |
|--------------------|-----------------------------------------------------|
|                    | Policy DM2, Environmentally sustainable development |

| Planning Authority         | Requirements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| EBC Local Plan (2016-2036) | <p>1. The Borough Council requires that:</p> <ul style="list-style-type: none"> <li>a. all new build residential development (C3 Use Class only) must achieve at the time a Reserved Matters or Full Planning Application is submitted: <ul style="list-style-type: none"> <li>i. a 19% improvement in predicted carbon emissions, compared with the building regulations standard current at the time, through increased energy efficiency of the building fabric, unless this is superseded by an updated building regulations requirement equivalent to 'zero carbon homes'; and</li> <li>ii. a predicted mains water consumption of no more than 110 litres/person/day.</li> </ul> </li> <li>b. all other development that is above 500m<sup>2</sup> of floorspace measured externally (including extensions and conversions to existing buildings) must achieve BREEAM 'excellent' (or equivalent) or BREEAM 'very good' plus 'Passivhaus' certification including a 15% improvement in predicted CO<sub>2</sub>e emissions, compared with the building regulations current at the time, through low or zero carbon energy generation on site or in a Borough location agreed by the Council.</li> <li>c. all other larger developments above 10,000m<sup>2</sup> of floorspace should also seek to fund post occupancy evaluation (POE) in addition to the above.</li> </ul> <p><b>Policy DM4, Zero or low carbon energy</b></p> <p>1. The Borough Council will permit the development of infrastructure to:</p> <ul style="list-style-type: none"> <li>a. generate zero or low carbon energy; and/or</li> <li>b. make more efficient use of energy sources e.g. installations deploying combined heat and power (CHP technology);</li> </ul> <p>2. Subject to general development criteria and provided that the development:</p> <ul style="list-style-type: none"> <li>a. has no significant adverse impact on the landscape or landscape features, biodiversity or the significance of heritage assets;</li> <li>b. does not involve the loss of land in public recreational use (see policy DM32);</li> <li>c. does not involve the permanent loss of the best and most versatile agricultural land (BMV).</li> </ul> |
| Future Homes Standard      | <p>Chapter 2 of the consultation outlined the Government's vision for the Future Homes Standard, which included a high-level specification incorporating very high fabric standards and low carbon heating. We expect an average semi-detached home built to meet the Standard would produce 75-80% less carbon dioxide emissions than one built to current Building Regulations requirements.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

| Planning Authority | Requirements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                    | The introduction of the Future Homes Standard will ensure that an average home will produce at least 75% lower CO <sub>2</sub> e emissions than one built to current energy efficiency requirements. In the short term this represents a considerable improvement in the energy efficiency standards for new homes. Homes built under the Future Homes Standard will be 'zero carbon ready', which means that in the longer term, no further retrofit work for energy efficiency will be necessary to enable them to become zero-carbon homes as the electricity grid continues to decarbonise. |

Table 2 are applicable to the site.

| Planning Authority         | Requirements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| EBC Local Plan (2016-2036) | <p><b>Policy DM2, Environmentally sustainable development</b></p> <p>1. The Borough Council requires that:</p> <p>a. all new build residential development (C3 Use Class only) must achieve at the time a Reserved Matters or Full Planning Application is submitted:</p> <p>i. a 19% improvement in predicted carbon emissions, compared with the building regulations standard current at the time, through increased energy efficiency of the building fabric, unless this is superseded by an updated building regulations requirement equivalent to 'zero carbon homes'; and</p> <p>ii. a predicted mains water consumption of no more than 110 litres/person/day.</p> <p>b. all other development that is above 500m<sup>2</sup> of floorspace measured externally (including extensions and conversions to existing buildings) must achieve BREEAM 'excellent' (or equivalent) or BREEAM 'very good' plus 'Passivhaus' certification including a 15% improvement in predicted CO<sub>2</sub>e emissions, compared with the building regulations current at the time, through low or zero carbon energy generation on site or in a Borough location agreed by the Council.</p> <p>c. all other larger developments above 10,000m<sup>2</sup> of floorspace should also seek to fund post occupancy evaluation (POE) in addition to the above.</p> |
|                            | <p><b>Policy DM4, Zero or low carbon energy</b></p> <p>1. The Borough Council will permit the development of infrastructure to:</p> <p>a. generate zero or low carbon energy; and/or</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

| Planning Authority    | Requirements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                       | <p>b. make more efficient use of energy sources e.g. installations deploying combined heat and power (CHP technology);</p> <p>2. Subject to general development criteria and provided that the development:</p> <p>a. has no significant adverse impact on the landscape or landscape features, biodiversity or the significance of heritage assets;</p> <p>b. does not involve the loss of land in public recreational use (see policy DM32);</p> <p>c. does not involve the permanent loss of the best and most versatile agricultural land (BMV).</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Future Homes Standard | <p>Chapter 2 of the consultation outlined the Government's vision for the Future Homes Standard, which included a high-level specification incorporating very high fabric standards and low carbon heating. We expect an average semi-detached home built to meet the Standard would produce 75-80% less carbon dioxide emissions than one built to current Building Regulations requirements.</p> <p>The introduction of the Future Homes Standard will ensure that an average home will produce at least 75% lower CO<sub>2</sub>e emissions than one built to current energy efficiency requirements. In the short term this represents a considerable improvement in the energy efficiency standards for new homes. Homes built under the Future Homes Standard will be 'zero carbon ready', which means that in the longer term, no further retrofit work for energy efficiency will be necessary to enable them to become zero-carbon homes as the electricity grid continues to decarbonise.</p> |

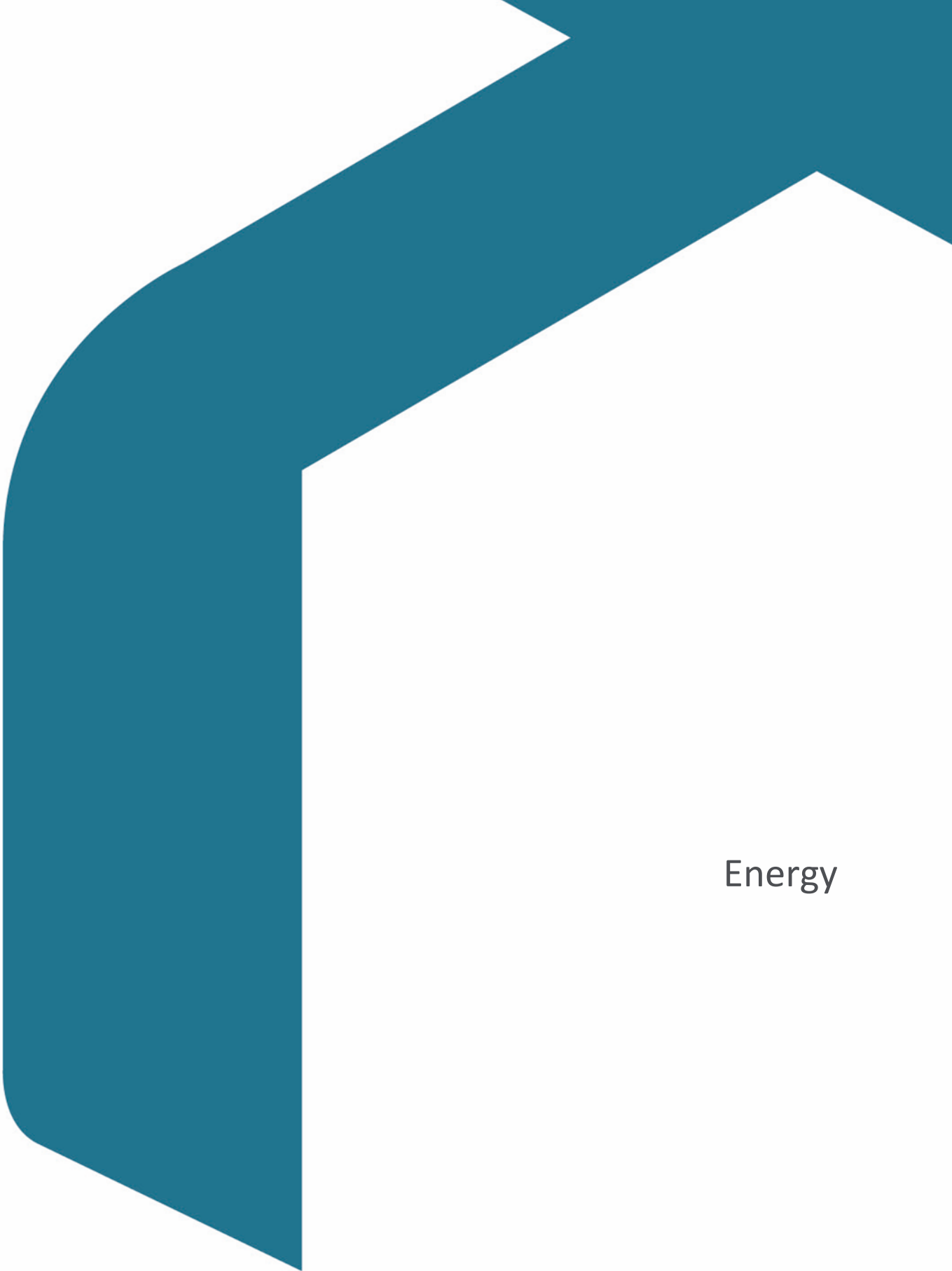
Table 2 - Summary of local planning policy requirements

## 1.2 Applicability to Proposed Development

In accordance with the above planning policy the following standards will be met:

- A 19% improvement over Building Regulations 2021 Part L
- A predicted water use of <110 litres/person/day or less
- The Proposed Development should seek to have no adverse impact on the local landscape or biodiversity
- Does not produce a loss of public land
- The Proposed Development will seek to comply with the Future Home Standards requirements to have 75% in carbon emissions by 2025.

As the total floor space is under 500m<sup>2</sup>, the requirement for Passivhaus certification is not applicable.

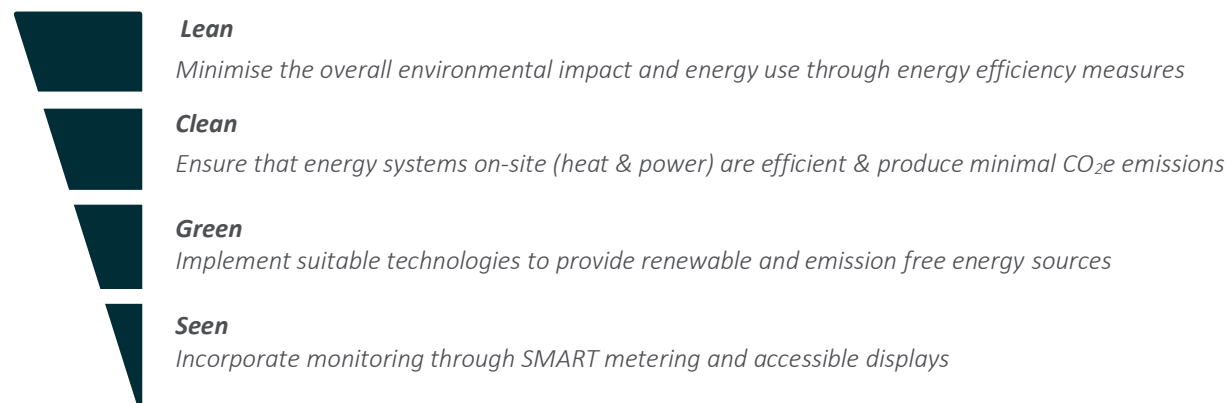


Energy

## 2.0 Energy

### 2.1 Method

The energy strategy design follows national policy guidance<sup>1</sup> and seeks to be:



The CO<sub>2</sub>e conversion factors, shown in Table 3, have been taken from the new Building Regulations 2021. Within SAP10.2 modelling, the CO<sub>2</sub>e conversion factor for electricity varies over the course of the year due to the changing mix of generation inputs into the electricity grid (i.e., increased photovoltaic (PV) generation in the summer months and gas/coal in the winter).

Therefore, CO<sub>2</sub>e conversion factors based on standard yearly figures taken from the Government SAP Guidance<sup>2</sup> will result in there being some natural discrepancy between the actual SAP10 modelling and any generic reporting results tool (such as checklists) when cross referenced.

| All                  | CO <sub>2</sub> e Conversion Factor (kgCO <sub>2</sub> e/kWh) |
|----------------------|---------------------------------------------------------------|
| Electricity (mains)  | 0.136                                                         |
| Electricity (offset) | -0.136                                                        |
| Gas (mains)          | 0.210                                                         |

Table 3 - CO<sub>2</sub>e conversion factors by energy source (SAP10.2)

The Target Emission Rate (TER) from the As Proposed Scheme (Green Scenario) is taken as the energy baseline to enable a clear comparison of actual building performance throughout the energy hierarchy. The notional model is the exact size and shape of the Proposed Development but is based on notional U-values and heating specifications outlined in Approved Document L. The TER for each building type is outlined within

<sup>1</sup>The New London Plan <https://www.london.gov.uk/what-we-do/planning/london-plan/new-london-plan>

<sup>2</sup> The Government Standard Assessment Procedure for Energy Rating of Dwellings Version 10.2 (Table 12, Pg 182): <https://files.bregroup.com/SAP/SAP%2010.2%20-%202017-12-2021.pdf>

| Scenario | Apartment Dwellings                                                          |                                                   | Terrace House                                                                |                                                   |
|----------|------------------------------------------------------------------------------|---------------------------------------------------|------------------------------------------------------------------------------|---------------------------------------------------|
|          | Average CO <sub>2</sub> e Emissions (kgCO <sub>2</sub> e/yr/m <sup>2</sup> ) | Fabric Energy Efficiency (kWh/m <sup>2</sup> /yr) | Average CO <sub>2</sub> e Emissions (kgCO <sub>2</sub> e/yr/m <sup>2</sup> ) | Fabric Energy Efficiency (kWh/m <sup>2</sup> /yr) |
| Baseline | 11.67                                                                        | 36.54                                             | 9.11                                                                         | 30.91                                             |

Table 4 for reference.

| Scenario | Apartment Dwellings                                                          |                                                   | Terrace House                                                                |                                                   |
|----------|------------------------------------------------------------------------------|---------------------------------------------------|------------------------------------------------------------------------------|---------------------------------------------------|
|          | Average CO <sub>2</sub> e Emissions (kgCO <sub>2</sub> e/yr/m <sup>2</sup> ) | Fabric Energy Efficiency (kWh/m <sup>2</sup> /yr) | Average CO <sub>2</sub> e Emissions (kgCO <sub>2</sub> e/yr/m <sup>2</sup> ) | Fabric Energy Efficiency (kWh/m <sup>2</sup> /yr) |
| Baseline | 11.67                                                                        | 36.54                                             | 9.11                                                                         | 30.91                                             |

Table 4 - Baseline CO<sub>2</sub>e emissions and Baseline Fabric Energy Efficiency

## 2.2 LEAN – Demand Reduction

The lean scenario achieves a reduction in CO<sub>2</sub>e emissions over the baseline using passive and active design measures. It also demonstrates improvements in the overall building fabric for the residential units as seen in Table 5 and Table 6 respectively.

| Scenario | Apartment Dwellings                                                          |                                          | Terrace House                                                                |                                          |
|----------|------------------------------------------------------------------------------|------------------------------------------|------------------------------------------------------------------------------|------------------------------------------|
|          | Average CO <sub>2</sub> e Emissions (kgCO <sub>2</sub> e/yr/m <sup>2</sup> ) | Percentage Improvement over Baseline (%) | Average CO <sub>2</sub> e Emissions (kgCO <sub>2</sub> e/yr/m <sup>2</sup> ) | Percentage Improvement over Baseline (%) |
| Baseline | 11.67                                                                        | -                                        | 9.11                                                                         | -                                        |
| Lean     | 11.17                                                                        | 4.28                                     | 8.17                                                                         | 10.32                                    |

Table 5 - Lean CO<sub>2</sub>e emissions and improvement over Baseline

| Scenario | Apartment Dwellings                               |                                          | Terrace House                                     |                                          |
|----------|---------------------------------------------------|------------------------------------------|---------------------------------------------------|------------------------------------------|
|          | Fabric Energy Efficiency (kWh/m <sup>2</sup> /yr) | Percentage Improvement over Baseline (%) | Fabric Energy Efficiency (kWh/m <sup>2</sup> /yr) | Percentage Improvement over Baseline (%) |
| Baseline | 36.54                                             | -                                        | 30.91                                             | -                                        |

|      |       |      |       |     |
|------|-------|------|-------|-----|
| Lean | 35.38 | 3.17 | 30.88 | 0.1 |
|------|-------|------|-------|-----|

Table 6 - Lean Fabric Efficiency and improvement over baseline

### 2.2.1 Passive Design Measures

All dwellings within the Proposed Development, will have high performance fabric and glazing elements similar to the proposed extension as well as having a low infiltration rate to improve air tightness. In addition, internal solar gains will be further controlled through the specification of triple glazing with a low G-Value to assist with Part O compliance and to help address any overheating risk.

In addition, the building will be designed to have a high air tightness and low infiltration rate such as to allow the effective operation of heating and ventilation systems.

The U-values will meet and exceed Building Regulations Part L V1 requirements (as stated in SAP10.2) and are shown in Table 7, with further details outlined in the SAP summary specification sheets in Appendix B.

| Element                             | Notional Compliance (U-value)                   | Proposed (U-value)                     |
|-------------------------------------|-------------------------------------------------|----------------------------------------|
| External Walls                      | 0.18                                            | 0.17                                   |
| Dormer Walls                        | 0.18                                            | 0.19                                   |
| Party Walls                         | 0.00                                            | 0.00                                   |
| Ground Floor                        | 0.13                                            | 0.08                                   |
| Roof                                | 0.11-0.13                                       | 0.09                                   |
| Windows                             | 1.20                                            | 1.00                                   |
| Roof Lights                         | 1.20                                            | 1.2                                    |
| External Doors                      | 1.00                                            | 1.2                                    |
| Air Tightness @ 50 N/m <sup>2</sup> | 5 (m <sup>3</sup> /hr/m <sup>2</sup> )          | 3 (m <sup>3</sup> /hr/m <sup>2</sup> ) |
| Thermal Bridge                      | Non-government approved scheme (where possible) |                                        |

Table 7 - Fabric energy efficiencies

### 2.2.2 Active Design Measures

The Proposed Development will utilise 100% light emitting diode (LED) lighting in excess of Building Regulation requirements. External lighting for the communal entrance and stair core, where installed, will also be energy efficient, and will be positioned to avoid excessive light pollution and be supported by PIR/daylight sensor and/or time controls to reduce operation times and subsequent energy use and emissions.

