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Energy & Sustainability Statement

Hallmark Property Group

66 Chalk Farm Road

Final

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ABOUT HODKINSON CONSULTANCY

Our team of technical specialists offer advanced levels of expertise and experience to our clients. We have a wide experience of the construction and development industry and tailor teams to suit each individual project.

We are able to advise at all stages of projects from planning applications to handover.

Our emphasis is to provide innovative and cost-effective solutions that respond to increasing demands for quality and construction efficiency.

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Executive Summary

The purpose of this Energy and Sustainability Statement is to demonstrate that the proposed development at 66 Chalk Farm Road by Hallmark Property Group in the London Borough of Camden is considered sustainable, as measured against relevant local, regional and national planning policies.

The proposed development will comprise a single dwelling located above an existing commercial space.

Through the incorporation of sustainable design and construction methods, energy and water saving measures, sustainable transport methods, waste reduction techniques and measures to enhance the ecological value of the site, a good quality and sustainable development is proposed.

The key features outlined in this combined Energy and Sustainability Statement are listed below:

Energy Strategy: The energy strategy has been formulated following the London Plan energy hierarchy: ***Be Lean***, ***Be Clean*** and ***Be Green***. The overriding objective is the formulation of a strategy which effectively balances a number of key elements, including CO_2 emissions, affordability of heat, climate change adaption, and the provision of high-quality living space. These elements need to work with the regulatory and planning requirements for the development.

> Energy demands to be reduced substantially through fabric '***Be Lean***' measures to ensure a sustainable level of building design is achieved. This locks in CO_2 savings irrespective of the source of the delivered energy;

> A balanced strategy for the generation of low carbon heating. Hallmark Property Group are committed to the delivery of heat which is both low in CO_2 and not unreasonably costly. A strategy has therefore been proposed which utilises an air source heat pump in the dwelling.

The commitment to energy efficient design and renewable technologies will enable a reduction in Regulated CO_2 of **49.1%** using SAP 10.0 CO_2 emissions factors, well above the minimum requirement of 19% for new builds within the London Borough of Camden.

	Regulated CO_2 (kg/yr)	Total CO_2 (kg/yr)	% Improvement (Regulated)
Baseline (TER)	1,304	1,567	-
Following *Be Lean* Measures	1,297	1,560	0.5%
Following *Be Clean* Measures	1,297	1,560	0.5%
Following *Be Green* Measures	663	927	**49.1%**

> **Water efficiency:** Flow control devices and water efficient fixtures and fittings will be installed to target a maximum internal daily water consumption of 105 litres/person/day.

> **Waste and recycling:** Adequate facilities will be provided for domestic and construction related waste, including segregated bins for refuse and recycling.

> **Materials:** Where practical, new building materials will be sourced locally to reduce transportation pollution and support the local economy. New materials will be selected based on their environmental impact and responsible suppliers will be used where possible.

> **Flood Risk and SUDs:** The proposed development site lies in a low flood risk zone and will benefit from SUDs such as a green roof.

> **Security:** The principles of Secure by Design will be implemented, where appropriate.

> **Sound insulation:** An improvement on Building Regulations Part E will be targeted.

> **Sustainable transport:** The site will benefit from a good existing public transport network and sustainable modes will be encouraged.

> **Biodiversity and ecology:** Enhancements will be implemented through the provision of a green roof.

CONTENTS

1. INTRODUCTION

1.1 This document has been prepared by Hodkinson Consultancy, a specialist energy and environmental consultancy for planning and development, appointed by Hallmark Property Group.

1.2 This Statement sets out the sustainable design and construction measures included in the planning application for the proposed development at 66 Chalk Farm Road in the London Borough of Camden.

Energy and Sustainability Statement Structure and Methodology

1.3 The Sustainability and Energy Strategy for the proposed development has taken into account several important objectives, including:

> To achieve a viable reduction in CO_2 emissions with an affordable, deliverable and technically appropriate strategy;

> To address all national and local planning policies and requirements;

> To provide a high-quality development that is adaptable to future changes in climate;

> To minimise the negative impact of the proposed development on both the local and wider climate and environment;

> To achieve the highest viable levels of sustainable design and construction;

> To provide a resilient supply of reasonably priced heat to the residents;

> To minimise emissions of pollutants such as oxides of nitrogen and particulate matter; and

> To create a pleasant, safe and friendly living environment that will be flexible to its occupants' needs.

1.4 The energy strategy first establishes a baseline assessment of the energy demands and associated CO_2 emissions. The strategy will then follow The London Plan Energy Hierarchy approach of Be Lean, Be Clean and Be Green to enable the maximum viable reductions in Regulated and Total CO_2 emissions to be achieved.

1.5 This Energy and Sustainability Statement does not duplicate the work of the technical reports prepared in support of the application but presents the findings in the overall context of sustainability.

1.6 **Section 2** introduces the site and the proposed development. **Section 3** sets out the relevant national and local policy documents which have been used to guide and inform the energy and sustainability strategies for the proposed development. **Sections 4 to 8** outline the energy and sustainability strategy of the proposed development in relation to the policy documents listed in Chapter 3.

1.7 **Section 9** provides a summary of the key sustainability features associated with the proposed development.

2. DEVELOPMENT OVERVIEW

2.1 The proposed development site at 66 Chalk Farm Rd in the London Borough of Camden is located at Chalk Farm, London, NW1 8AN, as shown in Figure 1 below.

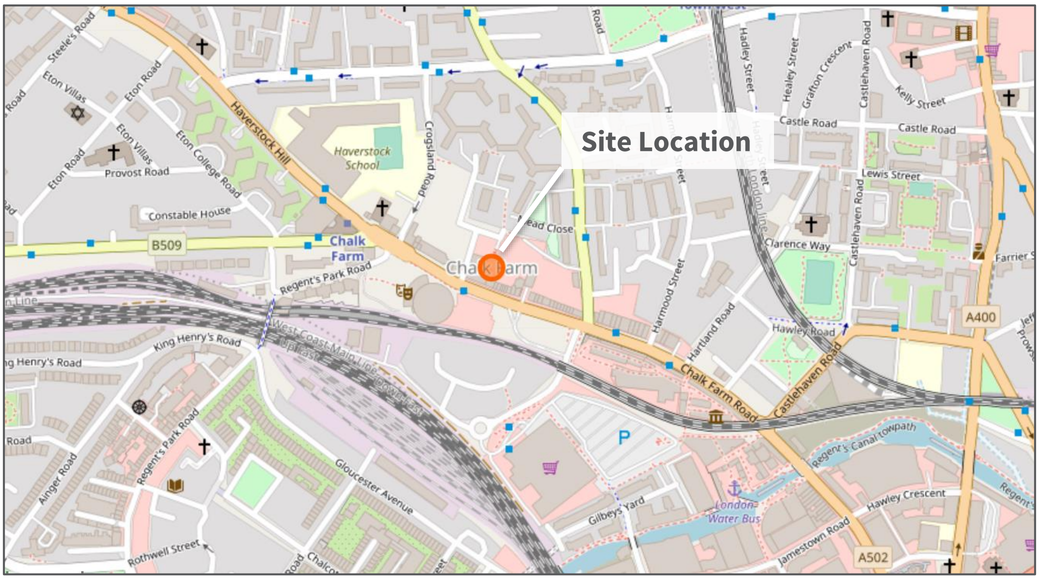


Figure 1: Site Location - OpenStreetMap © 2020

2.2 The site is currently occupied by retail units on the ground floor.

Proposed Development

2.3 The proposed development is described as follows:

"Proposed 1 bedroom first floor flat over existing commercial units."

2.4 Figure 2 illustrates the proposed site layout.

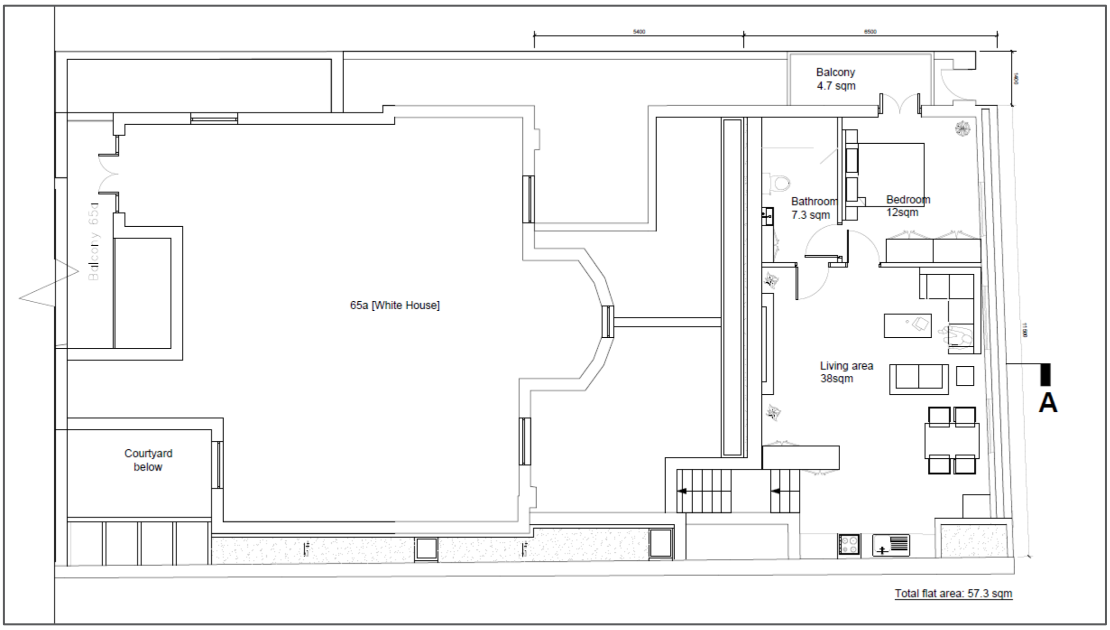


Figure 2: Proposed Plan of First Floor Extension (Contemporary Design Solutions, 2020)

3. RELEVANT PLANNINC POLICY

3.1 The planning policies and requirements in Figure 3 below have informed the sustainable design of the proposed development.

