
Energy & Sustainability Statement

Walled Garden
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Revision Log

Section	Revision	Author	Reviewer	Issue	Date
All	-	F. G	R. B	Issue 1	30/07/24

1 Executive Summary

Mesh Energy have been appointed to produce a Sustainability Statement to support the Planning Application for the proposed new dwelling development within a derelict walled garden within the Temple Dinsley Registered Park & Garden.

This report outlines the sustainable features to be incorporated into the design of the building to improve the overall environmental performance through both good building design and the implementation of renewable technologies.

The proposed design achieves energy efficiency through ‘Fabric-first’ approach, whereby household carbon emissions are cut via a more efficient use of energy by the dwelling in question and to encourage that part of this reduction is achieved by using low carbon technologies.

This report concludes that fabric efficiency measures in conjunction with a suitably sized ground source heat pump (GSHP) is the most desirable energy strategy option for the development, and offers a significant reduction in CO₂ emissions, along with the additional energy savings through technologies like mechanical ventilation and heat recovery (MVHR) and solar photovoltaics.

Energy & carbon calculations have been carried out using SAP 10. While the new building regulations have raised the bar on the minimum performance of buildings, the results summarised in the table below demonstrate that the proposed design is a substantial improvement on the minimum standards for new buildings. The figures below demonstrate:

- An emission rate improvement of 89.24% compared to notional building.
- Primary energy rating 81.97% better than notional building.

Below table shows the SAP 10 results for the proposed Walled Garden dwelling.

Emission Rating		Energy Rating		Fabric Rating	
Target Emission Rate (TER)	7.25	Target Primary Energy Rating (TPER)	44.51	Target Fabric Energy Efficiency	58.12
Dwelling Emission Rate (DER)	0.78	Dwelling Primary Energy Rating (DPER)	8.02	Dwelling Fabric Energy Efficiency	56.77
SAP Rating	96A	CO ₂ Emissions (t/year)	0.63	Environmental	99A

2 Introduction

This report has been prepared by Mesh Energy as an energy statement for the proposed development at Walled Garden, Hertfordshire. Full planning permission is sought for the development. This document will be considered as part of the planning application.

Government policies now require significant energy reductions from proposed buildings. Building a greener future sets a planned trajectory outlined via Part L 2021 of the Building Regulations. These commitments have been the key focus point in addressing policies and strategies to reduce energy use and carbon emissions through energy efficiency and low or zero carbon technologies (LZC).

The recommended strategy takes into consideration the site layout and requirements for the building to produce a design that incorporates the most appropriate technologies available to the site, whilst targeting compliance with building regulations.

2.1 Overview

Mesh Energy are working closely on Walled Garden to recommend the best energy strategy in terms of efficiency and carbon reduction.

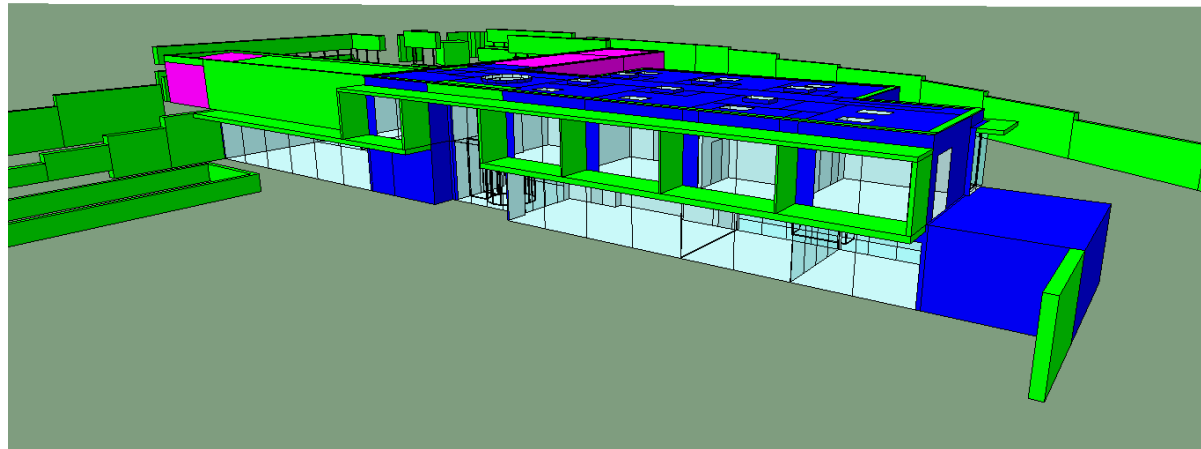


Figure 1: IES dynamic thermal model of the property

The energy strategy comprises of the following:

1. 'Fabric-First' U-values to achieve RIBA 2030 sustainable outcomes
2. Ground Source Heat Pump with a borehole collector
3. Mechanical Ventilation with Heat Recovery
4. Solar Photovoltaics & Battery
5. Energy efficient LED lighting where applicable

The Energy Strategy consists of passive design and energy efficient measures such as the provision of energy efficient lighting, the provision of time and temperature zone heating controls.