In modern air-tight buildings, careful consideration needs to be given to the specification of ventilation systems to ensure moisture is removed and ventilation standards are met to ensure a healthy standard of internal air is maintained.

Mechanical ventilation with Heat Recovery (MVHR) can enable adequate ventilation rates to be managed and maintained throughout the course of the day and also throughout the peak seasons (Summer and Winter) when ambient temperatures can vary considerably to what is needed internally. Natural ventilation can also be provided in all rooms for purge ventilation. The dwellings within the Proposed Development have been modelled with MVHR.

Wastewater heat recovery (WWHR) is included within the Part L Notional Building by default but has not been included in the units of the Proposed Development at this stage. This system recovers some of the waste heat that would otherwise be lost down the drain as wastewater from a shower or bath through a simple heat exchanger, either located in the shower tray or under the bath (thereby not impacting on space requirements). This heat is used to pre-warm the mains water supplying either the shower directly and/or the domestic hot water (DHW) heating source.

### 2.2.3 Cooling

The cooling hierarchy as outlined in Table 8 has been used to ensure that passive building design has been optimised to reduce the cooling load for the Proposed Development. No active cooling is proposed within the site, as outlined in Table 8.

| Cooling Hierarchy                                                            | Potential Design Measures                                                                                                                                                                                                                                      |
|------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Minimising internal heat generation through energy efficient design          | All primary pipework to be insulated, therefore low system losses. High specification DHW cylinder installed with low heat loss – or no cylinder if Point of Use (PoU) water heaters specified. Low energy lighting throughout.                                |
| Reducing the amount of heat entering the building in summer                  | Low E glass windows with low G-Values and internal blinds are to be provided to minimize solar gain. All walls are well insulated and airtight.                                                                                                                |
| Use of thermal mass and high ceilings to manage the heat within the building | Thermal mass is anticipated to be High to Medium within the Masonry frame structure.                                                                                                                                                                           |
| Passive Ventilation                                                          | Openable windows/doors will be provided to habitable rooms to make cross ventilation possible.                                                                                                                                                                 |
| Mechanical Ventilation                                                       | Balanced Mechanical Ventilation with Heat Recovery is proposed, with automatic summer bypass. Additional mechanical purge ventilation provided to certain occupied rooms to further reduce the overheating risks – outlined in SRE Thermal Comfort Assessment. |

Table 8 - Design measures following the cooling hierarchy

## 2.3 CLEAN – Heating Infrastructure

The Proposed Development is not located within an area of high heat density and as such there is no available District Heating Infrastructure to connect to. The heating system has been designed to be an air to water wet system to allow for future connections should they be available.

In addition to this, despite the size of the Proposed Development being suitable for a communal gas boiler system, the outcome of this would likely be an increase in emissions when compared to the use of individual boilers in each unit of the Proposed Development due to the increased transmission energy losses. The apartment scheme does discuss the likelihood of communal heat pumps in the green scenario.

## 2.4 GREEN – Low Carbon and Renewable Energy

The addition of 'Green' technologies will provide a significant reduction in CO<sub>2</sub>e emissions and enable the Proposed Development to meet the threshold of 19% improvement using LZC technologies over a Building Regulations Compliant design as well as working toward achieve the Future Home Standard Requirements of 75% improvement over current Building Regulations.

As one part of the 'Green' scenario, several different energy technology scenarios have been evaluated:

- ASHP
- ASHP + PV
- Communal ASHP (Apartments Only)
- Shoebox GSHP
- Shoebox GSHP + PV
- Communal GSHP (Apartments Only)
- Communal GSHP + PV (Apartments Only)
- Exhaust ASHP (EASHP).

|                            | Apartment Dwellings                                                             |                                             | Terrace House                                                                   |                                             |
|----------------------------|---------------------------------------------------------------------------------|---------------------------------------------|---------------------------------------------------------------------------------|---------------------------------------------|
|                            | Average CO <sub>2</sub> e Emissions<br>(kgCO <sub>2</sub> e/yr/m <sup>2</sup> ) | Percentage Improvement over Baseline<br>(%) | Average CO <sub>2</sub> e Emissions<br>(kgCO <sub>2</sub> e/yr/m <sup>2</sup> ) | Percentage Improvement over Baseline<br>(%) |
| Baseline                   | 11.67                                                                           | -                                           | 9.11                                                                            | -                                           |
| Lean                       | 11.17                                                                           | 4.28                                        | 8.17                                                                            | 10.32                                       |
| Clean                      | 11.17                                                                           | 4.28                                        | 8.17                                                                            | 10.32                                       |
| Green - ASHP               | 4.79                                                                            | 58.95                                       | 3.50                                                                            | 61.58                                       |
| Green – Communal ASHP      | 3.51                                                                            | 69.92                                       | -                                                                               | -                                           |
| Green – Communal GSHP      | 3.91                                                                            | 66.50                                       | -                                                                               | -                                           |
| Green – Shoebox GSHP       | 5.99                                                                            | 48.67                                       | 4.44                                                                            | 51.26                                       |
| Green – EASHP              | 4.44                                                                            | 61.95                                       | 3.02                                                                            | 66.85                                       |
| Green – ASHP + PV          | 1.15                                                                            | 90.14                                       | 1.62                                                                            | 82.22                                       |
| Green – Communal GSHP + PV | 0.27                                                                            | 97.73                                       | -                                                                               | -                                           |
| Shoebox + PV               | 2.35                                                                            | 79.84                                       | 2.55                                                                            | 72.01                                       |

Table 9 - Green CO<sub>2</sub>e emissions and improvement over Baseline

#### 2.4.1 Air Source Heat Pumps

All Heat Pump (HP) systems consume electricity to operate - the Coefficient of Performance (CoP) of the system is the ratio of electrical energy consumed, to heat energy emitted. Generally, a CoP of 3 or 4 can be achieved, meaning 3 or 4 units of thermal energy are produced for each unit of electricity consumed.

Heat pumps will only deliver low grade heat (up to circa 50°C) efficiently, and therefore HP systems alone are generally relatively inefficient in providing DHW, as this requires additional electrical input (immersion or increased compressor use).

The use of ASHP has the potential to supply 100% of the Proposed Development with the heating (and cooling) requirements, subject to the provision of oversized/low temperature radiators or an underfloor heating system (air-to-water systems).

ASHPs tend to generate some background noise and therefore the location of the external collectors within this compact site would be fundamental to their adoption and use.

EASHPs are variations of the ASHP in which the system used exhaust hot air and extracts the heat energy to be used within the heat exchanger. The EASHP is often best paired with MVHR units to make effect use of the generated exhaust air.

The Proposed Development has been modelled with energy scenarios that include individual ASHP, EASHP and a Communal ASHP system for the apartments.

#### 2.4.2 Ground Source Heat Pump (GSHP)

A GSHP incorporates a buried network of pipes/coils continuously circulating a 'transfer liquid' (glycol) to extract heat from the ground to provide a source of space and or DHW heating. The ground maintains a temperature of circa 11°C at 1m depth, which warms the 'transfer liquid' before passing through a compressor to raise the temperature but can achieve a high CoP averaging at circa 4.

The use of a GSHP would have the potential to supply the space heating for the Proposed Development, subject to the provision of under floor heating (wet system) to maximise the GSHP system performance.

An alternative version is the Shoebox GSHP in which individual dwellings have their own HP Unit, connected to a centralised borehole. This allows for individual heating and cooling without needing to heat the core of the building as with communal HP systems.

Traditional GSHPs usually requires an area that is 2.5x greater than that of the property it is aiming to heat. The Proposed Development has modelled scenarios with communal GSHP and Shoebox GSHP

#### 2.4.3 Photovoltaics (PV)

Photovoltaic (PV) panels convert energy from daylight into direct electrical current (DC) that is then converted to alternating electrical current (AC) via an inverter, or series of inverters subject to the size of the array. The panels are generally roof mounted and provide electrical generation which can either be utilised directly on-site (or nearby) by ASHPs, lighting and other electrical equipment, stored in batteries, or exported back to the National Grid.

Noise will not be an issue with PV as a PV system does not feature moving parts and is silent during operation.

The installation of PV could be used to offset electrical demand within the Proposed Development. As such a number of roof mounted PV arrays comprising individual unit sized systems connected into the electrical system of each unit have been modelled.

For each energy scenario within the Proposed Development, an option of installed PV has been included, to show the maximum CO<sub>2</sub>e savings. Below is the percentage CO<sub>2</sub>e reductions per scenario where PV is added against the non-PV scenarios:

- ASHP + PV – 37.37%
- Shoebox GSHP + PV – 31.05%
- Communal GSHP + PV – 41.43%.

Details of less feasible LZC technologies explored are shown in Appendix C.

#### 2.4.4 Energy Storage

Energy Storage, often in the form of batteries, can be used store electricity from the grid when costs are low (demand is low) allowing it to be used when cost are high (demand is high) allowing for cost savings for the user as well as reduce strain on the grid at times when demand is high as part of Demand Side Management (DSM).

In addition to this, energy storage measures can be used to store excess energy generated by PV arrays and used at times where there is minimal energy generation but energy use is at its highest.

At this stage energy storage options have not been considered, however they could provide CO<sub>2</sub>e saving benefits toward achieving the overall 75% improvement over building regulations as part of the Future Homes Standard.

#### 2.4.5 Energy Exporting

As an alternative to energy storage for excess generation, an export cable meter can be installed.

An export cable meter will allow for excess PV generation to be exported to the grid at a cost per kWh agreed by the energy provider as part of the Smart Export Guarantee (SEG) resulting in a lower carbon intensity within the National Grid.

In the Proposed Development, export cable meters have been modelled such as to allow for maximum CO<sub>2</sub>e emissions savings shows percentage improvements from all PV scenarios over that of the Future Home Standard.

### 2.5 SEEN – In-use monitoring

The Proposed Development will be supplied with smart meters (where available from the utility supplier) and PV generation meters along with the associated internal energy displays. This will further improve energy efficiency by allowing residents and building users to observe their energy use in ‘real time’ and manage it more effectively.

### 2.6 Conclusions

The Proposed Development will deliver passive and active energy demand reduction measures along with LZC technologies in order to reduce energy demand and associated CO<sub>2</sub>e emissions resulting from the Proposed Development’s operation.

|                            | Apartment Dwellings                                                           |                                             | Terrace House                                                                 |                                             |
|----------------------------|-------------------------------------------------------------------------------|---------------------------------------------|-------------------------------------------------------------------------------|---------------------------------------------|
|                            | Average CO <sub>2</sub> Emissions<br>(kgCO <sub>2</sub> e/yr/m <sup>2</sup> ) | Percentage Improvement over Baseline<br>(%) | Average CO <sub>2</sub> Emissions<br>(kgCO <sub>2</sub> e/yr/m <sup>2</sup> ) | Percentage Improvement over Baseline<br>(%) |
| Baseline                   | 11.67                                                                         | -                                           | 9.11                                                                          | -                                           |
| Lean                       | 11.17                                                                         | 4.28                                        | 8.17                                                                          | 10.32                                       |
| Clean                      | 11.17                                                                         | 4.28                                        | 8.17                                                                          | 10.32                                       |
| Green - ASHP               | 4.79                                                                          | 58.95                                       | 3.50                                                                          | 61.58                                       |
| Green – Communal ASHP      | 3.51                                                                          | 69.92                                       | -                                                                             | -                                           |
| Green – Communal GSHP      | 3.91                                                                          | 66.50                                       | -                                                                             | -                                           |
| Green – Shoebox GSHP       | 5.99                                                                          | 48.67                                       | 4.44                                                                          | 51.26                                       |
| Green – EASHP              | 4.44                                                                          | 61.95                                       | 3.02                                                                          | 66.85                                       |
| Green – ASHP + PV          | 1.15                                                                          | 90.14                                       | 1.62                                                                          | 82.22                                       |
| Green – Communal GSHP + PV | 0.27                                                                          | 97.73                                       | -                                                                             | -                                           |
| Shoebox + PV               | 2.35                                                                          | 79.84                                       | 2.55                                                                          | 72.01                                       |

Table 10 shows the incremental improvements of the energy scenarios as well as each version of the green scenario.

|              | Apartment Dwellings                                                           |                                             | Terrace House                                                                 |                                             |
|--------------|-------------------------------------------------------------------------------|---------------------------------------------|-------------------------------------------------------------------------------|---------------------------------------------|
|              | Average CO <sub>2</sub> Emissions<br>(kgCO <sub>2</sub> e/yr/m <sup>2</sup> ) | Percentage Improvement over Baseline<br>(%) | Average CO <sub>2</sub> Emissions<br>(kgCO <sub>2</sub> e/yr/m <sup>2</sup> ) | Percentage Improvement over Baseline<br>(%) |
| Baseline     | 11.67                                                                         | -                                           | 9.11                                                                          | -                                           |
| Lean         | 11.17                                                                         | 4.28                                        | 8.17                                                                          | 10.32                                       |
| Clean        | 11.17                                                                         | 4.28                                        | 8.17                                                                          | 10.32                                       |
| Green - ASHP | 4.79                                                                          | 58.95                                       | 3.50                                                                          | 61.58                                       |

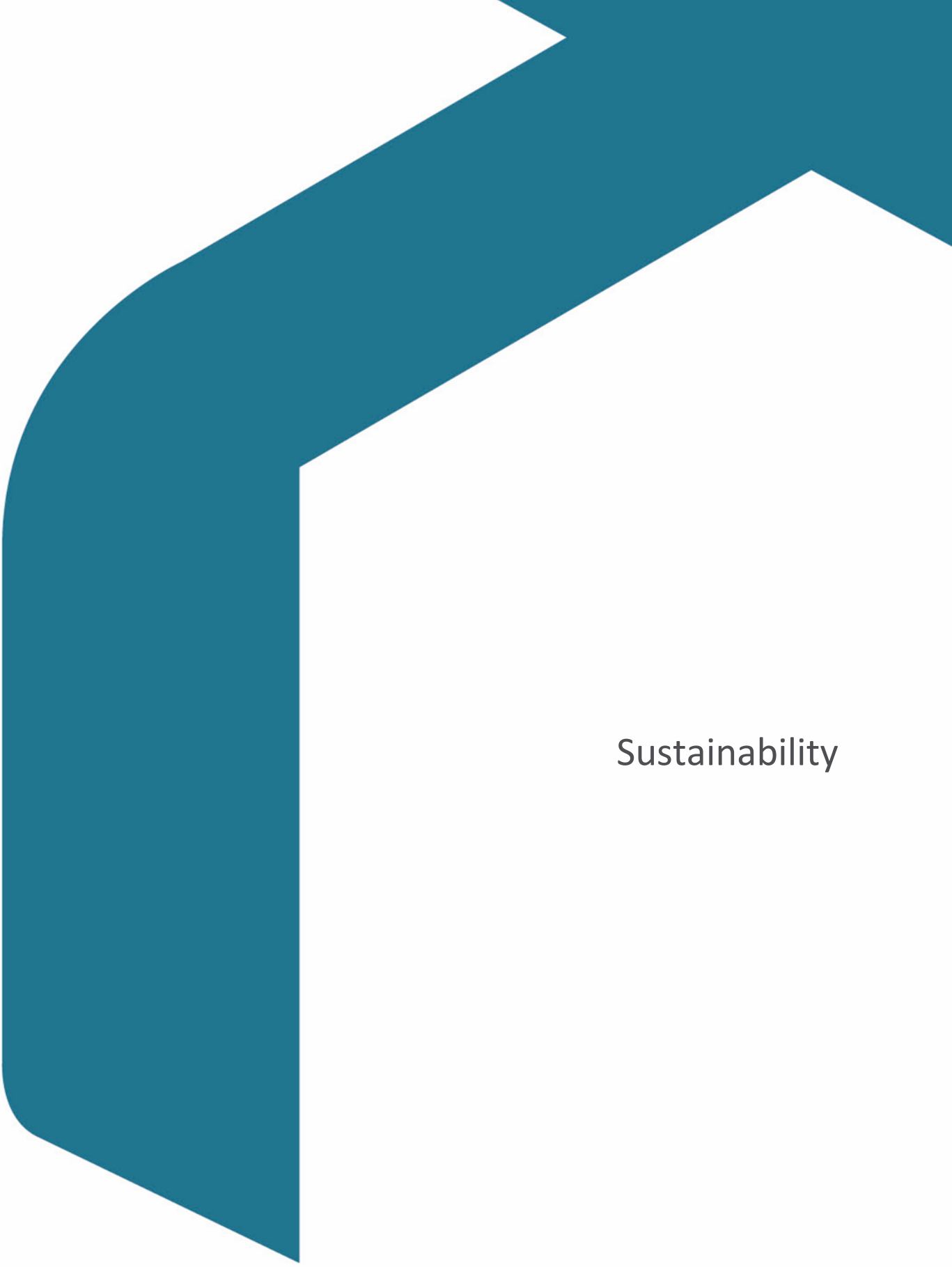
|                            | Apartment Dwellings |       | Terrace House |       |
|----------------------------|---------------------|-------|---------------|-------|
| Green – Communal ASHP      | 3.51                | 69.92 | -             | -     |
| Green – Communal GSHP      | 3.91                | 66.50 | -             | -     |
| Green – Shoebox GSHP       | 5.99                | 48.67 | 4.44          | 51.26 |
| Green – EASHP              | 4.44                | 61.95 | 3.02          | 66.85 |
| Green – ASHP + PV          | 1.15                | 90.14 | 1.62          | 82.22 |
| Green – Communal GSHP + PV | 0.27                | 97.73 | -             | -     |
| Shoebox + PV               | 2.35                | 79.84 | 2.55          | 72.01 |

Table 10 - Summary of CO<sub>2</sub>e emissions, incremental improvement and improvement over Baseline

The calculations undertaken (summarised in Appendix D) demonstrate that the Proposed Development will successfully exceed Building Regulations Part L V1 as well the 19% improvement over Building Regulations 2021 required by Eastleigh Borough Council.