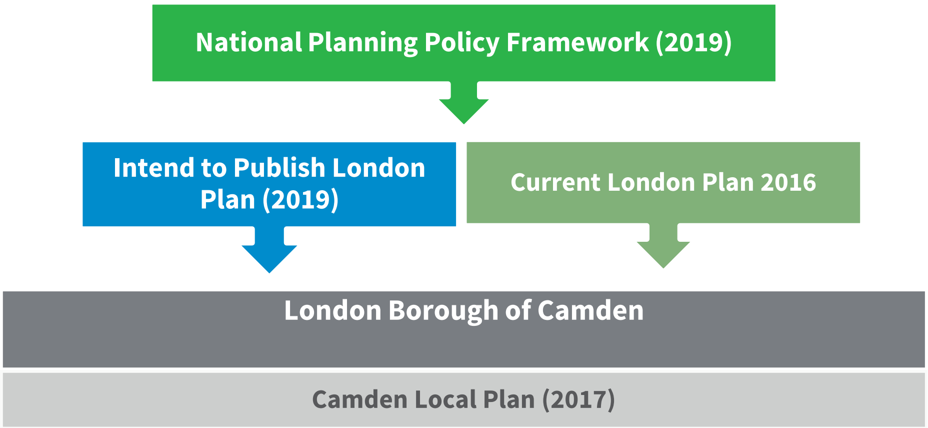


Figure 3: Relevant Planning Policy Documents.

National Policy: NPPF

3.2 The revised National Planning Policy Framework (NPPF) was published on the 19th June 2019 and sets out the Government's planning policies for England.

3.3 The NPPF provides a framework for achieving sustainable development, which has been summarised as "*meeting the needs of the present without compromising the ability of future generations to meet their own needs*" (Resolution 42/187 of the United National General Assembly). At the heart of the framework is a **presumption in favour of sustainable development**.

3.4 The document states that the planning system has three overarching objectives which are interdependent and need to be pursued in mutually supportive ways:

a) **An economic objective** – to help build a strong, responsive and competitive economy, by ensuring that sufficient land of the right types is available in the right places and at the right time to support growth, innovation and improved productivity; and by identifying and coordinating the provision of infrastructure;

b) **A social objective** – to support strong, vibrant and healthy communities, by ensuring that a sufficient number and range of homes can be provided to meet the needs of present and future generations; and by fostering a well-designed and safe built environment, with accessible services and open spaces that reflect current and future needs and support communities' health, social and cultural well-being; and

c) **An environmental objective** – to contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy.

Regional Policy: The London Plan

Adopted London Plan (2016)

3.5 The existing London Plan sets out an integrated economic, environmental, transport and social framework for the development of London. The following policies are considered relevant to the proposed development and this Statement:

3.6 **Policy 5.2 – Minimising Carbon Dioxide Emissions** requires that residential developments minimise carbon dioxide emissions in line with the energy hierarchy: *Be Lean, Be Clean, Be Green.*

3.7 **Policy 5.3 – Sustainable Design and Construction** states that the highest standards of sustainable design and construction should be achieved in London to improve the environmental performance of new developments and to adapt to the effects of climate change over their lifetime.

3.8 Development proposals should demonstrate that sustainable design standards are integral to the proposal, including its construction and operation, and ensure that they are considered at the beginning of the design process.

3.9 Major development proposals should meet the minimum standards outlined in the Mayor's supplementary planning guidance and this should be clearly demonstrated within a design and access statement. The standards include measures to achieve other policies in the London Plan and the following sustainable design principles:

a) Minimising carbon dioxide emissions across the site, including the building and services (such as heating and cooling systems)

b) Avoiding internal overheating and contributing to the urban heat island effect

c) Efficient use of natural resources (including water), including making the most of natural systems both within and around buildings

d) Minimising pollution (including noise, air and urban runoff)

e) Minimising the generation of waste and maximising reuse or recycling

f) Avoiding impacts from natural hazards (including flooding)

g) Ensuring developments are comfortable and secure for users, including avoiding the creation of adverse local climatic conditions

h) Securing sustainable procurement of materials, using local supplies where feasible, and

i) Promoting and protecting biodiversity and green infrastructure.

3.10 **Policy 5.13 – Sustainable Drainage** requires that development should use sustainable urban drainage systems (SUDS) unless there are practical reasons for not doing so, and should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible in line with the drainage hierarchy.

3.11 **Policy 5.15 – Water Use and Supplies** requires that development should minimise the use of mains water by incorporating water saving measures and equipment and that residential development is designed so that mains water consumption meets a target of 105 litres/person/day or less.

Intend to Publish London Plan (2020)

3.12 While not yet adopted, the Intend to Publish London Plan now carries increasing weight as a material consideration. The Mayor has set out his Intend to Publish version. The Intend to Publish version of the London Plan has been reviewed by the Secretary of State. Directions have been issued in respect of some policies but none that relate to the sustainability matters.

3.13 The policies, which are listed below, are considered relevant to the proposed development.

3.14 **Policy SI5 Water Infrastructure** states that in order to minimise the use of mains water, water supplies and resources should be protected and conserved in a sustainable manner. Development proposals should minimise the use of mains water in line with the Optional Requirement of the Building Regulations (residential development) achieving mains water consumption of 105 litres or less per head per day (excluding allowance of up to five litres for external water consumption).

Local Policy: London Borough of Camden

Camden Local Plan 2017

3.15 The London Borough of Camden's Local Plan will cover the period from 2016-2031. It sets out the key elements of the Council's planning vision and strategy for the borough. The principle policies relevant to the Energy and Sustainability Statement are presented below.

3.16 **Policy H6 Housing choice and mix** encourages inclusion of functional, adaptable and accessible spaces. Self-contained homes should meet the nationally described space standard; be accessible and adaptable in accordance with Building Regulation M4(2); and be suitable for occupation by a wheelchair user or easily adapted for occupation by a wheelchair user in accordance with Building Regulation M4(3).

3.17 **Policy C5 Safety and security** requires developments to demonstrate that they have incorporated design principles which contribute to safety and security.

3.18 **Policy C6 Access for all** requires the highest practicable standards of accessible and inclusive design to be met. Spaces, routes and facilities between buildings should be designed to be fully accessible.

3.19 **Policy A1 Managing the impact of development** requires that the amenity of occupiers and neighbours is protected. This involves considering daylight, noise, construction phase impacts, and transport impacts, among others.

3.20 **Policy A3 Biodiversity** seeks to protect and enhance biodiversity. Developments will be assessed against their ability to realise benefits for biodiversity through the layout, design and materials used in the built structure and landscaping elements of a proposed development, proportionate to the scale of development proposed. In addition, the demolition and construction phase of development is to be planned to avoid disturbance to habitats and species.

3.21 **Policy D1 Design** seeks to ensure the development is sustainable in design and construction, incorporating best practice in resource management and climate change mitigation and adaptation; is of sustainable and durable construction; comprises details and materials that are of high quality; is secure and designed to minimise crime and antisocial behaviour; and maximises opportunities for greening.

3.22 **Policy CC1 Climate change mitigation** requires development to promote zero carbon development and reduce carbon dioxide emissions in line with the energy hierarchy, ensure that the location of development minimises the need to travel by car, support and encourage sensitive energy efficiency improvements to existing buildings, and optimise resource efficiency.

3.23 **Policy CC2 Adapting to climate change** requires reducing surface water runoff through increasing permeable surfaces and use of Sustainable Drainage Systems, incorporating bio-diverse roofs, and measures to reduce the impact of overheating. New build residential development is encouraged to use the Home Quality Mark and Passivhaus design standards.