The use of further/ emerging technologies may be included for use within this development if their feasibility increases in the future, in line with best practice.

3 Planning Policy

3.1 National Policy (NPPF)

The National Planning Policy Framework (NPPF) was published on 27 March 2012 with updates in June 2019 and more recently, December 2023. This document sets the overarching policies for development in England and states that:

‘So that sustainable development is pursued in a positive way, at the heart of the Framework is a presumption in favour of sustainable development.’ (NPPF, 2023).

Paragraph 11 states: ‘... promote a sustainable pattern of development that seeks to: meet the development needs of their area; align growth and infrastructure; improve the environment; mitigate climate change (including by making effective use of land in urban areas) and adapt to its effects’.

Paragraph 157 - *The planning system should support the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change. It should help to: shape places in ways that contribute to radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience; encourage the reuse of existing resources, including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure.*

Paragraph 159 - *New development should be planned for in ways that:*

- a) *avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure; and*
- b) *can help to reduce greenhouse gas emissions, such as through its location, orientation and design. Any local requirements for the sustainability of buildings should reflect the Government’s policy for national technical standards.*

Paragraph 162 - *In determining planning applications, local planning authorities should expect new development to:*

- a) *comply with any development plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable; and*
- b) *take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.*

Paragraph 164 - *In determining planning applications, local planning authorities should give significant weight to the need to support energy efficiency and low carbon heating improvements to existing buildings, both domestic and non-domestic (including through installation of heat pumps and solar panels where these do not already benefit from permitted development rights). Where the proposals would affect conservation areas, listed buildings or other relevant designated heritage assets, local planning authorities should also apply the policies set out in chapter 16 of this Framework.*

3.2 North Herts District Local Plan

3.2.1 Policy SP9: Design and Sustainability

Policy SD9 states: ‘... *The Council considers good design to be a key aspect of sustainable development. We will:*

- d) *Ensure Strategic Masterplans are informed by a technical and design evidence base and include the following for Strategic Housing Sites and where applicable for other significant development:*
 - vi. *Sustainability & Energy Framework identifying site-wide and building scale opportunities for low and zero carbon.’*

3.2.2 Policy NE12: Design and Sustainability

Policy NE12 states about Renewable Energy: ‘... *Schemes can serve a single building or a whole community. Although development proposals for renewable and low carbon energy will be supported in appropriate locations, it is also important that development proposals incorporate energy efficient measures to help reduce the demand for energy in the first place.’*

3.3 Proposed Design Principles

Following principles are being followed for the proposed design.

3.3.1 Sustainable Development

Walled Garden delivers the vision and objectives, and principles in the district and thereby delivers sustainable development. This includes maximising passive solar shading, lighting, natural ventilation, and high-performance glazing. The dwellings consider orientation and solar gains in addressing energy and carbon concerns.

3.3.2 Climate Change

Walled Garden mitigates and adapts climate change in variety of ways:

- RIBA 2030 building fabric U-values which aligns closely with passive house standards.
- Adopting higher water efficiency standards to contribute to alleviating water stress across the district.
- Mitigating the urban heat island effect by employing green roofs.
- Integrating renewable technologies throughout the house.

4 Energy Efficiency Methodology

4.1 Analysis and Methodology

The report will aim to demonstrate the most feasible strategy for achieving CO₂ emissions and energy consumption reductions.

The aspirations targets on reducing energy demand and implement energy-efficiency measures in-line with the Energy Hierarchy, and that developments provide some of their energy demand from renewable or low carbon technologies.

The first stage of addressing the Energy Hierarchy is to establish the baseline energy demand and carbon emissions.