The following inputs and specifications will be provided to deliver the new Part L and Planning Policy standards as a minimum:

- Passive and active design measures
  - Improved External wall, roof & floor U-values
  - Triple glazed windows with low g-values (0.4)
  - Low Energy Lighting
  - Air tightness <3m<sup>3</sup>/hr/m<sup>2</sup>
  - MVHR
  - Enhanced Thermal Bridge Values
- The Use of various LZC technologies scenarios including ASHP, GHSP and PV
- Implementation of export cable meters where PV has been applied.

A large, teal-colored abstract graphic on the left side of the page. It consists of a thick, curved line that starts from the top left, curves downwards and to the right, then turns back to the left, forming a large, open 'C' shape. The right side of the 'C' is a straight vertical line. The overall shape is reminiscent of a stylized letter 'C' or a partial circle.

Sustainability

### 3.0 Sustainability

The World Commission on Environment and Development (WCED) report: Our Common Future, describes Sustainable Development as development that:

*“Meets the needs of the present without compromising the ability of future generations to meet their own needs.”*

The planning system focuses on three objectives to achieve a sustainable development: economic, social, and environmental. These objectives mutually support each other and have been adapted in this statement to meet the objectives of the EBC Local Plan. The current Local Plan prioritises promoting development that makes the best use of resources, increase the sustainability of the local communities and are adaptable to climate change. Careful considerations have been taken to ensure the Proposed Development meets these expectations.

#### 3.1 Pollution

##### 3.1.1 Air

The Proposed Development will aim to limit its contribution to local air pollution by not installing gas boilers, and instead using either variations of ASHP or GSHP to provide heating and DHW, in addition to the installation of roof mounted PV.

The Proposed Development is located within a medium NO<sub>x</sub> emissions area as defined by the UK NO<sub>x</sub> emissions map, as shown in Figure 2 and therefore minimising or reducing NO<sub>x</sub> is of importance.

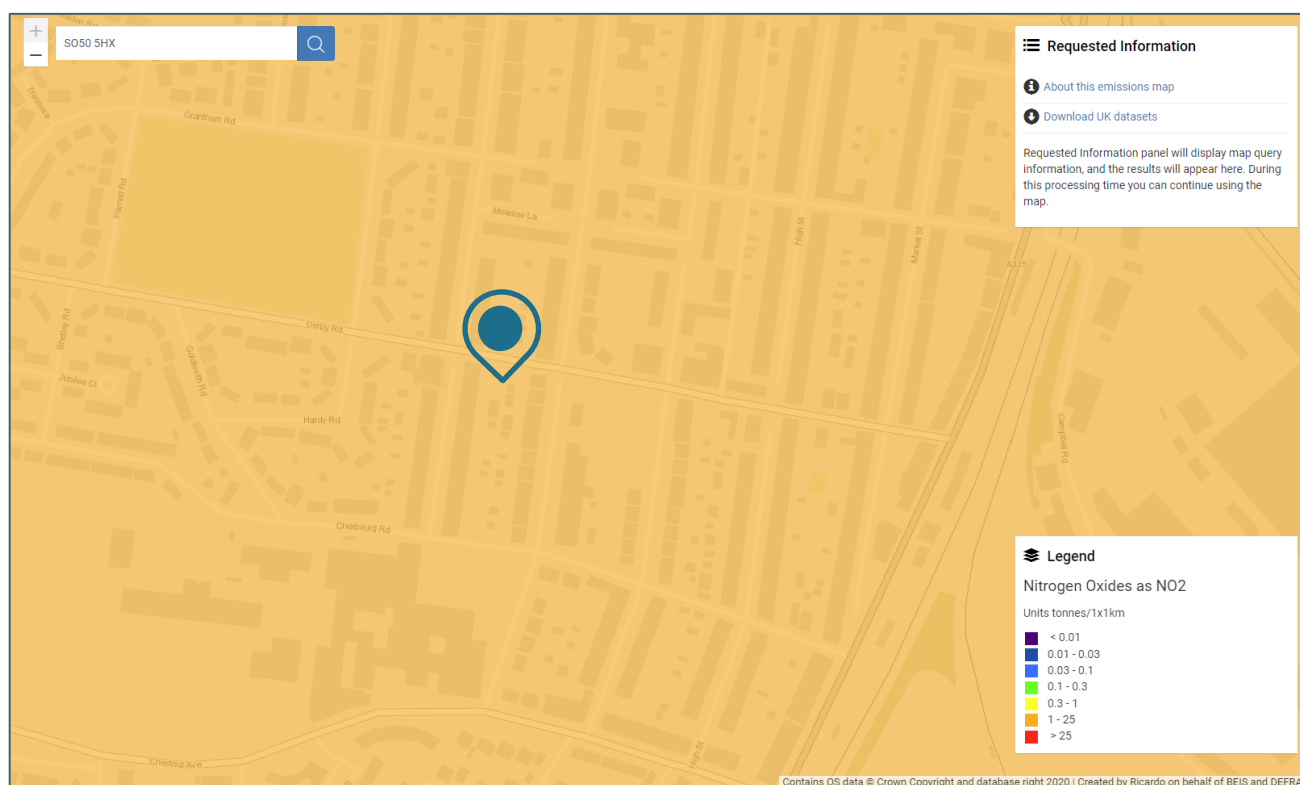


Figure 2 - UK Air Pollution Map showing pollution from Nitrogen Oxides as NO<sub>2</sub> (<https://naei.beis.gov.uk/emissionsapp/>)

The ASHP/GSHP heating and DHW systems will emit no onsite NO<sub>x</sub> emissions but will consume grid electricity (when not consuming electricity generated by the PV). As the NO<sub>x</sub> emissions resulting from the production of electricity decreases at the national scale, the resulting theoretical emissions from the Proposed Development will also. Furthermore, the use of PV panels will decrease the import of electricity from the National Grid and replace it with PV electricity which produces no emissions during operation.

### 3.1.2 Noise

The installation of an ASHP would likely generate a small amount of background noise. An acoustic enclosure will be considered at detailed design stage however one has not been considered at planning stage. The installation of triple glazing on the Proposed Development will reduce the impact of low levels of noise on the residents. Should a GSHP option be selected then noise will not be an issue as the system does not directly generate noise.

### 3.1.3 Light

The design and layout of the site for practical use has been considered while trying to maximise internal daylight levels. All spaces occupied by visitors have glazing to provide natural daylight, and light-coloured curtains or roller blinds will be encouraged to enable glare control and privacy when the space is occupied.

Light Pollution will be minimised where possible through the careful specification and positioning of external lighting around the Proposed Development – taking into consideration the dark skies policy applicable in the adjacent areas, ensuring minimal light pollution from the site. Special attention will be given to security lighting (where fitted) to ensure it is appropriately focused and controlled.

All external space lighting will be provided through low energy fittings and have PIR and daylight/timer controls. Any external signage on the commercial unit, where installed and lit, will be installed and controlled in line with best practice.

## 3.2 Flood Risk

Figure 3 shows that the selected site of the Proposed Development has a very low risk of flooding from rivers and seas. In addition to this the Proposed Development is in an area with low risk of surface water flooding as shown in Figure 4. As a result, further measures do not need to be implemented to reduce the potential impact of flooding.

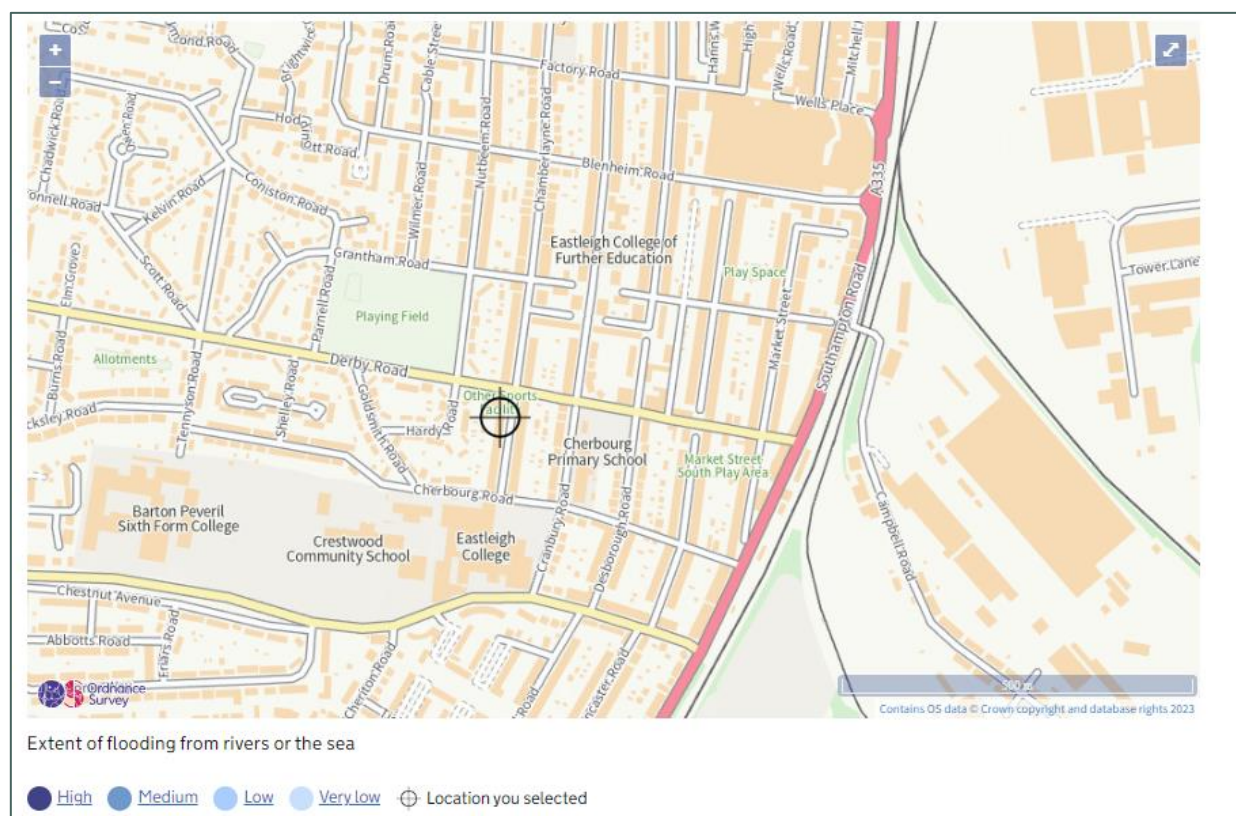


Figure 3 - Flood map showing risk of flooding from rivers or the sea  
(<https://flood-warning-information.service.gov.uk/long-term-flood-risk/map>)

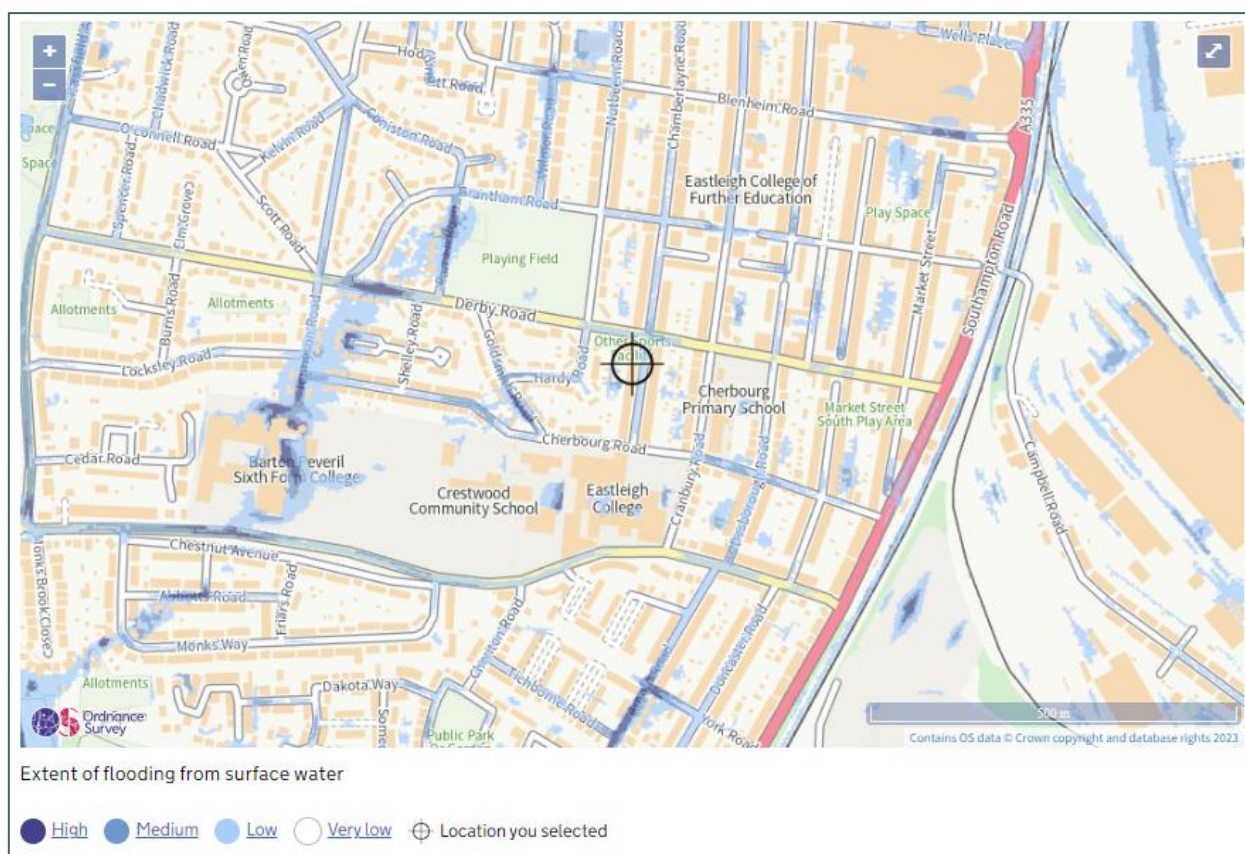


Figure 4 - Flood map showing risk of flooding from surface water  
<https://flood-warning-information.service.gov.uk/long-term-flood-risk/map>

### 3.3 Transport

#### 3.3.1 Public Transport

The Proposed Development is located adjacent to the bus stops on Derby Road allowing easy public transport around the local area. The Proposed Development is also 0.7 miles from the Eastleigh train station on the London-Southampton line providing excellent access to the local region and the wider National Rail network.

#### 3.3.2 Parking

The Proposed Development is located in an area with capacity for on-site parking.

#### 3.3.3 Electric Vehicle Charging

Electric vehicle (EV) charging points are to be provided in excess of planning policy and in line with best practice with 6 no. total double charging points on site.

#### 3.3.4 Cycle Storage

Secure covered cycle storage will also be provided on the site in line with the standard requirements thus promoting the use of low CO<sub>2</sub>e emission methods of transport for occupants and visitors.

### 3.4 Resource efficiency

#### 3.4.1 Construction Phase Waste Management

The Proposed Development will aim to minimise the waste produced during the construction phase.

A comprehensive Construction Management Plan will be implemented from the outset of site works and will follow the principles of the waste hierarchy, as shown in Figure 5. Targets will be set in relation to volume of construction waste and diversion from landfill prior to the consumption.

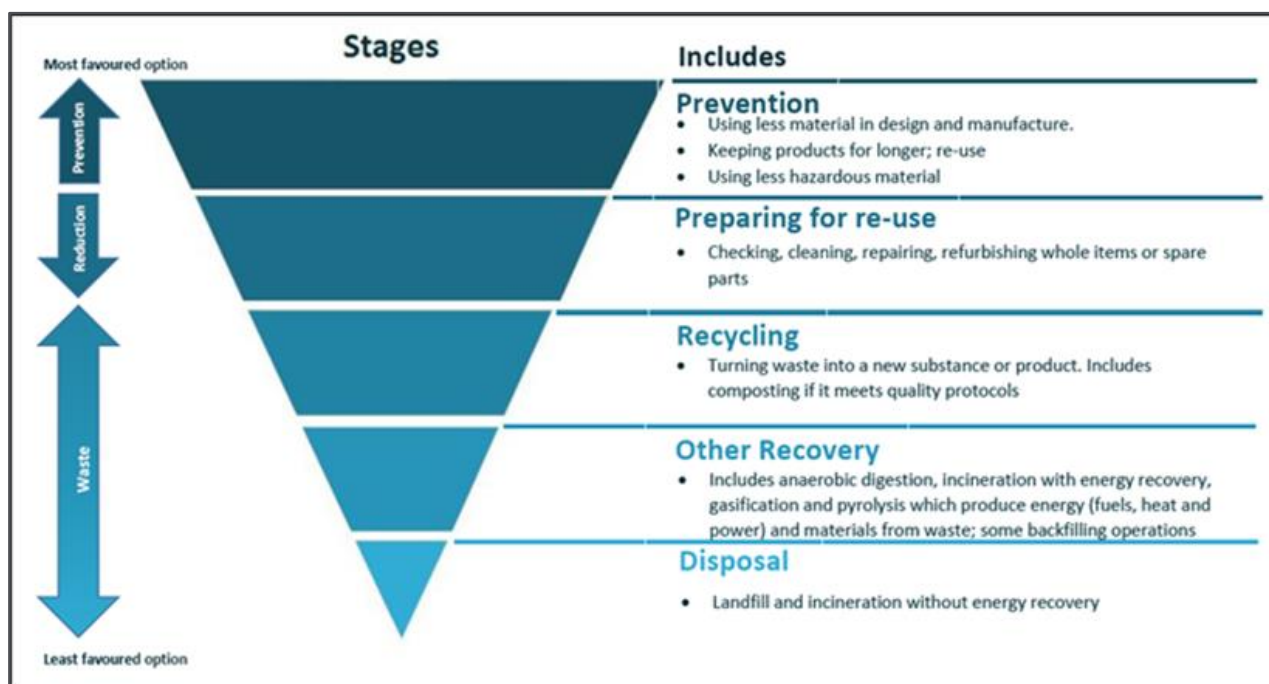


Figure 5 - The waste hierarchy

The construction waste generated as part of the redevelopment will be segregated and monitored as per best practice, with suitable materials being recycled as part of this process, either to be reused on site or introduced back into the supply chain through recycling by a Licensed Contractor, therefore minimising the amount of waste being disposed of in landfill sites.

