



AUGUST 2023

Updated Sustainability Statement

23/25 Vicarage Road, Haringey, N17 0BB

Iceni Projects Limited on behalf of
Mr Van Ly

August 2023

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ON BEHALF OF MR VAN LY

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CONTENTS

1. EXECUTIVE SUMMARY.....	1
2. INTRODUCTION.....	3
3. PLANNING AND REGULATORY CONTEXT	7
4. SUSTAINABILITY STATEMENT	14
5. SUMMARY	34

APPENDICES

A1. SITE PLAN	
A2. WATER USAGE CALCULATOR	
A3. LOCATION OF PROPOSED MVHR UNITS	
A4. LOCATION OF INTERNAL PORTION OF ASHP SYSTEM	
A5. DER/TER WORKSHEETS	
A6. RENEWABLE ENERGY FEASIBILITY ASSESSMENT	
A7. GENERAL NOTES	

1. EXECUTIVE SUMMARY

- 1.1 Icen Projects Ltd was commissioned by Mr Van Ly to produce a Sustainability Statement to support the planning application for the proposed development at 23/25 Vicarage Road, Haringey, N17 0BB.
- 1.2 This application proposes the provision of a two-storey, three-bedroom house to the rear of the properties at 23/25 Vicarage Road, and adjacent to 49 Argyle Road.
- 1.3 Sustainability is a core consideration of the application and has been incorporated from the project outset. Energy and water efficiency measures have been maximised, whilst the production of waste is to be minimised, thus ensuring the impact of the proposals on its immediate surroundings and environment as a whole is reduced.
- 1.4 Consideration has been given to the London Borough of Haringey Local Plan in the formulation of this strategy, aiming to minimise the environmental impact of the proposed development during construction and operation, and ensure the development is constructed to rigorous sustainability standards.
- 1.5 Section 4 of this report demonstrates that the siting and design of the proposals support relevant policy relating to sustainable development, based on the principles outlined in the London Borough of Haringey Local Plan policies SP4 (Working towards a Low Carbon Haringey) and DM21 (Sustainable Design, Layout and Construction). This shows that the proposed development:
- Will minimise energy demand through the use of high levels of insulation and energy efficient systems;
 - Will be fossil fuel free, using an air source heat pump system to provide space heating and hot water;
 - Will achieve an approximate 125.3% reduction in CO₂ emissions, following the Energy Hierarchy methodology, thereby achieving net zero carbon emissions in operation;
 - Will minimise internal water consumption to 105 litres per person per day;
 - Will incorporate measures to improve site biodiversity, including the provision of green roof planting, a bird box and soft landscaping within the front and rear gardens of the dwelling;
 - Will not increase the risk of surface water flooding onsite;
 - Will be adapted to the impacts of climate change including overheating;

- Will incorporate low-impact materials, according to the BRE Green Guide to Specification, and minimise waste production during construction and maximise the proportion of waste to be diverted from landfill; and
- Will promote the principles of sustainable development during operation.

1.6 Overall, the proposals constitute sustainable development in accordance with national, regional and local policy requirements and will provide a development that seeks to promote these principles in operation.

2. INTRODUCTION

- 2.1 Icen Projects Ltd was commissioned by Mr Van Ly to produce a Sustainability Statement for the proposed development at 23/25 Vicarage Road, Haringey, N17 0BB.

Report Objective

- 2.2 This document details the sustainable design and construction measures adopted by the proposed development and gives an overview of the design proposals that will ensure the development operates in a sustainable manner over the lifespan of the scheme. The report headlines will provide a framework for the project team to operate consistently within sustainability guidelines set out by the London Borough of Haringey.
- 2.3 The report is structured to meet these guidelines as follows:
- Section 3 discusses the planning context and policies which are relevant to sustainability and energy;
 - Section 4 discusses the development response to the policy drivers for sustainability and energy; and
 - Section 5 summarises the development's design response.

Site and Surroundings

- 2.4 The application site (Appendix A1) is located to the rear of the properties at 23/25 Vicarage Road, separate to the associated back gardens. The site is situated at the end of the terraces on Argyle Road, which runs perpendicular to Vicarage Road. In the existing case, the site is an empty garden space, with the southern and western boundaries formed by rear gardens associated with properties facing onto Vicarage Road, the eastern boundary formed by the property at 49 Argyle Road, and the northern boundary by Argyle Road. The surrounding area is characterised predominantly by residential uses, as can be seen in Figure 2.1 below.

Figure 2.1 The site

 Site location



The Proposed Development

- 2.5 The scheme proposes the erection of a two-storey, three-bedroom residential dwelling, which will mirror the footprint of the existing dwelling located opposite at 48 Argyle Street. The dwelling will include a front and rear garden, as well as cycle and refuse storage.
- 2.6 The images below show plans and elevations of the scheme, based on drawings provided by Satish Jassal Architects.

Figure 2.2 Ground (left) and first (right) floor plans

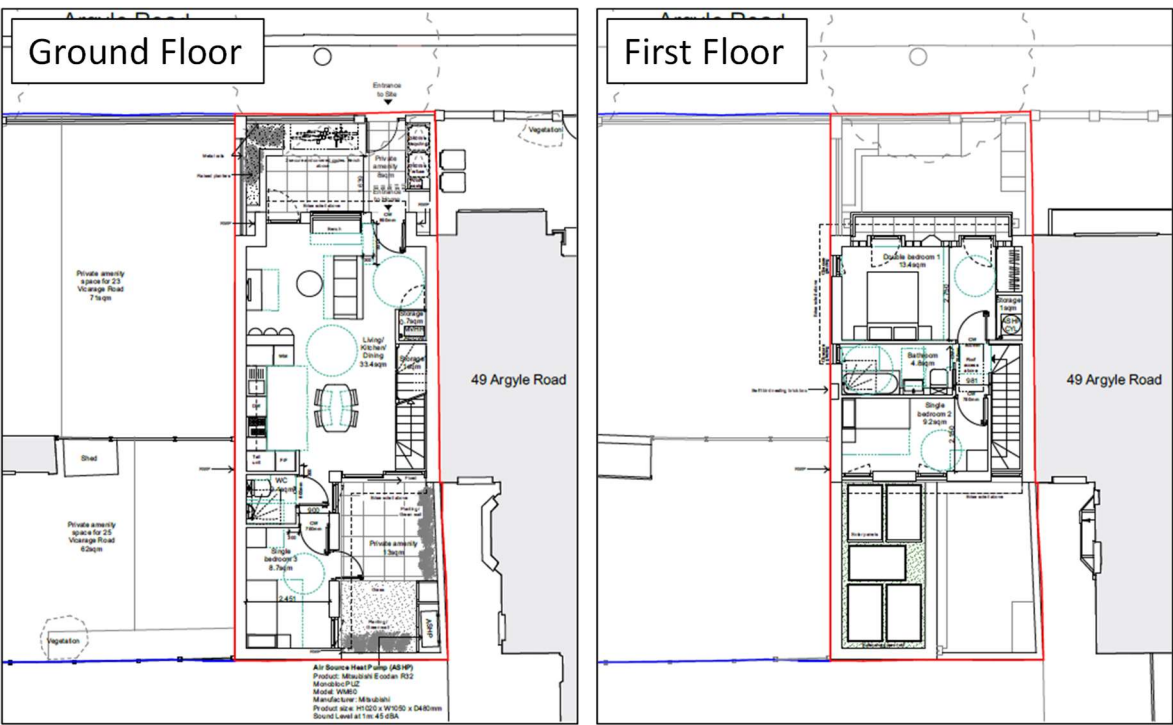


Figure 2.3 North (left) and south (right) elevations

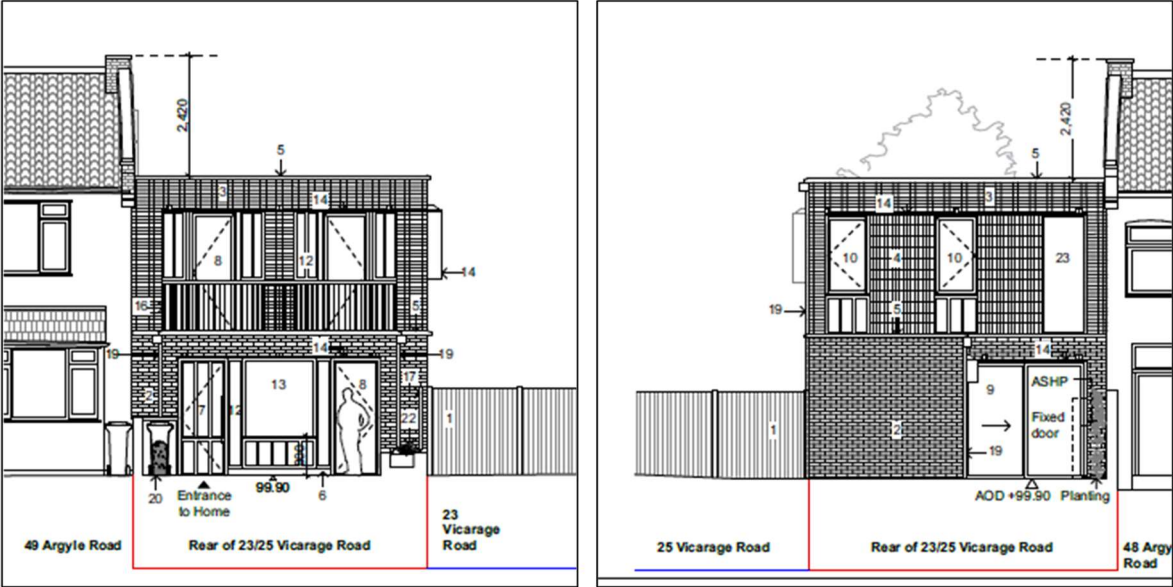


Figure 2.4 East elevation

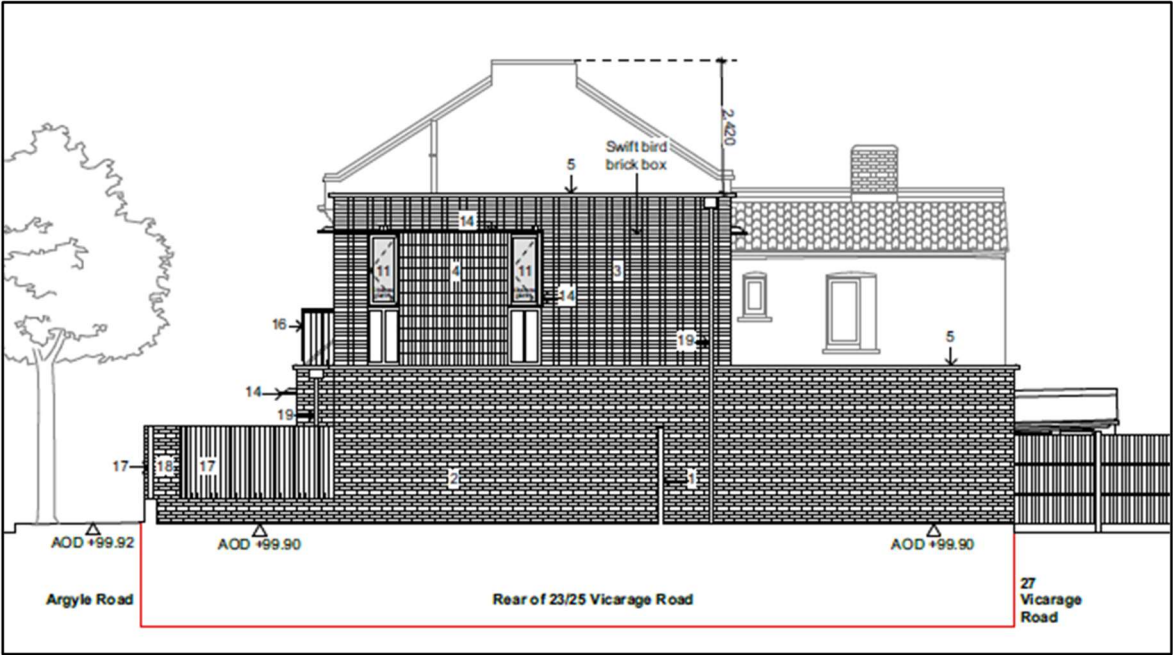
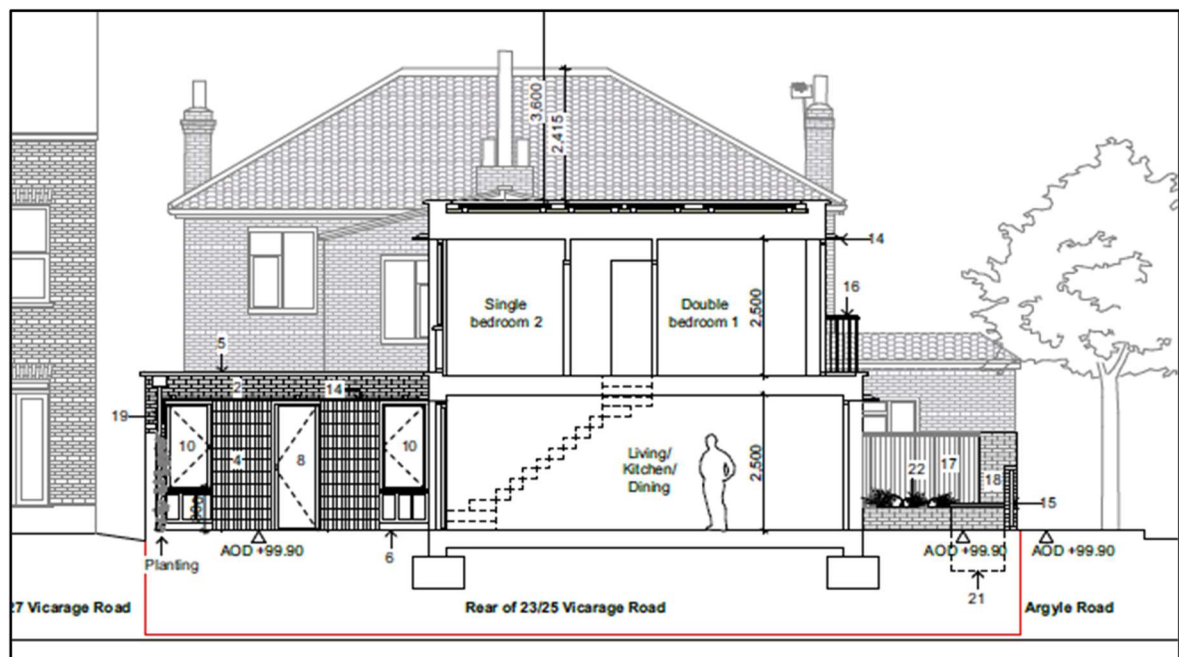


Figure 2.5 West elevation



3. PLANNING AND REGULATORY CONTEXT

- 3.1 Built environment sustainability is incorporated within policy and regulation at a national, regional and local level, as set out below.

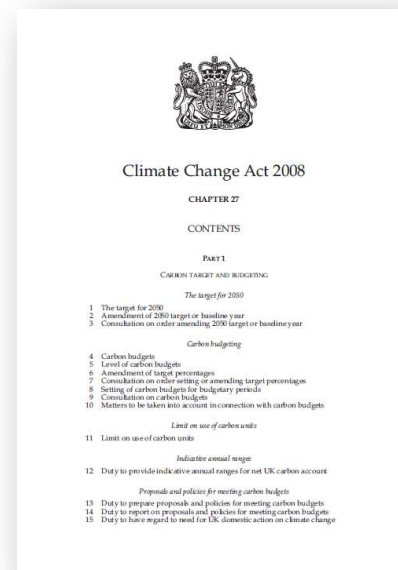
National

Climate Change Act 2008

- 3.2 On 26th November 2008, the UK Government published the Climate Change Act 2008; the world's first long-term legally binding framework to mitigate against climate change. Within this framework, the Act sets legally binding targets to increase greenhouse gas emission reductions through action in the UK and abroad from the 60% target set out in the Energy White Paper, to 80% by 2050.

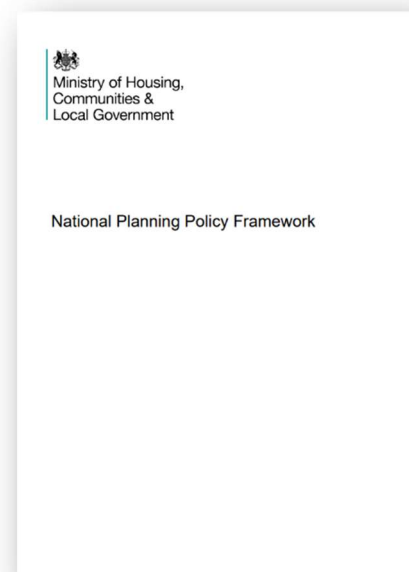
- 3.3 As required under Section 34 of the Climate Change Act, the Sixth Annual Carbon Budget was accepted by the Government in April 2021. This sets out a budget for UK emissions for the period 2033 – 2037.

- 3.4 Following a commitment in June 2019, the Climate Change Act has been amended to target net zero carbon emissions by 2050.



National Planning Policy Framework

- 3.5 The Ministry of Housing, Communities & Local Government determines national policies on different aspects of planning and the rules that govern the operation of the system. Accordingly, the National Planning Policy Framework (NPPF), which came into force in March 2012 and was updated in February 2019, aims to strengthen local decision making. Additional updates have since been made through the latter half of 2020 and in January 2021 to reflect changes related to use classes, permitted development rights, the calculation of housing need, and requirements to achieve beauty alongside sustainability.