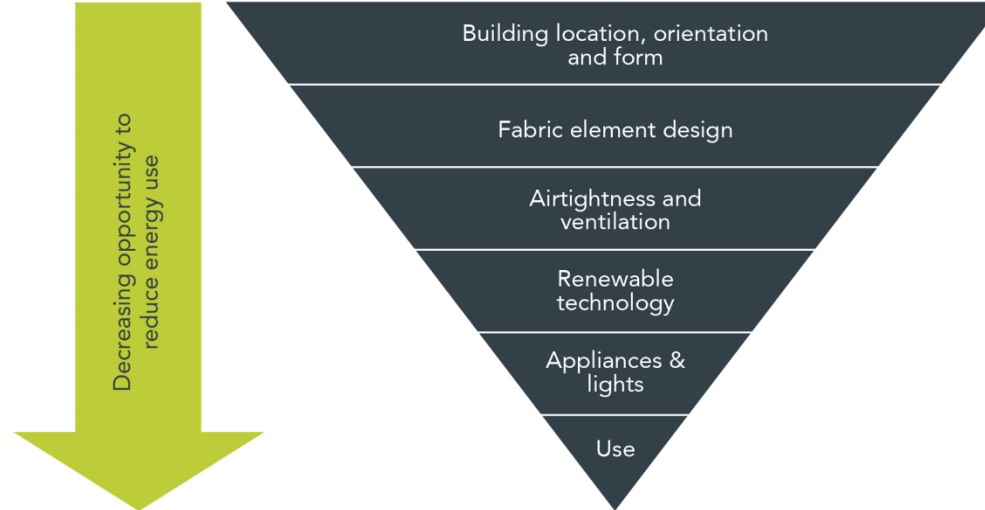


Figure 2: The Energy Hierarchy

- Step 1: Reduce elemental building fabric heat loss
- Step 2: Reduce unnecessary ventilation and air heat losses
- Step 3: Harvest energy more efficiently to heat home and produce hot water
- Step 4: Incorporate micro-generation to generate electricity and power efficient technology
- Step 5: Store surplus locally generated electricity to reduce imported electricity from the grid

This strategy is based on upon planning-stage SAP calculations undertaken on a drawing of the newly proposed dwelling, to provide a reasonable estimation for energy demand and carbon emissions at this stage.

It should be noted that these calculations are to inform the Planning Application only and should not be used for Building Control purposes. A baseline calculation of CO₂ emissions using the Target Emissions Rate for the new dwellings has been conducted and forms the basis of the energy and carbon savings detailed in this report.

4.2 Establishing the baseline CO₂ Emissions

As discussed above, this report establishes a baseline assessment of the energy demands and associated CO₂ emissions for the proposed development.

A planning stage SAP calculation of the proposed development has been used for the energy assessment. Elmhurst SAP 10 has been used to model the dwelling.

The geometry of the dwelling has been measured based on the following Band Architects latest drawings:

- Proposed Lower Ground Floor Plan, July 2024
- Proposed Ground Floor Plan, July 2024
- Proposed Roof Plan, July 2024
- Proposed Elevations, July 2024
- Proposed Sections, July 2024

4.3 Baseline CO₂ Emissions Methodology

To establish the baseline carbon emissions and energy demand for the development, the Target Emissions Rate as calculated in SAP has been used to model a 'base case scenario' for each element. The notional building fabric from Part L have been used as a performance standard.

4.4 Fabric First

To ensure that the sustainable aspirations of the development are met, the design team have improved U-values beyond that of the Notional Building. It is proposed to follow RIBA 2030 U-values. This will also ensure compliance with Part L of the Building Regulations.

5 Sustainable Design

5.1 Minimising Carbon Emissions

The proposed design aims to significantly reduce the energy/resource consumption by:

- Constructing to a high standard (beyond regulations) of building fabric performance.
- Prioritising low carbon materials such as recycled aggregates, blended cements, admixtures, and steel or hemp fibre. Locally source materials would also be given priority.
- Utilising low and zero carbon (LZC) technologies and or systems such as ground source heat pump and solar photovoltaics.
- Heat Pumps (GSHP) to provide hot water, heating, and cooling.
- Using mechanical ventilation and heat recovery to save space heating energy and maintain good indoor air quality during the heating season.
- Using low-flow fixtures and fittings to reduce potable (drinking) water consumption.

5.1.1 Building Fabric Performance

A ‘fabric first’ approach to building design involves maximising the performance of the components and materials that make up the building fabric itself, before considering the use of mechanical or electrical building services systems. This can help reduce capital and operational costs, improve energy efficiency, and reduce CO₂ emissions through methods such as:

- Maximising airtightness.
- Using super-high insulation.
- Optimising solar gain through the provision of opening and shading.
- Optimising natural ventilation.
- Using thermal mass of the building fabric.
- Using energy from occupants, electronic devices, cookers and so on.