Reusing materials on site will reduce the embodied CO<sub>2</sub>e (ECO<sub>2</sub>e) of the development through the reuse of the energy that exists in that material. Transportation of new material to the site will be reduced, reducing the CO<sub>2</sub>e emissions associated with transportation and material manufacture, as well as disruption to neighbours of the site from construction traffic.

Where waste will need to be disposed of, this will be done in line with the Waste Hierarchy, with as much as practicable being recycled, and the remainder being dealt with through a specialist waste recycling contractor. Nominal construction waste should be sent to landfill or for incineration unless this is unavoidable due to the materials found on the existing site.

#### 3.4.2 Resource Management

Policies will be put in place for management of site impacts such as air and water pollution in line with industry best practice. Monitoring and reporting on CO<sub>2</sub>e emissions and water use from site related activities will take place in line with national benchmarks.

The overall management of the construction waste will be monitored through the Considerate Constructors Scheme as part of Best Practice Site Management.

### 3.4.3 Materials

The Proposed Development is to use high quality, low impact materials in order to minimise the overall impact on the environment as far as possible.

The form of construction is anticipated to be a steel frame construction with timber cladding and triple glazing.

All timber and timber-based products used on-site will be legally sourced from a reputable forest certification scheme, such as Forest Stewardship Council (FSC) with appropriate Chain of Custody certification to confirm this. All other materials sourced from suppliers who have an accredited Environmental Management System (EMS) certified through ISO 14001 or the Eco-Management and Audit Scheme (EMAS) ensuring that any environmental impacts caused are managed and reduced. BES 6001 certification should also be considered to ensure products have been made with constituent materials that have been responsibly sourced.

As standard industry best-practice, all insulation on the site will have a Global Warming Potential (GWP) of <5. Other ozone depletion materials will be avoided where feasible, including high VOC content paints and sealants, further minimising the Proposed Development's effect on global Climate Change.

### 3.4.4 Water

Areas of the southeast of England have been declared areas of 'serious water stress'. Water is a vital resource and efficient usage should be encouraged in all new buildings. Average water use in the southeast of England is in the region of 150 litres/person/day<sup>3</sup>. The Proposed Development aims to significantly reduce mains water use through a combination of efficiency measures, including the use of fittings with a low capacity or flow restrictors to reduce water use. This is also inline with Eastleigh Borough Councils Planning Policy DM2 requirement for water use of no more than 110 Litres/person/day.

Internal water use will be reduced in line with Planning Policy and 'enhanced' water standards in Building Regulations Part G for the residential and non-residential elements of the scheme, with the below being an indicative specification to meet these requirements.

- WCs: 4/2.6 litre dual flush
- Taps (exc. Kitchen): 4.00 litres/minute
- Baths: 175 litres to overflow
- Showers: 9.00 litres/minute
- Kitchen Taps: 5.00 litres/minute
- Washing Machine: Max. 8.17 litres/kg dry load
- Dishwasher: 1.25 Litres/place setting.

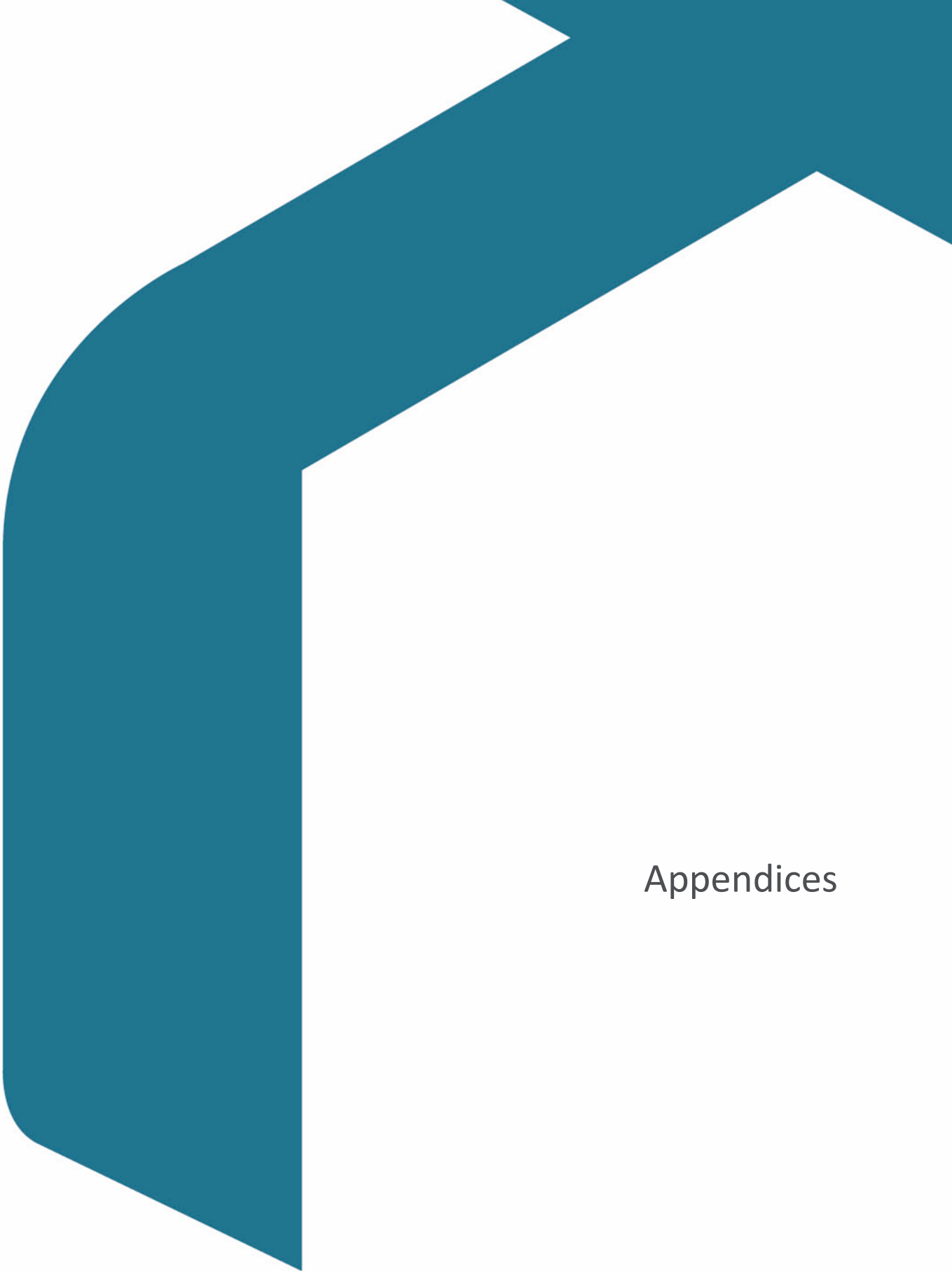
## 3.5 Sustainability Conclusions

Through a considered approach to sustainability through all aspects of the scheme's conception and design, the Proposed Development will significantly reduce its overall impact on both the local and global environment.

Overall, the Proposed Development has aimed to significantly minimise its impact on the environment at both construction and operational phases and will provide sustainable residential dwellings which will respond positively to its surroundings, as well as Building Regulations and planning policies.

---

<sup>3</sup> Energy Savings Trust: <https://www.energysavingtrust.org.uk/sites/default/files/reports/AtHomewithWater%287%29.pdf>

A large, teal-colored abstract graphic on the left side of the page. It consists of a thick, curved line that starts from the top left, curves downwards and to the right, and then continues as a straight line towards the bottom right. The shape is reminiscent of a stylized letter 'L' or a corner of a document.

## Appendices

## Appendix A – Site Plan



Appendix B – SAP Summary Building Performance Specification Sheets

| Chamberlayne Road                                                                        |         |                |             |                                                                                                                                                                                                                                                                                                  |                |                                                                                       |              |               |                       |                      |                               |                  |                          |                            |       |             |                 |                        |                                |                                |                                |                                |                                |                                |  |  |  |  |
|------------------------------------------------------------------------------------------|---------|----------------|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|---------------------------------------------------------------------------------------|--------------|---------------|-----------------------|----------------------|-------------------------------|------------------|--------------------------|----------------------------|-------|-------------|-----------------|------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|-------------------------------------------------------------------------------------|--|--|--|
| Stage LV1 2021                                                                           |         |                |             |                                                                                                                                                                                                                                                                                                  |                |                                                                                       |              |               |                       |                      |                               |                  |                          |                            |       |             |                 |                        |                                |                                |                                |                                |                                |                                |                                                                                     |  |  |  |
| Energy Option                                                                            | Unit    | Windows        | Roof Window | External doors                                                                                                                                                                                                                                                                                   | External Walls | Party Walls                                                                           | Ground Floor | Exposed floor | External roof (Pitch) | External roof (Flat) | Primary heating               | Air Permeability | Delayed Start Thermostat | Weather / Load Compensator | Frost | HW Cylinder | Renewables (PV) | Mechanical ventilation | Average DfE vs TFR improvement | Average DfE vs TFR improvement | Average DfE vs TFR improvement | Average DfE vs TFR improvement | Average DfE vs TFR improvement | Average DfE vs TFR improvement |                                                                                     |  |  |  |
| Type                                                                                     | Numbers | U Value        | U Value     | U Value                                                                                                                                                                                                                                                                                          | U Value        | U Value                                                                               | U Value      | U Value       | U Value               | U Value              | Make                          | m3/hr/m2         | Y/N                      | Y/N                        | Y/N   | (litres)    | (kWp)           | Type                   | %                              | %                              | %                              | %                              | %                              | %                              |                                                                                     |  |  |  |
| ASHP                                                                                     | various | 1.1 - 1.0      | 1.20        | 1.20                                                                                                                                                                                                                                                                                             | 0.17           | 0.00                                                                                  | 0.08         | 0.13          | 0.09                  | 0.09                 | Mitsubishi Ecodan PUZ-WM60VAA | 3                | N/A                      | N/A                        | N/A   | 145         | -               | Balanced - MVHR        | 58.9                           | 16.69                          | 3.17                           | 61.58                          | 21.41                          | 0.1                            |                                                                                     |  |  |  |
| Communal ASHP                                                                            | various | 1.1 - 1.0      | 1.20        | 1.20                                                                                                                                                                                                                                                                                             | 0.17           | 0.00                                                                                  | 0.08         | 0.13          | 0.09                  | 0.09                 | Communal ASHP - C.O.P 3.2     | 3                | N/A                      | N/A                        | N/A   | 145         | -               | Balanced - MVHR        | 69.86                          | 38.68                          | 3.17                           | -                              | -                              | -                              |                                                                                     |  |  |  |
| Communal GSHP                                                                            | various | 1.1 - 1.1      | 1.20        | 1.20                                                                                                                                                                                                                                                                                             | 0.17           | 0.00                                                                                  | 0.08         | 0.13          | 0.09                  | 0.09                 | Communal GSHP - C.O.P 3.0     | 3                | N/A                      | N/A                        | N/A   | 145         | -               | Balanced - MVHR        | 66.46                          | 31.86                          | 3.17                           | -                              | -                              | -                              |                                                                                     |  |  |  |
| Shedbox                                                                                  | various | 1.1 - 1.0      | 1.20        | 1.20                                                                                                                                                                                                                                                                                             | 0.17           | 0.00                                                                                  | 0.08         | 0.13          | 0.09                  | 0.09                 | Kensa Heat Pump S3-PDK        | 3                | N/A                      | N/A                        | N/A   | 145         | -               | Balanced - MVHR        | 48.59                          | -4.23                          | 3.17                           | 51.26                          | 0.41                           | 0.1                            |                                                                                     |  |  |  |
| EASHP                                                                                    | various | 1.1 - 1.0      | 1.20        | 1.20                                                                                                                                                                                                                                                                                             | 0.17           | 0.00                                                                                  | 0.08         | 0.13          | 0.09                  | 0.09                 | NIBE F470                     | 3                | N/A                      | N/A                        | N/A   | 145         | -               | Balanced - MVHR        | 61.98                          | 23.11                          | 3.17                           | 66.89                          | 32.32                          | 0.1                            |                                                                                     |  |  |  |
| ASHP + PV                                                                                | various | 1.1 - 1.0      | 1.20        | 1.20                                                                                                                                                                                                                                                                                             | 0.17           | 0.00                                                                                  | 0.08         | 0.13          | 0.09                  | 0.09                 | Mitsubishi Ecodan PUZ-WM60VAA | 3                | N/A                      | N/A                        | N/A   | 145         | 2.46            | Balanced - MVHR        | 69.40                          | 39.00                          | 3.17                           | 73.33                          | 46.75                          | 0.1                            |                                                                                     |  |  |  |
| Communal GSHP + PV                                                                       | various | 1.1 - 1.0      | 1.20        | 1.20                                                                                                                                                                                                                                                                                             | 0.17           | 0.00                                                                                  | 0.08         | 0.13          | 0.09                  | 0.09                 | Communal GSHP - C.O.P 3.0     | 3                | N/A                      | N/A                        | N/A   | 145         | 2.46            | Balanced - MVHR        | 80.37                          | 61.39                          | 3.17                           | -                              | -                              | -                              |                                                                                     |  |  |  |
| Shedbox + PV                                                                             | various | 1.1 - 1.0      | 1.20        | 1.20                                                                                                                                                                                                                                                                                             | 0.17           | 0.00                                                                                  | 0.08         | 0.13          | 0.09                  | 0.09                 | Kensa Heat Pump S3-PDK        | 3                | N/A                      | N/A                        | N/A   | 145         | -               | Balanced - MVHR        | 64.6                           | 29.79                          | 3.17                           | 63.34                          | 26.58                          | 0.1                            |                                                                                     |  |  |  |
| NOTE: A number of sample units have been modelled - 1 of each flat type and 1 house type |         |                |             |                                                                                                                                                                                                                                                                                                  |                |                                                                                       |              |               |                       |                      |                               |                  |                          |                            |       |             |                 |                        |                                |                                |                                |                                |                                |                                |                                                                                     |  |  |  |
| Element                                                                                  |         | U Values       |             | Description                                                                                                                                                                                                                                                                                      |                |                                                                                       |              |               |                       |                      |                               |                  |                          |                            |       |             |                 |                        |                                |                                |                                |                                |                                |                                |                                                                                     |  |  |  |
| External Wall<br>Wall Type 1                                                             |         | 0.17           |             | As recommended by Eastleigh Borough Council: 102.5mm Facing brickwork, Unventilated cavity, 110mm, Unilin (Xtratherm), ECO/CT full fill insulation, 100mm, Tarmac Topblock 3.6N, Plasterboard on dabs,                                                                                           |                |                                                                                       |              |               |                       |                      |                               |                  |                          |                            |       |             |                 |                        |                                |                                |                                |                                |                                |                                |                                                                                     |  |  |  |
| Ground Floor<br>Floor Type 1                                                             |         | 0.08           |             | As recommended by Eastleigh Borough Council: 65mm screed, Separation layer, 200mm, Unilin (Xtratherm), ECO360 MA, DPM 1200 gauge, Min 200mm concrete slab,                                                                                                                                       |                |                                                                                       |              |               |                       |                      |                               |                  |                          |                            |       |             |                 |                        |                                |                                |                                |                                |                                |                                |                                                                                     |  |  |  |
| External Roof (Pitch)<br>Roof Type 1                                                     |         | 0.09           |             | 50mm Ventilated Air Layer + Timber Battens, 150mm ECO360 MA or Equiv + Timber Battens, Vapour Control Layer, 125mm ECO360 MA or equiv, 12.5mm Plasterboard                                                                                                                                       |                |                                                                                       |              |               |                       |                      |                               |                  |                          |                            |       |             |                 |                        |                                |                                |                                |                                |                                |                                |                                                                                     |  |  |  |
| External Roof (Flat)<br>Roof Type 2                                                      |         | 0.09           |             | 150mm ECO360 MA or equiv, 125mm ECO360 MA + Timber Battens, 12.5mm Plasterboard                                                                                                                                                                                                                  |                |                                                                                       |              |               |                       |                      |                               |                  |                          |                            |       |             |                 |                        |                                |                                |                                |                                |                                |                                |                                                                                     |  |  |  |
| Windows                                                                                  |         | 1.1-1.0        |             | Triple glazed low E and argon filled windows with whole window U-value of 1.1 (Flats), 1.0 (Houses)                                                                                                                                                                                              |                |                                                                                       |              |               |                       |                      |                               |                  |                          |                            |       |             |                 |                        |                                |                                |                                |                                |                                |                                |                                                                                     |  |  |  |
| Roof Window                                                                              |         | 1.20           |             | Double glazed low E and argon filled windows with whole window U-value of 1.2                                                                                                                                                                                                                    |                |                                                                                       |              |               |                       |                      |                               |                  |                          |                            |       |             |                 |                        |                                |                                |                                |                                |                                |                                |                                                                                     |  |  |  |
| External Doors                                                                           |         | 1.20           |             | Solid doors with whole door U-value of 1.20                                                                                                                                                                                                                                                      |                |                                                                                       |              |               |                       |                      |                               |                  |                          |                            |       |             |                 |                        |                                |                                |                                |                                |                                |                                |                                                                                     |  |  |  |
| Primary Heating                                                                          |         | -              |             | ASHP option - Individual Mitsubishi Ecodan PUZ-WM60VAA units modelled.<br>Communal ASHP<br>GSHP option - Kensa Heat Pump S3-PDK<br>EASHP option - NIBE F470                                                                                                                                      |                |                                                                                       |              |               |                       |                      |                               |                  |                          |                            |       |             |                 |                        |                                |                                |                                |                                |                                |                                |                                                                                     |  |  |  |
| Heat Emitters                                                                            |         | -              |             | Radiators                                                                                                                                                                                                                                                                                        |                |                                                                                       |              |               |                       |                      |                               |                  |                          |                            |       |             |                 |                        |                                |                                |                                |                                |                                |                                |                                                                                     |  |  |  |
| Controls                                                                                 |         | -              |             | Controls to be confirmed - Programmer and two Room Thermostats                                                                                                                                                                                                                                   |                |                                                                                       |              |               |                       |                      |                               |                  |                          |                            |       |             |                 |                        |                                |                                |                                |                                |                                |                                |                                                                                     |  |  |  |
| HW Cylinder                                                                              |         | -              |             | ASHP, EASHP & Shedbox GSHP option - Megaflow Eco indirect unvented cylinders modelled - 145l model specified, with standing heat loss of 1.18kWh/day.<br>Communal ASHP option - Communal cylinders feeding Heat Interface Units in each flat (145 litre exchange volume with 1.85 kWh/day loss). |                |                                                                                       |              |               |                       |                      |                               |                  |                          |                            |       |             |                 |                        |                                |                                |                                |                                |                                |                                |                                                                                     |  |  |  |
| Mechanical Ventilation                                                                   |         | -              |             | Mechanical Ventilation with Heat Recovery (MVHR) (SPF 0.83, Efficiency 92%)                                                                                                                                                                                                                      |                |                                                                                       |              |               |                       |                      |                               |                  |                          |                            |       |             |                 |                        |                                |                                |                                |                                |                                |                                |                                                                                     |  |  |  |
| Air Pressure Test                                                                        |         | -              |             | Blower Door Method - 3 m3/hr/m2                                                                                                                                                                                                                                                                  |                |                                                                                       |              |               |                       |                      |                               |                  |                          |                            |       |             |                 |                        |                                |                                |                                |                                |                                |                                |                                                                                     |  |  |  |
| Renewables                                                                               |         | -              |             |                                                                                                                                                                                                                                                                                                  |                |                                                                                       |              |               |                       |                      |                               |                  |                          |                            |       |             |                 |                        |                                |                                |                                |                                |                                |                                |                                                                                     |  |  |  |
| Cooling                                                                                  |         | -              |             | N/A                                                                                                                                                                                                                                                                                              |                |                                                                                       |              |               |                       |                      |                               |                  |                          |                            |       |             |                 |                        |                                |                                |                                |                                |                                |                                |                                                                                     |  |  |  |
| Lighting                                                                                 |         | -              |             | 13W power, 90lm/W efficacy                                                                                                                                                                                                                                                                       |                |                                                                                       |              |               |                       |                      |                               |                  |                          |                            |       |             |                 |                        |                                |                                |                                |                                |                                |                                |                                                                                     |  |  |  |
| Electrical Tariff                                                                        |         | -              |             | Standard Electricity                                                                                                                                                                                                                                                                             |                |                                                                                       |              |               |                       |                      |                               |                  |                          |                            |       |             |                 |                        |                                |                                |                                |                                |                                |                                |                                                                                     |  |  |  |
| Shower                                                                                   |         | -              |             | Electric, 9l/min                                                                                                                                                                                                                                                                                 |                |                                                                                       |              |               |                       |                      |                               |                  |                          |                            |       |             |                 |                        |                                |                                |                                |                                |                                |                                |                                                                                     |  |  |  |
| Construction Details                                                                     |         | -              |             | As recommended by Eastleigh Borough Council                                                                                                                                                                                                                                                      |                |                                                                                       |              |               |                       |                      |                               |                  |                          |                            |       |             |                 |                        |                                |                                |                                |                                |                                |                                |                                                                                     |  |  |  |
| Name                                                                                     |         | (PP) M Maclean |             |                                                                                                                                                                                                                                                                                                  |                | Date                                                                                  |              | 19.05.2023    |                       |                      |                               |                  |                          |                            |       |             |                 |                        |                                |                                |                                |                                |                                |                                |                                                                                     |  |  |  |
| Sign Off of details                                                                      |         | Sign           |             | (on behalf of SRE)                                                                                                                                                                                                                                                                               |                |  |              |               |                       |                      |                               |                  |                          |                            |       |             |                 |                        |                                |                                |                                |                                |                                |                                | On behalf of the contractor/client:                                                 |  |  |  |