- 3.6 Paragraphs 10 and 11 of the NPPF confirm that at the heart of this document is a “*presumption in favour of sustainable development*”, and that development proposals that accord with an up-to-date development plan should be approved without delay.
- 3.7 Paragraph 7 states that the purpose of the planning system is to contribute to the achievement of sustainable development. At a very high level, the objective of sustainable development can be summarised as meeting the needs of the present without compromising the ability of future generations to meet their own needs.
- 3.8 Achieving sustainable development means that the planning system has three overarching activities, which are interdependent and need to be pursued in mutually supportive ways, so that opportunities can be taken to secure net gains across each of the different objectives:
- **An Economic Role** – ensuring the provision of land and infrastructure needed to help build a *strong, responsive and competitive economy*.
 - **A Social Role** – supplying the required amount of housing while at the same time ensuring and building *strong, vibrant and healthy communities*. Ensuring that the built environment is site around accessible local services which help support a community’s *health, social and cultural well-being*.
 - **An Environmental Role** – ensuring development contributes to the protection and enhancement of the *natural, built and historic environment* through the improvement of biodiversity, minimising the use of natural resources and production of pollution / waste, and guaranteeing sufficient adaptation to climate change.

Future Homes Standard 2025 (March 2019)

- 3.9 Within the Spring Statement 2019, the Chancellor announced the future introduction of the Future Homes Standard 2025. The Standard will mandate the end of fossil fuel heating systems in new homes from 2025, and target “world-leading levels of energy efficiency”. In doing this, the Standard aims to utilise green technology to reduce environmental impacts, as well as reducing consumer energy bills.
- 3.10 This Standard is expected to build on the Prime Minister’s Clean Growth Grand Challenge missions, which aim to at least halve the energy usage of new-build properties by 2030. It also looks to halve the costs of renovating existing buildings to achieve a similar standard of energy efficiency as new buildings, whilst improving their quality and safety.



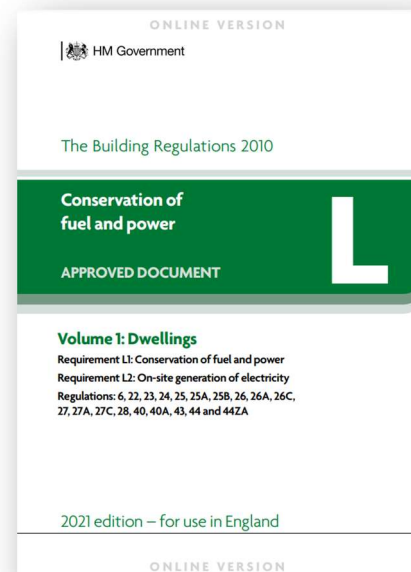
Part L:2021 of the Building Regulations

3.11 Part L of the Building Regulations relates to the conservation of fuel and power, and applies to both new and existing buildings. The current edition covers the energy efficiency requirements of the building regulations as set out in Part L of Schedule 1 to the Building Regulations. Technical guidance is contained in two Part L Approved Documents.

3.12 The documents of relevance to this scheme include:

- **Approved Document L Volume 1: Dwellings.**

This provides the methodology for new build, domestic buildings to meet current energy efficiency standards, including backstop U-values, carbon dioxide emissions calculations and minimising the risk of overheating. Carbon dioxide emissions reductions are prescribed for 'regulated' emissions only, and relate to heating, hot water, lighting, auxiliary and cooling (where specified). Emissions from domestic appliances (cooking, for example) are considered to be unregulated emissions, and are excluded from the analysis.



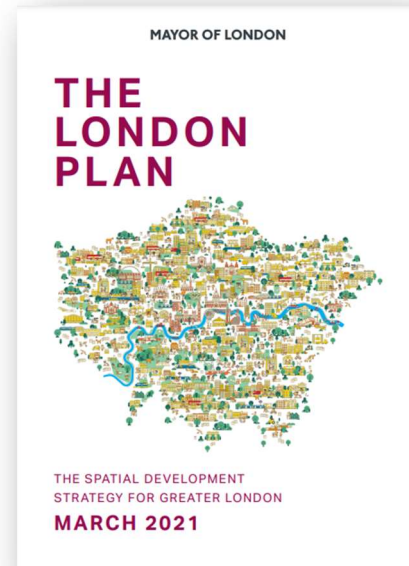
Regional

- 3.13 Within Greater London, key sustainable development principles for economic, environmental and social improvement are set out below:

The London Plan (March 2021)

- 3.14 The London Plan is the overall strategic plan for London and includes policies for sustainable development and energy within Chapter 9 (London's response to climate change). Key policies of relevance to this scheme are as follows:

- **Policy SI2 Minimising Greenhouse Gas Emissions.** This states that major development proposals should be net zero-carbon, by reducing greenhouse gas emissions in operation and minimising both annual and peak energy demand in accordance with the following energy hierarchy:
 1. Be lean: use less energy
 2. Be clean: supply energy efficiently
 3. Be green: use renewable energy
 4. Be seen: monitor, verify and report energy performance
- **Policy SI3 Energy Infrastructure.** This policy recognises that combined heat and power installations can have negative effects on London's air quality and shifts the focus of decentralised energy networks to the use of waste or secondary heat sources, where available. The policy also recognises that, compared to increasingly decarbonised electricity generation, gas-fired heat will become comparatively more carbon intensive as the electricity grid is further decarbonised.
- **Policy SI4 Managing Heat Risk.** This policy states that development proposals should minimise adverse impacts on the urban heat island effect through design, layout, orientation, materials and the incorporation of green infrastructure. Major development proposals should demonstrate through an energy strategy how they will reduce the potential for internal overheating and reliance on air conditioning systems in accordance with the following cooling hierarchy:
 1. Reduce the amount of heat entering a building through orientation, shading, high albedo materials, fenestration, insulation and the provision of green infrastructure
 2. Minimise internal heat generation through energy efficient design

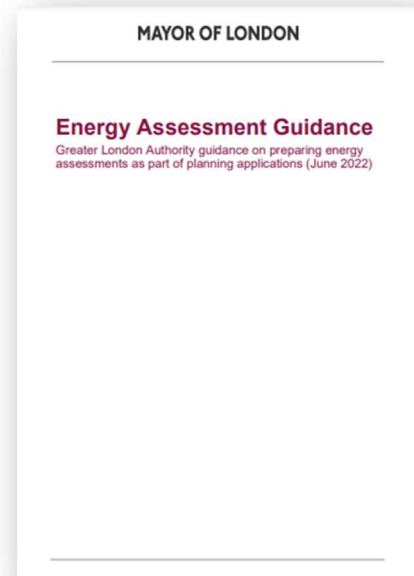


3. Manage the heat within the building through exposed internal thermal mass and high ceilings
4. Provide passive ventilation
5. Provide mechanical ventilation
6. Provide active cooling systems.

Energy Planning – GLA guidance on preparing energy assessments (June 2022)

3.15 The guidance note provides further detail on addressing the London Plan's energy hierarchy through the provision of an energy assessment to accompany planning applications. The document sets out the expected carbon dioxide emissions targets for different building types.

- The guidance outlines the requirement for all major application within London to achieve a minimum 35% carbon dioxide emissions savings over the Part L:2021 baseline through on-site means alone. The guidance also sets out the requirement to report the Energy Use Intensity (EUI) and the space heating demand of the development using the GLA's carbon emissions reporting spreadsheet.



Local

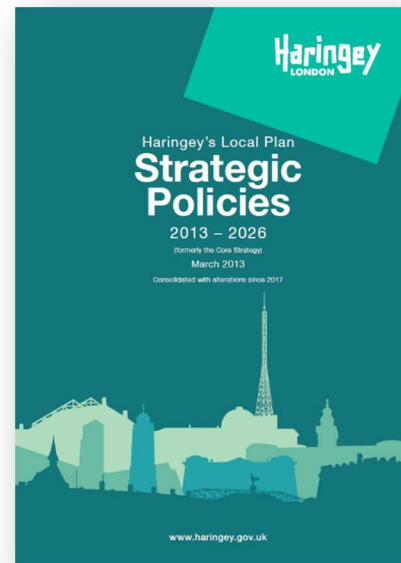
3.16 In determining the local context, the London Borough of Haringey policy is set out in the following Development Plan documents:

- Haringey's Local Plan Strategic Policies 2013 – 2026 (adopted March 2013); and
- Development Management Development Plan Document (DPD) (adopted July 2017).

Haringey's Local Plan Strategic Policies 2013 – 2026 (adopted March 2013)

3.17 The Strategic Policies document is the main document of the Haringey Local Plan and includes policies to manage the city and deliver Haringey's future sustainable development. Policies of relevance to this project in the context of sustainability and energy are as follows:

- **SP4: Working towards a Low Carbon Haringey** states that the Council will promote the measures outlined below to reduce carbon emissions from new and existing buildings.
- In line with London Plan policy, the Council will promote and require all new developments to take measures to reduce energy use and carbon emissions during design, construction and occupation. All new residential development shall be zero carbon from 2016 onwards.
- The Council will promote low- and zero-carbon energy generation by requiring all developments to assess, identify and implement, where viable, site-wide and area-wide decentralised energy facilities including the potential to link into a wider network, by establishing local networks of decentralised heat and energy facilities by requiring developers to prioritise connection to existing or planned networks where feasible, and by working with neighbouring boroughs and other partners to explore ways of implementing sub-regional decentralised energy networks including the potential in the Upper Lee Valley Opportunity Area.
- All new developments are required, where viable, to achieve a reduction in predicted carbon dioxide emissions of 20% from onsite renewable energy regeneration, which can include connections to local sources of decentralised renewable energy.



Haringey Development Management Development Plan Document (DPD) (adopted July 2017)

3.18 This document provides the local variations of the development management policies set out in the London Plan, thereby introducing new policies to further the vision set out in the Haringey Development Strategy. Relevant extracts include:

- **Policy DM21: Sustainable Design, Layout and Construction** states that all new development, including building and landscape works, will be expected to consider and implement sustainable design, layout and construction techniques. Proposals should:

- Apply the energy hierarchy to minimise energy use in order to meet, and if possible exceed, minimum carbon dioxide reduction requirements;
 - Apply the cooling hierarchy to reduce the potential for overheating and limit reliance on mechanical air conditioning systems;
 - Maximise opportunities to enhance biodiversity on-site, including through appropriate landscaping, Sustainable Drainage Systems, living roofs and green walls;
 - Wherever possible, use building materials with high environmental performance ratings; and
 - Seek opportunities for locally sourced labour.
- Consideration will be given to the use of carbon offset payments, to be secured by planning obligations, where it can be demonstrated that proposals are unable to meet carbon dioxide emission reduction targets on-site.



Other Considerations

Declaration of a Climate Emergency (March 2019)

3.19 On the 18th March 2019, Councillors agreed a motion to declare a Climate Emergency. The Council has agreed to collectively work towards making Haringey carbon neutral by 2030, delivering impact on both production and consumption emissions, and to work with partners across the borough and beyond to deliver this new goal through all relevant strategies and plans.

4. SUSTAINABILITY STATEMENT

- 4.1 Although the proposed scheme is not referable to the Greater London Authority (GLA), the sustainability strategy for the proposed development has been developed using London Plan guidance and policy. This enables a holistic sustainability approach for the proposed development. The principle of sustainable design and construction is referenced within the London Borough of Haringey's Local Plan, and therefore the London Plan policies represent best practice guidance to meet high standards of sustainable design and construction.

Sustainable Design and Construction

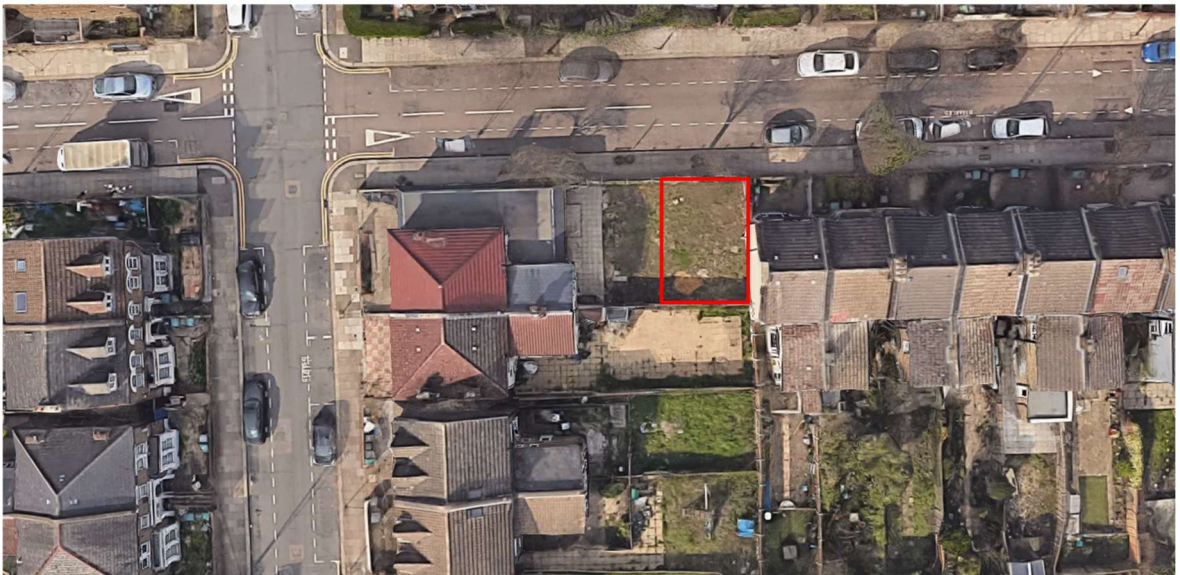
- 4.2 The sustainability features of the proposed development are outlined below.

Land

- 4.3 As shown in Figure 4.1 below, the site currently comprises an empty garden space, located in between the built-form of one existing dwelling and the rear gardens of two dwellings. The utilisation of small site such as this for new housing forms a key part of the borough's housing strategy.

Figure 4.1 View of the existing site

 Approximate site boundary



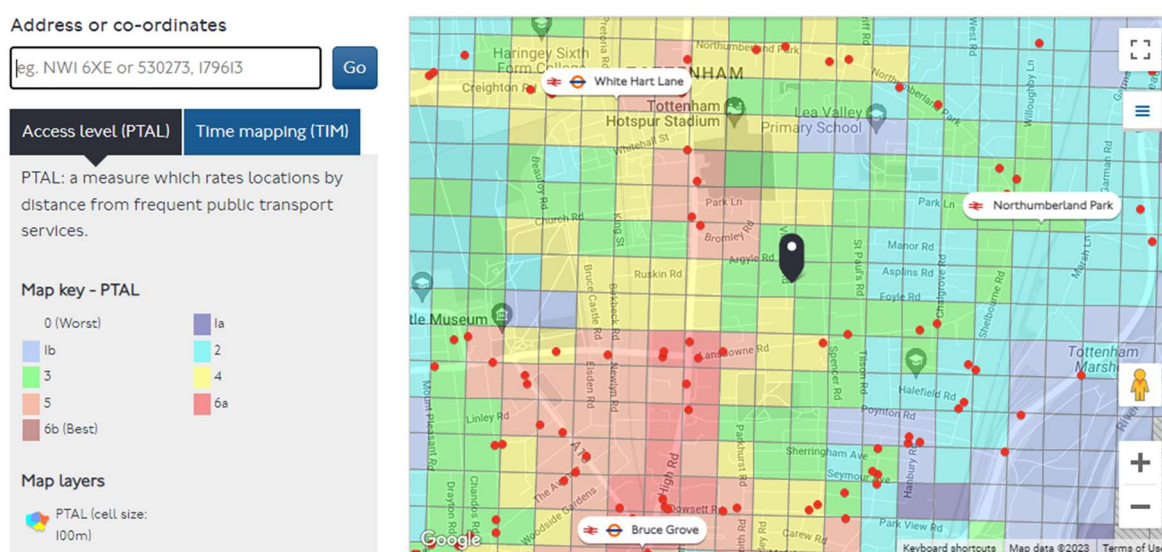
- 4.4 The scale of the proposed development has been developed based on guidance and feedback provided by the London Borough of Haringey and in line with the local context.

Location and Transport

- 4.5 As demonstrated below, the site achieves a PTAL rating of 3, demonstrating that future residents will have access to public transport links. Northumberland Park railway station, located a 10-minute walk

to the east of the site, provides access to Stratford and Bishops Stortford via Greater Anglia services, and to Stansted via the Stansted Express service. White Hart Lane station, which is served by the Transport for London (TfL) Overground service, is located an approximate 12-minute walk to the north-west, and provides access between Cheshunt and London Liverpool Street. The closest bus stops to the site are located an approximate 8-minute walk to the south on Lansdowne Road. These stops are served by the 381, 341 and 476 services, which provide access to a range of destinations, including Edmonton, King's Cross, Waterloo, Stamford Hill and Northumberland Park.

Figure 4.2 Extract from TfL PTAL map



- 4.6 In order to encourage future residents to reduce reliance on private car usage, the proposed development will not include for off-street car parking. It is noted, however, that on-street car parking is available in the surrounding area on both Argyle Street and Vicarage Road. These roads are subject to a Tottenham Event Day Controlled Parking Zone (CPZ). The proposed development will include for two secure and covered cycle storage spaces in the front garden area, which will aid in encouraging future residents to use active transport modes.

Water Efficiency and Recycling

- 4.7 The city often consumes more water than is available during dry weather. As the population of London continues grows, this situation will be further exacerbated, with greater pressure on the supply of potable water.
- 4.8 In order to actively mitigate against this, water saving fittings and appliances shall be installed to target an internal water consumption rate of 105 litres or less per person per day, based on the DCLG water efficiency calculator for the residential elements. Full details of the water calculation are provided in Appendix A2.

4.9 The following form a basis for the residential element of the proposals, subject to change at later detailed design stages:

- Low volume dual flush toilets of 6 / 3 litres;
- Water consumption levels not higher than 3 litres / minute in wash hand basins and 4 litres / minute in kitchen sink taps;
- Bath with a capacity to overflow not higher than 180 litres;
- Showers with a flow rate of 8 litres / minute using a flow restrictor.

4.10 Washing machines and dishwashers, and therefore their associated water consumptions, have not been specified. However, further reductions in water consumption can be achieved by specifying washing machines with a water consumption lower than 18 litres / kilogram, and dishwashers with a water consumption no higher than 4.5 litres per place setting.

Materials and Waste

4.11 Selection of materials is determined by a variety of factors, such as the architectural context, design rationale, embodied carbon and maintenance requirements. For the proposed development, consideration will be given to the lifecycle environmental performance, with materials selected in consideration of the BRE's Green Guide to Specification, aiming for A or B rated materials wherever possible. At this stage, it is intended that a minimum of 80% of the materials used to construct the proposed development be responsibly sourced, with a low environmental impact, with an aspirational target to exceed this.