3.24 **Policy CC3 Water and flooding** seeks to ensure that development does not increase flood risk and reduces the risk of flooding where possible. Developments should incorporate water efficiency measures and utilise Sustainable Drainage Systems (SuDS).

3.25 **Policy T1 Prioritising walking, cycling and public transport** seeks to promote sustainable transport by prioritising walking, cycling and public transport.

3.26 **Policy T2 Parking and car-free development** seeks to limit the availability of parking and require all new developments to be car-free.

3.27 **Policy CC5 Waste** requires developments to include facilities for the storage and collection of waste and recycling.

Other planning guidance

3.28 The Council has a number of documents that provide advice and guidance on how the planning policies will be applied for certain cases known as Supplementary Planning Guidance (SPG). These documents do not have the same weight in decision making as Camden development plan document but they are important supporting documents. The following are those relevant to this statement:

3.29 **Amenity CPG – March 2018** specifies key requirements for in relation to privacy, daylight and sunlight, construction management plans, and noise and vibration.

3.30 **Design CPG – March 2019** provides guidance that supports Local Plan policies C5, C6, A1, A3, D1, T1, CC2, and CC5, which are relevant to this statement.

3.31 **CPG 2 Housing – March 2019** provides guidance that supports Local Plan policies H6, A1, and D1, which are relevant to this statement.

3.32 **Altering and extending your home CPG - March 2019** seeks to ensure extensions or alterations to residential houses and flats can be designed to a high quality to respect the character of the property, neighbours, and surrounding environment and to help promote improved health and wellbeing. It provides guidance that supports Local Plan policies CC2, A1, A3 and D1, which are relevant to this statement.

3.33 **Access for all CPG – March 2019** expects all development to be inclusively designed and useable by all to promote equality of opportunity. Design and Access Statements should contain an inclusive design statement, including the specific needs of disabled people.

3.34 **Energy efficiency and adaptation CPG - March 2019** requires carbon dioxide emissions to be reduced by following the energy hierarchy in accordance with Local Plan policy CC1. Energy strategies are to be designed following the steps set out in the energy hierarchy.

Energy Efficiency and Adaption – Camden Planning Guidance 2019

3.35 Table 2a of this guidance document sets out that minor domestic planning applications should achieve a minimum of a 19% reduction in Regulated CO_2 emissions over Part L Building Regulations (2013) Baseline.

4. ASSESSMENT METHODOLOGY – BASELINE EMISSIONS

4.1 This statement first establishes a baseline assessment of the energy demands and associated CO_2 emissions for the developments.

4.2 The report will then follow the hierarchy approach of Be Lean, Be Clean and Be Green to enable the maximum viable reductions in Regulated and Total CO_2 emissions over the calculated baseline.

4.3 The estimated annual energy demand for dwelling has been calculated using Standard Assessment Procedure methodology. SAP calculates the Regulated energy demands associated with hot water, space heating and fixed electrical items. The unregulated energy demands for appliances and cooking are taken from BRE standard occupancy calculations.

4.4 As the development only compromises a single dwelling, calculations have been performed on this unit.

Baseline Emissions

4.5 A baseline calculation has been carried out to establish the Regulated CO_2 emissions by which this energy strategy will be compared against. SAP 10.0 emission factors have been utilised in this energy strategy.

4.6 Table 1 shows the Regulated and Total baseline CO_2 emissions rates. TER worksheets supporting these calculations are presented in Appendix B.

Table 1: TER Baseline case.

Baseline CO_2 emissions (kg CO_2 per annum)		
	Regulated	Total
Baseline (TER)	1,304	1,567

5. *BE LEAN* – ENERGY EFFICIENCY

5.1 Section 5 sets out the potential measures to be implemented to enable the targets outlined in Section 1 to be achieved, thereby locking in significant CO_2 reductions through a reduction in energy demands.

Insulation Standards

5.2 All dwellings will incorporate enhanced insulation in the building envelope (walls, roofs, floors and glazing) to achieve U-values which are likely to be similar to the following:

> Glazing with a U-value of 1.30 W/m².K;

> External wall U-value of 0.18 W/m².K;

> Exposed floor (over existing premises) U-value of 0.15 W/m².K;

> A main roof U-value of 0.16 W/m².K;

Air Tightness & Ventilation

5.3 Air tightness standards will conform to, and exceed, Approved Document Part L requirements. By reducing air leakage loss and convective bypass of insulation, an improvement of design air permeability rate from $10m^3/h.m^2$ to $4.0m^3/h.m^2$ will further reduce space heating requirements.

5.4 Extract fans will be installed within all wet rooms. Additionally, the dwelling will have openable windows and therefore have the ability to naturally ventilate should the occupant desire. Convective ventilation and night purging of heat will therefore be facilitated.

Thermal Bridging

5.5 In well insulated buildings, as much as 30% of heat loss can occur through thermal bridges, which occur when highly conductive elements (e.g. metal studs) in the wall construction enable a low resistance escape route for heat. Hallmark Property Group are committed to delivering a development which prioritises the conservation of energy through lean design and have therefore placed particular importance on the development of construction details which minimise the effect of thermal bridges.

5.6 Figure 4 illustrates the benefits of reducing thermal bridges.

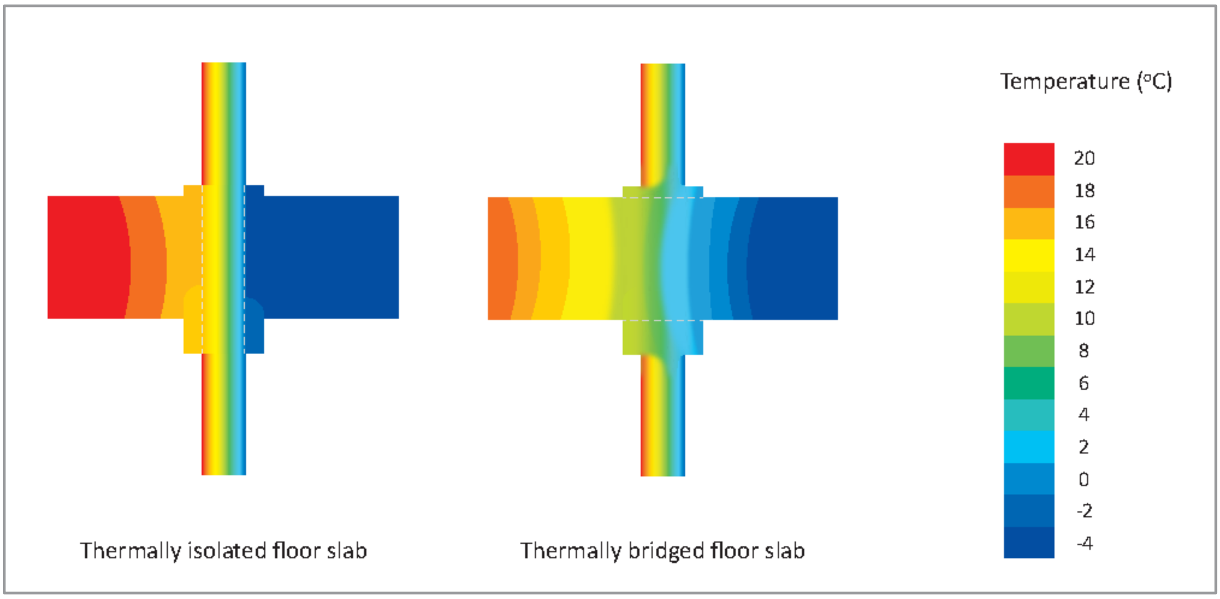


Figure 4: Thermal Bridging.

5.7 It is also considered that a specification which actively seeks to design out poor junction performance demonstrates a more balanced approach than the use of very low U-values.

5.8 It is proposed that for this development Accredited Construction Details (ACDs) or bespoke calculations are required to recognise the performance from thermal bridges across the development.

Space Heating & Hot Water

5.9 The space heating requirement will be reduced by the fabric, air tightness and ventilation measures detailed above.

5.10 In line with energy assessment guidance, a gas boiler baseline has been used in the Be Lean stage assessment.

5.11 The size of the development is the predominant reason as to why individual heat sources are more appropriate than a communal heating system.

5.12 As the 66 Chalk Farm Road development only compromises a single dwelling, the heat demands are low and thus decentralised heating is not appropriate.

Lighting & Appliances

5.13 Energy efficient lighting will be installed in 100% of internal fittings in the homes.

5.14 It is very difficult to design and construct homes to reduce the unregulated electricity demands, because this is almost entirely dependent on the occupant of a home and can vary substantially. However, efforts are made to enable the residents to minimise their unregulated electricity consumption.

Limiting the Risk of Summer Overheating

5.15 Minimising the risk of summer overheating is important so as to ensure that homes are adapted to climate change and remain comfortable to occupy in the future.