## Appendix C – Less feasible LZC Technologies

### **Biomass Boiler**

Biomass boilers generate heat from the burning of renewable or 'waste' biomass. They require a regular feed of fuel and regular heat demand to operate efficiently. A flue taller than the surrounding buildings must be incorporated into the design to minimise air pollution impacts at ground level from particulate emissions.

The use of a biomass boiler system to supply space heating and DHW has been deemed unsuitable due to the high level of particulates emitted from their use and the mix of uses and user profiles on this site. The use of such a system would negatively impact the air quality of the surrounding residential area and open spaces.

### **Wind Power**

Wind power is a developed and productive method of renewable energy generation, however, the main limiting factor to its implementation is opposition at a local public and local government level.

There are also technical constraints with the Proposed Development, being in an urban location, sheltered and surrounded by existing residential developments that would make the system technically and socially unviable.

To generate a meaningful amount of electricity, large-scale turbines are required which have noise and the visual impacts for the local area and inappropriate for this residential scheme.

### **Solar Water Heating**

Solar Water Heating (SWH) can be used to offset a proportion of the domestic hot water (DHW) demand within a building and operate well with other electric based hot water systems (heat pumps and immersion).

However, due to the reduced DHW demand at the Proposed Development it is likely to provide minimal CO<sub>2</sub>e emissions reductions, while taking up roof-space, better utilised for photovoltaics.

## Appendix D – SAP10 Outputs – ASHP + PV option

# Full SAP Calculation Printout

|                      |                                                                  |                |            |
|----------------------|------------------------------------------------------------------|----------------|------------|
| Property Reference   | EAST-CHAM-2860 - End House                                       | Issued on Date | 16/06/2023 |
| Assessment Reference | New ASHP + PV                                                    | Prop Type Ref  | House      |
| Property             | The Parour, 237, Chamberlayne Rd, Eastleigh, Hampshire, SO50 8HX |                |            |

|                                    |          |             |       |     |       |
|------------------------------------|----------|-------------|-------|-----|-------|
| SAP Rating                         | EPC      | DSR         | TER   | EPC | TER   |
| Exclusions                         | NA       | % DSR < TER | 82.22 |     |       |
| CO <sub>2</sub> Emissions (t/year) | 5.12     | DSR         | 20.88 | TER | 26.91 |
| Compliance Check                   | See BRES | % DSR < TER | 5.18  |     |       |
| % DSR < TER                        | 51.08    | DSR         | 20.22 | TER | 47.37 |

|                  |                   |             |            |
|------------------|-------------------|-------------|------------|
| Assessor Details | Mr Malcolm Mackay | Assessor ID | 16607-0002 |
| Client           |                   |             |            |

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

**1. Overall dwelling characteristics**

|                                                        | Area (m <sup>2</sup> ) | Storey height (m) | Volume (m <sup>3</sup> )          |                   |
|--------------------------------------------------------|------------------------|-------------------|-----------------------------------|-------------------|
| Ground floor                                           | 43.7500 (1b)           | x                 | 2.4000 (2b)                       | = 105.0000 (1b) - |
| First floor                                            | 42.2300 (1c)           | x                 | 2.7000 (2c)                       | = 114.0210 (1c) - |
| Second floor                                           | 30.4500 (1d)           | x                 | 2.8000 (2d)                       | = 85.2600 (1d) -  |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 116.4300               |                   |                                   |                   |
| Dwelling volume                                        |                        |                   | (1a)+(1b)+(1c)+(1d)+(1e)...(1n) = | 279.9210 (5)      |

**2. Ventilation rate**

|                                                                                                         | m <sup>3</sup> per hour     |               |
|---------------------------------------------------------------------------------------------------------|-----------------------------|---------------|
| Number of open chimneys                                                                                 | 0 * 80 =                    | 0.0000 (6a)   |
| Number of open flues                                                                                    | 0 * 20 =                    | 0.0000 (6b)   |
| Number of chimneys / flues attached to closed fire                                                      | 0 * 10 =                    | 0.0000 (6c)   |
| Number of flues attached to solid fuel boiler                                                           | 0 * 20 =                    | 0.0000 (6d)   |
| Number of flues attached to other heater                                                                | 0 * 35 =                    | 0.0000 (6e)   |
| Number of blocked chimneys                                                                              | 0 * 20 =                    | 0.0000 (6f)   |
| Number of intermittent extract fans                                                                     | 0 * 10 =                    | 0.0000 (7a)   |
| Number of passive vents                                                                                 | 0 * 10 =                    | 0.0000 (7b)   |
| Number of flueless gas fires                                                                            | 0 * 40 =                    | 0.0000 (7c)   |
| <b>Air changes per hour</b>                                                                             |                             |               |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) =           | 0.0000 / (5) =              | 0.0000 (8)    |
| Pressure test                                                                                           | Yes                         |               |
| Pressure Test Method                                                                                    | Blower Door                 |               |
| Measured/design AP50                                                                                    | 1.0000                      | (17)          |
| Infiltration rate                                                                                       | 0.1500                      | (18)          |
| Number of sides sheltered                                                                               | 2                           | (19)          |
| Shelter factor                                                                                          | (20) = 1 - [(0.075 x (19))] | = 0.8500 (20) |
| Infiltration rate adjusted to include shelter factor                                                    | (21) = (18) x (20)          | = 0.1275 (21) |
| <b>Wind speed</b>                                                                                       |                             |               |
| Jan                                                                                                     | 5.1000                      |               |
| Feb                                                                                                     | 5.0000                      |               |
| Mar                                                                                                     | 4.9000                      |               |
| Apr                                                                                                     | 4.8000                      |               |
| May                                                                                                     | 4.7000                      |               |
| Jun                                                                                                     | 4.6000                      |               |
| Jul                                                                                                     | 4.5000                      |               |
| Aug                                                                                                     | 4.4000                      |               |
| Sep                                                                                                     | 4.3000                      |               |
| Oct                                                                                                     | 4.2000                      |               |
| Nov                                                                                                     | 4.1000                      |               |
| Dec                                                                                                     | 4.0000                      |               |
| Wind factor                                                                                             | 1.2750                      | (22)          |
| Adj infilt rate                                                                                         | 0.1626                      | (23a)         |
| Balanced mechanical ventilation with heat recovery                                                      |                             |               |
| If mechanical ventilation                                                                               |                             | 0.5000 (23b)  |
| If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) |                             | 0.5000 (23b)  |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =            |                             | 81.9000 (23c) |
| Effective ac                                                                                            | 0.2531                      | (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 |
|---------------|----------------------|-------------------------|------------------------|----------------------------|-----------|-----------------------------|------------|
| External Door |                      |                         | 2.1000                 | 1.2000                     | 2.5200    |                             | (26)       |

SAP 10 Online 2.7.1
Page 1 of 9

## Full SAP Calculation Printout



|                                                                                 |          |          |          |          |          |          |               |           |                        |          |                       |          |                |
|---------------------------------------------------------------------------------|----------|----------|----------|----------|----------|----------|---------------|-----------|------------------------|----------|-----------------------|----------|----------------|
| Windows (Uw = 1.80)                                                             |          |          |          |          |          | 19.7600  | 0.9615        | 19.0000   |                        |          |                       |          | (27)           |
| Roof Window                                                                     |          |          |          |          |          | 0.1900   | 1.1450        | 0.4466    |                        |          |                       |          | (27a)          |
| Heat Loss Floor 1                                                               |          |          |          |          |          | 43.7500  | 0.0000        | 3.5000    | 0.0000                 | 0.0000   | 0.0000                | 0.0000   | (28a)          |
| GF Unsheltered EW                                                               | 54.0300  | 11.1100  |          |          |          | 42.9200  | 0.1700        | 7.2964    | 190.0000               |          | 8154.0000             |          | (29a)          |
| FF Unsheltered EW                                                               | 36.0500  | 8.4500   |          |          |          | 27.6000  | 0.1700        | 4.6920    | 190.0000               |          | 5244.0000             |          | (29a)          |
| Dormer Walls                                                                    | 10.9500  | 2.3000   |          |          |          | 8.6500   | 0.1900        | 1.6435    | 190.0000               |          | 1643.5000             |          | (29a)          |
| 2F Unsheltered EW                                                               | 26.0600  |          |          |          |          | 26.0600  | 0.1600        | 4.1696    | 190.0000               |          | 4951.4000             |          | (29a)          |
| External Roof 1                                                                 | 10.6300  | 0.3000   |          |          |          | 10.2400  | 0.0000        | 0.9216    | 9.0000                 |          | 92.1600               |          | (30)           |
| Flat Roof Dormer                                                                | 2.3000   |          |          |          |          | 2.3000   | 0.0000        | 0.2070    | 9.0000                 |          | 20.7000               |          | (30)           |
| External Roof 3                                                                 | 11.8500  |          |          |          |          | 11.8500  | 0.0000        | 1.0665    | 9.0000                 |          | 106.6500              |          | (30)           |
| Total net area of external elements $\sum(A, m^2)$                              |          |          |          |          |          | 195.6200 |               |           |                        |          |                       |          | (31)           |
| Fabric heat loss, $W/K = \sum(A \times U)$                                      |          |          |          |          |          | (26)...  | (30) + (32) = | 45.4632   |                        |          |                       |          | (33)           |
| Party Wall 1                                                                    |          |          |          |          |          | 22.0000  | 0.0000        | 0.0000    | 100.0000               |          | 3960.0000             |          | (32)           |
| Party Wall 2                                                                    |          |          |          |          |          | 22.0000  | 0.0000        | 0.0000    | 100.0000               |          | 3960.0000             |          | (32)           |
| Party Wall 3                                                                    |          |          |          |          |          | 10.5000  | 0.0000        | 0.0000    | 100.0000               |          | 1904.4000             |          | (32)           |
| Internal Wall 1                                                                 |          |          |          |          |          | 100.0000 |               | 9.0000    | 900.0000               |          | 900.0000              |          | (32)           |
| Internal Floor 1                                                                |          |          |          |          |          | 42.2300  |               | 18.0000   | 760.1400               |          | 760.1400              |          | (32d)          |
| Internal Floor 2                                                                |          |          |          |          |          | 30.4500  |               | 18.0000   | 548.1000               |          | 548.1000              |          | (32d)          |
| Heat capacity $Cm = \sum(A \times k)$                                           |          |          |          |          |          |          |               | (28)...   | (30) + (32) + (32a)... | (32e) =  | 32245.8500            |          | (34)           |
| Thermal mass parameter (TMP = $Cm / TFA$ ) in $kJ/m^2K$                         |          |          |          |          |          |          |               |           |                        |          | 276.9548              |          | (35)           |
| List of Thermal Bridges                                                         |          |          |          |          |          |          |               |           |                        |          |                       |          |                |
| E1 Element                                                                      |          |          |          |          |          |          | Length        | Psi-value | Total                  |          |                       |          |                |
| E2 Other lintels (including other steel lintels)                                |          |          |          |          |          |          | 14.1900       | 0.2600    | 3.6894                 |          |                       |          |                |
| E3 Sill                                                                         |          |          |          |          |          |          | 13.1900       | 0.0070    | 0.0923                 |          |                       |          |                |
| E4 Jamb                                                                         |          |          |          |          |          |          | 33.2800       | 0.0090    | 0.2995                 |          |                       |          |                |
| E5 Ground floor (normal)                                                        |          |          |          |          |          |          | 20.0000       | 0.1200    | 2.4000                 |          |                       |          |                |
| E6 Intermediate floor within a dwelling                                         |          |          |          |          |          |          | 36.9600       | 0.0000    | 0.0000                 |          |                       |          |                |
| E18 Party wall between dwellings                                                |          |          |          |          |          |          | 13.8000       | 0.0430    | 0.5934                 |          |                       |          |                |
| E16 Corner (normal)                                                             |          |          |          |          |          |          | 13.8000       | 0.0067    | 0.0925                 |          |                       |          |                |
| R6 Flat ceiling                                                                 |          |          |          |          |          |          | 10.4000       | 0.1200    | 1.2480                 |          |                       |          |                |
| R8 Roof to wall (rafter)                                                        |          |          |          |          |          |          | 10.4000       | 0.1200    | 1.2480                 |          |                       |          |                |
| P1 Party wall - Ground floor                                                    |          |          |          |          |          |          | 8.1400        | 0.0740    | 0.6024                 |          |                       |          |                |
| Thermal bridges ( $\sum(L \times Psi)$ ) calculated using Appendix K            |          |          |          |          |          |          |               |           |                        |          | 14.2655               |          | (36)           |
| Point Thermal bridges                                                           |          |          |          |          |          |          |               |           |                        |          | (36a) =               | 0.0000   |                |
| Total fabric heat loss                                                          |          |          |          |          |          |          |               |           |                        |          | (33) + (36) + (36a) = | 59.7286  | (37)           |
| Ventilation heat loss calculated monthly $(38)m = 0.33 \times (25)m \times (5)$ |          |          |          |          |          |          |               |           |                        |          |                       |          |                |
| (38)m                                                                           | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul           | Aug       | Sep                    | Oct      | Nov                   | Dec      |                |
| Heat transfer coeff                                                             | 23.3764  | 23.0819  | 22.7875  | 21.3153  | 21.0208  | 19.5486  | 19.5486       | 19.2542   | 20.1375                | 21.0208  | 21.6897               | 22.1986  | (38)           |
| Average = $\sum(39)m / 12 =$                                                    | 83.1050  | 82.8106  | 82.5161  | 81.0439  | 80.7495  | 79.2773  | 79.2773       | 78.9828   | 79.8662                | 80.7495  | 81.3384               | 81.9272  | (39)           |
|                                                                                 |          |          |          |          |          |          |               |           |                        |          |                       | 80.9703  |                |
| HLP                                                                             | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul           | Aug       | Sep                    | Oct      | Nov                   | Dec      |                |
| HLP (average)                                                                   | 0.7138   | 0.7112   | 0.7087   | 0.6961   | 0.6935   | 0.6809   | 0.6809        | 0.6784    | 0.6860                 | 0.6935   | 0.6986                | 0.7037   | (40)           |
| Days in mont                                                                    | 31       | 28       | 31       | 30       | 31       | 30       | 31            | 31        | 30                     | 31       | 30                    | 31       |                |
| 4. Water heating energy requirements (kWh/year)                                 |          |          |          |          |          |          |               |           |                        |          |                       |          |                |
| Assumed occupancy                                                               |          |          |          |          |          |          |               |           |                        |          |                       |          | 2.8484 (42)    |
| Hot water usage for mixer showers                                               |          |          |          |          |          |          |               |           |                        |          |                       |          |                |
|                                                                                 | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | 0.0000                 | 0.0000   | 0.0000                | 0.0000   | (42a)          |
| Hot water usage for baths                                                       |          |          |          |          |          |          |               |           |                        |          |                       |          |                |
|                                                                                 | 31.0762  | 30.6146  | 29.9647  | 28.7664  | 27.8691  | 26.8741  | 26.3367       | 26.9820   | 27.6847                | 28.7494  | 29.9724               | 30.9711  | (42b)          |
| Hot water usage for other uses                                                  |          |          |          |          |          |          |               |           |                        |          |                       |          |                |
|                                                                                 | 43.8004  | 42.2077  | 40.6150  | 39.0222  | 37.4295  | 35.8367  | 35.8367       | 37.4295   | 39.0222                | 40.6150  | 42.2077               | 43.8004  | (42c)          |
| Average daily hot water use (litres/day)                                        |          |          |          |          |          |          |               |           |                        |          |                       |          | 68.6311 (43)   |
|                                                                                 | Jan      | Feb      | Mar      | Apr      | May      | Jun      | Jul           | Aug       | Sep                    | Oct      | Nov                   | Dec      |                |
| Daily hot water use                                                             | 74.8766  | 72.8223  | 70.5797  | 67.7886  | 65.2985  | 62.7108  | 62.1734       | 64.4115   | 66.7069                | 69.3643  | 72.1881               | 74.7715  | (44)           |
| Energy conte                                                                    | 118.5862 | 103.6980 | 108.4783 | 92.7992  | 87.9044  | 77.1183  | 75.1933       | 79.7549   | 82.2563                | 94.1268  | 102.8138              | 117.0742 | (45)           |
| Energy content (annual)                                                         |          |          |          |          |          |          |               |           |                        |          |                       |          |                |
| Distribution loss (46)m = 0.15 x (45)m                                          |          |          |          |          |          |          |               |           |                        |          |                       |          |                |
|                                                                                 | 17.7879  | 15.5547  | 16.2717  | 13.9199  | 13.1857  | 11.5665  | 11.2790       | 11.9632   | 12.3385                | 14.1190  | 15.4251               | 17.5611  | (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                                                |          |          |          |          |          |          |               |           |                        |          |                       |          | 0.5400 (49)    |
| Enter (49) or (54) in (55)                                                      |          |          |          |          |          |          |               |           |                        |          |                       |          | 0.6372 (55)    |
| Total storage loss                                                              |          |          |          |          |          |          |               |           |                        |          |                       |          |                |
|                                                                                 | 19.7532  | 17.8416  | 19.7532  | 19.1160  | 19.7532  | 19.1160  | 19.7532       | 19.7532   | 19.1160                | 19.7532  | 19.1160               | 19.7532  | (56)           |
| If cylinder contains dedicated solar storage                                    |          |          |          |          |          |          |               |           |                        |          |                       |          |                |
|                                                                                 | 19.7532  | 17.8416  | 19.7532  | 19.1160  | 19.7532  | 19.1160  | 19.7532       | 19.7532   | 19.1160                | 19.7532  | 19.1160               | 19.7532  | (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)           |
| Comb loss                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | 0.0000                 | 0.0000   | 0.0000                | 0.0000   | (61)           |
| Total heat required for water heating calculated for each month                 |          |          |          |          |          |          |               |           |                        |          |                       |          |                |
|                                                                                 | 161.6018 | 142.5508 | 151.4939 | 134.4272 | 130.9200 | 118.7383 | 118.2089      | 122.7795  | 123.8843               | 137.1424 | 144.4618              | 160.0898 | (62)           |
| WHR5                                                                            | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | 0.0000                 | 0.0000   | 0.0000                | 0.0000   | (63a)          |
| Pv diverter                                                                     | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000  | -0.0000       | -0.0000   | -0.0000                | -0.0000  | -0.0000               | -0.0000  | (63b)          |
| Solar input                                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | 0.0000                 | 0.0000   | 0.0000                | 0.0000   | (63c)          |
| FGHR5                                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | 0.0000                 | 0.0000   | 0.0000                | 0.0000   | (63d)          |
| Output from w/h                                                                 |          |          |          |          |          |          |               |           |                        |          |                       |          |                |
|                                                                                 | 161.6018 | 142.5508 | 151.4939 | 134.4272 | 130.9200 | 118.7383 | 118.2089      | 122.7795  | 123.8843               | 137.1424 | 144.4618              | 160.0898 | (64)           |
| Total per year (kWh/year) = $\sum(64)m =$                                       |          |          |          |          |          |          |               |           |                        |          |                       |          | 1646.2896 (64) |
| 12Total per year (kWh/year)                                                     |          |          |          |          |          |          |               |           |                        |          |                       |          | 1646 (64)      |
| Electric shower(s)                                                              |          |          |          |          |          |          |               |           |                        |          |                       |          |                |
|                                                                                 | 57.6425  | 51.3599  | 56.0830  | 53.5194  | 54.5236  | 52.0103  | 53.7439       | 54.5236   | 53.5194                | 56.0830  | 55.0285               | 57.6425  | (64a)          |
| Total Energy used by instantaneous electric shower(s) = $\sum(64a)m =$          |          |          |          |          |          |          |               |           |                        |          |                       |          | 655.6795 (64a) |