Construction Element	Building Regulations Limiting Fabric Parameters, (W/m²K)	Proposed Fabric Parameters, (W/m²K)
Ground floors	0.18	0.10
External Walls	0.26	0.10
Roof	0.16	0.10
Windows	1.60	0.80
External doors	1.60	1.0
Infiltration Rate	8m³/h.m²@50Pa	0.6m³/h.m²@50Pa

5.2 Low Carbon and Energy Technology Feasibility Summary

Technology	Energy Generation	Physical, Spatial & Land Use Impact	Noise Impact	Sustainability of technology	Feasible?
Wind Turbine	Electric	Are wind speeds at least 6 m/s for stand-alone or at least 3.5m/s for small scale? Is the area free from obstructions that could cause local wind turbulence?	Wind turbines generate noise that can be heard up to a few hundred metres away. However, this level is normal only marginal greater than the actual wind noise itself.	Average windspeed at site is 3.68m/s which is slightly above the requirements for small scale. A wind turbine would not be acceptable for visual amenity.	✗
Solar Photovoltaics	Electric	Will the buildings have an east to west (through south) facing roof or flat roof? Are roofs free from over shadowing for most of the day from buildings or other structures?	None	The installation of solar PV meets the requirement in energy production	✓
Solar thermal	Hot Water	Will the buildings have a year-round demand for hot water? Will the buildings have an open aspect southeast to southwest facing roof of at least 4m2? Is space available for hot water cylinder near the panels? Is the building in a conservation area?	None	Solar hot water works best when the panels can be located close to the water storage therefore, run distance to lower flats makes it impractical	✗
Biomass	Heat and hot water	Is there a local supply and space for storage of biomass fuel or can one be set up? Is a	Normal noises associated with boiler plant. Potential additional noise	This is not suitable for the site because of the size of the systems and storage of fuel.	✗

Technology	Energy Generation	Physical, Spatial & Land Use Impact	Noise Impact	Sustainability of technology	Feasible?
		room heater or boiler required?	generation associates with the fuel deliveries.		
Air-source heat pump	Heat and hot water	Is there space for siting the heat pump, including the desired room for air movement?	Minimal external noise	Concerns about visual amenity	✗
Ground-source heat pump	Heat and hot water	Will there be room for a horizontal buried pipe? Is the ground suitable for vertical pipe system?	No external noise	There is sufficient space for the GSHP boreholes infrastructure.	✓
Combined heat and power	Heat and hot water	CHP works well with a large demand (large plots) to create more electricity generation, as the boiler itself is not that efficient with small demand requirements.	Normal noises associated with boiler plant	The size of the dwelling within this development makes the installation of CHP plant inefficient	✗

5.3 Low Carbon and Energy Design

A low energy design has been the aspiration from the beginning and has adopted the following strategies:

- The design maximises a passive solution by optimizing the orientation as well as providing a highly insulated and a highly airtight dwelling.
- With a Fabric First approach, the thermal performance of the building fabric targets a significant improvement on current Building Regulations Part L (2021).
- Mixed mode ventilation strategy with mechanical heat recovery will be adapted for the whole dwelling; openable windows will also be provided for natural cooling, which is highly recommended for residential properties.
- A new highly efficient (at least 400%) centralised GSHP will provide space heating throughout the property and cooling to select areas only.
- The GSHP will provide domestic hot water supplied to highly insulated storage.
- A solar PV array will meet the expected loads of the property.

5.4 Mechanical Ventilation and Heat Recovery (MVHR)

5.4.1 Technology Introduction

An MVHR unit operates by utilising a network of concealed ducting to recover heat produced within a property from lighting, cooking, general electrical appliances, heating systems and occupants. This recovered heat is then used to warm up incoming cooler fresh air.

5.4.2 The benefits of MVHR

The installation of an MVHR system will reduce the annual consumption of the home by 13%, while maintaining good indoor air quality during the heating season.

5.5 Underfloor heating

5.5.1 Technology Introduction

Low central heating flow temperatures allow heating systems to operate more efficiently. This is particularly true when installing heat pump technology, which works best with flow temperatures of between 35-45°C. Heat loss calculations have confirmed that the most appropriate flow temperature for the central heating system at this property is 40°C.

5.6 Ground Source Heat Pumps

5.6.1 Technology Introduction

Ground source heating uses electricity to convert energy gathered from the ground into low temperature water for domestic heating and hot water use. The energy is collected externally via horizontal loops buried beneath the ground or alternatively by vertical boreholes (to a depth of 100m) if space is restricted. The size of the collector array required is influenced by the size of the heat pump, the expected full load equivalent run hours of the heat pump and the ground conditions.