4.12 It is noted that, due to the vacant nature of the development site, no structures are present and it is not expected that any demolition will be required to facilitate the proposed development. However, should any demolition works be required, it is intended that any materials arising be recycled or reused, either onsite or within the local surrounding area. This will be explored in further detail, should demolition be required on the site.

4.13 During detailed design of the building fabric, consideration will be given to minimising the impact of materials, by selecting non-toxic and robust materials to ensure longevity and a minimal impact on the health of occupants.

4.14 Timber will be selected and purchased in consideration of sustainability certification. It is intended that all structural timber elements, along with any timber used for temporary uses such as scaffolding, will be sustainably sourced (e.g. from FSC and/or PEFC sources).

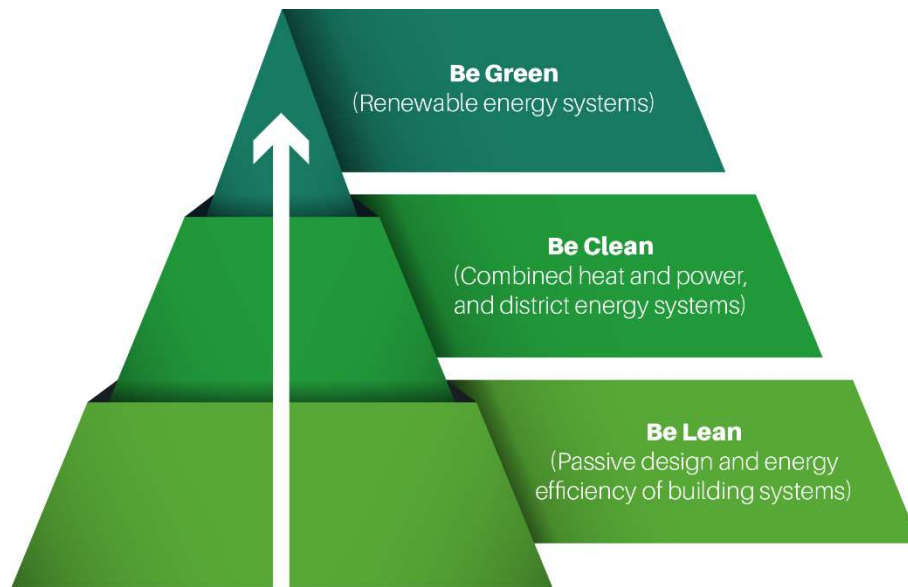
4.15 To encourage a greater proportion of the operational waste to be diverted from landfill, it is proposed to provide a dedicated space of sufficient size, and in convenient locations. Internal storage will be

considerate of the Building Regulations, Council and other relevant requirements. A dedicated external waste storage area for the scheme for refuse and recycling has been located within the front garden area, adjacent to the northern boundary of the site, at the ground floor level.

Energy and CO₂ Emissions

- 4.16 With reference to the policy requirements, guidance and industry best practice detailed in Section 3, an energy and carbon dioxide (CO₂) emissions strategy has been defined for the proposed development. The proposed energy performance of the scheme has been analysed and evaluated to target a high level of CO₂ emissions performance when assessed against Part L:2021 of the Building Regulations and associated policies, accounting for economic, technical and functional feasibility.
- 4.17 In order to maintain a degree of flexibility in meeting the national standards set out in the Building Regulations on carbon and energy performance, as required by the Greater London Authority and the London Borough of Haringey Council, the measures outlined below describe a potential means of achieving a reduction in CO₂ emissions over the Part L:2021 baseline. Therefore, the final building specification may be subject to change during subsequent design.
- 4.18 As the proposed development is considered to be a minor development, it is not required to comply with the requirement of Policy SI2 of the London Plan to achieve a minimum 35% in carbon dioxide emissions against the Part L:2021 baseline.
- 4.19 However, the proposed development is required to comply with Policy SP4 of the Haringey Local Plan, which requires new development to achieve zero carbon emissions in operation, where feasible. An energy and carbon dioxide (CO₂) emissions assessment has therefore been carried out for the proposed development, targeting a minimum 100% reduction in CO₂ emissions over the Part L:2021 baseline in order to achieve net zero carbon emissions in operation. The measures proposed to achieve this are summarised below.
- 4.20 The proposed energy strategy is based upon the principles of the Energy Hierarchy on the basis that it is preferable to reduce carbon dioxide emissions through reduced energy consumption above decarbonisation through alternative energy sources.
- 4.21 The tiers of the Energy Hierarchy are:
- Be Lean Use less energy
 - Be Clean Supply energy efficiently
 - Be Green Use renewable energy

Figure 4.3 The Energy Hierarchy



‘Be Lean’ (Use Less Energy)

- 4.22 Within the first stage of the energy hierarchy, it is proposed to incorporate high levels of passive and energy efficient design measures in order to reduce the development’s energy consumption and associated CO₂ emissions, utilising a ‘fabric first’ approach to reduce energy demand.
- 4.23 Details of the passive design and energy efficiency measures proposed have been detailed below.
- 4.24 Passive design utilises daylight, solar energy, shading and stack or wind driven ventilation to illuminate, heat, shade where necessary and ventilate/cool the building, thus requiring less (mechanical) energy to achieve the performance standards for health and wellbeing of the residents.
- 4.25 Site characteristics relating to local climate, surroundings, scale and size of the development therefore passively influence the potential energy requirement and savings that can be achieved through the consideration of these aspects. The parameters that most influence the potential to utilise sunlight and solar gains are the orientation and layout of buildings, however these are typically driven by various factors other than energy efficiency or bioclimatic design considerations (e.g. aesthetics, function, etc.).
- 4.26 As shown in Figure 2.2, the orientation of the dwelling will be dictated by the plot orientation in order to give the overall scheme a cohesive design approach. The distance between the proposed building and the neighbouring properties has been optimised to ensure sufficient access to natural daylight and passive solar gains to both the proposed and existing dwellings. Light and solar gain will also be influenced by the fenestration and the selection of glazing with a high degree of light transmittance.

- 4.27 The following U-values are proposed as a means of limiting heat loss through the building fabric. It should be noted that the U-values presented below are indicative at this stage, and are to be confirmed following further detailed design. In particular, the proposed ground floor, external wall and roof U-values will be reduced if investigations show this can be achieved without altering the design of the scheme.

Table 4.1 Proposed building fabric U-values

Building Fabric Element	Part L1:2021 backstop U-values (W/m ² K)	Proposed U-values (W/m ² K)
Ground floor	0.18	0.10
External wall	0.26	0.15
Roof	0.16	0.10
Windows	1.60 (including frame)	1.30 (including frame)

- 4.28 The glazing will be double glazed, argon filled with a low emissivity coating. Although this has yet to be formally specified, it is expected that window U-values will be 1.30 W/m²K or better (including frame), with a g-value of 0.63 and light transmission of ~70% to improve natural daylight penetration.
- 4.29 A high level of air tightness is proposed, where a level equal to or below 3 m³/h/m² shall be targeted, meaning that air infiltration between the internal and the external environment will be largely controlled, and space heating/cooling demand further reduced.
- 4.30 The other significant means of heat loss from dwellings is due to thermal (or cold) bridging. This is typically a construction detail which has higher thermal conductivity than the surrounding materials, creating a path of least resistance for heat transfer. Thermal bridges result in an overall reduction in thermal resistance of the building elements and should be designed out where possible to minimise unwanted heat loss. In order to minimise heat loss through thermal bridges a ψ -value of 0.05 has been assumed for the proposed dwelling. This is subject to confirmation following the undertaking of detailed thermal bridging calculations at the detailed design stage.
- 4.31 High efficiency plant, equipment and controls are proposed to limit the energy consumed in order to provide the required level of indoor environmental performance and control. Performance efficiency values were tested and improved in energy models to benchmark the resulting predicted CO₂ reduction.
- Low energy LED lighting will be installed throughout the dwelling.

- Although the proposed residential unit will be provided with opening windows to mitigate against overheating, outside air will be provided via mechanical ventilation with heat recovery (MVHR), with a specific fan power (SFP) of 0.53 W/l/s. A heat exchanger with an efficiency of 90% has also been specified. These efficiencies are higher than those set out in Part L of the Building Regulations. A plan showing the location of the proposed MVHR units within the dwelling is provided at Appendix A3.
 - In order to meet the requirements of the GLA's Energy Planning Guidance document under the 'Be Lean' scenario, space and water heating has been specified as gas-fired boilers with an efficiency of 93%.
 - Heating will be controlled via the suitable arrangement of plumbing and electrical services.
 - Energy management systems, such as smart meters, will be installed in the dwelling to enable future residents to monitor their energy usage, and therefore aid in reducing their energy consumption.
- 4.32 Energy modelling of the proposed scheme has been undertaken using the Standard Assessment Procedure (SAP) for the proposed dwelling.
- 4.33 Based on the energy analysis of the proposed dwelling, the total energy demand for the scheme is shown below:

Table 4.2 Energy demand

Energy demand following energy efficiency measures (kWh/year)					
Space heating	Hot water	Lighting	Auxiliary	Cooling	Unregulated loads
497.2	1508.4	213.2	194.2	0.0	3,132.9

- 4.34 The carbon dioxide emissions for the sampled dwelling are shown below. DER/TER reports showing the performance of the modelled dwelling under the 'Be Lean' tier of the energy hierarchy are provided in Appendix A3. A copy of the Greater London Authority's (GLA) Carbon Emission Reporting Spreadsheet has also been submitted in support of this application.

Figure 4.4 Regulated carbon dioxide emissions – Be Lean

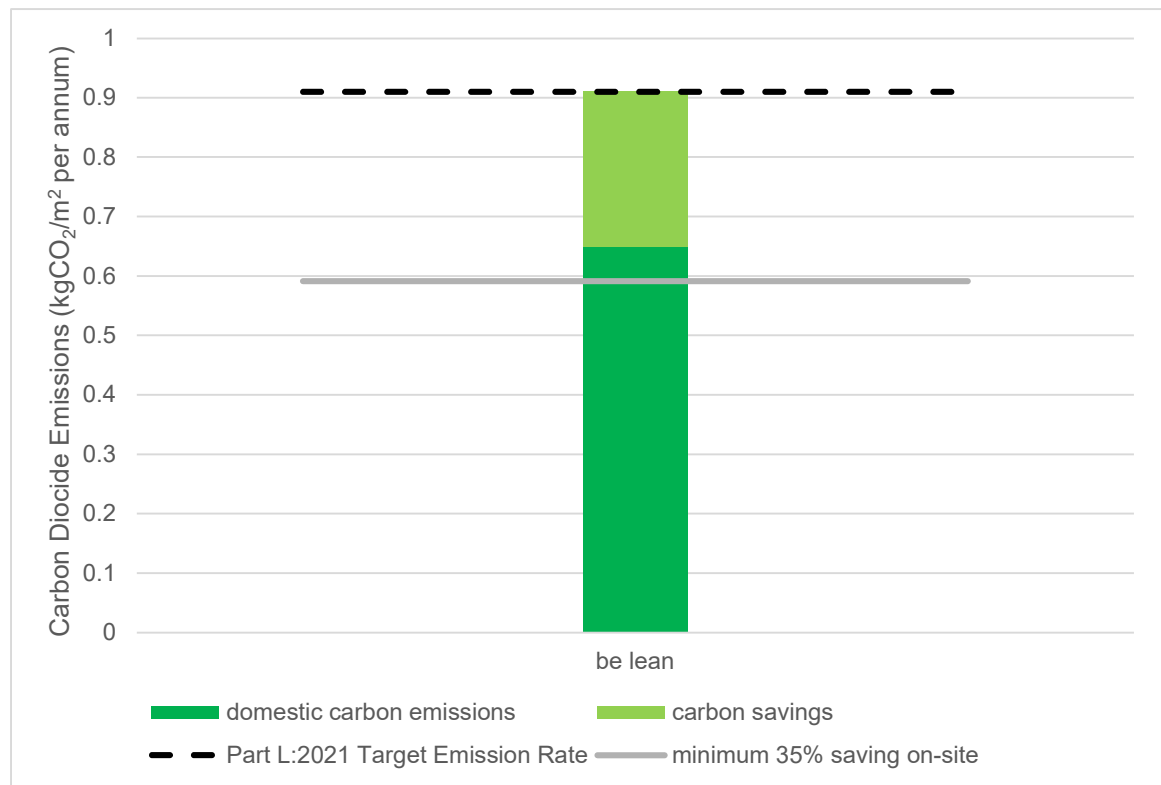


Table 4.3 Regulated carbon dioxide emissions – Be Lean

Dwelling Reference	TER: Part Emissions per annum	Baseline: L:2021 (tCO ₂ per annum)	DER: Proposed Dwelling Emissions (tCO ₂ per annum)	Emissions Savings (kgCO ₂ per annum)	Emissions Savings (%)
Proposed Dwelling		0.91	0.65	0.26	28.6%

- 4.35 The above analysis shows that the proposed dwelling will achieve an approximate onsite carbon dioxide emissions saving of 28% through energy efficiency measures under the 'Be Lean' tier of the energy hierarchy.

'Be Clean' (Supply Energy Efficiently)

- 4.36 The potential for the proposed development to incorporate a low carbon heating/cooling system has been reviewed for the scheme, in line with the hierarchy presented in the London Plan policy SI2, copied below:

1. Connection to existing heating or cooling networks;

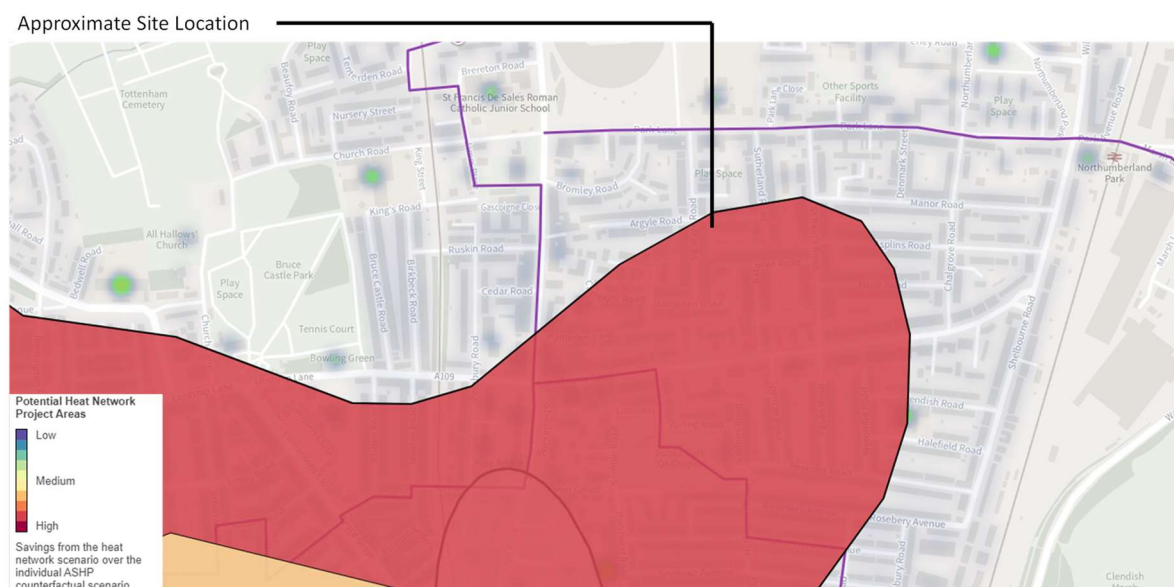
2. Site wide combined heat and power (CHP) network; and
3. Communal heating and cooling.

4.37 The London Heat Map is a tool provided by the Mayor of London to identify opportunities for decentralised energy projects in London. It builds on the 2005 London Community Heating Development Study.

4.38 The image below is an extract from the London Heat Map, showing the area in the vicinity of the site. It illustrates;

- Heat demand (areas of heat demand are shown in red, with areas with a high density of heat demand appearing more opaque, and areas of zero heat demand appearing transparent);
- Existing heat networks (shown as red lines);
- Proposed heat networks (shown as purple lines);
- Heatmap study areas (shown as transparent white circles);
- Potential Heat Network Project Areas (shown as semi-transparent orange and red areas); and
- Potential heat supply sites (shown as purple dots).

Figure 4.5 Extract from the London Heat Map



4.39 The extract above indicates that the proposed development site is located within an area of low heat density. There are no existing district heat networks located within the surrounding area, however there are proposed district heat networks to the east and north of the site along the High Road and

Park Lane, respectively. There are no identified potential heat sources within close proximity to the proposed development site, and it is not located within a Heatmap Study Area. However, the site is located within a Potential Heat Network Project Area that has the potential to deliver significant carbon dioxide emissions savings when compared to the provision of individual air source heat pump (ASHP) systems. However, there are no clear timelines on the delivery of a heat network of this type within the area for which there is potential for the proposed development to connect. At this stage, it is therefore not intended that the proposed development be connected to a local heat network, however where feasible, the proposals will be designed to allow for future connection, should a heat network come forward within the surrounding area.