## Full SAP Calculation Printout



Heat gains from water heating, kWh/month  
88.2530 78.4018 84.5023 77.5380 77.2716 71.9441 72.8502 74.5619 74.0325 79.7304 81.2518 87.7503 (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                                                                               | 142.4199  | 142.4199  | 142.4199  | 142.4199  | 142.4199  | 142.4199  | 142.4199  | 142.4199  | 142.4199  | 142.4199  | 142.4199  | 142.4199  | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 149.0313  | 164.9989  | 149.0313  | 153.9990  | 149.0313  | 153.9990  | 149.0313  | 149.0313  | 153.9990  | 149.0313  | 153.9990  | 149.0313  | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 280.4899  | 283.4005  | 276.0659  | 268.4513  | 240.7407  | 222.2155  | 209.8396  | 206.9289  | 214.2636  | 229.8782  | 249.5888  | 268.1119  | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 37.2420   | 37.2420   | 37.2420   | 37.2420   | 37.2420   | 37.2420   | 37.2420   | 37.2420   | 37.2420   | 37.2420   | 37.2420   | 37.2420   | (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)                                 | -113.9359 | -113.9359 | -113.9359 | -113.9359 | -113.9359 | -113.9359 | -113.9359 | -113.9359 | -113.9359 | -113.9359 | -113.9359 | -113.9359 | (71) |
| Water heating gains (Table 5)                                                       | 118.6196  | 116.6694  | 113.5783  | 107.6916  | 103.8597  | 99.9224   | 97.9170   | 100.2176  | 102.8229  | 107.1645  | 112.8497  | 117.9439  | (72) |
| Total internal gains                                                                | 613.8668  | 630.7947  | 604.4814  | 587.8678  | 559.3576  | 541.8628  | 522.5138  | 521.9038  | 536.8114  | 551.7999  | 582.1633  | 608.8150  | (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 | 3.9100                 | 11.2829                                    | 0.4300                            | 0.7000                             | 0.7700                       | 9.2024     | (75) |
| Southeast | 8.0900                 | 36.7938                                    | 0.4300                            | 0.7000                             | 0.7700                       | 62.8982    | (77) |
| South     | 5.9500                 | 46.7521                                    | 0.4300                            | 0.7000                             | 0.7700                       | 58.8253    | (78) |
| Northwest | 1.8100                 | 11.2829                                    | 0.4300                            | 0.7000                             | 0.7700                       | 4.2599     | (81) |
| Northwest | 0.3900                 | 16.3666                                    | 0.4200                            | 0.7000                             | 1.0000                       | 1.6889     | (82) |

|             |          |          |          |          |           |           |          |          |          |          |          |          |      |
|-------------|----------|----------|----------|----------|-----------|-----------|----------|----------|----------|----------|----------|----------|------|
| Solar gains | 135.2667 | 231.6720 | 321.5435 | 408.0206 | 467.2166  | 468.7051  | 449.8282 | 404.6694 | 351.2025 | 257.1599 | 162.2191 | 115.6461 | (83) |
| Total gains | 749.1335 | 862.4667 | 925.9450 | 995.8884 | 1026.5742 | 1010.5679 | 972.3419 | 926.5731 | 888.0119 | 808.9598 | 744.3824 | 716.4611 | (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                    | 107.7815 | 108.1647 | 108.5507 | 110.5225 | 110.9256 | 112.9855 | 112.9855 | 113.4067 | 112.1524                  | 110.9256 | 110.1225 | 109.5389 |      |
| alpha                  | 8.1854   | 8.2110   | 8.2367   | 8.3682   | 8.3950   | 8.5324   | 8.5324   | 8.5684   | 8.4768                    | 8.3950   | 8.3415   | 8.2887   |      |
| util living area       | 0.9970   | 0.9899   | 0.9698   | 0.8862   | 0.7165   | 0.5014   | 0.3587   | 0.3920   | 0.6164                    | 0.9095   | 0.9891   | 0.9979   | (86) |
| Living                 | 20.4133  | 20.5609  | 20.7265  | 20.9100  | 20.9858  | 20.9993  | 21.0000  | 20.9999  | 20.9966                   | 20.9044  | 20.6382  | 20.3934  |      |
| Non living             | 20.0832  | 20.2310  | 20.3950  | 20.5751  | 20.6425  | 20.6591  | 20.6595  | 20.6608  | 20.6548                   | 20.5727  | 20.3136  | 20.0678  |      |
| 24 / 16                | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0                         | 0        | 0        | 0        |      |
| 24 / 9                 | 3        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0                         | 0        | 0        | 0        |      |
| 16 / 9                 | 28       | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0                         | 0        | 0        | 10       |      |
| MIT                    | 20.6999  | 20.5609  | 20.7265  | 20.9100  | 20.9858  | 20.9993  | 21.0000  | 20.9999  | 20.9966                   | 20.9044  | 20.6382  | 20.4782  | (87) |
| Th 2                   | 20.6431  | 20.6444  | 20.6456  | 20.6520  | 20.6532  | 20.6595  | 20.6595  | 20.6608  | 20.6570                   | 20.6532  | 20.6507  | 20.6482  | (88) |
| util rest of house     | 0.9985   | 0.9884   | 0.9652   | 0.8723   | 0.6929   | 0.4749   | 0.3310   | 0.3632   | 0.5870                    | 0.8951   | 0.9874   | 0.9975   | (89) |
| MIT 2                  | 20.3567  | 20.2310  | 20.3950  | 20.5751  | 20.6425  | 20.6591  | 20.6595  | 20.6608  | 20.6548                   | 20.5727  | 20.3136  | 20.1489  | (90) |
| Living area fraction   |          |          |          |          |          |          |          |          | FLA = Living area / (4) = |          |          | 0.1031   | (91) |
| MIT                    | 20.3921  | 20.2650  | 20.4292  | 20.6096  | 20.6779  | 20.6942  | 20.6946  | 20.6957  | 20.6900                   | 20.6069  | 20.3471  | 20.1829  | (92) |
| Temperature adjustment |          |          |          |          |          |          |          |          |                           |          |          | 0.0000   |      |
| adjusted MIT           | 20.3921  | 20.2650  | 20.4292  | 20.6096  | 20.6779  | 20.6942  | 20.6946  | 20.6957  | 20.6900                   | 20.6069  | 20.3471  | 20.1829  | (93) |

## 8. Space heating requirement

|                                                                                | Jan       | Feb       | Mar       | Apr      | May      | Jun      | Jul      | Aug      | Sep      | Oct           | Nov       | Dec       |       |
|--------------------------------------------------------------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|----------|---------------|-----------|-----------|-------|
| Utilisation                                                                    | 0.9962    | 0.9864    | 0.9621    | 0.8705   | 0.6946   | 0.4776   | 0.3338   | 0.3661   | 0.5898   | 0.8931        | 0.9854    | 0.9969    | (94)  |
| Useful gains                                                                   | 746.2504  | 850.7329  | 890.8377  | 866.8965 | 713.0199 | 482.6670 | 324.5918 | 339.2497 | 523.7553 | 722.4469      | 733.5155  | 714.2632  | (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                                                               | 1337.3303 | 1272.3847 | 1149.3838 | 948.9896 | 724.9580 | 483.1320 | 324.6104 | 339.2893 | 526.3171 | 808.0487      | 1077.4964 | 1309.4340 | (97)  |
| Space heating kWh                                                              | 439.7635  | 283.3500  | 192.3583  | 59.1070  | 8.8819   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 63.6877       | 247.6662  | 442.8070  | (98a) |
| Space heating requirement - total per year (kWh/year)                          |           |           |           |          |          |          |          |          |          |               |           | 1737.6216 |       |
| Solar heating kWh                                                              | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000        | 0.0000    | 0.0000    | (98b) |
| Solar heating contribution - total per year (kWh/year)                         |           |           |           |          |          |          |          |          |          |               |           | 0.0000    |       |
| Space heating kWh                                                              | 439.7635  | 283.3500  | 192.3583  | 59.1070  | 8.8819   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 63.6877       | 247.6662  | 442.8070  | (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) |           |           |           |          |          |          |          |          |          |               |           | 1737.6216 |       |
| Space heating per m <sup>2</sup>                                               |           |           |           |          |          |          |          |          |          | (98c) / (4) = |           | 14.9242   | (99)  |

## Full SAP Calculation Printout



## 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 %)                                                     |          |          |          |          |           |           |           |          |          |          |          |          | 243.1000 (206)   |
| Efficiency of main space heating system 2 (in %)                                                     |          |          |          |          |           |           |           |          |          |          |          |          | 0.0000 (207)     |
| Efficiency of secondary/supplementary heating system, %                                              |          |          |          |          |           |           |           |          |          |          |          |          | 0.0000 (208)     |
|                                                                                                      | Jan      | Feb      | Mar      | Apr      | May       | Jun       | Jul       | Aug      | Sep      | Oct      | Nov      | Dec      |                  |
| Space heating requirement                                                                            | 439.7635 | 283.3500 | 192.3583 | 59.1070  | 8.8819    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 63.6877  | 247.6662 | 442.8070 | (98)             |
| Space heating efficiency (main heating system 1)                                                     | 243.1000 | 243.1000 | 243.1000 | 243.1000 | 243.1000  | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 243.1000 | 243.1000 | 243.1000 | (210)            |
| Space heating fuel (main heating system)                                                             | 180.8975 | 116.5565 | 79.1269  | 24.3138  | 3.6536    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 26.1981  | 101.8780 | 182.1495 | (211)            |
| Space heating efficiency (main heating system 2)                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (212)            |
| Space heating fuel (main heating system 2)                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (213)            |
| Space heating fuel (secondary)                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (215)            |
| Water heating                                                                                        |          |          |          |          |           |           |           |          |          |          |          |          |                  |
| Water heating requirement                                                                            | 161.6018 | 142.5508 | 151.4939 | 134.4272 | 130.9200  | 118.7383  | 118.2089  | 122.7705 | 123.8843 | 137.1424 | 144.4618 | 160.0898 | (64)             |
| Efficiency of water heater                                                                           | 190.5953 | 190.5953 | 190.5953 | 190.5953 | 190.5953  | 190.5953  | 190.5953  | 190.5953 | 190.5953 | 190.5953 | 190.5953 | 190.5953 | (216)            |
| Fuel for water heating, kWh/month                                                                    | 84.7879  | 74.7924  | 79.4846  | 70.5382  | 68.6900   | 62.2086   | 62.0209   | 64.4142  | 64.9986  | 71.9547  | 75.7950  | 83.9946  | (219)            |
| Space cooling fuel requirement                                                                       |          |          |          |          |           |           |           |          |          |          |          |          |                  |
| (221)m                                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (221)            |
| Pumps and Fa                                                                                         | 26.4810  | 23.9184  | 26.4810  | 25.6268  | 26.4810   | 25.6268   | 26.4810   | 26.4810  | 25.6268  | 26.4810  | 25.6268  | 26.4810  | (231)            |
| Lighting                                                                                             | 33.3961  | 26.7916  | 24.1229  | 17.6734  | 13.6515   | 11.1534   | 12.4533   | 16.1873  | 21.0257  | 27.5869  | 31.1593  | 34.3243  | (232)            |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |           |           |           |          |          |          |          |          |                  |
| (233a)m                                                                                              | -41.7216 | -60.1746 | -87.2731 | -98.4392 | -107.9677 | -101.9747 | -101.3892 | -94.7173 | -83.0951 | -68.5137 | -46.2152 | -35.9851 | (233a)           |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |          |           |           |           |          |          |          |          |          |                  |
| (234a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (234a)           |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |          |           |           |           |          |          |          |          |          |                  |
| (235a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (235a)           |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |          |           |           |           |          |          |          |          |          |                  |
| (235c)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (235c)           |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |          |           |           |           |          |          |          |          |          |                  |
| (233b)m                                                                                              | -13.3444 | -28.5899 | -56.4813 | -84.9044 | -111.5193 | -111.2035 | -110.1363 | -94.4999 | -71.6413 | -42.8564 | -18.4652 | -10.5398 | (233b)           |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |          |           |           |           |          |          |          |          |          |                  |
| (234b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (234b)           |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |          |           |           |           |          |          |          |          |          |                  |
| (235b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (235b)           |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |          |           |           |           |          |          |          |          |          |                  |
| (235d)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | (235d)           |
| Annual totals kWh/year                                                                               |          |          |          |          |           |           |           |          |          |          |          |          |                  |
| Space heating fuel - main system 1                                                                   |          |          |          |          |           |           |           |          |          |          |          |          | 714.7739 (211)   |
| Space heating fuel - main system 2                                                                   |          |          |          |          |           |           |           |          |          |          |          |          | 0.0000 (213)     |
| Space heating fuel - secondary                                                                       |          |          |          |          |           |           |           |          |          |          |          |          | 0.0000 (215)     |
| Efficiency of water heater                                                                           |          |          |          |          |           |           |           |          |          |          |          |          | 190.5953         |
| Water heating fuel used                                                                              |          |          |          |          |           |           |           |          |          |          |          |          | 863.7619 (219)   |
| Space cooling fuel                                                                                   |          |          |          |          |           |           |           |          |          |          |          |          | 0.0000 (221)     |
| Electricity for pumps and fans:                                                                      |          |          |          |          |           |           |           |          |          |          |          |          |                  |
| (Balanced with Heat Recovery, Database: in-use factor = 1.1000, SFP = 0.9130)                        |          |          |          |          |           |           |           |          |          |          |          |          |                  |
| mechanical ventilation fans (SFP = 0.9130)                                                           |          |          |          |          |           |           |           |          |          |          |          |          | 311.7928 (230a)  |
| Total electricity for the above, kWh/year                                                            |          |          |          |          |           |           |           |          |          |          |          |          | 311.7928 (231)   |
| Electricity for lighting (calculated in Appendix L)                                                  |          |          |          |          |           |           |           |          |          |          |          |          | 269.5256 (232)   |
| Energy saving/generation technologies (Appendices M, N and Q)                                        |          |          |          |          |           |           |           |          |          |          |          |          |                  |
| PV generation                                                                                        |          |          |          |          |           |           |           |          |          |          |          |          | -1681.5702 (233) |
| Wind generation                                                                                      |          |          |          |          |           |           |           |          |          |          |          |          | 0.0000 (234)     |
| Hydro-electric generation (Appendix N)                                                               |          |          |          |          |           |           |           |          |          |          |          |          | 0.0000 (235a)    |
| Electricity generated - Micro CHP (Appendix N)                                                       |          |          |          |          |           |           |           |          |          |          |          |          | 0.0000 (235)     |
| Appendix Q - special features                                                                        |          |          |          |          |           |           |           |          |          |          |          |          |                  |
| Energy saved or generated                                                                            |          |          |          |          |           |           |           |          |          |          |          |          | -0.0000 (236)    |
| Energy used                                                                                          |          |          |          |          |           |           |           |          |          |          |          |          | 0.0000 (237)     |
| Total delivered energy for all uses                                                                  |          |          |          |          |           |           |           |          |          |          |          |          | 1133.9635 (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               | 714.7739           | 0.1579                        | 112.8378 (261)           |
| Total CO2 associated with community systems |                    |                               | 0.0000 (373)             |
| Water heating (other fuel)                  | 863.7619           | 0.1407                        | 121.5277 (264)           |
| Energy for instantaneous electric shower(s) | 655.6795           | 0.1391                        | 91.2195 (264a)           |
| Space and water heating                     |                    |                               | 234.3654 (265)           |
| Pumps, fans and electric keep-hot           | 311.7928           | 0.1387                        | 43.2495 (267)            |
| Energy for lighting                         | 269.5256           | 0.1443                        | 38.9009 (268)            |
| Energy saving/generation technologies       |                    |                               |                          |
| PV Unit electricity used in dwelling        | -927.3885          | 0.1342                        | -124.5804                |
| PV Unit electricity exported                | -754.1816          | 0.1268                        | -95.8085                 |