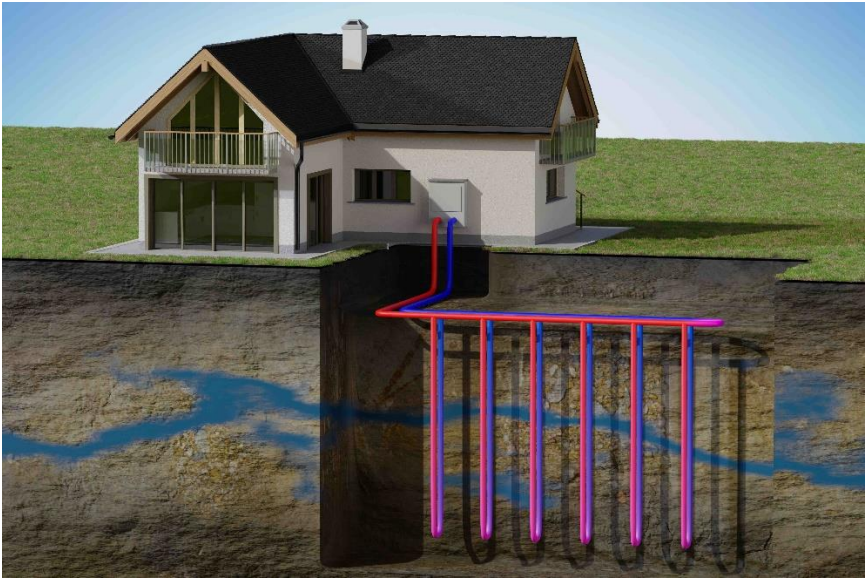


Figure 3: Diagrammatic GSHP horizontal collector design

Externally this property is estimated to need approx. 5 number of boreholes. This property has ample space for this type of ground collector which can be installed nearer to the property.

Internally the heat pump unit which converts the low-grade energy from the outdoor ground collector to higher temperature heating water will be located within the dedicated plant room. The further addition of a buffer cylinder is also required to regulate heating water distribution and maximise system efficiency and running costs. The domestic hot water cylinder will be in the plant room as well.

5.7 Solar Photovoltaics

5.7.1 Technology Introduction

Solar photovoltaic panels are employed to reduce the amount of energy used by the household from the main electricity network and in turn reduce the overall electricity bill for the home. Photovoltaic systems have minimal internal components to consider and can easily be integrated into the home electricity supply.

5.7.2 Installation Considerations

The most suitable location for a solar PV array is illustrated in Figure 4 Usually, the limiting factor on solar PV at this site is the availability of suitable roof space and visual amenity. The potential roof space discussed should be orientated towards South and unshaded. 445W panels have been used to be installed on the flat roof. The flat would allow up to 36 panels, which equates to 16.2kWp of installed capacity. In this position annual generation is estimated to be 784.26kWh/kWp.

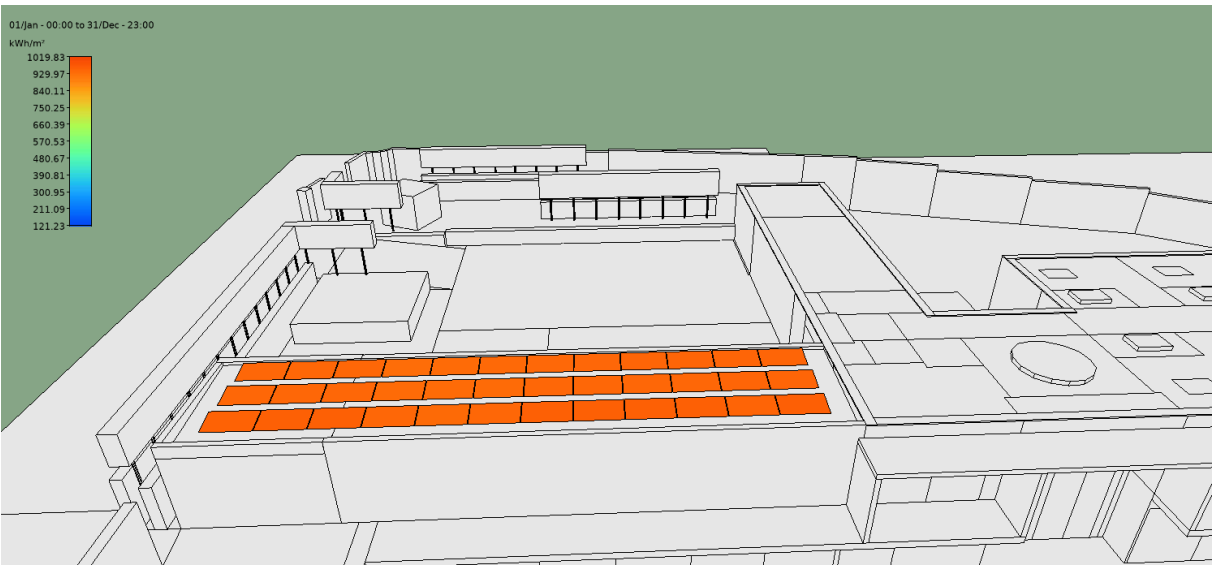


Figure 4: Solar PV array indicating the potential annual energy (kWh/m2)