- 4.40 The use of CHP is considered to be unviable for the proposed development site, in particular due to the small scale of the proposed scheme. CHP technology is appropriate for building uses with large hot water demands due to the requirements for CHP to be kept running to meet a base load. As heating is not required during summer months, base loads are driven by hot water demand. Due to the planned use of the proposed development as a single residential dwelling, hot water demand for the development is low and as such CHP does not represent a feasible technology for the scheme.
- 4.41 It is instead proposed that the space and water heating demand of the proposed development be served by an individual air source heat pump (ASHP) system. It is noted that, through the use of all-electric systems, the carbon emissions associated with the development will decrease in line with the decarbonisation of the electricity grid. The use of the proposed all-electric systems has been included for within the “Be Green” modelling of the proposed development, the results for which are presented in the next section. In this way, the carbon dioxide emissions associated with the proposed development under the “Be Clean” tier of the Energy Hierarchy will be the same as those under the “Be Lean” tier. This is demonstrated below:

Figure 4.6 Regulated carbon dioxide emissions – Be Clean

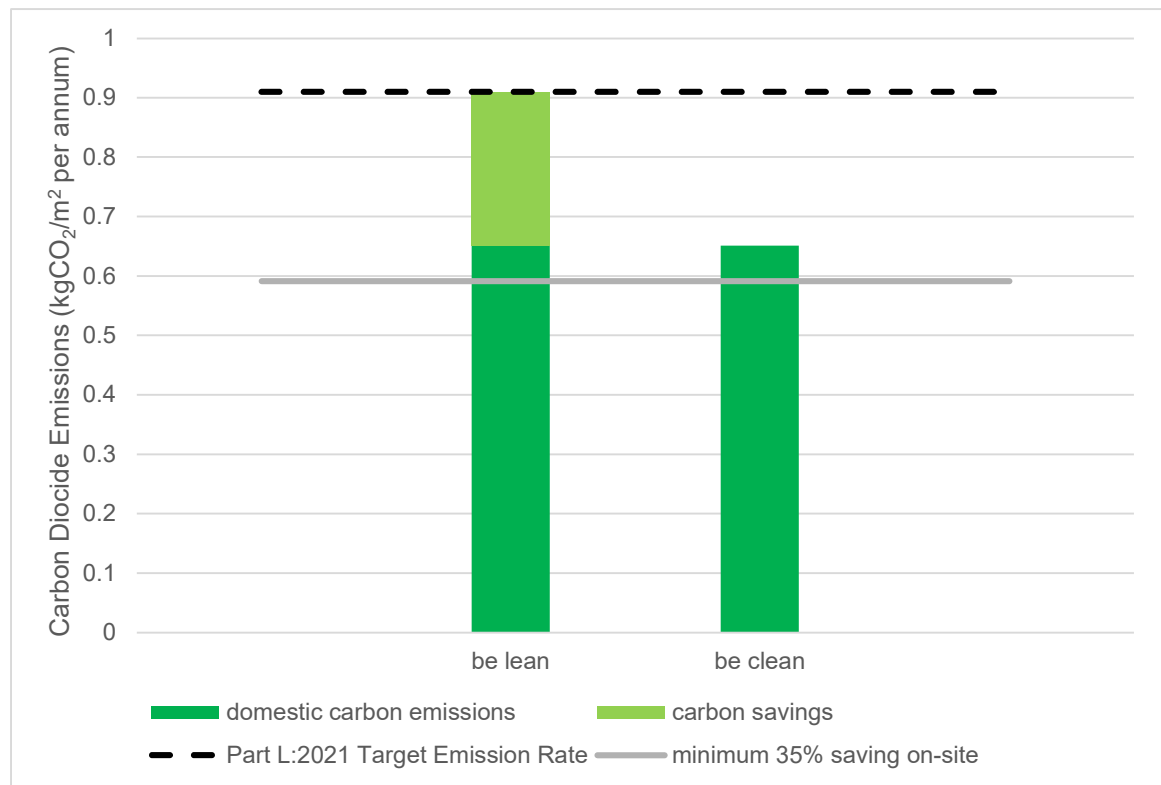


Table 4.4 Regulated carbon dioxide emissions – Be Clean

Dwelling Reference	TER: Part Emissions per annum)	Baseline: L:2021 (tCO ₂ per annum)	DER: Proposed Dwelling Emissions (tCO ₂ per annum)	Emissions Savings (kgCO ₂ per annum)	Emissions Savings (%)
Proposed Dwelling		0.91	0.65	0.26	28.6%

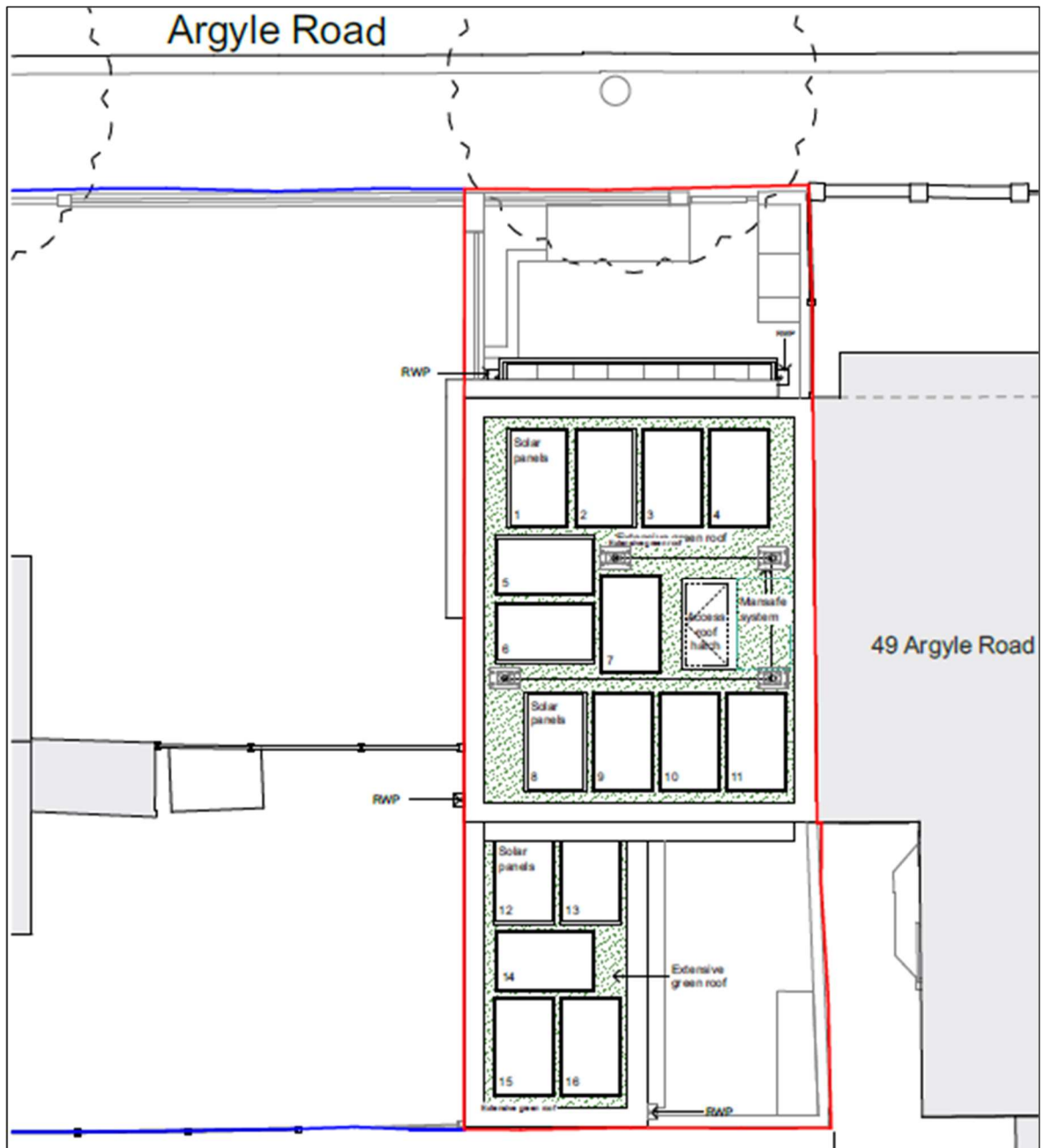
‘Be Green’ (Utilise Renewable Technologies)

- 4.42 The proposed development has given consideration to renewable energy technologies that may be applicable to deliver the required level of carbon dioxide savings over the Part L:2021 baseline, and the likely local effects on the environment.
- 4.43 A full review of potentially applicable renewable technologies has been carried out, considering both the effectiveness and viability of the different technologies. Full details of the assessment and outcomes are provided in Appendix A6.
- 4.44 It is intended that air source heat pump (ASHP) technology will be employed to serve both the space and water heating demand of the proposed dwelling. Although this has yet to be formally specified,

typical manufacturer specifications for the proposed systems quote a heating coefficient of 4.81 at a supply temperature of 35degC, and a hot water efficiency of over 100%. The location of the external portion of the ASHP is shown in Appendix A3, within an enclosure in the southeastern corner of the site, whilst the location of the internal portion of the ASHP system, which comprises an ASHP cylinder, is shown in Appendix A4, within a storage area at the first floor level. It is expected that the proposed ASHP system will deliver 100% of the space and water heating demands of the proposed development.

- 4.45 The specified system will be designed to operate quietly and will be positioned away from proposed and existing bedroom windows; however it is noted that if required, additional acoustic measures will be employed to further limit the noise generated by the outside unit of the system during operation. This may include the provision of an acoustic enclosure and the employment of vibration isolation dampener mounts. To ensure the visual impact of the external portion of the ASHP system is minimised, it is intended that it be incorporated within the planted area to the rear of the dwelling, with planting provided to act as a screen. If required, an enclosure may also be erected, which will further reduce the visual impact of the system.
- 4.46 Rooftop photovoltaic (PV) technology is also proposed to generate renewable electricity onsite. The location of the proposed arrays is shown on the roof plan displayed below.

Figure 4.7 Proposed rooftop PV panel locations



- 4.47 The roof area, which has been maximised based on the available roof space when taking the proposed roof lights into account, is proposed to house 16 PV panels. The PV coverage extends to all reasonably available roof space that is unshaded, with a net PV panel area of 28.3m² to be incorporated across approximately 31.4m² of the proposed roof space. PV panels have been modelled with an assumed efficiency of up to 22.6% and a dimension of 1.0 x 1.7m, providing approximately 400W per panel (peak output) and a resultant peak output of 6.4kWp. Panels will be oriented to maximise output per panel. The PV panels will be incorporated in conjunction with the proposed green roof, which will improve the performance of the PV panels through improvements to the rooftop microclimate brought about by the cooling effect of the green roof.

- 4.48 With respect to a demand-side response, the proposals will employ highly efficient systems and services to minimise energy consumption during operation. Whilst the proposed development will employ an extensive array of PV panels, due to space constraints associated with the plot itself and the proposed dwelling, it is not possible to incorporate battery storage within the proposals. However, it is intended that, where possible, any electricity generated on the site in excess of the amount required by the proposed dwelling will be exported back to the national grid. Details of how this will be achieved will be provided at a later stage, should this be required.
- 4.49 Energy modelling of the proposed scheme has been undertaken using the Standard Assessment Procedure (SAP) for the proposed dwelling.
- 4.50 The carbon dioxide emissions for the sampled dwelling are shown below. DER/TER reports showing the performance of the modelled dwelling under the 'Be Green' tier of the Energy Hierarchy are provided in Appendix A3.

Figure 4.8 Regulated carbon dioxide emissions – Be Green

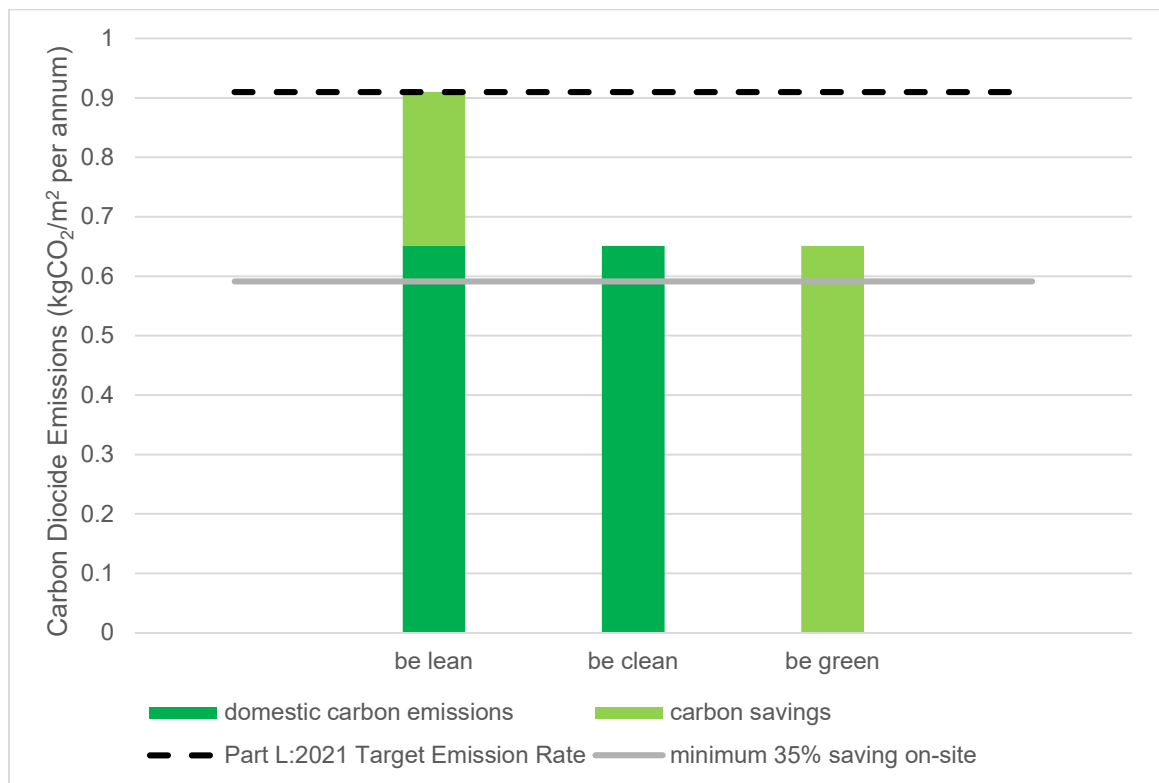


Table 4.5 Regulated carbon dioxide emissions – Be Green

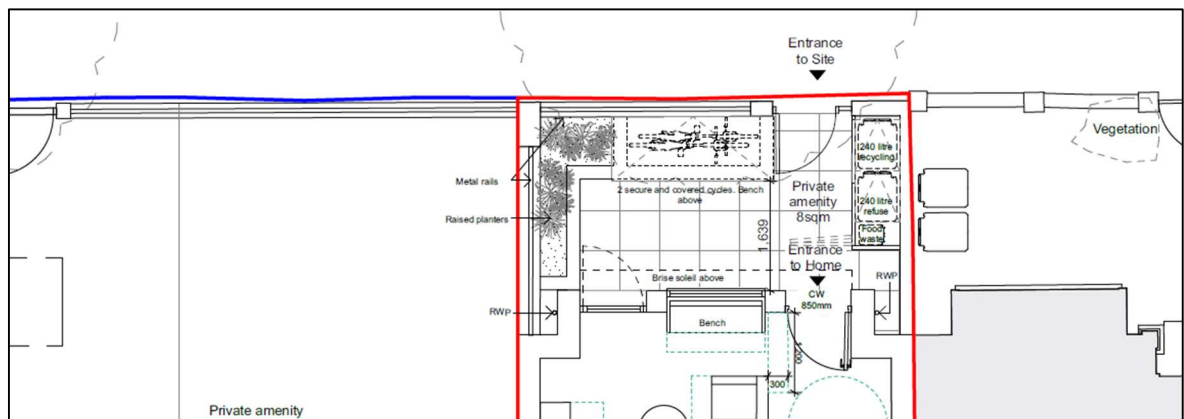
Dwelling Reference	TER: Part Emissions per annum)	Baseline: L:2021 (tCO ₂ per annum)	DER: Proposed Dwelling Emissions (tCO ₂ per annum)	Emissions Savings (kgCO ₂ per annum)	Emissions Savings (%)
Proposed Dwelling		0.91	-0.23	1.14	125.3%

- 4.51 The above analysis shows that the proposed dwelling will achieve an approximate onsite carbon dioxide emissions saving of 125.3% through energy efficiency measures and renewable technologies. This is in exceedance of the carbon emissions reduction requirements set out within the London Borough of Haringey Council's policies.

Biodiversity

- 4.52 As demonstrated in Figure 4.7 above, the proposed development will incorporate green roof planting. This, in combination with the proposed planting to be provided within the front and rear garden areas, shown in Figures 4.9 and 4.10 below, will aid in delivering opportunities for enhanced biodiversity.

Figure 4.9 Proposed front garden planting



The floor plan shows the rear garden with the following areas and dimensions:

- WC:** 2.4sqm, 800mm wide, with a 300mm radius.
- CW (Cloakroom/Washroom):** 750mm wide, 300mm deep.
- Single bedroom 3:** 8.7sqm, with a 2.451m wide section.
- Private amenity space:** 13sqm, featuring a grass area, planting/green wall, and a fixed structure.
- Vegetation:** A dashed circle indicates a specific area.
- ASHP (Air Source Heat Pump):** Located in the bottom right corner.
- Dimensions:** 900mm, 750mm, 800mm, 300mm, 2.451m, 2.4sqm, 8.7sqm, 13sqm.
- Other labels:** "Briar sole above", "Planting / Green wall", "Grass", "Fixed", "RRP", "Vegetation".

- 29

Figure 4.11 Example of proposed bird box

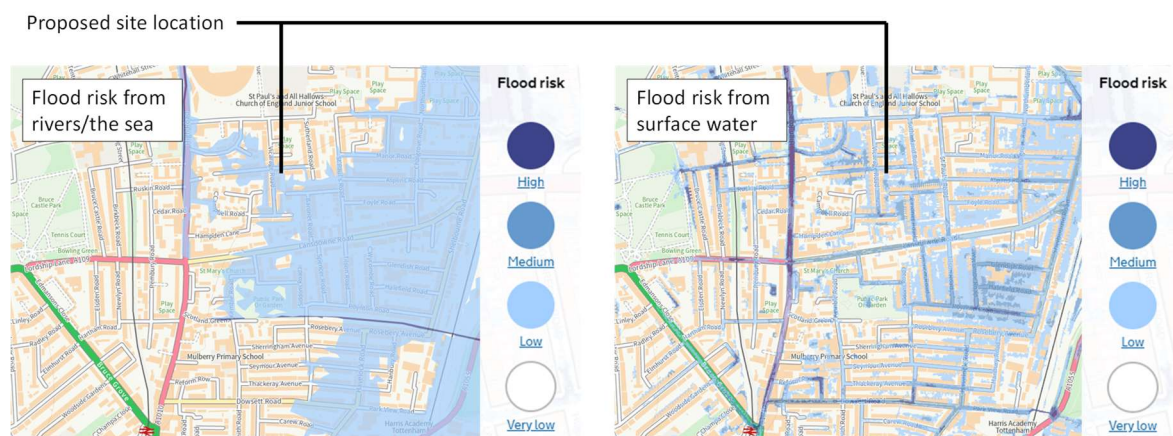


- 4.54 All planting specified on the site will rely on precipitation or manual watering to ensure that potable water use is minimised, although the potential to incorporate rainwater harvesting may be explored at a more detailed design stage. It is recommended that the planting provided also be drought resistant to ensure they will acclimatise to climate change effects.