## Full SAP Calculation Printout



|                                                 |                 |
|-------------------------------------------------|-----------------|
| Total                                           | -219.5088 (269) |
| Total CO <sub>2</sub> , kg/year                 | 188.2265 (272)  |
| EPC Dwelling Carbon Dioxide Emission Rate (DER) | 1.6280 (273)    |

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

|                                                         | Energy kWh/year | Primary energy factor kg CO <sub>2</sub> /kWh | Primary energy kWh/year |
|---------------------------------------------------------|-----------------|-----------------------------------------------|-------------------------|
| Space heating - main system 1                           | 714.7739        | 1.5844                                        | 1132.4719 (275)         |
| Total CO <sub>2</sub> associated with community systems |                 |                                               | 0.0000 (473)            |
| Water heating (other fuel)                              | 863.7619        | 1.5202                                        | 1313.1177 (278)         |
| Energy for instantaneous electric shower(s)             | 655.6795        | 1.5143                                        | 992.9179 (278a)         |
| Space and water heating                                 |                 |                                               | 2445.5897 (279)         |
| Pumps, fans and electric keep-hot                       | 311.7928        | 1.5128                                        | 471.6802 (281)          |
| Energy for lighting                                     | 269.5256        | 1.5338                                        | 413.4073 (282)          |
| Energy saving/generation technologies                   |                 |                                               |                         |
| PV Unit electricity used in dwelling                    | -927.3885       | 1.4961                                        | -1387.5834              |
| PV Unit electricity exported                            | -754.1816       | 0.4625                                        | -348.7724               |
| Total                                                   |                 |                                               | -1736.2758 (283)        |
| Total Primary energy kWh/year                           |                 |                                               | 2587.3192 (286)         |
| Dwelling Primary energy Rate (DPER)                     |                 |                                               | 22.2280 (287)           |

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

## 1. Overall dwelling characteristics

|                                                        | Area (m <sup>2</sup> ) | Storey height (m)               | Volume (m <sup>3</sup> ) |
|--------------------------------------------------------|------------------------|---------------------------------|--------------------------|
| Ground floor                                           | 43.7500 (1b)           | x 2.4000 (2b)                   | = 105.0000 (1b) -        |
| First floor                                            | 42.2300 (1c)           | x 2.7000 (2c)                   | = 114.0210 (1c) -        |
| Second floor                                           | 30.4500 (1d)           | x 2.0000 (2d)                   | = 60.9000 (1d) -         |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) | 116.4300               |                                 | (4)                      |
| Dwelling volume                                        |                        | (3a)+(3b)+(3c)+(3d)+(3e)...(3n) | = 279.9210 (5)           |

## 2. Ventilation rate

|                                                                                               | m <sup>3</sup> per hour                 |
|-----------------------------------------------------------------------------------------------|-----------------------------------------|
| Number of open chimneys                                                                       | 0 * 80 = 0.0000 (6a)                    |
| Number of open flues                                                                          | 0 * 20 = 0.0000 (6b)                    |
| Number of chimneys / flues attached to closed fire                                            | 0 * 10 = 0.0000 (6c)                    |
| Number of flues attached to solid fuel boiler                                                 | 0 * 20 = 0.0000 (6d)                    |
| Number of flues attached to other heater                                                      | 0 * 35 = 0.0000 (6e)                    |
| Number of blocked chimneys                                                                    | 0 * 20 = 0.0000 (6f)                    |
| Number of intermittent extract fans                                                           | 4 * 10 = 40.0000 (7a)                   |
| Number of passive vents                                                                       | 0 * 10 = 0.0000 (7b)                    |
| Number of flueless gas fires                                                                  | 0 * 40 = 0.0000 (7c)                    |
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) = | 40.0000 / (5) = 0.1429 (8)              |
| Pressure test                                                                                 | Yes                                     |
| Pressure test Method                                                                          | Blower Door                             |
| Measured/design APSD                                                                          | 5.0000 (17)                             |
| Infiltration rate                                                                             | 0.3929 (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) = 0.3340 (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 | 0.4258 | 0.4175 | 0.4091 | 0.3674 | 0.3590 | 0.3173 | 0.3173 | 0.3089 | 0.3340 | 0.3590 | 0.3757 | 0.3924 (22b) |
| Effective ac    | 0.5987 | 0.5871 | 0.5837 | 0.5675 | 0.5644 | 0.5503 | 0.5503 | 0.5477 | 0.5558 | 0.5644 | 0.5706 | 0.5770 (25)  |

## 3. Heat losses and heat loss parameter

| Element | Gross | Openings | NetArea | U-value | A x U | K-value | A x K |
|---------|-------|----------|---------|---------|-------|---------|-------|
|---------|-------|----------|---------|---------|-------|---------|-------|

## Full SAP Calculation Printout



|                                                                        | m2       | m2       | m2       | W/m2K                | W/K       | kJ/m2K   | kJ/K                  |               |
|------------------------------------------------------------------------|----------|----------|----------|----------------------|-----------|----------|-----------------------|---------------|
| TER Opaque door                                                        |          |          | 2.1000   | 1.0000               | 2.1000    |          |                       | (26)          |
| TER Opening Type (Uw = 1.20)                                           |          |          | 19.7600  | 1.1450               | 22.6260   |          |                       | (27)          |
| Roof Window                                                            |          |          | 0.3900   | 1.4151               | 0.5519    |          |                       | (27a)         |
| Heat Loss Floor 1                                                      |          |          | 43.7500  | 0.1300               | 5.6875    |          |                       | (28a)         |
| GF Unsheltered EW                                                      | 54.0300  | 11.1100  | 42.9200  | 0.1800               | 7.7256    |          |                       | (29a)         |
| FF Unsheltered EW                                                      | 36.0500  | 8.4500   | 27.6000  | 0.1800               | 4.9680    |          |                       | (29a)         |
| Dormer Walls                                                           | 10.9500  | 2.3000   | 8.6500   | 0.1800               | 1.5570    |          |                       | (29a)         |
| 2F Unsheltered EW                                                      | 26.0600  |          | 26.0600  | 0.1800               | 4.6908    |          |                       | (29a)         |
| External Roof 1                                                        | 10.6300  | 0.3900   | 10.2400  | 0.1100               | 1.1264    |          |                       | (30)          |
| Flat Roof Dormer                                                       | 2.3000   |          | 2.3000   | 0.1100               | 0.2530    |          |                       | (30)          |
| External Roof 3                                                        | 11.8500  |          | 11.8500  | 0.1100               | 1.3035    |          |                       | (30)          |
| Total net area of external elements A <sub>ext</sub> (m <sup>2</sup> ) |          |          | 195.6200 |                      |           |          |                       | (31)          |
| Fabric heat loss, W/K = Sum (A x U)                                    |          |          |          | (26)...(30) + (32) = | 52.5896   |          |                       | (32)          |
| Party Wall 1                                                           |          |          | 22.0000  | 0.0000               | 0.0000    |          |                       | (32)          |
| Party Wall 2                                                           |          |          | 22.0000  | 0.0000               | 0.0000    |          |                       | (32)          |
| Party Wall 3                                                           |          |          | 10.5000  | 0.0000               | 0.0000    |          |                       | (32)          |
| Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K                      |          |          |          |                      |           |          | 276.9548              | (35)          |
| List of Thermal Bridges                                                |          |          |          | Length               | Psi-value |          | Total                 |               |
| E1 Element                                                             |          |          |          | 14.1500              | 0.0500    |          | 0.7075                |               |
| E2 Other lintels (including other steel lintels)                       |          |          |          | 11.1500              | 0.0500    |          | 0.5575                |               |
| E3 Sill                                                                |          |          |          | 31.2800              | 0.0500    |          | 1.5640                |               |
| E4 Jamb                                                                |          |          |          | 20.0000              | 0.1600    |          | 3.2000                |               |
| E5 Ground floor (normal)                                               |          |          |          | 36.9600              | 0.0000    |          | 0.0000                |               |
| E6 Intermediate floor within a dwelling                                |          |          |          | 13.8000              | 0.0000    |          | 0.0000                |               |
| E18 Party wall between dwellings                                       |          |          |          | 13.8000              | 0.0900    |          | 1.2420                |               |
| E16 Corner (normal)                                                    |          |          |          | 10.4000              | 0.0600    |          | 0.6240                |               |
| R6 Flat ceiling                                                        |          |          |          | 10.4000              | 0.0600    |          | 0.6240                |               |
| R8 Roof to wall (rafter)                                               |          |          |          | 8.1400               | 0.0000    |          | 0.0000                |               |
| P1 Party wall - Ground floor                                           |          |          |          |                      |           |          | 10.2022               | (36)          |
| Thermal bridges (Sum(L x Psi) calculated using Appendix K)             |          |          |          |                      |           |          | 0.0000                |               |
| Point Thermal bridges                                                  |          |          |          |                      |           |          | (36a) =               |               |
| Total fabric heat loss                                                 |          |          |          |                      |           |          | (33) + (36) + (36a) = | 62.7918 (37)  |
| Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)    |          |          |          |                      |           |          |                       |               |
| Jan                                                                    | 54.5610  | 54.2359  | 53.9171  | 52.4200              | 52.1399   | 50.8360  | 50.8360               | 50.5945       |
| Feb                                                                    |          |          |          |                      |           |          |                       |               |
| Mar                                                                    |          |          |          |                      |           |          |                       |               |
| Apr                                                                    |          |          |          |                      |           |          |                       |               |
| May                                                                    |          |          |          |                      |           |          |                       |               |
| Jun                                                                    |          |          |          |                      |           |          |                       |               |
| Jul                                                                    |          |          |          |                      |           |          |                       |               |
| Aug                                                                    |          |          |          |                      |           |          |                       |               |
| Sep                                                                    |          |          |          |                      |           |          |                       |               |
| Oct                                                                    |          |          |          |                      |           |          |                       |               |
| Nov                                                                    |          |          |          |                      |           |          |                       |               |
| Dec                                                                    |          |          |          |                      |           |          |                       |               |
| Heat transfer coeff                                                    | 117.3529 | 117.0277 | 116.7090 | 115.2119             | 114.9318  | 113.6278 | 113.6278              | 113.3864      |
| Average = Sum(39)m / 12 =                                              |          |          |          |                      |           |          |                       |               |
| Jan                                                                    | 1.0079   | 1.0051   | 1.0024   | 0.9895               | 0.9871    | 0.9759   | 0.9759                | 0.9739        |
| Feb                                                                    |          |          |          |                      |           |          |                       |               |
| Mar                                                                    |          |          |          |                      |           |          |                       |               |
| Apr                                                                    |          |          |          |                      |           |          |                       |               |
| May                                                                    |          |          |          |                      |           |          |                       |               |
| Jun                                                                    |          |          |          |                      |           |          |                       |               |
| Jul                                                                    |          |          |          |                      |           |          |                       |               |
| Aug                                                                    |          |          |          |                      |           |          |                       |               |
| Sep                                                                    |          |          |          |                      |           |          |                       |               |
| Oct                                                                    |          |          |          |                      |           |          |                       |               |
| Nov                                                                    |          |          |          |                      |           |          |                       |               |
| Dec                                                                    |          |          |          |                      |           |          |                       |               |
| HLP                                                                    | 31       | 28       | 31       | 30                   | 31        | 30       | 31                    | 31            |
| HLP (average)                                                          |          |          |          |                      |           |          |                       |               |
| Days in month                                                          |          |          |          |                      |           |          |                       |               |
| 4. Water heating energy requirements (kWh/year)                        |          |          |          |                      |           |          |                       |               |
| Assumed occupancy                                                      |          |          |          |                      |           |          |                       | 2.8484 (42)   |
| Hot water usage for mixer showers                                      |          |          |          |                      |           |          |                       |               |
| 71.9781                                                                | 70.8964  | 69.3202  | 66.3043  | 64.0787              | 61.5967   | 60.1860  | 61.7503               | 63.4650       |
| Hot water usage for baths                                              |          |          |          |                      |           |          |                       |               |
| 31.0762                                                                | 30.6146  | 29.9647  | 28.7664  | 27.8691              | 26.8741   | 26.3367  | 26.9820               | 27.6847       |
| Hot water usage for other uses                                         |          |          |          |                      |           |          |                       |               |
| 43.8004                                                                | 42.2077  | 40.6150  | 39.0222  | 37.4295              | 35.8367   | 35.8367  | 37.4295               | 39.0222       |
| Average daily hot water use (litres/day)                               |          |          |          |                      |           |          |                       |               |
| Jan                                                                    | 146.8547 | 143.7187 | 139.8998 | 134.0929             | 129.3772  | 124.3075 | 122.3593              | 126.1618      |
| Feb                                                                    |          |          |          |                      |           |          |                       |               |
| Mar                                                                    |          |          |          |                      |           |          |                       |               |
| Apr                                                                    |          |          |          |                      |           |          |                       |               |
| May                                                                    |          |          |          |                      |           |          |                       |               |
| Jun                                                                    |          |          |          |                      |           |          |                       |               |
| Jul                                                                    |          |          |          |                      |           |          |                       |               |
| Aug                                                                    |          |          |          |                      |           |          |                       |               |
| Sep                                                                    |          |          |          |                      |           |          |                       |               |
| Oct                                                                    |          |          |          |                      |           |          |                       |               |
| Nov                                                                    |          |          |          |                      |           |          |                       |               |
| Dec                                                                    |          |          |          |                      |           |          |                       |               |
| Daily hot water use                                                    | 232.5819 | 204.6535 | 215.0208 | 183.5665             | 174.1666  | 152.8506 | 147.9830              | 156.2146      |
| Energy cont                                                            |          |          |          |                      |           |          |                       |               |
| Energy content (annual)                                                |          |          |          |                      |           |          |                       |               |
| Distribution loss (46)m = 0.15 x (45)m                                 |          |          |          |                      |           |          |                       |               |
| 34.8873                                                                | 30.6080  | 32.2531  | 27.5350  | 26.1250              | 22.9276   | 22.1975  | 23.4322               | 24.8773       |
| 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 (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               | 22.1368       |
| If cylinder contains dedicated solar storage                           |          |          |          |                      |           |          |                       |               |
| 22.8747                                                                | 20.6610  | 22.8747  | 22.1368  | 22.8747              | 22.1368   | 22.8747  | 22.1368               | 22.8747       |
| Primary loss                                                           | 23.2624  | 21.0112  | 23.2624  | 22.5120              | 23.2624   | 22.5120  | 23.2624               | 22.5120       |
| Combi loss                                                             | 0.0000   | 0.0000   | 0.0000   | 0.0000               | 0.0000    | 0.0000   | 0.0000                | 0.0000        |
| Total heat required for water heating calculated for each month        | 278.7190 | 246.3257 | 261.1579 | 228.2153             | 220.3037  | 197.4094 | 194.1201              | 202.3517      |
| WARRS                                                                  | -32.9054 | -29.1018 | -30.4737 | -25.2334             | -23.5167  | -20.1234 | -18.8625              | -20.0583      |
| PV diverter                                                            | -0.0000  | -0.0000  | -0.0000  | -0.0000              | -0.0000   | -0.0000  | -0.0000               | -0.0000       |
| Solar input                                                            | 0.0000   | 0.0000   | 0.0000   | 0.0000               | 0.0000    | 0.0000   | 0.0000                | 0.0000        |
| FGRRS                                                                  | 0.0000   | 0.0000   | 0.0000   | 0.0000               | 0.0000    | 0.0000   | 0.0000                | 0.0000        |
| Output from w/h                                                        | 245.8136 | 217.2240 | 230.6842 | 202.9818             | 196.7870  | 177.3760 | 175.2576              | 182.2934      |
| Total per year (kWh/year)                                              |          |          |          |                      |           |          |                       |               |
| Electric shower(s)                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000               | 0.0000    | 0.0000   | 0.0000                | 0.0000        |
| Heat gains from water heating, kWh/month                               | 114.2431 | 101.3851 | 108.4041 | 96.7549              | 94.8201   | 86.5419  | 86.1140               | 88.8510       |