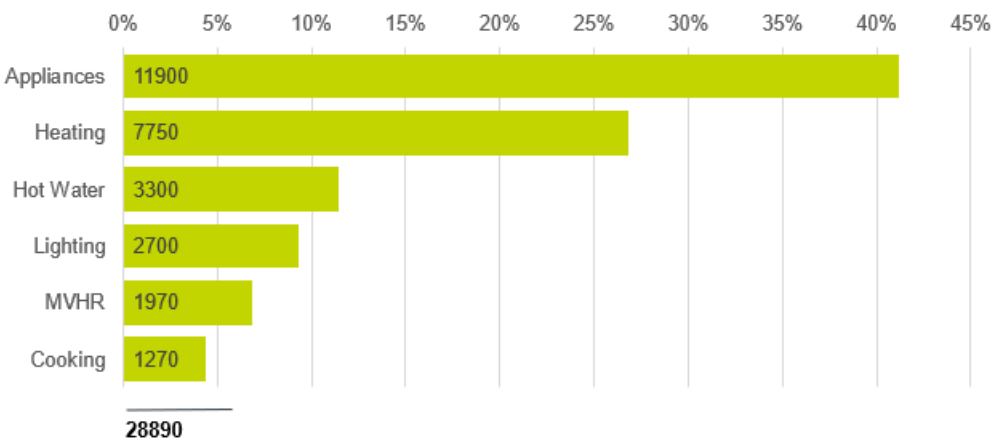


Figure 5: Likely end use electricity consumption (kWh)

Figure 6 demonstrates the monthly daily average of energy generated and consumed onsite, based on 16.2kWp solar PV installed on flat roof. You'll see from this graph that the energy generated by the 16.2kWp system exceeds the daytime load of the property in the height of summer. With solar PV installed on the roof, there will be some excess that can be stored in a 10kWh battery.