5.16 The following overheating measures are to be adopted for the development to assist in reducing any risk:

> Solar control glazing to reduce uncomfortable solar heat gains whilst maximising energy efficiency - a g-value of 0.5 has been applied to all facades.

> Openable windows to allow for purging of internal heat;

5.17 It has been assumed that windows can be openable during summer nights to mitigate overheating in bedrooms.

CO_2 Emissions at Be Lean Stage

5.18 **Table 2** outlines the CO_2 emissions following the inclusion of the above energy efficiency measures for the development. It can be seen that the TER baseline has been exceeded by 0.5%.

Table 2: Regulated and total emissions following Be Lean measures.

	Regulated CO_2 (kg/yr)	Total CO_2 (kg/yr)	% Improvement
Baseline (TER)	1,304	1,567	-
Following *Be Lean* Measures	1,297	1,560	**0.5**

5.19 The dwelling also exceeds the Target Fabric Energy Efficiency (TFEE) requirements of Building Regulations Part L 2013 by 15.2%, as shown in **Table 3** by the SAP calculations. This represents a high level of sustainable design.

Table 3: TFEE and DFEE results for sampled dwelling types.

Residential - Example Unit Type	Unit Area (m^2)	TFEE ($kWh/m^2/yr$)	DFEE ($kWh/m^2/yr$)	% Improvement
66 Chalk Farm Road	60.4	72.6	61.6	**15.2%**

5.20 Further calculations including Dwelling Emissions Rate (DER) worksheet can be seen in appendix A.

6. BE GREEN: RENEWABLE ENERGY TECHNOLOGIES

6.1 The final part of the Energy Hierarchy is Be Green which seeks for renewable energy technologies to be specified to provide, where feasible, a reduction in expected CO_2 emissions.

6.2 In line with GLA guidance, heat pumps have been considered as a Be Green measure.

Solar Thermal Panels

6.3 Solar thermal panels generate heat for hot water. However, as the proposed development will incorporate a curved roof space, the mounting of solar thermal panels would provide a significant technical challenge whilst also requiring a safe method of access for routine maintenance.

6.4 Due to the structure of the proposed roof space and the requirement for safe access not being met, the incorporation of solar thermal panels is not considered feasible.

Wind Turbines

6.5 Small rooftop wind turbines are designed to generate electricity from the wind for use within each dwelling. However, urban rooftop wind turbines do not generally perform sufficiently well to warrant their installation, due to the low and turbulent wind conditions present. They are therefore likely to remain technically unfeasible.

Air Source Heat Pumps (Proposed)

6.6 As two of the central aims in the preparation of this energy strategy are to be low in CO_2 emissions for the lifespan of the development and for the cost of heat to not be unreasonably high, it is proposed for individual dwelling heat pumps to be installed.

6.7 The selection of air over ground or water source has been made due to restrictions that the site location would place on access to the latter two. Air source does not require the expensive and complex boreholes that ground source does, or the unique access that water source does.

6.8 ASHPs generate heat via compression of a refrigerant which has extracted ambient heat from the external air. The compressive action raises the temperature of the refrigerant and allows it to provide heating.

6.9 ASHP's have been specified for heating and hot water provision in the dwelling.

6.10 The layout of the apartment has where possible catered for the flexibility to incorporate differing heat pump systems. For instance, balcony space has been maximised so as to allow for the inclusion of external units. Additionally, space has been set aside within the apartment to account for a hot water cylinder.

6.11 A Monobloc Mitsubishi Ecodan unit (datasheet provided as Appendix D) has been used in the calculations for this energy strategy. Hallmark Property Group shall aim to match the performance characteristics of this unit with whichever system and model they select once the design has progressed further.

Photovoltaic (PV) Panels

6.12 PV panels enable developments to generate electricity onsite that can subsequently be used within the dwelling. This has the benefit of reducing electricity bills to residents.

6.13 As mentioned above, the proposed development will incorporate a curved roof space and therefore the mounting of PV panels would provide a significant technical challenge whilst also requiring a safe method of access for maintenance.

6.14 Due to the structure of the proposed roof space and the requirement for safe access not being met, the incorporation of PV panels is not considered feasible. Furthermore, the inclusion of an air source heat pump contributes to a significant reduction in regulated emissions well beyond the Camden requirement of 19%.

CO_2 Emissions at *Be Green* Stage

6.15 Table 4, below, shows the Regulated and Total CO_2 reductions following the application of ***Be Green*** measures. DER worksheets can be found in Appendix F. This shows that the local Camden requirement of a 19% reduction in regulated CO_2 has been significantly exceeded with a reduction of **49.1%** achieved.

Table 4: Be Green reductions.

	Regulated CO_2 (kg/yr)	Total CO_2 (kg/yr)	% Improvement (Regulated)
Baseline (TER)	1,304	1,567	-
Following *Be Lean* Measures	1,297	1,560	0.5%
Following *Be Clean* Measures	1,297	1,560	0.5%
Following *Be Green* Measures	663	927	**49.1%**

7. SUSTAINABILITY: DESIGN CONSIDERATIONS

This section will summarise other sustainability measures that will apply to this development

Building Quality

Security

7.1 Hallmark Property Group are committed to ensuring the development is safe and secure for the occupants; reduce the risks and costs associated with crime; and improve occupiers' quality of life by reducing the fear of crime.

7.2 As such, the proposed development will be aiming to incorporate the principles of Secured by Design where appropriate. This may involve consultation with a Security Consultant during the detailed design stage.

Sound Insulation

7.3 In order to reduce the likelihood of noise complaints and to ensure a high quality development is created, the development will be aiming to achieve airborne sound insulation values that will improve upon the performance standards outlined within the Building Regulations for England and Wales, Approved Document E.

Inclusive Design

7.4 Hallmark Property Group will endeavour to incorporate the requirements of the Equality Act (2010) into their design, making reasonable adjustments to enable disabled access, regularly reviewing whether the buildings are accessible and effective, and providing necessary design adjustments where it is practical to do so.

Overheating

7.5 Minimising the risk of summer overheating and high uncontrollable temperatures is important so as to ensure that homes are comfortable for their occupants and remain comfortable in the future. Hallmark Property Group commits to ensuring that the dwelling will not have a high risk of summer overheating and will adopt appropriate measures to ensure this is delivered.

Appliances

7.6 The EU Labelling Scheme shows how appliances are rated according to their energy consumption. Due to improved energy efficiency in many new products, more appliances achieve A+, A++ and A+++. In January 2019, it was announced that A+ to A+++ will be phased-out over the coming years and the new grading system will revert back to A to G ratings. This should make it easier for consumers to understand how appliances compare against each other.

7.7 The choice of energy efficient appliances and the effective use of them will not only reduce unregulated CO_2 emissions but will save occupants money. Where provided, white goods will aim to be energy efficient with at least a B rating.

Sustainable construction

7.8 Sustainable construction involves the prudent use of existing and new resources and the efficient management of the construction process. This includes the following measures:

> Reducing waste during construction and sorting waste on site where practical;

> Reducing the risk of statutory nuisance to neighbouring properties as much as possible through effective site management;

> Controlling dust and emissions from demolition and construction; and

> Complying with protected species legislation.

Considerate Constructors Scheme

7.9 The development site will be registered with the Considerate Constructors Scheme. This is designed to encourage environmentally and socially considerate ways of working, to reduce any adverse impacts arising from the construction process. As commonly known, the Considerate Constructors Scheme aims are as follows:

> Enhancing the appearance;

> Respecting the community;

> Protecting the environment;

> Securing everyone's safety;

> Caring for the workforce.

Monitoring Construction Site Impacts

7.10 During the construction processes, control procedures will be put in place to minimise noise and dust pollution and roads will be kept clean. The management systems will generally comprise procedures and working methods that are approved by the development team together with commercial arrangements to ensure compliance.

7.11 Further to the above, additional measures will be adopted to minimise the impact on the local area during construction. This will include the limiting of air and water pollution in accordance with best practice principles.

7.12 In terms of construction traffic, this will be minimised by restricting deliveries and arrival times in order to manage potential impacts on existing site occupants and users. Work will be limited to appropriate hours to be agreed with the Council, and suppressors will be used to reduce noise from machinery.

Water reduction

Internal Water Efficiency

7.13 Increased frequency of drought across Europe lines up with climate change projections and water companies in the UK capture much less rain for our use than people assume. As of February 2019, 12 out of the 23 water companies operating in areas of England were classified as being under 'serious' stress (Energy Saving Trust, 2019). Each individual in the UK currently uses on average 140 litres/person/day and total UK demand for water in the 2080s is projected to increase by between 4-18% (CCRA2, 2015).

7.14 Reducing water consumption will not only help to preserve our water sources but will also save energy. As much as 25% of a household's energy consumption is used for heating water. As such, internal water consumption will be significantly reduced through the use of practical and hygienic water saving measures.