## Full SAP Calculation Printout



## 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                                                                               | 142.4199  | 142.4199  | 142.4199  | 142.4199  | 142.4199  | 142.4199  | 142.4199  | 142.4199  | 142.4199  | 142.4199  | 142.4199  | 142.4199 (66)  |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5     | 145.3496  | 145.3496  | 145.3496  | 145.3496  | 145.3496  | 145.3496  | 145.3496  | 145.3496  | 145.3496  | 145.3496  | 145.3496  | 145.3496 (67)  |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | 280.4899  | 280.4899  | 280.4899  | 280.4899  | 280.4899  | 280.4899  | 280.4899  | 280.4899  | 280.4899  | 280.4899  | 280.4899  | 280.4899 (68)  |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5    | 37.2420   | 37.2420   | 37.2420   | 37.2420   | 37.2420   | 37.2420   | 37.2420   | 37.2420   | 37.2420   | 37.2420   | 37.2420   | 37.2420 (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)                                 | -113.9359 | -113.9359 | -113.9359 | -113.9359 | -113.9359 | -113.9359 | -113.9359 | -113.9359 | -113.9359 | -113.9359 | -113.9359 | -113.9359 (71) |
| Water heating gains (Table 5)                                                       | 153.5526  | 153.5526  | 153.5526  | 153.5526  | 153.5526  | 153.5526  | 153.5526  | 153.5526  | 153.5526  | 153.5526  | 153.5526  | 153.5526 (72)  |
| Total internal gains                                                                | 648.1181  | 648.1181  | 648.1181  | 648.1181  | 648.1181  | 648.1181  | 648.1181  | 648.1181  | 648.1181  | 648.1181  | 648.1181  | 648.1181 (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 | 3.9100                 | 11.2829                                    | 0.6300                            | 0.7000                             | 0.7700                       | 13.4825 (75) |
| Southeast | 8.8900                 | 36.7938                                    | 0.6300                            | 0.7000                             | 0.7700                       | 98.9694 (77) |
| South     | 5.9500                 | 46.7521                                    | 0.6300                            | 0.7000                             | 0.7700                       | 85.8138 (78) |
| Northwest | 1.8100                 | 11.2829                                    | 0.6300                            | 0.7000                             | 0.7700                       | 6.2413 (81)  |
| Northwest | 0.3900                 | 16.3666                                    | 0.6300                            | 0.7000                             | 1.8000                       | 2.5334 (82)  |

|             |          |           |           |           |           |           |           |           |           |          |          |               |
|-------------|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|----------|---------------|
| Solar gains | 198.2404 | 330.5477  | 471.3223  | 598.1751  | 685.0438  | 687.2630  | 659.5686  | 593.2946  | 514.8281  | 376.9185 | 237.7442 | 169.4830 (83) |
| Total gains | 846.3585 | 1088.6676 | 1187.1682 | 1211.9288 | 1267.3064 | 1245.5961 | 1196.2284 | 1130.7226 | 1068.7488 | 952.6527 | 848.8880 | 803.7775 (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                                                                         | 76.3269      | 76.5390 | 76.7480 | 77.7453 | 77.9348 | 78.8291 | 78.8291 | 78.9970 | 78.4822 | 77.9348 | 77.5524 | 77.1567      |
| alpha                                                                       | 6.0885       | 6.1026  | 6.1165  | 6.1830  | 6.1957  | 6.2553  | 6.2553  | 6.2665  | 6.2321  | 6.1957  | 6.1702  | 6.1438       |
| util living area                                                            | 0.9966       | 0.9899  | 0.9729  | 0.9133  | 0.7783  | 0.5753  | 0.4169  | 0.4593  | 0.7044  | 0.9381  | 0.9907  | 0.9975 (86)  |
| MIT                                                                         | 20.8298      | 20.2254 | 20.4649 | 20.7496 | 20.9280 | 20.9907 | 20.9989 | 20.9981 | 20.9697 | 20.7370 | 20.3338 | 19.9999 (87) |
| Th 2                                                                        | 20.8767      | 20.8791 | 20.8813 | 20.8921 | 20.8941 | 20.8934 | 20.8934 | 20.8952 | 20.8998 | 20.8941 | 20.8900 | 20.8858 (88) |
| util rest of house                                                          | 0.9954       | 0.9864  | 0.9636  | 0.8860  | 0.7222  | 0.4987  | 0.3326  | 0.3711  | 0.6258  | 0.9122  | 0.9868  | 0.9966 (89)  |
| MIT 2                                                                       | 18.9514      | 19.2815 | 19.5829 | 19.8507 | 20.0387 | 20.0987 | 20.1031 | 20.1046 | 20.0819 | 19.8454 | 19.3490 | 18.9282 (90) |
| Living area fraction                                                        | 19.0626      | 19.3070 | 19.6020 | 19.9434 | 20.1384 | 20.1906 | 20.1955 | 20.1967 | 20.1734 | 19.9373 | 19.4585 | 19.0315 (91) |
| MIT                                                                         | 19.0626      | 19.3070 | 19.6020 | 19.9434 | 20.1384 | 20.1906 | 20.1955 | 20.1967 | 20.1734 | 19.9373 | 19.4585 | 19.0315 (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       |
| adjusted MIT                                                                | 19.0626      | 19.3070 | 19.6020 | 19.9434 | 20.1384 | 20.1906 | 20.1955 | 20.1967 | 20.1734 | 19.9373 | 19.4585 | 19.0315 (93) |

## 8. Space heating requirement

|                                                                                | Jan                        | Feb       | Mar       | Apr       | May      | Jun      | Jul      | Aug      | Sep      | Oct       | Nov       | Dec            |
|--------------------------------------------------------------------------------|----------------------------|-----------|-----------|-----------|----------|----------|----------|----------|----------|-----------|-----------|----------------|
| Utilisation                                                                    | 0.9934                     | 0.9825    | 0.9574    | 0.8888    | 0.7247   | 0.5063   | 0.3413   | 0.3882   | 0.6325   | 0.9067    | 0.9831    | 0.9950 (94)    |
| Useful gains                                                                   | 840.8081                   | 985.9074  | 1060.8367 | 1067.4826 | 918.3621 | 630.6059 | 408.2194 | 429.8618 | 676.8136 | 863.8006  | 834.5656  | 799.7850 (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                                                               | 1732.4321                  | 1686.8200 | 1529.1216 | 1272.3296 | 968.9199 | 635.2533 | 408.5440 | 430.4900 | 693.1590 | 1073.1535 | 1426.4651 | 1721.7987 (97) |
| Space heating kWh                                                              | 663.3742                   | 470.4757  | 348.9991  | 147.4898  | 37.6150  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 155.7586  | 426.1677  | 685.9782 (98a) |
| Space heating requirement - total per year (kWh/year)                          | 2935.8583                  |           |           |           |          |          |          |          |          |           |           |                |
| Solar heating kWh                                                              | 0.0000                     | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000 (98b)   |
| Solar heating contribution - total per year (kWh/year)                         | 0.0000                     |           |           |           |          |          |          |          |          |           |           |                |
| Space heating kWh                                                              | 663.3742                   | 470.4757  | 348.9991  | 147.4898  | 37.6150  | 0.0000   | 0.0000   | 0.0000   | 0.0000   | 155.7586  | 426.1677  | 685.9782 (98c) |
| Space heating requirement after solar contribution - total per year (kWh/year) | 2935.8583                  |           |           |           |          |          |          |          |          |           |           |                |
| Space heating per m2                                                           | (98c) / (4) = 25.2157 (99) |           |           |           |          |          |          |          |          |           |           |                |

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

|                                                                       |              |
|-----------------------------------------------------------------------|--------------|
| Fraction of space heat from secondary/supplementary system (Table 11) | 0.0000 (201) |
|-----------------------------------------------------------------------|--------------|

## Full SAP Calculation Printout



|                                                         |               |
|---------------------------------------------------------|---------------|
| Fraction of space heat from main system(s)              | 1.0000 (202)  |
| Efficiency of main space heating system 1 (in %)        | 92.3000 (206) |
| Efficiency of main space heating system 2 (in %)        | 0.0000 (207)  |
| Efficiency of secondary/supplementary heating system, % | 0.0000 (208)  |

|                                                                                                      | Jan      | Feb      | Mar      | Apr       | May       | Jun       | Jul       | Aug       | Sep       | Oct      | Nov      | Dec      |                  |
|------------------------------------------------------------------------------------------------------|----------|----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|----------|----------|----------|------------------|
| Space heating requirement                                                                            | 663.3742 | 470.4757 | 348.9991 | 147.4898  | 37.6150   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 155.7586 | 426.1677 | 685.9782 | (98)             |
| Space heating efficiency (main heating system 1)                                                     | 92.3000  | 92.3000  | 92.3000  | 92.3000   | 92.3000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 92.3000  | 92.3000  | 92.3000  | (210)            |
| Space heating fuel (main heating system)                                                             | 718.7153 | 509.7245 | 378.1139 | 159.7940  | 40.7530   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 168.7525 | 461.7201 | 743.2050 | (211)            |
| Space heating efficiency (main heating system 2)                                                     | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | (212)            |
| Space heating fuel (main heating system 2)                                                           | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | (213)            |
| Space heating fuel (secondary)                                                                       | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | (215)            |
| Water heating                                                                                        |          |          |          |           |           |           |           |           |           |          |          |          |                  |
| Water heating requirement                                                                            | 245.8136 | 217.2240 | 230.6842 | 202.9818  | 196.7870  | 177.3760  | 175.2576  | 182.2934  | 184.3434  | 205.4565 | 218.2792 | 243.1837 | (64)             |
| Efficiency of water heater                                                                           |          |          |          |           |           |           |           |           |           |          |          |          | (216)            |
| (217)m                                                                                               | 86.1724  | 85.7454  | 84.9857  | 83.3553   | 81.1193   | 79.8000   | 79.8000   | 79.8000   | 79.8000   | 83.4469  | 85.5326  | 86.2540  | (217)            |
| Fuel for water heating, kWh/month                                                                    | 285.2580 | 253.3361 | 271.4388 | 243.5141  | 242.5896  | 222.2757  | 219.6211  | 228.4378  | 231.0068  | 246.2123 | 255.1999 | 281.9391 | (219)            |
| Space cooling fuel requirement                                                                       |          |          |          |           |           |           |           |           |           |          |          |          |                  |
| (221)m                                                                                               | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | (221)            |
| Pumps and Fa                                                                                         | 7.3041   | 6.5973   | 7.3041   | 7.0685    | 7.3041    | 7.0685    | 7.3041    | 7.3041    | 7.0685    | 7.3041   | 7.0685   | 7.3041   | (231)            |
| Lighting                                                                                             | 30.2008  | 24.2282  | 21.8148  | 15.9825   | 12.3453   | 10.0862   | 11.2618   | 14.6385   | 19.0140   | 24.9474  | 28.1780  | 31.0402  | (232)            |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |           |           |           |           |           |           |          |          |          |                  |
| (233a)m                                                                                              | -42.0597 | -50.8872 | -86.9122 | -98.6608  | -107.1332 | -100.2028 | -98.9859  | -92.9762  | -82.6805  | -68.8464 | -46.4262 | -36.2892 | (233a)           |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |           |           |           |           |           |           |          |          |          |                  |
| (234a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | (234a)           |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |           |           |           |           |           |           |          |          |          |                  |
| (235a)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | (235a)           |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |           |           |           |           |           |           |          |          |          |                  |
| (235c)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | (235c)           |
| Electricity generated by PVs (Appendix M) (negative quantity)                                        |          |          |          |           |           |           |           |           |           |          |          |          |                  |
| (233b)m                                                                                              | -21.9989 | -46.4710 | -92.7424 | -139.8655 | -185.5256 | -186.6805 | -184.5455 | -156.0392 | -114.0450 | -66.7207 | -29.4519 | -17.3868 | (233b)           |
| Electricity generated by wind turbines (Appendix M) (negative quantity)                              |          |          |          |           |           |           |           |           |           |          |          |          |                  |
| (234b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | (234b)           |
| Electricity generated by hydro-electric generators (Appendix M) (negative quantity)                  |          |          |          |           |           |           |           |           |           |          |          |          |                  |
| (235b)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | (235b)           |
| Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) |          |          |          |           |           |           |           |           |           |          |          |          |                  |
| (235d)m                                                                                              | 0.0000   | 0.0000   | 0.0000   | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000    | 0.0000   | 0.0000   | 0.0000   | (235d)           |
| Annual totals kWh/year                                                                               |          |          |          |           |           |           |           |           |           |          |          |          |                  |
| Space heating fuel - main system 1                                                                   |          |          |          |           |           |           |           |           |           |          |          |          | 3180.7782 (211)  |
| Space heating fuel - main system 2                                                                   |          |          |          |           |           |           |           |           |           |          |          |          | 0.0000 (213)     |
| Space heating fuel - secondary                                                                       |          |          |          |           |           |           |           |           |           |          |          |          | 0.0000 (215)     |
| Efficiency of water heater                                                                           |          |          |          |           |           |           |           |           |           |          |          |          | 79.8000          |
| Water heating fuel used                                                                              |          |          |          |           |           |           |           |           |           |          |          |          | 2900.8292 (219)  |
| Space cooling fuel                                                                                   |          |          |          |           |           |           |           |           |           |          |          |          | 0.0000 (221)     |
| Electricity for pumps and fans:                                                                      |          |          |          |           |           |           |           |           |           |          |          |          |                  |
| Total electricity for the above, kWh/year                                                            |          |          |          |           |           |           |           |           |           |          |          |          | 86.0000 (231)    |
| Electricity for lighting (calculated in Appendix L)                                                  |          |          |          |           |           |           |           |           |           |          |          |          | 243.7376 (232)   |
| Energy saving/generation technologies (Appendices M, N and Q)                                        |          |          |          |           |           |           |           |           |           |          |          |          |                  |
| PV generation                                                                                        |          |          |          |           |           |           |           |           |           |          |          |          | -2162.4534 (233) |
| Wind generation                                                                                      |          |          |          |           |           |           |           |           |           |          |          |          | 0.0000 (234)     |
| Hydro-electric generation (Appendix N)                                                               |          |          |          |           |           |           |           |           |           |          |          |          | 0.0000 (235a)    |
| Electricity generated - Micro CHP (Appendix N)                                                       |          |          |          |           |           |           |           |           |           |          |          |          | 0.0000 (235)     |
| Appendix Q - special features                                                                        |          |          |          |           |           |           |           |           |           |          |          |          |                  |
| Energy saved or generated                                                                            |          |          |          |           |           |           |           |           |           |          |          |          | -0.0000 (236)    |
| Energy used                                                                                          |          |          |          |           |           |           |           |           |           |          |          |          | 0.0000 (237)     |
| Total delivered energy for all uses                                                                  |          |          |          |           |           |           |           |           |           |          |          |          | 4328.8917 (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                 | 3180.7782          | 0.2100                        | 667.9634                 | (261) |
| Total CO2 associated with community systems   |                    |                               | 0.0000                   | (373) |
| Water heating (other fuel)                    | 2900.8292          | 0.2100                        | 609.1741                 | (264) |
| Space and water heating                       |                    |                               | 1293.9376                | (265) |
| Pumps, fans and electric keep-hot             | 86.0000            | 0.1387                        | 11.9293                  | (267) |
| Energy for lighting                           | 243.7376           | 0.1443                        | 35.1780                  | (268) |
| Energy saving/generation technologies         |                    |                               |                          |       |
| PV Unit electricity used in dwelling          | -920.9002          | 0.1344                        | -123.7772                |       |
| PV Unit electricity exported                  | -1241.4731         | 0.1258                        | -156.1364                |       |
| Total                                         |                    |                               | -279.9136                | (269) |
| Total CO2, kg/year                            |                    |                               | 1061.1321                | (272) |
| EPC Target Carbon Dioxide Emission Rate (TER) |                    |                               | 9.1100                   | (273) |

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

|  | Energy Primary energy factor | Primary energy |
|--|------------------------------|----------------|
|--|------------------------------|----------------|

# Full SAP Calculation Printout



|                                             | kWh/year   | kg CO2/kWh | kWh/year         |
|---------------------------------------------|------------|------------|------------------|
| Space heating - main system 1               | 3180.7782  | 1.1300     | 3594.2794 (275)  |
| Total CO2 associated with community systems |            |            | 0.0000 (473)     |
| Water heating (other fuel)                  | 2980.8292  | 1.1300     | 3368.3370 (278)  |
| Space and water heating                     |            |            | 6962.6164 (279)  |
| Pumps, fans and electric keep-hot           | 86.0000    | 1.5128     | 130.1008 (281)   |
| Energy for lighting                         | 243.7376   | 1.5338     | 373.8529 (282)   |
| Energy saving/generation technologies       |            |            |                  |
| PV Unit electricity used in dwelling        | -920.9802  | 1.4067     | -1378.4301       |
| PV Unit electricity exported                | -1241.4731 | 0.4616     | -573.1195        |
| Total                                       |            |            | -1951.5496 (283) |
| Total Primary energy kWh/year               |            |            | 5515.0205 (286)  |
| Target Primary Energy Rate (TPIR)           |            |            | 47.3700 (287)    |



SRE Registered Office | Greenforde Farm

Stoner Hill Road | Froxfield

Petersfield | Hampshire | GU32 1DY

01730 710044

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

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