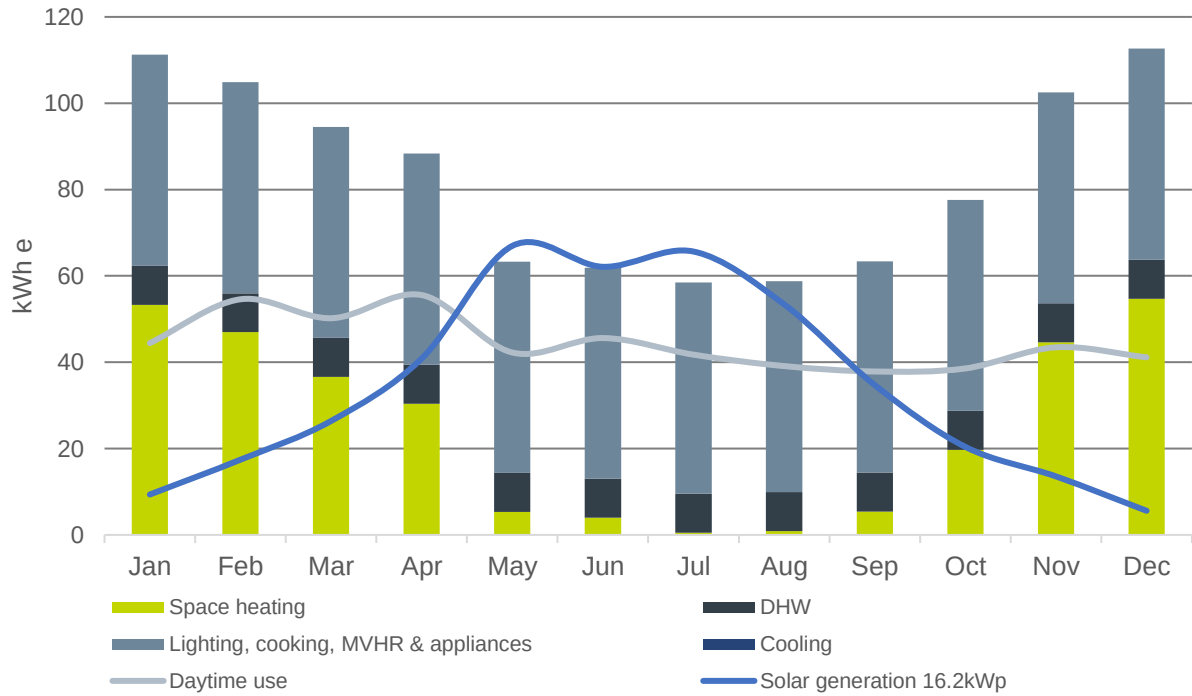


Figure 6: Likely end use electricity consumption

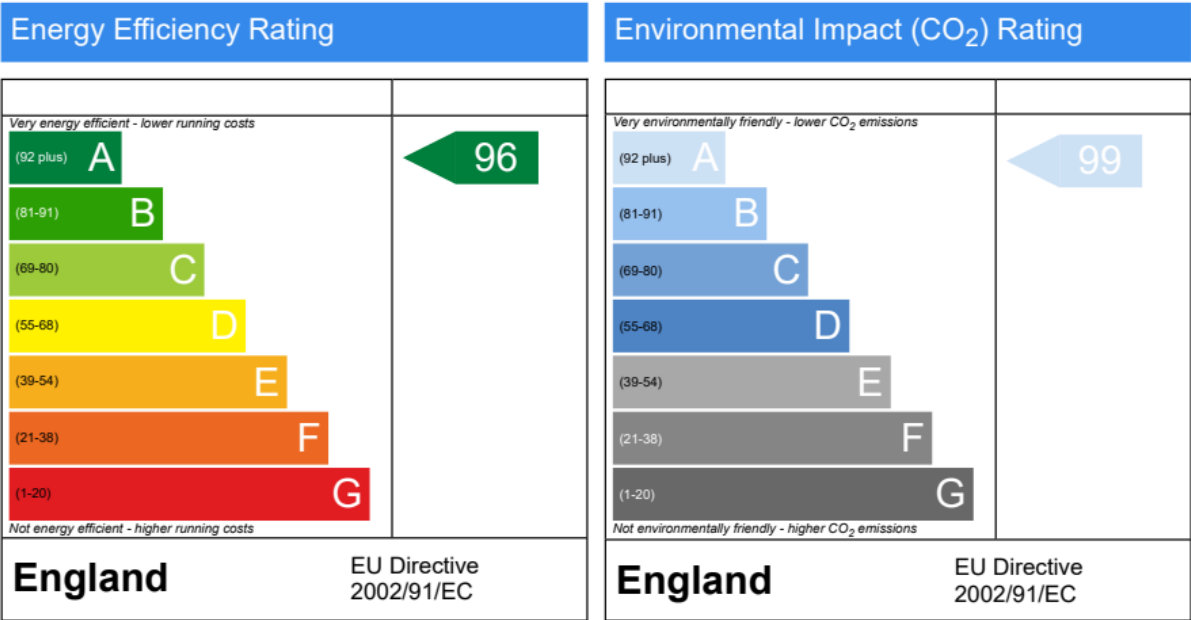
5.8 Minimising Pollution

- Noise: The GSHP is located internally within the plant room on the ground floor, ensuring there is no noise impact at street level.
- Air: GSHP technology has been selected as the primary heating source. These run from ‘clean’ electricity therefore with no flues and no associated localized NOx emissions.
- The GSHP has been specified to meet the domestic hot water load and satisfy acoustic requirements, which would have been challenged if an air source heat pump had been specified.
- The proposed green roof can help catch dust and smog particulars, improving localised air quality.
- Light: Light emitting diode (LED) technology and low energy fluorescent fittings will also be incorporated throughout the dwelling.
- All external lighting will be specified with low energy fittings and dusk to dawn sensors and / or timers to reduce energy use.

6 SAP Rating

The proposed strategy shows an 89.24% improvement on current Building Regulations using SAP 10 carbon factors and an EPC rating of 96 (A). The energy efficiency (DPER) shows 81.97% improvement over the notional building (TPER).

Based on SAP results, CO₂ emissions was calculated to be only 0.63 tonnes annually with an environmental impact rating of 99 (A).



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

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

Figure 7: EPC output from SAP 10 for the proposed design

7 Overheating & Cooling

For development of Walled Garden, the CIBSE TM59 Design methodology for the assessment of overheating risk in homes is used as the basis for setting the design standards. During the design stage of this project, the overheating and cooling have been reviewed.

7.1 Part O – CIBSE TM59 Overheating Assessment

The Part O assessment has confirmed that all the habitable areas pass the overheating criteria through natural ventilation only. The efficient building fabric, triple glazing low emissivity glass, and through effective window opening has helped reduce the overheating hours considerably.

Naturally ventilated rooms – criterion (a)

Criterion (a) states that for living rooms, kitchens and bedrooms, the number of hours during which ΔT is greater than or equal to 1K from May to September (or November to March for southern hemisphere locations) shall not exceed 3% of occupied hours.