Residential Water Use

7.15 The dwelling will target a minimum water efficiency standard of 105 litres/person/day in accordance with Policy 5.15 of the Adopted London Plan and Policy SI5 of the Intend to Publish London Plan and the optional tighter Building Regulations Approved Document G requirement (110 litres/person/day).

Waste Management

7.16 Waste reduction and recycling is another key challenge of sustainable development and something which is strongly encouraged in the London Plan (Policy 5.17). The waste hierarchy, illustrated in Figure 5 below, prioritises those waste management options which are best for the environment.

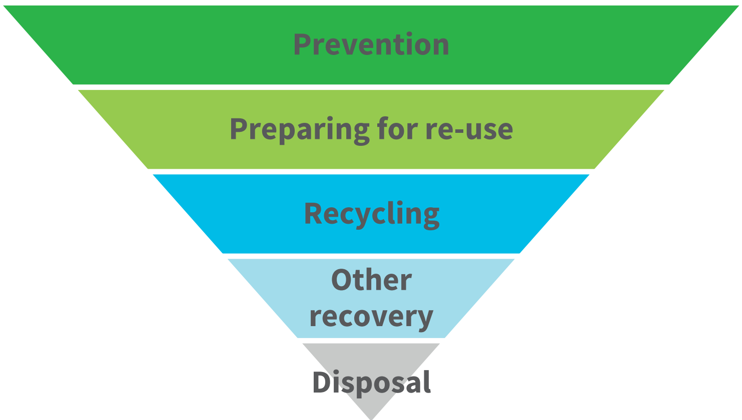


Figure 5: Waste Hierarchy

7.17 The waste hierarchy establishes waste management options according to what is best for the environment. It places great importance on preventing waste in the first place. When waste is created it prioritises preparing if for re-use, then recycling, recovery and lastly disposal (e.g. landfill).

Construction waste

7.18 The reduction of construction waste not only minimises environmental impacts through ensuring the responsible use of resources and waste disposal but can also significantly reduce construction costs for the developer

7.19 The following waste minimisation actions will be considered:

> Design for the use of fewer materials;

> Return packaging for reuse;

> Consider community reuse of surplus materials or offcuts; and

> Engage with supply chains and include waste minimisation initiatives and targets in tenders and contracts.

7.20 As part of their commitment to divert construction waste from landfill, Hallmark Property Group will regularly monitor and record the site's waste reduction performance. This will be compared against a target benchmark where at least 85% (by volume) of non-hazardous waste is to be diverted from landfill.

Household Waste

7.21 Adequate internal refuse storage will be provided in accordance with the London Borough of Camden's collection service.

7.22 This will include space for segregated recycling waste bins within the kitchen areas. This will involve the installation of recycling bins, where waste can be segregated into paper, glass, cans, plastic and cardboard, if necessary.

8. SUSTAINABILITY: LOCAL ENVIRONMENTAL IMPACTS

Ecology

8.1 The site has been previously used for development and is therefore considered 'brownfield'. Redeveloping and revitalising vacant and under-used sites is supported by the NPPF.

Green Roof

8.2 Green roof is to be provided in order to meet Policy 5.11 of the London Plan. Green roofs have demonstrable sustainability benefits, including:

> Reduction in urban heat island effect (localised cooling through increased evaporation);

> Provision of ecological habitats for fauna and flora, particularly where these roofs can replicate pre-existing ecological conditions; and

> Reduction in surface water run-off.

Materials

Environmental Impact

8.3 New building materials will be selected, where possible, to ensure that they minimise environmental impact and have low embodied energy – from manufacture, transportation and operational stages, through to eventual demolition and disposal.

8.4 All insulation materials will have an Ozone Depleting Potential (ODP) of zero and a Global Warming Potential (GWP) of less than 5.

Local and Responsible Sourcing

8.5 In accordance with London Plan Policy 5.3, preference will be given to the use of locally sourced materials and local suppliers, where viable. This will benefit the local economy as well as having environmental benefits through reduced transportation.

8.6 The main building materials will be responsibly and legally sourced from manufacturers with environmental management systems and/or responsible sourcing credentials, such as BES 6001.

8.7 Timber used on site, including timber used in the construction phase, such as hoarding, fencing and scaffolding, will be sourced from sustainable forestry sources (e.g. PEFC and FSC) where possible.

Recycled Materials

8.8 Where feasible, Hallmark Property Group will commit to using materials that have been recycled. The use of recycled materials (e.g. crushed concrete from waste, used for hard-standing) has less embodied energy impact, other than that expended in their processing or transport.

Flood Risk and Surface Water Run-off

8.9 Developments in low flood risk areas are promoted to, not only protect homes and local communities and reduce the cost implications if flooding occurs, but to protect the environment from the transfer of pollutants during flooding events.

8.10 As shown in the Environment Agency's Flood Map in Figure 6, the proposed development lies in a low risk flood zone (Flood Zone 1).

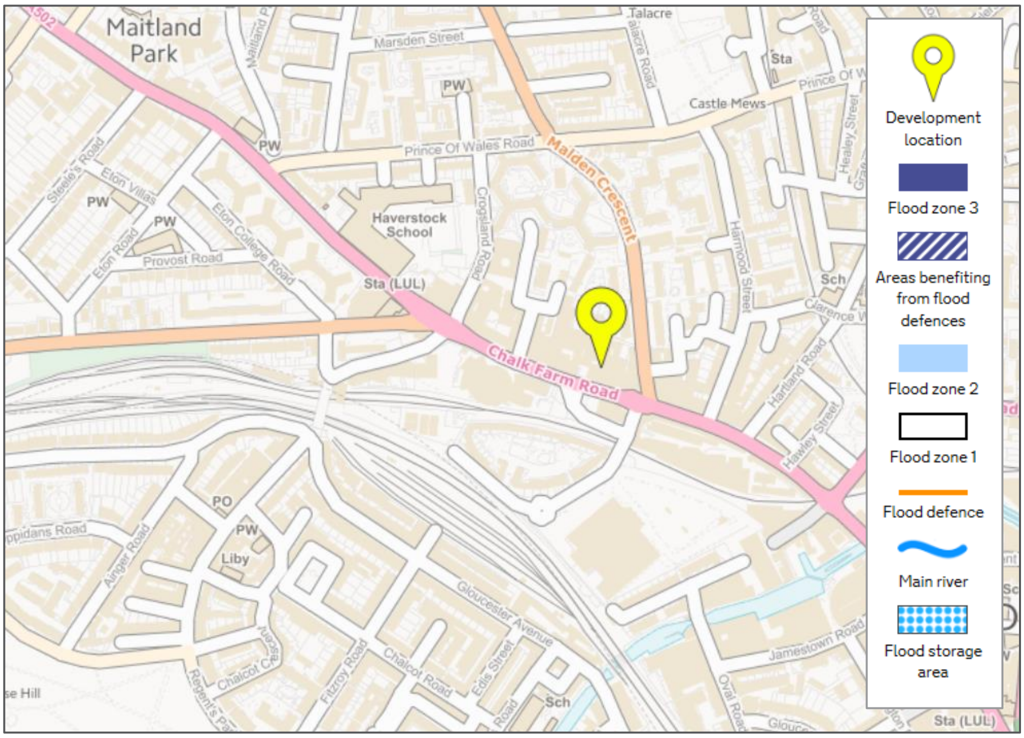


Figure 6: Environment Agency Flood Map – https://flood-map-for-planning.service.gov.uk

Sustainable drainage systems

8.11 Sustainable drainage systems (SuDS) can deliver multiple benefits which broadly fit into four categories: water quantity, water quality, amenity and biodiversity. The overarching principle of SuDS design is that surface water runoff should be managed for maximum benefit. Sustainable drainage takes account of the quantity and quality of runoff, and the amenity and aesthetic value of surface water in the urban environment.

8.12 Green roofs are proposed as part of the SuDS. These will not only help to attenuate surface water but will provide the necessary water treatment. They will help to intercept and retain precipitation, reducing the volume of runoff and attenuating peak flows.

Sustainable Transport and Local Amenities

8.13 Sustainable transport links are central to the sustainability debate. They provide a positive contribution to environmental, societal and economic sustainability of the places they serve.

8.14 The provision of alternative sustainable transport options and associated facilities reduces dependency on traditionally fuelled cars and has the following benefits:

> Encourages active travel and helps improve people's health and wellbeing;

- Reduces congestion and encourages clean travel which helps to improve the air quality of the local area; and
- Provides cost savings compared with maintaining and running traditionally fuelled cars.

Local Amenities

8.15 The proposed development has access to the following key amenities in the local area which will help to reduce dependency on private transport:

- Administrative services (e.g. post office, banks and cash points);
- Health services (e.g. pharmacies);
- Small/large scale retail services (e.g. shops and restaurants);
- Recreation and leisure facilities (e.g. gyms and cinemas); and
- Education and community facilities (e.g. nurseries, schools and community centres).