Adaptation to Climate Change: SuDS

- 4.55 Figure 4.12 below confirms that there is a low risk of flooding on the site from fluvial/tidal sources. The risk of surface water flooding within the site boundaries is low, as is the risk shown to be present along Argyle Street to the north of the site.

Figure 4.12 Extract from the Environment Agency's online flood map



- 4.56 The proposed development will not result in an increase in the hardstanding area of the site, therefore there will be no exacerbation of the risk of flooding from surface water sources either on the site or in the immediate surroundings as a result of the proposed development. In addition, the incorporation of the proposed green roof planting and soft landscaping within the front garden, as well as the integration of permeable surfaces within both the front garden and rear private amenity space, will positively contribute to the management of the 5m storm event, therefore limiting runoff for the typical everyday rainfall event.

Adaptation to Climate Change: Overheating

- 4.57 In order to protect the development against overheating in the future, a number of key design features have been proposed to ensure the proposals are resilient to increased temperatures, which may be experienced as a result of climate change and the urban heat island effect. A summary of the measures included to reduce overheating risk is provided below:

Reduction of the amount of heat entering the building in the summer

- The building's south facing facades will have a limited amount of glazing to mitigate direct solar heat gain while optimising daylight penetration.
- The total proportion of the dwelling's façade that will be glazed has been limited to 14%. This will comprise 20.6sqm of glass, contained within 143.7sqm of solid components.
- Vegetation will be incorporated within the front and rear landscaped areas, which will aid in minimising the amount of heat entering the building. Street trees are also present on Argyle Road to the north of the proposed development site, which will further aid in minimising the amount of heat that enters the building.
- To further minimise the amount of heat entering the building during the summer, there is potential for shutters and/or blinds to be installed on the glazed areas.

Minimisation of internal heat generation through energy efficient design

- Heat gain from lighting is kept to a minimum as a result of an energy-efficient lighting design solution.
- The availability of natural light is maximised by optimising the light transmittance of the glass elements of the façade.
- The scheme will use an air source heat pump system for heating and hot water. This is a low temperature distribution system, leading to lower internal heat gains from distribution pipework.

Management of the heat within the building through exposed thermal mass and high ceilings

- The proposed green roof will have a high degree of in-built thermal mass to mitigate heat gain and heat loss.
- The proposed dwelling will have high ceilings, with a floor to ceiling height of approximately 2.5m, which will facilitate passive stack ventilation, whereby warm air rises towards the ceiling, drawing cooler air in at the floor level.

Passive ventilation

- Openable windows on multiple aspects will provide a passive ventilation strategy that utilises crossflow ventilation to maximise the potential for natural ventilation within the scheme.
- The proposed dwelling has been designed with a shallow floorplate, being fairly rectangular in shape. This supports the crossflow ventilation delivered by the provision of opening on multiple aspects.

Mechanical and active cooling

- The proposed dwelling will incorporate mechanical ventilation with heat recovery (MVHR), for which it is recommended that a summer bypass mode be included. This will ensure air entering the dwelling via the mechanical ventilation system is not pre-warmed, as it will not pass through the heat exchanger.
- It is also intended that, where feasible, the mechanical ventilation system be positioned such that it takes in air from shaded areas. In this way, the proposals will benefit from free cooling, whereby cooler air is taken in by the ventilation system.
- Cooling is not proposed for the dwelling.

Operational Sustainability

- 4.58 As detailed above, it is intended that time and temperature control zones by the suitable arrangement of plumbing and electrical services will be employed within the dwelling to control heating consumption. It is also intended that lighting controls will be designed to allow for localised control,

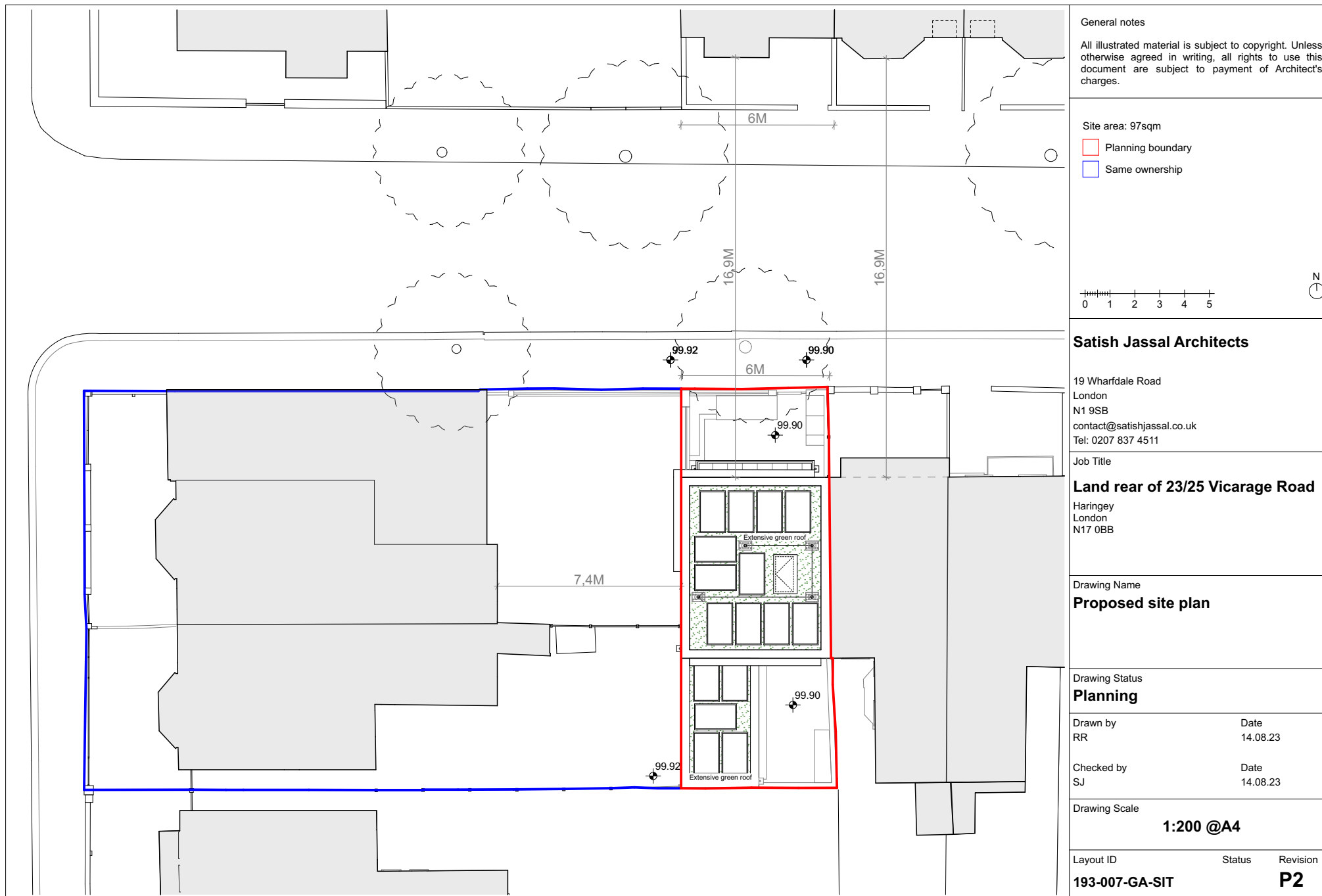
with further details to be provided at a more detailed design stage. This information will be provided in full detail to future residents, to ensure the optimal operation of those services.

- 4.59 Smart meters will be fitted within the dwelling to monitor energy and water consumption, which will aid occupants in eliminating unnecessary energy and water use, and reducing running costs.
- 4.60 It should also be noted that, considering the excellent connectivity of the site with respect to access to public transport services, it is intended to deliver a car-free development. Dedicated cycle storage space is to be provided within the proposed gated front garden, adjacent to the northern boundary of the site, at the ground floor level. This will aid in promoting active transport once the proposed development is in operation, therefore reducing reliance on private cars.

5. SUMMARY

- 5.1 This Sustainability Statement provides an overview as to how the proposed development at 23/25 Vicarage Road contributes to sustainable development in the context of the strategic, design and construction considerations.
- 5.2 Consideration has been given to the London Borough of Haringey Local Plan in the formulation of this strategy, aiming to minimise the environmental impact of the proposed development during construction and operation, and ensure the development is constructed to rigorous sustainability standards.
- 5.3 Section 4 of this report demonstrates that the siting and design of the proposals support relevant policy relating to sustainable development, based on the principles outlined in the London Borough of Haringey Local Plan policies SP4 (Working towards a Low Carbon Haringey) and DM21 (Sustainable Design, Layout and Construction). This shows that the proposed development:
- Will minimise energy demand through the use of high levels of insulation and energy efficient systems;
 - Will be fossil fuel free, using an air source heat pump system to provide space heating and hot water;
 - Will achieve an approximate 125.3% reduction in CO₂ emissions, following the Energy Hierarchy methodology, thereby achieving net zero carbon emissions in operation;
 - Will minimise internal water consumption to 105 litres per person per day;
 - Will incorporate measures to improve site biodiversity, including the provision of green roof planting, and soft landscaping within the front garden of the dwelling;
 - Will not increase the risk of surface water flooding onsite;
 - Will be adapted to the impacts of climate change including overheating;
 - Will incorporate low-impact materials, according to the BRE Green Guide to Specification, and minimise waste production during construction and maximise the proportion of waste to be diverted from landfill; and
 - Will promote the principles of sustainable development during operation.
- 5.4 Overall, the proposals constitute sustainable development in accordance with local policy requirements and will provide a development that seeks to promote these principles in operation.

A1. SITE PLAN



A2. WATER USAGE CALCULATOR



Job no:	23-IF014
Date:	10/05/2023
Assessor name:	
Registration no:	N/A
Development name:	23/25 Vicarage Road

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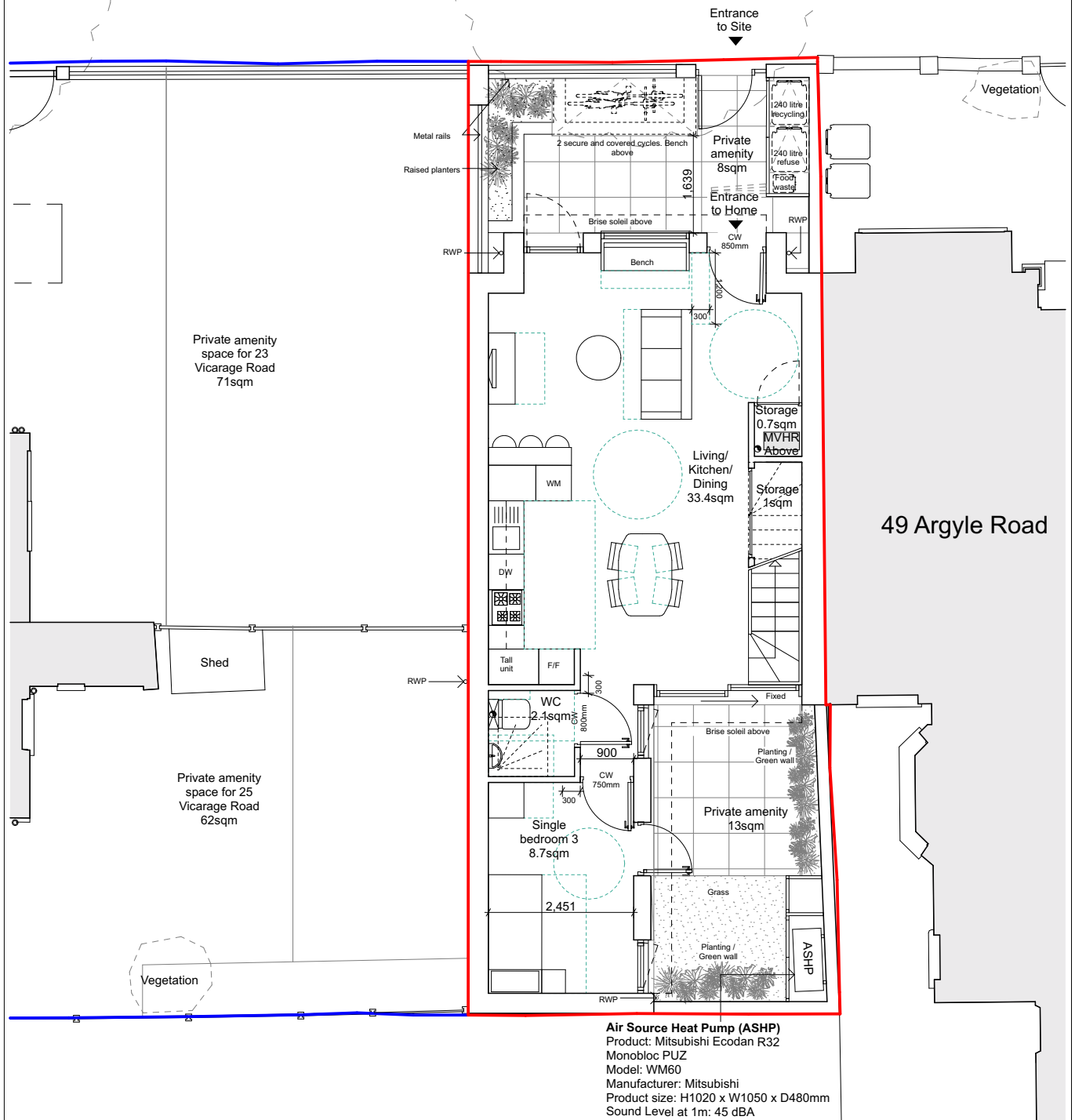
PRINTING: before printing please make sure that in "Page Setup" you have selected the page to be as "Landscape" and that the Scale has been set up to 70% (maximum)

WATER EFFICIENCY CALCULATOR FOR NEW DWELLINGS - (BASIC CALCULATOR)

	House Type:	Type 1		Type 2		Type 3		Type 4		Type 5		Type 6		Type 7		Type 8		Type 9		Type 10	
		Description:		Typical Unit																	
Installation Type	Unit of measure	Capacity/flow rate	Litres/person/day	Capacity/flow rate	Litres/person/day	Capacity/flow rate	Litres/person/day	Capacity/flow rate	Litres/person/day	Capacity/flow rate	Litres/person/day	Capacity/flow rate	Litres/person/day	Capacity/flow rate	Litres/person/day	Capacity/flow rate	Litres/person/day	Capacity/flow rate	Litres/person/day	Capacity/flow rate	Litres/person/day
Is a dual or single flush WC specified?		Dual		Select option:		Select option:		Select option:		Select option:		Select option:		Select option:		Click to Select		Click to Select		Click to Select	
WC	Full flush volume	6	8.76		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00
	Part flush volume	3	8.88		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00
Taps (excluding kitchen and external taps)	Flow rate (litres / minute)	3	6.32		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00
Are both a Bath & Shower Present?		Bath & Shower		Select option:		Select option:		Select option:		Select option:		Select option:		Select option:		Select option:		Select option:		Select option:	
Bath	Capacity to overflow	180	19.80		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00
Shower	Flow rate (litres / minute)	8	34.96		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00
Kitchen sink taps	Flow rate (litres / minute)	4	12.12		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00
Has a washing machine been specified?		No		Select option:		Select option:		Select option:		Select option:		Select option:		Select option:		Select option:		Select option:		Select option:	
Washing Machine	Litres / kg		17.16		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00
Has a dishwasher been specified?		No		Select option:		Select option:		Select option:		Select option:		Select option:		Select option:		Select option:		Select option:		Select option:	
Dishwasher	Litres / place setting		4.50		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00
Has a waste disposal unit been specified?		No		Select option:		Select option:		Select option:		Select option:		Select option:		Select option:		Select option:		Select option:		Select option:	
Water Softener	Litres / person / day		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00
Calculated Use		112.5		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0	
Normalisation factor		0.91		0.91		0.91		0.91		0.91		0.91		0.91		0.91		0.91		0.91	
Code for Sustainable Homes	Total Consumption	102.4		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0	
	Mandatory level	Level 3/4		-		-		-		-		-		-		-		-		-	
Building Regulations 17.K	External use	5.0		5.0		5.0		5.0		5.0		5.0		5.0		5.0		5.0		5.0	
	Total Consumption	107.4		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0	
	17.K Compliance?	Yes		-		-		-		-		-		-		-		-		-	

A3. LOCATION OF PROPOSED MVHR UNITS

Argyle Road



Housing standards - 3 bedrooms, 4 people		
Area	Proposed	Min standards*
GIA	85.3sqm	84sqm
Double bedroom 1	13.4sqm	11.5sqm
Single bedroom 2	9.2sqm	7.5sqm
Single bedroom 3	8.7sqm	7.5sqm
Storage	2.7sqm	2.5sqm
Private amenity	21sqm	7sqm
Cycle spaces	2	2
Refuse - recycling	240litre	240litre
Refuse - general	240litre	240litre
Refuse - food waste	std. caddy	std. caddy

*As per National Housing Standards, London Plan, London Plan's Housing SPG and Haringey Waste Standards