Room name	Occupied hours	No. hours $\Delta T \geq 1^{\circ}\text{K}$	% Occupied hours $\Delta T \geq 1^{\circ}\text{K}$	Criterion a check
L00: Bedroom 01	3672	45	1.2	Pass
L00: Bedroom 02	3672	44	1.2	Pass
L00: Bedroom 03	3672	59	1.6	Pass
L00: Bedroom 04	3672	67	1.8	Pass
L00: Bedroom 05	3672	52	1.4	Pass
L00: Master Suite	3672	46	1.3	Pass
L00: Study	1989	35	1.8	Pass
LG: Cinema	1989	7	0.4	Pass
LG: Kitchen/Dining	1989	50	2.5	Pass
LG: Living	1989	53	2.7	Pass
LG: Snug	1989	50	2.5	Pass

Figure 8: CIBSE TM59 Overheating Criteria A results

Naturally ventilated rooms – criterion (b)

Criterion (b) states that the operative temperature of the bedrooms from 22:00-07:00 shall not exceed 26°C for more than 1% of annual hours (33 hours is therefore recorded as a fail). Any rooms that are not bedrooms are therefore not assessed, hence the corresponding N/A values.

Room name	No. hours > 26°C 22:00-24:00	No. hours > 26°C 00:00-07:00	Total hours > 26°C	Criterion b check
L00: Bedroom 01	6	0	6	Pass
L00: Bedroom 02	6	0	6	Pass
L00: Bedroom 03	12	8	20	Pass
L00: Bedroom 04	12	10	22	Pass
L00: Bedroom 05	12	9	21	Pass
L00: Master Suite	5	0	5	Pass
L00: Study	N/A	N/A	N/A	N/A
LG: Cinema	N/A	N/A	N/A	N/A
LG: Kitchen/Dining	N/A	N/A	N/A	N/A
LG: Living	N/A	N/A	N/A	N/A
LG: Snug	N/A	N/A	N/A	N/A

Figure 9: CIBSE TM59 Overheating Criteria B results

7.2 The Cooling Hierarchy

The project will follow and implement a strategy based upon the following cooling hierarchy.

7.2.1 Reducing the amount of heat entering the building in summer

External vertical fixed shades and overhangs, to avoid summer solar gains, has been implemented.

7.2.2 Using thermal mass and high ceilings to manage heat within the building

Where practical and possible exposed thermal mass has been used to reduce the likelihood of overheating.

7.2.3 Passive Cooling

Where practical and possible openable windows and dual aspects have been used.

7.2.4 Mechanical Ventilation

Mechanical ventilation will include a summer by-pass on any heat recovery system installed.

7.2.5 Mechanical Cooling (fan coil units)

Mechanical cooling is proposed for certain areas i.e. gym, yoga, cinema room in the house to provide comfortable temperatures through cooling. The heat pump will work in reverse to cool rather than heat and chilled water is distributed via pipes to the rooms that require cooling. A fan coil unit, discretely located within the wall or ceiling of the room then uses this as the source to cool the air.



Figure 10: Example of cooling wall vent and thermostat (right) and ceiling fan coil unit (left)

8 Portable Water Usage

8.1 Efficient Use of Resources

To achieve a low environmental impact, water systems will be designed, used and managed efficiently, saving water and reducing associated energy and CO2 emissions.

The potable water use is calculated according to Building Regulations Part G Appendix A Water efficiency calculator for new dwellings.

8.2 Part G Result

In specifying the following fixture and fitting flow rates potable water usage is will be 119.1 l/p/d.

Space	Design
Kitchen sink taps (litres/min)	8
Dishwasher (litres/place setting)	0.9
Washing machine (litres/kg dry load)	6
Waste disposal (litres/use)	1.18
Bathroom sink (litres/min)	4.2
Shower only (litres/min)	6
Bath only	105
Bathroom dual flush WC (6/4 litres)	3.06
Water consumption (litres/person/day)	119.1

9 Summary

9.1 Energy Efficiency

- 89.24% improvement of dwelling emission rate (DER) over target emission rate (TER)
- 81.97% improvement of energy efficiency over notional building.
- Improvement on thermal performance, helping reduce the energy required for space heating.
- Highly efficient ground source heat pump providing space heating throughout and cooling to a select number of spaces.

9.2 Minimising overheating

- Glazing to optimise natural daylight.
- External fixed vertical shades and overhangs.
- Openable windows throughout.
- Openable rooflights in bedrooms.
- Mixed mode ventilation with mechanical ventilation and heat recovery.
- Cooling via highly efficient ground source heat pump through fan-coil units.

9.3 Minimising overheating

- The ground source heat pump will be situated internal plant room.
- Highly efficient no-NOx ground source heat pump providing domestic hot water.
- All external lighting to be fitted with dusk/dawn sensors.

9.4 Low water consumption

- Low flow sanitary fixtures and fittings.
- 'A' rated water efficient domestic white goods.

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