Public Transport

8.16 The site is well located within close proximity to a number of transport links, such as:

- **Chalk Farm Station,** which is approximately 250 meters from the site, provides trains to Morden, Edgware, and Kennington;
- **Camden Town Station** provides trains to Morden, Edgware, High Barnet, Kennington, and Mill Hill East; and
- **Local bus services** including 393, 24, 31, 27, and 168 within the vicinity of the site, providing frequent trips in all directions.

8.17 The Transport for London Public Transport Accessibility Level (PTAL) map for the site is presented in Figure 7 below. The site's PTAL rating of 6 represents a very good level of transport accessibility.

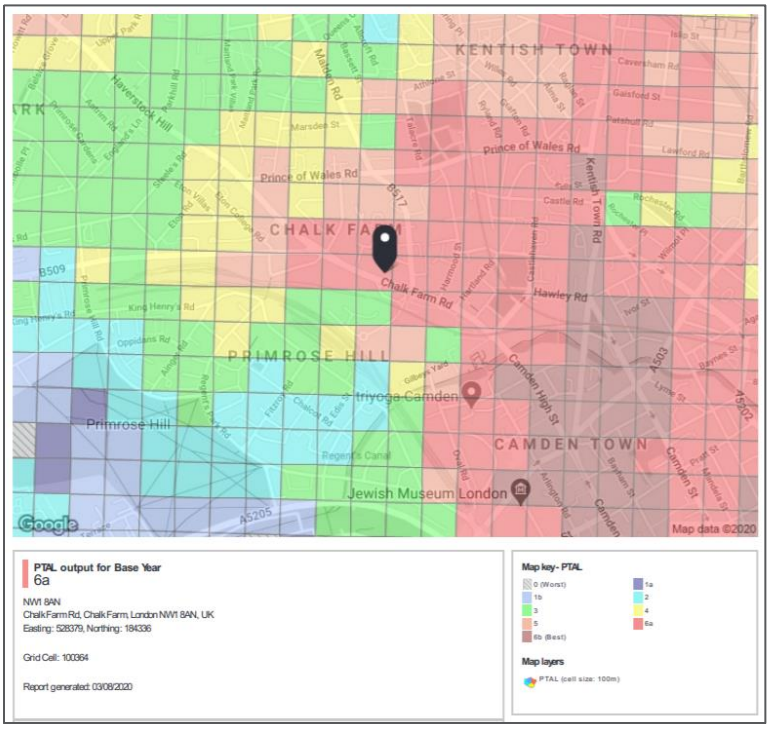


Figure 7: PTAL map - https://tfl.gov.uk/

Working from Home

8.18 The concept of working from home will be promoted by the provision of internal services and infrastructure, enabling a home office to be established in the dwelling. This will offer additional environmental benefits in terms of potentially reducing the demand for transportation.

The home office space will likely comprise the provision of two double electric sockets, a broadband connection, good ventilation and adequate internal daylight levels.

9. SUMMARY

9.1 The purpose of this Energy and Sustainability Statement is to demonstrate that the proposed development at 66 Chalk Farm Road by Hallmark Property Group in the London Borough of Camden is considered sustainable, as measured against relevant local, regional and national planning policies.

9.2 The proposed development will comprise a single dwelling located above an existing commercial space.

9.3 Through the incorporation of sustainable design and construction methods, energy and water saving measures, sustainable transport methods, waste reduction techniques and measures to enhance the ecological value of the site, a good quality and sustainable development is proposed.

9.4 The key features outlined in this combined Energy and Sustainability Statement are listed below:

Energy Strategy: The energy strategy has been formulated following the London Plan energy hierarchy: ***Be Lean***, ***Be Clean*** and ***Be Green***. The overriding objective is the formulation of a strategy which effectively balances a number of key elements, including CO_2 emissions, affordability of heat, climate change adaption, and the provision of high-quality living space. These elements need to work with the regulatory and planning requirements for the development.

> Energy demands to be reduced substantially through fabric '***Be Lean***' measures to ensure a sustainable level of building design is achieved. This locks in CO_2 savings irrespective of the source of the delivered energy;

> A balanced strategy for the generation of low carbon heating. Hallmark Property Group are committed to the delivery of heat which is both low in CO_2 and not unreasonably costly. A strategy has therefore been proposed which utilises an air source heat pump in the dwelling. No existing heat networks are in the vicinity of 66 Chalk Farm Road;

9.5 The commitment to energy efficient design and renewable technologies will enable a reduction in Regulated CO_2 of **49.1%** using SAP 10.0 CO_2 emissions factors, well above the minimum requirement of 19% for new builds within the London Borough of Camden.

	Regulated CO_2 (kg/yr)	Total CO_2 (kg/yr)	% Improvement (Regulated)
Baseline (TER)	1,304	1,567	-
Following *Be Lean* Measures	1,297	1,560	0.5%
Following *Be Clean* Measures	1,297	1,560	0.5%
Following *Be Green* Measures	663	927	**49.1%**

- **Water efficiency:** Flow control devices and water efficient fixtures and fittings will be installed to target a maximum internal daily water consumption of 105 litres/person/day.
- **Waste and recycling:** Adequate facilities will be provided for domestic and construction related waste, including segregated bins for refuse and recycling.
- **Materials:** Where practical, new building materials will be sourced locally to reduce transportation pollution and support the local economy. New materials will be selected based on their environmental impact and responsible suppliers will be used where possible.
- **Flood Risk and SUDs:** The proposed development site lies in a low flood risk zone and will benefit from SUDs such as a green roof.
- **Security:** The principles of Secure by Design will be implemented, where appropriate.
- **Sound insulation:** An improvement on Building Regulations Part E will be targeted.
- **Sustainable transport:** The site will benefit from a good existing public transport network and sustainable modes will be encouraged.
- **Biodiversity and ecology:** Enhancements will be implemented through the provision of a green roof.

APPENDICES

Appendix A

Building Regulations, ***Be Lean*** *and* ***Be Green*** Calculations – SAP 10.0 Calculations

Appendix B

TER Worksheets for Representative Dwellings

Appendix C

DER Worksheets for Representative Dwellings (Be Lean)

Appendix D

Indicative Heat Pump Specification

Appendix E

DER Worksheets for Representative Dwellings (Be Green)

Appendix A

Building Regulations, Be Lean and Be Green Calculations – SAP 10.0

Appendix A - Building Regulations, ***Be Lean and Be Green*** Calculations

SAP Outputs per Dwelling Type - Be Lean

Description	Orientation	Energy (kWh/yr)				Energy (kWh/m²/yr)		Regulated CO_2 (kg/m2/yr)		Total CO_2 (kg/m2/yr)	
		Space Heating	Hot Water	Regulated Electrical	Unregulated Appliances & Cooking	TFEE	DFEE	TER	DER	TER	DER
66 Chalk Farm Road	SW	3,643	2,142	353	2,308	72.6	61.6	21.6	21.5	25.94	25.83

Energy Demands & CO_2 Emissions - Be Lean

Description	Unit Area (m2)	No. Units	Energy (kWh/yr)				Energy (kWh/yr)		Regulated CO_2 (kg/yr)		Total CO_2 (kg/m2/yr)	
			Space Heating	Hot Water	Regulated Electrical	Unregulated Appliances & Cooking	TFEE	DFEE	TER	DER	TER	DER
66 Chalk Farm Road	60.4	1	3,643	2,142	353	2,308	4,385	3,718	1,304	1,297	1,567	1,560
TOTAL (Residential)			**3,643**	**2,142**	**353**	**2,308**	**4,385**	**3,718**	**1,304**	**1,297**	**1,567**	**1,560**
Area Weighted Average (/m2)							**72.6**	**61.6**	**21.58**	**21.48**	**25.9**	**25.8**
Improvement over Target							**15.2%**		**0.5%**		**0.4%**	

SAP Outputs per Dwelling Type - Be Green

Description	Orientation	Energy (kWh/yr)				Energy (kWh/m²/yr)		Regulated CO_2 (kg/m2/yr)		Total CO_2 (kg/m2/yr)	
		Space Heating	Hot Water	Regulated Electrical	Unregulated Appliances & Cooking	TFEE	DFEE	TER	DER	TER	DER
66 Chalk Farm Road	SW	1,383	1,186	278	2,308	72.6	61.6	21.6	10.98	25.94	15.34

Energy Demands & CO_2 Emissions - Be Green

Description	Unit Area (m2)	No. Units	Energy (kWh/yr)				Energy (kWh/yr)		Regulated CO_2 (kg/yr)		Total CO_2 (kg/m2/yr)	
			Space Heating	Hot Water	Regulated Electrical	Unregulated Appliances & Cooking	TFEE	DFEE	TER	DER	TER	DER
66 Chalk Farm Road	60.4	1	1,383	1,186	278	2,308	4,385	3,718	1,304	663	1,567	927
TOTAL (Residential)			**1,383**	**1,186**	**278**	**2,308**	**4,385**	**3,718**	**1,304**	**663**	**1,567**	**927**
Area Weighted Average (/m2)							**72.6**	**61.6**	**21.6**	**11.0**	**25.9**	**15.3**
Improvement over Target							**15.2%**		**49.1%**		**40.9%**	