Planning boundary	0 1 2 3
Same ownership	

General notes

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Tel: 0207 837 4511

Job Title

Land rear of 23/25 Vicarage Road

Haringey
London
N17 0BB

Drawing Name

Proposed ground floor plan

Drawing Status

Planning

Drawn by

RR

Date

14.08.23

Checked by

SJ

Date

14.08.23

Drawing Scale

1:100 @A4

Layout ID

193-008-GA-PLN

Status

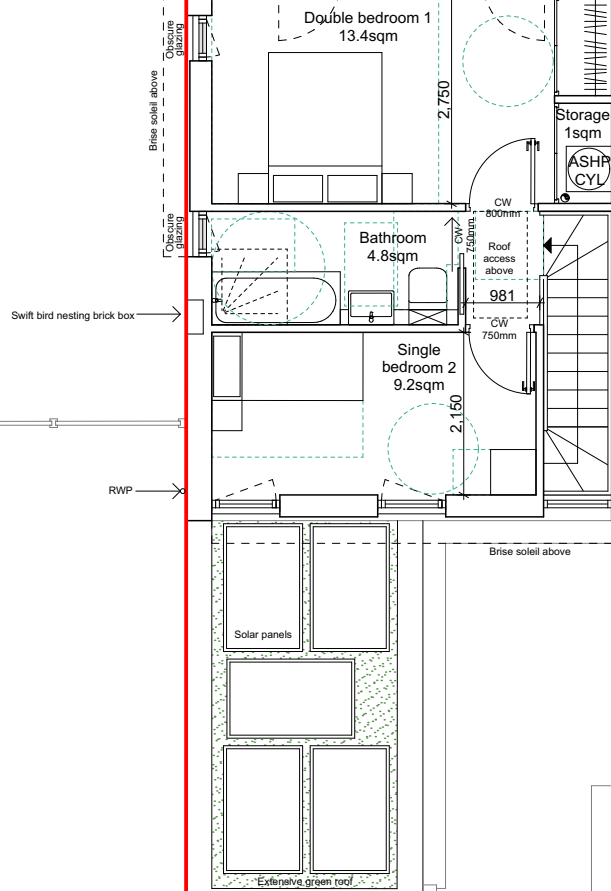
Revision

P2

A4. LOCATION OF INTERNAL PORTION OF ASHP SYSTEM

Argyle Road

49 Argyle Road

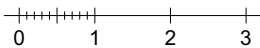


Housing standards - 3 bedrooms, 4 people

Area	Proposed	Min standards*
GIA	85.3sqm	84sqm
Double bedroom 1	13.4sqm	11.5sqm
Single bedroom 2	9.2sqm	7.5sqm
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Refuse - recycling	240litre	240litre
Refuse - general	240litre	240litre
Refuse - food waste	std. caddy	std. caddy

*As per National Housing Standards, London Plan, London Plan's Housing SPG and Haringey Waste Standards

- Planning boundary
- Same ownership



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Tel: 0207 837 4511

Job Title

Land rear of 23/25 Vicarage Road

Haringey
London
N17 0BB

Drawing Name

Proposed first floor plan

Drawing Status

Planning

Drawn by
RR

Date
14.08.23

Checked by
SJ

Date
14.08.23

Drawing Scale

1:100 @A4

Layout ID

193-009-GA-PLN

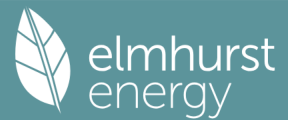
Status

Revision

P2

A5. DER/TER WORKSHEETS

Full SAP Calculation Printout



Property Reference	23 25 Vicarage Road				Issued on Date	15/08/2023
Assessment Reference	Be Lean		Prop Type Ref	Proposed Dwelling		
Property	23 25 Vicarage Road, 23 25 , Vicarage Road, London, N17 0BB					
SAP Rating	82 B	DER	11.32	TER	10.57	
Environmental	91 B	% DER < TER				-7.10
CO ₂ Emissions (t/year)	0.78	DFEE	37.21	TFEE	37.33	
Compliance Check	See BREL	% DFEE < TFEE				0.32
% DPER < TPER	-27.96	DPER	70.46	TPER	55.06	
Assessor Details	[REDACTED]				Assessor ID	BE76-0001
Client	Mr Van Ly, Mr Van Ly					

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 ²)	Storey height (m)	Volume (m ³)
Ground floor	50.4000 (1b)	x 2.5000 (2b)	= 126.0000 (1b) -
First floor	35.7000 (1c)	x 2.5000 (2c)	= 89.2500 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 215.2500 (5)

2. Ventilation rate

	m ³ 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	1 * 10 = 10.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour 10.0000 / (5) = 0.0465 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	3.0000 (17)
Infiltration rate	0.1965 (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) = 0.1670 (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	0.2129	0.2087	0.2046	0.1837	0.1795	0.1586	0.1586	0.1545	0.1670	0.1795	0.1879	0.1962 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												72.0000 (23c)
Effective ac	0.3529	0.3487	0.3446	0.3237	0.3195	0.2986	0.2986	0.2945	0.3070	0.3195	0.3279	0.3362 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.4000	1.0000	2.4000		(26)
Opening Type 2 (Uw = 1.26)			26.8000	1.1995	32.1478		(27)

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Heatloss Floor 1			50.4000	0.1000	5.0400	(28a)
External Wall 1	117.7000	29.2000	88.5000	0.1500	13.2750	(29a)
External Roof 1	50.4000		50.4000	0.1000	5.0400	(30)
Total net area of external elements Aum(A, m2)			218.5000			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		57.9028	(33)
Party Wall 1			33.0000	0.0000	0.0000	(32)

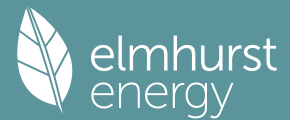
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K						250.0000 (35)
List of Thermal Bridges						
K1 Element				Length	Psi-value	Total
E5 Ground floor (normal)				18.1000	0.1600	2.8960
E6 Intermediate floor within a dwelling				29.0000	0.0000	0.0000
E16 Corner (normal)				10.0000	0.0900	0.9000
E18 Party wall between dwellings				10.0000	0.0600	0.6000
Thermal bridges (Sum(L x Psi) calculated using Appendix K)						4.3960 (36)
Point Thermal bridges					(36a) =	0.0000
Total fabric heat loss					(33) + (36) + (36a) =	62.2988 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	25.0681	24.7716	24.4751	22.9924	22.6958	21.2131	21.2131	20.9166	21.8062	22.6958	23.2889	23.8820	(38)
Average = Sum(39)m / 12 =	87.3669	87.0704	86.7738	85.2911	84.9946	83.5119	83.5119	83.2153	84.1049	84.9946	85.5877	86.1807	(39)
												85.2170	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0147	1.0113	1.0078	0.9906	0.9872	0.9699	0.9699	0.9665	0.9768	0.9872	0.9940	1.0009	(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													2.5685 (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													
	29.0579	28.6264	28.0187	26.8981	26.0591	25.1288	24.6262	25.2297	25.8868	26.8823	28.0259	28.9597	(42b)
Hot water usage for other uses													
	40.9339	39.4454	37.9569	36.4684	34.9799	33.4914	33.4914	34.9799	36.4684	37.9569	39.4454	40.9339	(42c)
Average daily hot water use (litres/day)													64.1539 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	69.9918	68.0718	65.9755	63.3665	61.0390	58.6201	58.1176	60.2096	62.3551	64.8392	67.4712	69.8936	(44)
Energy content (annual)	110.8499	96.9333	101.4020	86.7456	82.1702	72.0803	70.2882	74.5520	76.8901	87.9861	96.1252	109.4365	(45)
Distribution loss (46)m = 0.15 x (45)m													
	16.6275	14.5400	15.2103	13.0118	12.3255	10.8120	10.5432	11.1828	11.5335	13.1979	14.4188	16.4155	(46)
Water storage loss:													
Store volume													150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.8600 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.0044 (55)
Total storage loss													
	31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	30.1320	31.1364	30.1320	31.1364	(56)
If cylinder contains dedicated solar storage													
	31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	30.1320	31.1364	30.1320	31.1364	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	165.2487	146.0677	155.8008	139.3896	136.5690	124.7243	124.6870	128.9508	129.5341	142.3849	148.7692	163.8353	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	165.2487	146.0677	155.8008	139.3896	136.5690	124.7243	124.6870	128.9508	129.5341	142.3849	148.7692	163.8353	(64)
12Total per year (kWh/year)													
Electric shower(s)													1705.9614 (64)
	53.8840	48.0111	52.4262	50.0297	50.9685	48.6190	50.2396	50.9685	50.0297	52.4262	51.4404	53.8840	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													612.9269 (64a)
Heat gains from water heating, kWh/month													
	93.8476	83.5406	90.3417	83.4655	83.5828	78.2366	79.4498	81.0497	80.1886	85.8810	86.9369	93.3777	(65)

5. Internal gains (see Table 5 and 5a)													
Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	128.4245	128.4245	128.4245	128.4245	128.4245	128.4245	128.4245	128.4245	128.4245	128.4245	128.4245	128.4245	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	116.8747	129.3970	116.8747	120.7705	116.8747	120.7705	116.8747	116.8747	120.7705	116.8747	120.7705	116.8747	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	231.7171	234.1216	228.0623	215.1629	198.8797	183.5757	173.3517	170.9473	177.0065	189.9060	206.1892	221.4931	(68)
Pumps, fans	35.8424	35.8424	35.8424	35.8424	35.8424	35.8424	35.8424	35.8424	35.8424	35.8424	35.8424	35.8424	(69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)

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	-102.7396	-102.7396	-102.7396	-102.7396	-102.7396	-102.7396	-102.7396	-102.7396	-102.7396	-102.7396	-102.7396	-102.7396	(71)
Water heating gains (Table 5)	126.1393	124.3164	121.4271	115.9244	112.3424	108.6620	106.7873	108.9378	111.3730	115.4314	120.7457	125.5076	(72)
Total internal gains	539.2584	552.3623	530.8914	516.3851	492.6241	474.5356	458.5411	458.2870	470.6774	486.7394	512.2327	528.4027	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				5.1000	10.6334	0.7000		0.7000		0.7700		18.4150 (74)
East				10.7000	19.6403	0.7000		0.7000		0.7700		71.3609 (76)
South				1.6000	46.7521	0.7000		0.7000		0.7700		25.4010 (78)
West				9.4000	19.6403	0.7000		0.7000		0.7700		62.6909 (80)
Solar gains	177.8678	339.0260	544.6528	785.7900	963.7021	988.7563	940.2885	805.7901	629.5274	397.9237	219.9729	147.5381 (83)
Total gains	717.1261	891.3882	1075.5442	1302.1750	1456.3262	1463.2918	1398.8296	1264.0772	1100.2048	884.6631	732.2056	675.9408 (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)														
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
alpha	68.4374	68.6705	68.9052	70.1030	70.3476	71.5966	71.5966	71.8518	71.0917	70.3476	69.8602	69.3794		
util living area	5.5625	5.5780	5.5937	5.6735	5.6898	5.7731	5.7731	5.7901	5.7394	5.6898	5.6573	5.6253		
	0.9901	0.9693	0.9063	0.7368	0.5350	0.3646	0.2626	0.3026	0.5210	0.8502	0.9743	0.9926	(86)	
MIT	20.2272	20.4292	20.6729	20.8755	20.9345	20.9453	20.9461	20.9462	20.9391	20.8186	20.4874	20.1992	(87)	
Th 2	20.0711	20.0740	20.0768	20.0912	20.0940	20.1085	20.1085	20.1113	20.1027	20.0940	20.0883	20.0826	(88)	
util rest of house	0.9871	0.9608	0.8842	0.6946	0.4855	0.3141	0.2094	0.2443	0.4560	0.8088	0.9657	0.9903	(89)	
MIT 2	19.3739	19.5731	19.8036	19.9884	20.0334	20.0543	20.0547	20.0577	20.0456	19.9515	19.6447	19.3561	(90)	
Living area fraction	19.7059	19.9062	20.1418	20.3335	20.3840	20.4010	20.4015	20.4034	fLA = Living area / (4) =	20.3933	20.2889	19.9726	0.3891	(91)
MIT	19.7059	19.9062	20.1418	20.3335	20.3840	20.4010	20.4015	20.4034	20.3933	20.2889	19.9726	19.6841	(92)	
Temperature adjustment												-0.1500		
adjusted MIT	19.5559	19.7562	19.9918	20.1835	20.2340	20.2510	20.2515	20.2534	20.2433	20.1389	19.8226	19.5341	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	0.9850	0.9574	0.8819	0.6991	0.4933	0.3222	0.2180	0.2536	0.4663	0.8110	0.9626	0.9886	(94)	
Useful gains	706.4026	853.3815	948.4936	910.2904	718.3816	471.4583	304.9099	320.5747	513.0763	717.4987	704.8552	668.2485	(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	1332.8621	1293.5359	1170.7365	962.3837	725.3466	471.9236	304.9461	320.6597	516.6778	810.7541	1088.8949	1321.5083	(97)	
Space heating kWh	466.0858	295.7838	165.3487	37.5072	5.1820	0.0000	0.0000	0.0000	0.0000	69.3820	276.5085	486.0253	(98a)	
Space heating requirement - total per year (kWh/year)												1801.8234		
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	466.0858	295.7838	165.3487	37.5072	5.1820	0.0000	0.0000	0.0000	0.0000	69.3820	276.5085	486.0253	(98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												1801.8234		
Space heating per m2										(98c) / (4) =		20.9271	(99)	

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.0000	(206)
Efficiency of main space heating system 2 (in %)													0.0000	(207)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	466.0858	295.7838	165.3487	37.5072	5.1820	0.0000	0.0000	0.0000	0.0000	69.3820	276.5085	486.0253	(98)	
Space heating efficiency (main heating system 1)	90.0000	90.0000	90.0000	90.0000	90.0000	0.0000	0.0000	0.0000	0.0000	90.0000	90.0000	90.0000	(210)	
Space heating fuel (main heating system)	517.8732	328.6486	183.7208	41.6747	5.7577	0.0000	0.0000	0.0000	0.0000	77.0912	307.2317	540.0281	(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)	

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Water heating													
Water heating requirement	165.2487	146.0677	155.8008	139.3896	136.5690	124.7243	124.6870	128.9508	129.5341	142.3849	148.7692	163.8353	(64)
Efficiency of water heater												93.0000	(216)
(217)m	89.4682	89.3294	89.0191	88.4170	88.0716	88.0000	88.0000	88.0000	88.0000	88.6459	89.2907	89.4877	(217)
Fuel for water heating, kWh/month	184.7010	163.5158	175.0195	157.6502	155.0658	141.7321	141.6898	146.5350	147.1979	160.6221	166.6122	183.0813	(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	21.0760	19.0364	21.0760	20.3961	21.0760	20.3961	21.0760	21.0760	20.3961	21.0760	20.3961	21.0760	(231)
Lighting	26.4140	21.1903	19.0795	13.9784	10.7974	8.8215	9.8497	12.8030	16.6299	21.8193	24.6448	27.1481	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												2002.0260	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												93.0000	
Water heating fuel used												1923.4228	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)													
mechanical ventilation fans (SFP = 0.7420)												194.8529	(230a)
central heating pump												53.3000	(230c)
Total electricity for the above, kWh/year												248.1529	(231)
Electricity for lighting (calculated in Appendix L)												213.1758	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												4999.7044	(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2002.0260	0.2100	420.4255 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1923.4228	0.2100	403.9188 (264)
Energy for instantaneous electric shower(s)	612.9269	0.1391	85.2717 (264a)
Space and water heating			824.3442 (265)
Pumps, fans and electric keep-hot	248.1529	0.1387	34.4219 (267)
Energy for lighting	213.1758	0.1443	30.7679 (268)
Total CO2, kg/year			974.8057 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			11.3200 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2002.0260	1.1300	2262.2893 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1923.4228	1.1300	2173.4677 (278)
Energy for instantaneous electric shower(s)	612.9269	1.5143	928.1762 (278a)
Space and water heating			4435.7571 (279)
Pumps, fans and electric keep-hot	248.1529	1.5128	375.4057 (281)
Energy for lighting	213.1758	1.5338	326.9762 (282)
Total Primary energy kWh/year			6066.3152 (286)
Dwelling Primary energy Rate (DPER)			70.4600 (287)

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CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	50.4000 (1b)	x 2.5000 (2b)	= 126.0000 (1b) -
First floor	35.7000 (1c)	x 2.5000 (2c)	= 89.2500 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	215.2500 (5)

2. Ventilation rate

	m ³ 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	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1394 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3894 (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) = 0.3310 (21)