Appendix B

TER Worksheet

TER Worksheet
Design - Draft

This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Jonathan Peck	Assessor number	10160
Client		Last modified	07/08/2020
Address	66 , Camden, NW1 8AN		

1. Overall dwelling dimensions

		Area (m²)			Average storey height (m)			Volume (m³)	
Lowest occupied		60.40	(1a)	x	2.40	(2a)	=	144.96	(3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) =	60.40	(4)						
Dwelling volume					(3a) + (3b) + (3c) + (3d)...(3n) =			144.96	(5)

2. Ventilation rate

			m³ per hour	
Number of chimneys	0	x 40 =	0	(6a)
Number of open flues	0	x 20 =	0	(6b)
Number of intermittent fans	2	x 10 =	20	(7a)
Number of passive vents	0	x 10 =	0	(7b)
Number of flueless gas fires	0	x 40 =	0	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) =	20	÷ (5) =	0.14	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5.00	(17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)		0.39	(18)
Number of sides on which the dwelling is sheltered		0	(19)
Shelter factor	1 - [0.075 x (19)] =	1.00	(20)
Infiltration rate incorporating shelter factor	(18) x (20) =	0.39	(21)

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	(22)
Wind factor (22)m ÷ 4	1.28	1.25	1.23	1.10	1.08	0.95	0.95	0.93	1.00	1.08	1.13	1.18	(22a)
Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.49	0.48	0.48	0.43	0.42	0.37	0.37	0.36	0.39	0.42	0.44	0.46	(22b)

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	N/A	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	N/A	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
d) natural ventilation or whole house positive input ventilation from loft	0.62	0.62	0.61	0.59	0.59	0.57	0.57	0.56	0.58	0.59	0.60	0.60	(24d)
Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	0.62	0.62	0.61	0.59	0.59	0.57	0.57	0.56	0.58	0.59	0.60	0.60	(25)

3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²		U-value W/m²K		A x U W/K	κ-value, kJ/m².K	A x κ, kJ/K	
Door			2.10	x	1.00	=	2.10			(26)
Window			9.83	x	1.33	=	13.03			(27)
Ground floor			60.40	x	0.13	=	7.85			(28a)
External wall			91.77	x	0.18	=	16.52			(29a)
Roof			54.24	x	0.13	=	7.05			(30)
Total area of external elements ∑A, m²			218.34							(31)

Fabric heat loss, W/K = ∑(A × U)	(26)...(30) + (32) =	46.55	(33)
Heat capacity Cm = ∑(A x κ)	(28)...(30) + (32) + (32a)...(32e) =	N/A	(34)
Thermal mass parameter (TMP) in kJ/m²K		250.00	(35)
Thermal bridges: ∑(L x Ψ) calculated using Appendix K		14.95	(36)
Total fabric heat loss	(33) + (36) =	61.50	(37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	29.77	29.54	29.32	28.27	28.08	27.17	27.17	27.00	27.52	28.08	28.47	28.89	(38)
Heat transfer coefficient, W/K (37)m + (38)m	91.27	91.05	90.82	89.78	89.58	88.67	88.67	88.50	89.02	89.58	89.98	90.39	

Average = ∑(39)1...12/12 = 89.78 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss parameter (HLP), W/m²K (39)m ÷ (4)	1.51	1.51	1.50	1.49	1.48	1.47	1.47	1.47	1.47	1.48	1.49	1.50	

Average = ∑(40)1...12/12 = 1.49 (40)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)

4. Water heating energy requirement

Assumed occupancy, N	1.99	(42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	81.53	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	89.69	86.42	83.16	79.90	76.64	73.38	73.38	76.64	79.90	83.16	86.42	89.69	

∑(44)1...12 = 978.38 (44)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	133.00	116.32	120.03	104.65	100.41	86.65	80.29	92.14	93.24	108.66	118.61	128.80	

∑(45)1...12 = 1282.81 (45)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Distribution loss 0.15 x (45)m	19.95	17.45	18.01	15.70	15.06	13.00	12.04	13.82	13.99	16.30	17.79	19.32	(46)
Water storage loss calculated for each month (55) x (41)m	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(56)
If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(57)
Primary circuit loss for each month from Table 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(59)
Combi loss for each month from Table 3a, 3b or 3c	45.70	39.78	42.38	39.40	39.05	36.19	37.39	39.05	39.40	42.38	42.62	45.70	(61)
Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m	178.70	156.10	162.41	144.05	139.47	122.84	117.69	131.19	132.64	151.04	161.23	174.51	(62)

Solar DHW input calculated using Appendix G or Appendix H

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)

Output from water heater for each month (kWh/month) (62)m + (63)m

178.70	156.10	162.41	144.05	139.47	122.84	117.69	131.19	132.64	151.04	161.23	174.51	

∑(64)1...12 = 1771.87 (64)

Heat gains from water heating (kWh/month) 0.25 × [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m]

55.65	48.62	50.51	44.65	43.15	37.86	36.05	40.40	40.85	46.72	50.09	54.25	(65)

5. Internal gains

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5)	99.65	99.65	99.65	99.65	99.65	99.65	99.65	99.65	99.65	99.65	99.65	99.65	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	16.13	14.32	11.65	8.82	6.59	5.57	6.01	7.82	10.49	13.32	15.55	16.57	(67)
Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	173.95	175.76	171.21	161.53	149.30	137.81	130.14	128.33	132.88	142.57	154.79	166.28	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.96	32.96	32.96	32.96	32.96	32.96	32.96	32.96	32.96	32.96	32.96	32.96	(69)
Pump and fan gains (Table 5a)	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70)
Losses e.g. evaporation (Table 5)	-79.72	-79.72	-79.72	-79.72	-79.72	-79.72	-79.72	-79.72	-79.72	-79.72	-79.72	-79.72	(71)
Water heating gains (Table 5)	74.80	72.35	67.88	62.01	58.00	52.58	48.45	54.30	56.74	62.80	69.57	72.92	(72)
Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m	320.77	318.33	306.64	288.25	269.79	251.85	240.49	246.34	256.01	274.58	295.80	311.67	(73)

6. Solar gains

	Access factor Table 6d		Area m²		Solar flux W/m²		g specific data or Table 6b		FF specific data or Table 6c		Gains W	
SouthWest	0.77	x	7.52	x	36.79	x 0.9 x	0.63	x	0.70	=	84.56	(79)
SouthEast	0.77	x	2.31	x	36.79	x 0.9 x	0.63	x	0.70	=	25.98	(77)

Solar gains in watts ∑(74)m...(82)m	110.54	188.28	257.62	319.20	357.53	354.94	342.20	313.61	278.94	208.09	132.40	94.60	(83)
Total gains - internal and solar (73)m + (83)m	431.31	506.61	564.25	607.45	627.32	606.80	582.70	559.95	534.95	482.67	428.20	406.26	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1(˚C) 21.00 (85)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area n1,m (see Table 9a)	1.00	0.99	0.98	0.96	0.90	0.78	0.62	0.66	0.86	0.97	0.99	1.00	(86)
Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)	19.40	19.59	19.89	20.26	20.61	20.86	20.96	20.95	20.77	20.32	19.79	19.37	(87)
Temperature during heating periods in the rest of dwelling from Table 9, Th2(˚C)	19.68	19.68	19.68	19.70	19.70	19.71	19.71	19.71	19.71	19.70	19.70	19.69	(88)
Utilisation factor for gains for rest of dwelling n2,m	0.99	0.99	0.97	0.94	0.85	0.67	0.46	0.51	0.78	0.95	0.99	1.00	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

17.60	17.87	18.30	18.84	19.31	19.62	19.70	19.69	19.53	18.93	18.17	17.56	(90)

Living area fraction — Living area ÷ (4) = 0.59 (91)

Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2

18.66	18.89	19.24	19.68	20.08	20.35	20.44	20.43	20.26	19.75	19.13	18.63	(92)

Apply adjustment to the mean internal temperature from Table 4e where appropriate

18.66	18.89	19.24	19.68	20.08	20.35	20.44	20.43	20.26	19.75	19.13	18.63	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, ηm	0.99	0.99	0.97	0.94	0.87	0.73	0.56	0.60	0.82	0.95	0.99	0.99	(94)
Useful gains, ηmGm, W (94)m x (84)m	428.14	499.40	548.38	570.79	545.44	443.19	324.50	334.92	436.25	458.73	422.41	403.90	(95)
Monthly average external temperature from Table U1	4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m]	1311.06	1273.80	1156.83	967.88	750.44	510.00	340.77	356.98	548.59	819.88	1082.34	1304.30	(97)
Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m	656.90	520.40	452.68	285.90	152.52	0.00	0.00	0.00	0.00	268.70	475.15	669.90	