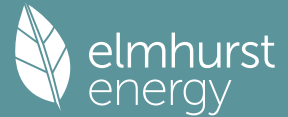
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4220	0.4137	0.4054	0.3641	0.3558	0.3144	0.3144	0.3061	0.3310	0.3558	0.3723	0.3889 (22b)
Effective ac	0.5890	0.5856	0.5822	0.5663	0.5633	0.5494	0.5494	0.5469	0.5548	0.5633	0.5693	0.5756 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.4000	1.0000	2.4000		(26)
TER Opening Type (Uw = 1.20)			19.1300	1.1450	21.9046		(27)
Heatloss Floor 1			50.4000	0.1300	6.5520		(28a)
External Wall 1	117.7000	21.5300	96.1700	0.1800	17.3106		(29a)
External Roof 1	50.4000		50.4000	0.1100	5.5440		(30)
Total net area of external elements Aum(A, m ²)			218.5000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	53.7112		(33)
Party Wall 1			33.0000	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E5 Ground floor (normal)				18.1000	0.1600	2.8960	
E6 Intermediate floor within a dwelling				29.0000	0.0000	0.0000	
E16 Corner (normal)				10.0000	0.0900	0.9000	
E18 Party wall between dwellings				10.0000	0.0600	0.6000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.3960 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	58.1072 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	41.8406	41.5950	41.3543	40.2237	40.0121	39.0274	39.0274	38.8450	39.4067	40.0121	40.4401	40.8875 (38)
Average = Sum(39)m / 12 =	99.9478	99.7022	99.4615	98.3308	98.1193	97.1345	97.1345	96.9522	97.5138	98.1193	98.5472	98.9946 (39)
												98.3298
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1608	1.1580	1.1552	1.1421	1.1396	1.1282	1.1282	1.1260	1.1326	1.1396	1.1446	1.1498 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5685 (42)
Hot water usage for mixer showers												
67.2849	66.2737	64.8002	61.9810	59.9005	57.5804	56.2616	57.7239	59.3269	61.8180	64.6978	67.0271 (42a)	
Hot water usage for baths												
29.0579	28.6264	28.0187	26.8981	26.0591	25.1288	24.6262	25.2297	25.8868	26.8823	28.0259	28.9597 (42b)	
Hot water usage for other uses												
40.9339	39.4454	37.9569	36.4684	34.9799	33.4914	33.4914	34.9799	36.4684	37.9569	39.4454	40.9339 (42c)	
Average daily hot water use (litres/day)												126.1883 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	137.2767	134.3455	130.7758	125.3476	120.9395	116.2005	114.3792	117.9335	121.6820	126.6572	132.1690	136.9207 (44)
Energy content (annual)	217.4127	191.3062	200.9975	171.5946	162.8079	142.8821	138.3318	146.0263	150.0461	171.8726	188.2990	214.3847 (45)
Distribution loss (46)m = 0.15 x (45)m												2095.9614
32.6119	28.6959	30.1496	25.7392	24.4212	21.4323	20.7498	21.9039	22.5069	25.7809	28.2449	32.1577 (46)	
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	264.0076	233.3919	247.5924	216.6864	209.4028	187.9739	184.9267	192.6212	195.1380	218.4675	233.3909	260.9796 (62)
WWHRS	-30.7598	-27.2042	-28.4867	-23.5881	-21.9833	-18.8113	-17.6326	-18.7505	-19.4629	-22.9446	-25.9934	-30.1902 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	233.2478	206.1876	219.1057	193.0983	187.4195	169.1627	167.2941	173.8708	175.6751	195.5229	207.3975	230.7894 (64)
	Total per year (kWh/year) = Sum(64)m =											2358.7713 (64)
12Total per year (kWh/year)												2359 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											0.0000 (64a)
Heat gains from water heating, kWh/month	109.5656	97.2779	104.1076	93.1287	91.4095	83.5818	83.2712	85.8297	85.9638	94.4236	98.6829	108.5588 (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	128.4245	128.4245	128.4245	128.4245	128.4245	128.4245	128.4245	128.4245	128.4245	128.4245	128.4245	128.4245 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	116.8833	129.4065	116.8833	120.7794	116.8833	120.7794	116.8833	116.8833	120.7794	116.8833	120.7794	116.8833 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	231.7171	234.1216	228.0623	215.1629	198.8797	183.5757	173.3517	170.9473	177.0065	189.9060	206.1892	221.4931 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8424	35.8424	35.8424	35.8424	35.8424	35.8424	35.8424	35.8424	35.8424	35.8424	35.8424	35.8424 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-102.7396	-102.7396	-102.7396	-102.7396	-102.7396	-102.7396	-102.7396	-102.7396	-102.7396	-102.7396	-102.7396	-102.7396 (71)
Water heating gains (Table 5)	147.2657	144.7587	139.9296	129.3454	122.8623	116.0858	111.9237	115.3625	119.3942	126.9134	137.0596	145.9124 (72)
Total internal gains	560.3934	572.8142	549.4025	529.8150	503.1526	481.9683	463.6861	464.7204	478.7074	498.2300	528.5555	548.8162 (73)

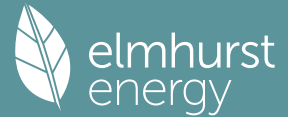
6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				6.7100	10.6334	0.6300	0.7000	0.7700	21.8055 (74)			
East				3.6400	19.6403	0.6300	0.7000	0.7700	21.8484 (76)			
South				7.6400	46.7521	0.6300	0.7000	0.7700	109.1606 (78)			
West				1.1400	19.6403	0.6300	0.7000	0.7700	6.8426 (80)			
Solar gains	159.6572	276.5743	390.9714	505.9290	586.6366	591.2603	566.3419	504.7161	430.5289	309.0302	192.0669	136.0971 (83)
Total gains	720.0506	849.3884	940.3739	1035.7440	1089.7892	1073.2286	1030.0280	969.4365	909.2364	807.2602	720.6224	684.9133 (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)	

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	59.8229	59.9703	60.1154	60.8066	60.9377	61.5555	61.5555	61.6713	61.3161	60.9377	60.6731	60.3989
alpha	4.9882	4.9980	5.0077	5.0538	5.0625	5.1037	5.1037	5.1114	5.0877	5.0625	5.0449	5.0266
util living area	0.9914	0.9800	0.9557	0.8869	0.7532	0.5637	0.4122	0.4553	0.6905	0.9159	0.9811	0.9932 (86)
MIT	19.8130	20.0392	20.3240	20.6619	20.8857	20.9791	20.9965	20.9943	20.9438	20.6494	20.1739	19.7762 (87)
Th 2	19.9515	19.9538	19.9560	19.9666	19.9686	19.9779	19.9779	19.9796	19.9743	19.9686	19.9646	19.9604 (88)
util rest of house	0.9886	0.9739	0.9423	0.8547	0.6932	0.4803	0.3179	0.3568	0.6064	0.8842	0.9742	0.9910 (89)
MIT 2	18.5922	18.8791	19.2342	19.6420	19.8792	19.9669	19.9769	19.9777	19.9399	19.6398	19.0599	18.5521 (90)
Living area fraction	19.0672	19.3305	19.6582	20.0388	20.2708	20.3607	20.3736	20.3733	20.3305	20.0326	19.4933	0.3891 (91)
MIT	19.0672	19.3305	19.6582	20.0388	20.2708	20.3607	20.3736	20.3733	20.3305	20.0326	19.4933	19.0284 (92)
Temperature adjustment												0.0000
adjusted MIT	19.0672	19.3305	19.6582	20.0388	20.2708	20.3607	20.3736	20.3733	20.3305	20.0326	19.4933	19.0284 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9855	0.9693	0.9377	0.8572	0.7118	0.5122	0.3547	0.3952	0.6370	0.8865	0.9701	0.9883 (94)
Useful gains	709.6313	823.3048	881.7617	887.8772	775.7058	549.7344	365.3315	383.1330	579.2012	715.6269	699.1031	676.9157 (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	1475.9500	1438.7504	1308.7362	1095.2875	840.9590	559.5638	366.5442	385.2154	607.5586	925.5194	1221.3279	1467.9324 (97)
Space heating kWh	570.1411	413.5795	317.6690	149.3354	48.5484	0.0000	0.0000	0.0000	0.0000	156.1600	376.0019	588.5164 (98a)
Space heating requirement - total per year (kWh/year)												2619.9518
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	570.1411	413.5795	317.6690	149.3354	48.5484	0.0000	0.0000	0.0000	0.0000	156.1600	376.0019	588.5164 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2619.9518
Space heating per m2										(98c) / (4) =		30.4292 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	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	570.1411	413.5795	317.6690	149.3354	48.5484	0.0000	0.0000	0.0000	0.0000	156.1600	376.0019	588.5164 (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)	617.7043	448.0818	344.1701	161.7935	52.5985	0.0000	0.0000	0.0000	0.0000	169.1875	407.3693	637.6126 (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	233.2478	206.1876	219.1057	193.0983	187.4195	169.1627	167.2941	173.8708	175.6751	195.5229	207.3975	230.7894 (64)
Efficiency of water heater (217)m	85.9845	85.5886	84.8919	83.4902	81.4994	79.8000	79.8000	79.8000	79.8000	83.5605	85.3769	79.8000 (216)
Fuel for water heating, kWh/month	271.2672	240.9054	258.0997	231.2825	229.9641	211.9833	209.6417	217.8832	220.1442	233.9896	242.9198	268.1547 (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	24.2860	19.4832	17.5424	12.8523	9.9275	8.1109	9.0562	11.7716	15.2902	20.0615	22.6594	24.9610 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-44.9387	-62.2565	-87.9607	-97.1614	-103.3294	-95.9239	-94.7042	-90.0733	-81.7331	-70.3262	-48.9988	-38.9797 (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	-28.8568	-60.2681	-119.0014	-177.6209	-233.8136	-234.5657	-231.8318	-196.7924	-144.8948	-85.8471	-38.4127	-22.8550 (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												2838.5176 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)

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Efficiency of water heater	79.8000
Water heating fuel used	2836.2355 (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)	196.0023 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-2491.1463 (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	3465.6091 (238)

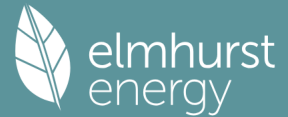
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2838.5176	0.2100	596.0887 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2836.2355	0.2100	595.6095 (264)
Space and water heating			1191.6982 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	196.0023	0.1443	28.2892 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-916.3859	0.1350	-123.6771
PV Unit electricity exported	-1574.7604	0.1261	-198.5438
Total			-322.2209 (269)
Total CO2, kg/year			909.6957 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.5700 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2838.5176	1.1300	3207.5249 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2836.2355	1.1300	3204.9461 (278)
Space and water heating			6412.4710 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	196.0023	1.5338	300.6348 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-916.3859	1.4988	-1373.4948
PV Unit electricity exported	-1574.7604	0.4628	-728.8052
Total			-2102.2999 (283)
Total Primary energy kWh/year			4740.9067 (286)
Target Primary Energy Rate (TPER)			55.0600 (287)

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Property Reference	23 25 Vicarage Road			Issued on Date	15/08/2023
Assessment Reference	Be Green	Prop Type Ref	Proposed Dwelling		
Property	23 25 Vicarage Road, 23 25 , Vicarage Road, London, N17 0BB				
SAP Rating	101 A	DER	-2.64	TER	10.57
Environmental	102 A	% DER < TER			124.98
CO ₂ Emissions (t/year)	-0.28	DFEE	37.21	TFEE	37.33
Compliance Check	See BREL	% DFEE < TFEE			0.32
% DPER < TPER	99.49	DPER	0.28	TPER	55.06
Assessor Details				Assessor ID	BE76-0001
Client	Mr Van Ly, Mr Van Ly				

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 ²)	Storey height (m)	Volume (m ³)
Ground floor	50.4000 (1b)	x 2.5000 (2b)	= 126.0000 (1b) -
First floor	35.7000 (1c)	x 2.5000 (2c)	= 89.2500 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 215.2500 (5)

2. Ventilation rate

	m ³ 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	1 * 10 = 10.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

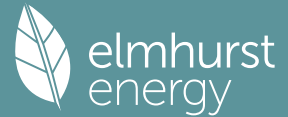
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	10.0000 / (5) = 0.0465 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	3.0000 (17)
Number of sides sheltered	0.1965 (18)
	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1670 (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	0.2129	0.2087	0.2046	0.1837	0.1795	0.1586	0.1586	0.1545	0.1670	0.1795	0.1879	0.1962 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												72.0000 (23c)
Effective ac	0.3529	0.3487	0.3446	0.3237	0.3195	0.2986	0.2986	0.2945	0.3070	0.3195	0.3279	0.3362 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.4000	1.0000	2.4000		(26)
Opening Type 2 (Uw = 1.26)			26.8000	1.1995	32.1478		(27)

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Heatloss Floor 1			50.4000	0.1000	5.0400	(28a)
External Wall 1	117.7000	29.2000	88.5000	0.1500	13.2750	(29a)
External Roof 1	50.4000		50.4000	0.1000	5.0400	(30)
Total net area of external elements Aum(A, m2)			218.5000			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		57.9028	(33)
Party Wall 1			33.0000	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E5 Ground floor (normal)	18.1000	0.1600	2.8960	
E6 Intermediate floor within a dwelling	29.0000	0.0000	0.0000	
E16 Corner (normal)	10.0000	0.0900	0.9000	
E18 Party wall between dwellings	10.0000	0.0600	0.6000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				4.3960 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	62.2988 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	25.0681	24.7716	24.4751	22.9924	22.6958	21.2131	21.2131	20.9166	21.8062	22.6958	23.2889	23.8820	(38)
Average = Sum(39)m / 12 =	87.3669	87.0704	86.7738	85.2911	84.9946	83.5119	83.5119	83.2153	84.1049	84.9946	85.5877	86.1807	(39)
												85.2170	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0147	1.0113	1.0078	0.9906	0.9872	0.9699	0.9699	0.9665	0.9768	0.9872	0.9940	1.0009	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

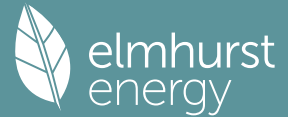
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.5685 (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	29.0579	28.6264	28.0187	26.8981	26.0591	25.1288	24.6262	25.2297	25.8868	26.8823	28.0259	28.9597	(42b)
Hot water usage for other uses	40.9339	39.4454	37.9569	36.4684	34.9799	33.4914	33.4914	34.9799	36.4684	37.9569	39.4454	40.9339	(42c)
Average daily hot water use (litres/day)													64.1539 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	69.9918	68.0718	65.9755	63.3665	61.0390	58.6201	58.1176	60.2096	62.3551	64.8392	67.4712	69.8936	(44)
Energy content (annual)	110.8499	96.9333	101.4020	86.7456	82.1702	72.0803	70.2882	74.5520	76.8901	87.9861	96.1252	109.4365	(45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1065.4594	
Water storage loss:	16.6275	14.5400	15.2103	13.0118	12.3255	10.8120	10.5432	11.1828	11.5335	13.1979	14.4188	16.4155	(46)
Store volume													150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.8600 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.0044 (55)
Total storage loss	31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	30.1320	31.1364	30.1320	31.1364	(56)
If cylinder contains dedicated solar storage	31.1364	28.1232	31.1364	30.1320	31.1364	30.1320	31.1364	31.1364	30.1320	31.1364	30.1320	31.1364	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	165.2487	146.0677	155.8008	139.3896	136.5690	124.7243	124.6870	128.9508	129.5341	142.3849	148.7692	163.8353	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	165.2487	146.0677	155.8008	139.3896	136.5690	124.7243	124.6870	128.9508	129.5341	142.3849	148.7692	163.8353	(64)
12Total per year (kWh/year)								Total per year (kWh/year) = Sum(64)m =				1705.9614	(64)
Electric shower(s)	53.8840	48.0111	52.4262	50.0297	50.9685	48.6190	50.2396	50.9685	50.0297	52.4262	51.4404	53.8840	(64a)
Heat gains from water heating, kWh/month	93.8476	83.5406	90.3417	83.4655	83.5828	78.2366	79.4498	81.0497	80.1886	85.8810	86.9369	93.3777	(65)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												612.9269	(64a)

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	128.4245	128.4245	128.4245	128.4245	128.4245	128.4245	128.4245	128.4245	128.4245	128.4245	128.4245	128.4245	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	116.8747	129.3970	116.8747	120.7705	116.8747	120.7705	116.8747	116.8747	120.7705	116.8747	120.7705	116.8747	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	231.7171	234.1216	228.0623	215.1629	198.8797	183.5757	173.3517	170.9473	177.0065	189.9060	206.1892	221.4931	(68)
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)													

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	-102.7396	-102.7396	-102.7396	-102.7396	-102.7396	-102.7396	-102.7396	-102.7396	-102.7396	-102.7396	-102.7396	-102.7396	(71)
Water heating gains (Table 5)	126.1393	124.3164	121.4271	115.9244	112.3424	108.6620	106.7873	108.9378	111.3730	115.4314	120.7457	125.5076	(72)
Total internal gains	536.2584	549.3623	527.8914	513.3851	489.6241	474.5356	458.5411	458.2870	470.6774	483.7394	509.2327	525.4027	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North					9.4000	10.6334		0.7000	0.7000		0.7700		33.9413 (74)	
East					5.1000	19.6403		0.7000	0.7000		0.7700		34.0131 (76)	
South					10.7000	46.7521		0.7000	0.7000		0.7700		169.8689 (78)	
West					1.6000	19.6403		0.7000	0.7000		0.7700		10.6708 (80)	
Solar gains	248.4942	430.4764	608.5524	787.5140	913.1613	920.3659	881.5745	785.6343	670.1346	480.9989	298.9392	211.8234 (83)		
Total gains	784.7526	979.8387	1136.4439	1300.8991	1402.7854	1394.9015	1340.1156	1243.9214	1140.8120	964.7383	808.1720	737.2262 (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)														
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
alpha	68.4374	68.6705	68.9052	70.1030	70.3476	71.5966	71.5966	71.8518	71.0917	70.3476	69.8602	69.3794		
util living area	5.5625	5.5780	5.5937	5.6735	5.6898	5.7731	5.7731	5.7901	5.7394	5.6898	5.6573	5.6253		
	0.9851	0.9549	0.8880	0.7373	0.5539	0.3822	0.2741	0.3075	0.5035	0.8109	0.9611	0.9889	(86)	
Living	20.2875	20.4978	20.7058	20.8752	20.9325	20.9450	20.9461	20.9461	20.9402	20.8477	20.5483	20.2549		
Non living	19.2523	19.5147	19.7632	19.9590	20.0147	20.0389	20.0394	20.0425	20.0301	19.9395	19.5928	19.2208		
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	20.6355	20.4978	20.7058	20.8752	20.9325	20.9450	20.9461	20.9461	20.9402	20.8477	20.5483	20.3591	(87)	
Th 2	20.0711	20.0740	20.0768	20.0912	20.0940	20.1085	20.1085	20.1113	20.1027	20.0940	20.0883	20.0826	(88)	
util rest of house	0.9807	0.9433	0.8632	0.6951	0.5032	0.3294	0.2186	0.2482	0.4402	0.7654	0.9489	0.9856	(89)	
MIT 2	19.7447	19.5147	19.7632	19.9590	20.0147	20.0389	20.0394	20.0425	20.0301	19.9395	19.5928	19.3761	(90)	
Living area fraction									fLA = Living area / (4) =			0.3891	(91)	
MIT	20.0913	19.8972	20.1299	20.3155	20.3718	20.3914	20.3922	20.3941	20.3842	20.2928	19.9645	19.7586	(92)	
Temperature adjustment												0.0000		
adjusted MIT	20.0913	19.8972	20.1299	20.3155	20.3718	20.3914	20.3922	20.3941	20.3842	20.2928	19.9645	19.7586	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	0.9808	0.9407	0.8647	0.7059	0.5189	0.3462	0.2363	0.2671	0.4603	0.7761	0.9470	0.9841	(94)	
Useful gains	769.7123	921.7722	982.7287	918.3188	727.9488	482.9535	316.6360	332.2514	525.0839	748.7103	765.3288	725.5316	(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	1379.6355	1305.8102	1182.7194	973.6397	737.0575	483.6521	316.6944	332.3684	528.5309	823.8393	1101.0459	1340.8508	(97)	
Space heating kWh	453.7829	258.0736	148.7931	39.8310	6.7769	0.0000	0.0000	0.0000	0.0000	55.8960	241.7163	457.7974	(98a)	
Space heating requirement - total per year (kWh/year)												1662.6672		
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	453.7829	258.0736	148.7931	39.8310	6.7769	0.0000	0.0000	0.0000	0.0000	55.8960	241.7163	457.7974	(98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												1662.6672		
Space heating per m2												(98c) / (4) =	19.3109	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													354.0271	(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	453.7829	258.0736	148.7931	39.8310	6.7769	0.0000	0.0000	0.0000	0.0000	55.8960	241.7163	457.7974	(98)	
Space heating efficiency (main heating system 1)	354.0271	354.0271	354.0271	354.0271	354.0271	0.0000	0.0000	0.0000	0.0000	354.0271	354.0271	354.0271	(210)	
Space heating fuel (main heating system)	128.1774	72.8966	42.0287	11.2508	1.9142	0.0000	0.0000	0.0000	0.0000	15.7886	68.2762	129.3114	(211)	
Space heating efficiency (main heating system 2)														

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0.0000	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	165.2487	146.0677	155.8008	139.3896	136.5690	124.7243	124.6870	128.9508	129.5341	142.3849	148.7692	163.8353 (64)
Efficiency of water heater	190.5625	190.5625	190.5625	190.5625	190.5625	190.5625	190.5625	190.5625	190.5625	190.5625	190.5625	190.5625 (216)
Fuel for water heating, kWh/month	86.7163	76.6508	81.7584	73.1464	71.6663	65.4506	65.4310	67.6685	67.9746	74.7182	78.0684	85.9746 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
(221)m	16.5492	14.9476	16.5492	16.0153	16.5492	16.0153	16.5492	16.5492	16.0153	16.5492	16.0153	16.5492 (231)
Pumps and Fa	26.4140	21.1903	19.0795	13.9784	10.7974	8.8215	9.8497	12.8030	16.6299	21.8193	24.6448	27.1481 (232)
Lighting												
Electricity generated by PVs (Appendix M) (negative quantity)	-79.9659	-108.7875	-149.7168	-159.4745	-167.2833	-155.5832	-154.6157	-148.4865	-134.9847	-118.6462	-85.7871	-69.4534 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	-48.2556	-105.1772	-214.6896	-328.9019	-436.0646	-437.6039	-430.7322	-362.9349	-265.5608	-154.8793	-66.3020	-37.8460 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												469.6440 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												190.5625
Water heating fuel used												895.2242 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7420)												
mechanical ventilation fans (SFP = 0.7420)												194.8529 (230a)
Total electricity for the above, kWh/year												194.8529 (231)
Electricity for lighting (calculated in Appendix L)												213.1758 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-4421.7328 (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												-2035.9090 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	469.6440	0.1584	74.3830 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	895.2242	0.1405	125.7804 (264)
Energy for instantaneous electric shower(s)	612.9269	0.1391	85.2717 (264a)
Space and water heating			200.1634 (265)
Pumps, fans and electric keep-hot	194.8529	0.1387	27.0285 (267)
Energy for lighting	213.1758	0.1443	30.7679 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1532.7847	0.1354	-207.5749
PV Unit electricity exported	-2888.9481	0.1255	-362.5988
Total			-570.1738 (269)
Total CO2, kg/year			-226.9423 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			-2.6400 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	469.6440	1.5862	744.9617 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	895.2242	1.5195	1360.2961 (278)
Energy for instantaneous electric shower(s)	612.9269	1.5143	928.1762 (278a)
Space and water heating			2105.2578 (279)
Pumps, fans and electric keep-hot	194.8529	1.5128	294.7735 (281)
Energy for lighting	213.1758	1.5338	326.9762 (282)
Energy saving/generation technologies			

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PV Unit electricity used in dwelling	-1532.7847	1.5005	-2300.0171
PV Unit electricity exported	-2888.9481	0.4607	-1331.0128
Total			-3631.0300 (283)
Total Primary energy kWh/year			24.1537 (286)
Dwelling Primary energy Rate (DPER)			0.2800 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	50.4000 (1b)	x 2.5000 (2b)	= 126.0000 (1b) -
First floor	35.7000 (1c)	x 2.5000 (2c)	= 89.2500 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.1000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	215.2500 (5)

2. Ventilation rate

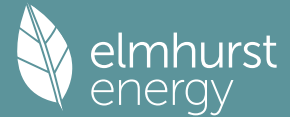
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1394 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3894 (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) = 0.3310 (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	0.4220	0.4137	0.4054	0.3641	0.3558	0.3144	0.3144	0.3061	0.3310	0.3558	0.3723	0.3889 (22b)
Effective ac	0.5890	0.5856	0.5822	0.5663	0.5633	0.5494	0.5494	0.5469	0.5548	0.5633	0.5693	0.5756 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.4000	1.0000	2.4000		(26)
TER Opening Type (Uw = 1.20)			19.1300	1.1450	21.9046		(27)
Heatloss Floor 1			50.4000	0.1300	6.5520		(28a)
External Wall 1	117.7000	21.5300	96.1700	0.1800	17.3106		(29a)
External Roof 1	50.4000		50.4000	0.1100	5.5440		(30)
Total net area of external elements Aum(A, m ²)			218.5000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	53.7112		(33)
Party Wall 1			33.0000	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E5 Ground floor (normal)				18.1000	0.1600	2.8960	
E6 Intermediate floor within a dwelling				29.0000	0.0000	0.0000	
E16 Corner (normal)				10.0000	0.0900	0.9000	
E18 Party wall between dwellings				10.0000	0.0600	0.6000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.3960 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	58.1072 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	41.8406	41.5950	41.3543	40.2237	40.0121	39.0274	39.0274	38.8450	39.4067	40.0121	40.4401	40.8875	(38)
Heat transfer coeff	99.9478	99.7022	99.4615	98.3308	98.1193	97.1345	97.1345	96.9522	97.5138	98.1193	98.5472	98.9946	(39)
Average = Sum(39)m / 12 =												98.3298	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1608	1.1580	1.1552	1.1421	1.1396	1.1282	1.1282	1.1260	1.1326	1.1396	1.1446	1.1498	(40)
HLP (average)												1.1420	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.5685 (42)
Hot water usage for mixer showers	67.2849	66.2737	64.8002	61.9810	59.9005	57.5804	56.2616	57.7239	59.3269	61.8180	64.6978	67.0271	(42a)
Hot water usage for baths	29.0579	28.6264	28.0187	26.8981	26.0591	25.1288	24.6262	25.2297	25.8868	26.8823	28.0259	28.9597	(42b)
Hot water usage for other uses	40.9339	39.4454	37.9569	36.4684	34.9799	33.4914	33.4914	34.9799	36.4684	37.9569	39.4454	40.9339	(42c)
Average daily hot water use (litres/day)												126.1883	(43)
Daily hot water use	137.2767	134.3455	130.7758	125.3476	120.9395	116.2005	114.3792	117.9335	121.6820	126.6572	132.1690	136.9207	(44)
Energy content (annual)	217.4127	191.3062	200.9975	171.5946	162.8079	142.8821	138.3318	146.0263	150.0461	171.8726	188.2990	214.3847	(45)
Distribution loss (46)m = 0.15 x (45)m	32.6119	28.6959	30.1496	25.7392	24.4212	21.4323	20.7498	21.9039	22.5069	25.7809	28.2449	32.1577	(46)
Water storage loss:												150.0000	(47)
Store volume												1.3938	(48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400	(49)
Temperature factor from Table 2b												0.7527	(55)
Enter (49) or (54) in (55)													
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	264.0076	233.3919	247.5924	216.6864	209.4028	187.9739	184.9267	192.6212	195.1380	218.4675	233.3909	260.9796	(62)
WWHRS	-30.7598	-27.2042	-28.4867	-23.5881	-21.9833	-18.8113	-17.6326	-18.7505	-19.4629	-22.9446	-25.9934	-30.1902	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	233.2478	206.1876	219.1057	193.0983	187.4195	169.1627	167.2941	173.8708	175.6751	195.5229	207.3975	230.7894	(64)
12Total per year (kWh/year)												2358.7713	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month	109.5656	97.2779	104.1076	93.1287	91.4095	83.5818	83.2712	85.8297	85.9638	94.4236	98.6829	108.5588	(65)

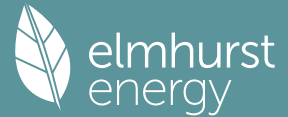
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	128.4245	128.4245	128.4245	128.4245	128.4245	128.4245	128.4245	128.4245	128.4245	128.4245	128.4245	128.4245	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	116.8833	129.4065	116.8833	120.7794	116.8833	120.7794	116.8833	116.8833	120.7794	116.8833	120.7794	116.8833	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	231.7171	234.1216	228.0623	215.1629	198.8797	183.5757	173.3517	170.9473	177.0065	189.9060	206.1892	221.4931	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8424	35.8424	35.8424	35.8424	35.8424	35.8424	35.8424	35.8424	35.8424	35.8424	35.8424	35.8424	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-102.7396	-102.7396	-102.7396	-102.7396	-102.7396	-102.7396	-102.7396	-102.7396	-102.7396	-102.7396	-102.7396	-102.7396	(71)
Water heating gains (Table 5)	147.2657	144.7587	139.9296	129.3454	122.8623	116.0858	111.9237	115.3625	119.3942	126.9134	137.0596	145.9124	(72)
Total internal gains	560.3934	572.8142	549.4025	529.8150	503.1526	481.9683	463.6861	464.7204	478.7074	498.2300	528.5555	548.8162	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	6.7100	10.6334	0.6300	0.7000	0.7700	21.8055 (74)
East	3.6400	19.6403	0.6300	0.7000	0.7700	21.8484 (76)

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South				7.6400		46.7521		0.6300		0.7000		0.7700		109.1606 (78)
West				1.1400		19.6403		0.6300		0.7000		0.7700		6.8426 (80)

Solar gains	159.6572	276.5743	390.9714	505.9290	586.6366	591.2603	566.3419	504.7161	430.5289	309.0302	192.0669	136.0971	(83)	
Total gains	720.0506	849.3884	940.3739	1035.7440	1089.7892	1073.2286	1030.0280	969.4365	909.2364	807.2602	720.6224	684.9133	(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	59.8229	59.9703	60.1154	60.8066	60.9377	61.5555	61.5555	61.6713	61.3161	60.9377	60.6731	60.3989		
alpha	4.9882	4.9980	5.0077	5.0538	5.0625	5.1037	5.1037	5.1114	5.0877	5.0625	5.0449	5.0266		
util living area														
	0.9914	0.9800	0.9557	0.8869	0.7532	0.5637	0.4122	0.4553	0.6905	0.9159	0.9811	0.9932	(86)	
MIT	19.8130	20.0392	20.3240	20.6619	20.8857	20.9791	20.9965	20.9943	20.9438	20.6494	20.1739	19.7762	(87)	
Th 2	19.9515	19.9538	19.9560	19.9666	19.9686	19.9779	19.9779	19.9796	19.9743	19.9686	19.9646	19.9604	(88)	
util rest of house														
	0.9886	0.9739	0.9423	0.8547	0.6932	0.4803	0.3179	0.3568	0.6064	0.8842	0.9742	0.9910	(89)	
MIT 2	18.5922	18.8791	19.2342	19.6420	19.8792	19.9669	19.9769	19.9777	19.9399	19.6398	19.0599	18.5521	(90)	
Living area fraction									fLA = Living area / (4) =					
MIT	19.0672	19.3305	19.6582	20.0388	20.2708	20.3607	20.3736	20.3733	20.3305	20.0326	19.4933	19.0284	(92)	
Temperature adjustment												0.0000		
adjusted MIT	19.0672	19.3305	19.6582	20.0388	20.2708	20.3607	20.3736	20.3733	20.3305	20.0326	19.4933	19.0284	(93)	

8. Space heating requirement														

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9855	0.9693	0.9377	0.8572	0.7118	0.5122	0.3547	0.3952	0.6370	0.8865	0.9701	0.9883	(94)	
Useful gains	709.6313	823.3048	881.7617	887.8772	775.7058	549.7344	365.3315	383.1330	579.2012	715.6269	699.1031	676.9157	(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														
	1475.9500	1438.7504	1308.7362	1095.2875	840.9590	559.5638	366.5442	385.2154	607.5586	925.5194	1221.3279	1467.9324	(97)	
Space heating kWh														
	570.1411	413.5795	317.6690	149.3354	48.5484	0.0000	0.0000	0.0000	0.0000	156.1600	376.0019	588.5164	(98a)	
Space heating requirement - total per year (kWh/year)												2619.9518		
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														
	570.1411	413.5795	317.6690	149.3354	48.5484	0.0000	0.0000	0.0000	0.0000	156.1600	376.0019	588.5164	(98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												2619.9518		
Space heating per m2										(98c) / (4) =			30.4292 (99)	

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)	
Fraction of space heat from main system(s)													1.0000 (202)	
Efficiency of main space heating system 1 (in %)													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														
	570.1411	413.5795	317.6690	149.3354	48.5484	0.0000	0.0000	0.0000	0.0000	156.1600	376.0019	588.5164	(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)														
	617.7043	448.0818	344.1701	161.7935	52.5985	0.0000	0.0000	0.0000	0.0000	169.1875	407.3693	637.6126	(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														
	233.2478	206.1876	219.1057	193.0983	187.4195	169.1627	167.2941	173.8708	175.6751	195.5229	207.3975	230.7894	(64)	
Efficiency of water heater														
(217)m	85.9845	85.5886	84.8919	83.4902	81.4994	79.8000	79.8000	79.8000	79.8000	83.5605	85.3769	86.0657	(217)	
Fuel for water heating, kWh/month														
	271.2672	240.9054	258.0997	231.2825	229.9641	211.9833	209.6417	217.8832	220.1442	233.9896	242.9198	268.1547	(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														
	24.2860	19.4832	17.5424	12.8523	9.9275	8.1109	9.0562	11.7716	15.2902	20.0615	22.6594	24.9610	(232)	
Electricity generated by PVs (Appendix M) (negative quantity)														
(233a)m	-44.9387	-62.2565	-87.9607	-97.1614	-103.3294	-95.9239	-94.7042	-90.0733	-81.7331	-70.3262	-48.9988	-38.9797	(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)	

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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	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)														
(233b)m	-28.8568	-60.2681	-119.0014	-177.6209	-233.8136	-234.5657	-231.8318	-196.7924	-144.8948	-85.8471	-38.4127	-22.8550		(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													2838.5176	(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													2836.2355	(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)													196.0023	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV generation													-2491.1463	(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													3465.6091	(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2838.5176	0.2100	596.0887 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2836.2355	0.2100	595.6095 (264)
Space and water heating			1191.6982 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	196.0023	0.1443	28.2892 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-916.3859	0.1350	-123.6771
PV Unit electricity exported	-1574.7604	0.1261	-198.5438
Total			-322.2209 (269)
Total CO2, kg/year			909.6957 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.5700 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2838.5176	1.1300	3207.5249 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2836.2355	1.1300	3204.9461 (278)
Space and water heating			6412.4710 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	196.0023	1.5338	300.6348 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-916.3859	1.4988	-1373.4948
PV Unit electricity exported	-1574.7604	0.4628	-728.8052
Total			-2102.2999 (283)
Total Primary energy kWh/year			4740.9067 (286)
Target Primary Energy Rate (TPER)			55.0600 (287)

A6. RENEWABLE ENERGY FEASIBILITY ASSESSMENT

A6.1 In line with GLA London Plan requirements, a feasibility assessment of potential renewable energy technologies has been undertaken, and the results from this are presented below.

Table A6.1 Renewable energy feasibility assessment

Technology	Appraisal	Included in development?
Biomass	This technology is not considered a practical solution to reducing CO ₂ emissions, in the view of limited storage space for the combustible material, accessibility of the site for regular deliveries of the material, associated carbon emissions of this technology which are not normally accounted for within energy modelling, and local air quality issues arising from the combustion of biomass material.	
Air source heat pump (ASHP)	This technology is deemed appropriate to provide both space and water heating to the proposed dwelling. Full details of the proposed system efficiencies and associated carbon dioxide savings are provided in Section 4.	
Ground source heat pump (GSHP)	This technology is not deemed appropriate as heat is already due to be provided to the scheme by an air source heat pump system.	
Photovoltaics (PV)	As detailed above in Section 4, the use of PV panels is considered appropriate for this scheme, and its use has been maximised in accordance with the roof space available. Full details of the proposed PV arrays, areas, locations, outputs and associated carbon dioxide savings are provided in Section 4.	

Solar thermal hot water (STHW)	Whilst technically feasible, this technology is rejected on the basis that hot water produced by STHW panels would compete with that provided by the proposed ASHP system. In addition, the STHW panels would also compete for roof space with the PV panels detailed above, which are considered to be a more appropriate usage of roof space. This technology is therefore rejected.	
Wind turbines	This technology is rejected on the basis of its potential impact on visual amenity and relatively low efficiency from unpredictable, turbulent wind conditions in urban locations.	

A7. GENERAL NOTES

- A7.1 The report is based on information available at the time of the writing and discussions with the client during any project meetings. Where any data supplied by the client or from other sources have been used it has been assumed that the information is correct. No responsibility can be accepted by Iceni Projects Ltd for inaccuracies in the data supplied by any other party.
- A7.2 The review of planning policy and other requirements does not constitute a detailed review. Its purpose is as a guide to provide the context for the development and to determine the likely requirements of the Local Authority.
- A7.3 No site visits have been carried out, unless otherwise specified.
- A7.4 This report is prepared and written in the context of an agreed scope of work and should not be used in a different context. Furthermore, new information, improved practices and changes in guidance may necessitate a re-interpretation of the report in whole or in part after its original submission.
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