∑(98)1...5, 10...12 = 3482.15 (98)

Space heating requirement kWh/m²/year — (98) ÷ (4) = 57.65 (99)

9a. Energy requirements - individual heating systems including micro-CHP

Space heating

Fraction of space heat from secondary/supplementary system (table 11)		0.00	(201)
Fraction of space heat from main system(s)	1 - (201) =	1.00	(202)
Fraction of space heat from main system 2		0.00	(202)
Fraction of total space heat from main system 1	(202) x [1- (203)] =	1.00	(204)
Fraction of total space heat from main system 2	(202) x (203) =	0.00	(205)
Efficiency of main system 1 (%)		93.40	(206)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating fuel (main system 1), kWh/month	703.32	557.17	484.67	306.11	163.29	0.00	0.00	0.00	0.00	287.68	508.72	717.24

∑(211)1...5, 10...12 = 3728.21 (211)

Water heating

Efficiency of water heater	88.03	87.85	87.49	86.74	85.28	80.30	80.30	80.30	80.30	86.49	87.61	88.11	(217)
Water heating fuel, kWh/month	203.00	177.69	185.63	166.07	163.55	152.97	146.56	163.38	165.18	174.64	184.04	198.06	

∑(219a)1...12 = 2080.75 (219)

Annual totals

Space heating fuel - main system 1		3728.21	
Water heating fuel		2080.75	
Electricity for pumps, fans and electric keep-hot (Table 4f)			
central heating pump or water pump within warm air heating unit	30.00		(230c)
boiler flue fan	45.00		(230e)
Total electricity for the above, kWh/year		75.00	(231)

Electricity for lighting (Appendix L)	284.78	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =	6168.74	(238)

10a. Fuel costs - individual heating systems including micro-CHP

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	3728.21	x	3.48	x 0.01 =	129.74	(240)
Water heating	2080.75	x	3.48	x 0.01 =	72.41	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	284.78	x	13.19	x 0.01 =	37.56	(250)
Additional standing charges					120.00	(251)
Total energy cost				(240)...(242) + (245)...(254) =	369.61	(255)

11a. SAP rating - individual heating systems including micro-CHP

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	1.47	(257)
SAP value	79.45	
SAP rating (section 13)	79	(258)
SAP band	C	

12a. CO_2 emissions - individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO_2/kWh		Emissions kg CO_2/year	
Space heating - main system 1	3728.21	x	0.216	=	805.29	(261)
Water heating	2080.75	x	0.216	=	449.44	(264)
Space and water heating				(261) + (262) + (263) + (264) =	1254.74	(265)
Pumps and fans	75.00	x	0.519	=	38.93	(267)
Electricity for lighting	284.78	x	0.519	=	147.80	(268)
Total CO_2, kg/year				(265)...(271) =	1441.46	(272)
Dwelling CO_2 emission rate				(272) ÷ (4) =	23.87	(273)
EI value					81.67	
EI rating (section 14)					82	(274)
EI band					B	

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

	Energy kWh/year		Primary factor		Primary Energy kWh/year	
Space heating - main system 1	3728.21	x	1.22	=	4548.41	(261)
Water heating	2080.75	x	1.22	=	2538.52	(264)
Space and water heating				(261) + (262) + (263) + (264) =	7086.93	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	284.78	x	3.07	=	874.29	(268)
Primary energy kWh/year					8191.47	(272)
Dwelling primary energy rate kWh/m2/year					135.62	(273)

Appendix C

DER Worksheet (Be Lean)

DER Worksheet
Design - Draft

This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Jonathan Peck	Assessor number	10160
Client		Last modified	07/08/2020
Address	66 , Camden, NW1 8AN		

1. Overall dwelling dimensions

		Area (m²)			Average storey height (m)			Volume (m³)	
Lowest occupied		60.40	(1a)	x	2.40	(2a)	=	144.96	(3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) =	60.40	(4)						
Dwelling volume					(3a) + (3b) + (3c) + (3d)...(3n) =			144.96	(5)

2. Ventilation rate

			m³ per hour	
Number of chimneys	0	x 40 =	0	(6a)
Number of open flues	0	x 20 =	0	(6b)
Number of intermittent fans	2	x 10 =	20	(7a)
Number of passive vents	0	x 10 =	0	(7b)
Number of flueless gas fires	0	x 40 =	0	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) =	20	÷ (5) =	0.14	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4.00	(17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)		0.34	(18)
Number of sides on which the dwelling is sheltered		0	(19)
Shelter factor	1 - [0.075 x (19)] =	1.00	(20)
Infiltration rate incorporating shelter factor	(18) x (20) =	0.34	(21)

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	(22)
Wind factor (22)m ÷ 4	1.28	1.25	1.23	1.10	1.08	0.95	0.95	0.93	1.00	1.08	1.13	1.18	(22a)
Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.34	0.36	0.38	0.40	(22b)

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	N/A	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	N/A	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
d) natural ventilation or whole house positive input ventilation from loft	0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(24d)
Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(25)

3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²		U-value W/m²K		A x U W/K	κ-value, kJ/m².K	A x κ, kJ/K	
Door			2.10	x	1.00	=	2.10			(26)
Window			9.83	x	1.24	=	12.15			(27)
Ground floor			60.40	x	0.15	=	9.06			(28a)
External wall			91.77	x	0.18	=	16.52			(29a)
Roof			54.24	x	0.16	=	8.68			(30)
Total area of external elements ∑A, m²			218.34							(31)

Fabric heat loss, W/K = ∑(A × U)	(26)...(30) + (32) =	48.50	(33)
Heat capacity Cm = ∑(A x κ)	(28)...(30) + (32) + (32a)...(32e) =	N/A	(34)
Thermal mass parameter (TMP) in kJ/m²K		100.00	(35)
Thermal bridges: ∑(L x Ψ) calculated using Appendix K		15.64	(36)
Total fabric heat loss	(33) + (36) =	64.14	(37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	28.36	28.19	28.02	27.22	27.08	26.38	26.38	26.26	26.65	27.08	27.38	27.69	(38)
Heat transfer coefficient, W/K (37)m + (38)m	92.50	92.33	92.16	91.36	91.22	90.52	90.52	90.40	90.79	91.22	91.52	91.83	
Average = ∑(39)1...12/12 =												91.36	(39)
Heat loss parameter (HLP), W/m²K (39)m ÷ (4)	1.53	1.53	1.53	1.51	1.51	1.50	1.50	1.50	1.50	1.51	1.52	1.52	
Average = ∑(40)1...12/12 =												1.51	(40)
Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)

4. Water heating energy requirement

Assumed occupancy, N	1.99	(42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	81.53	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	89.69	86.42	83.16	79.90	76.64	73.38	73.38	76.64	79.90	83.16	86.42	89.69	
∑(44)1...12 =												978.38	(44)
Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	133.00	116.32	120.03	104.65	100.41	86.65	80.29	92.14	93.24	108.66	118.61	128.80	
∑(45)1...12 =												1282.81	(45)
Distribution loss 0.15 x (45)m	19.95	17.45	18.01	15.70	15.06	13.00	12.04	13.82	13.99	16.30	17.79	19.32	(46)
Water storage loss calculated for each month (55) x (41)m	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(56)
If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(57)
Primary circuit loss for each month from Table 3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(59)
Combi loss for each month from Table 3a, 3b or 3c	53.05	47.90	53.00	51.26	52.94	51.21	52.90	52.93	51.23	52.98	51.30	53.04	(61)
Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m	186.05	164.22	173.03	155.91	153.36	137.86	133.19	145.06	144.47	161.64	169.92	181.84	(62)

Solar DHW input calculated using Appendix G or Appendix H

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)

Output from water heater for each month (kWh/month) (62)m + (63)m

186.05	164.22	173.03	155.91	153.36	137.86	133.19	145.06	144.47	161.64	169.92	181.84	

∑(64)1...12 = 1906.54 (64)

Heat gains from water heating (kWh/month) 0.25 × [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m]

57.48	50.65	53.16	47.61	46.62	41.61	39.92	43.87	43.81	49.37	52.26	56.09	(65)

5. Internal gains

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5)	99.65	99.65	99.65	99.65	99.65	99.65	99.65	99.65	99.65	99.65	99.65	99.65	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.76	14.00	11.38	8.62	6.44	5.44	5.88	7.64	10.25	13.02	15.19	16.20	(67)
Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	173.95	175.76	171.21	161.53	149.30	137.81	130.14	128.33	132.88	142.57	154.79	166.28	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.96	32.96	32.96	32.96	32.96	32.96	32.96	32.96	32.96	32.96	32.96	32.96	(69)
Pump and fan gains (Table 5a)	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	(70)
Losses e.g. evaporation (Table 5)	-79.72	-79.72	-79.72	-79.72	-79.72	-79.72	-79.72	-79.72	-79.72	-79.72	-79.72	-79.72	(71)
Water heating gains (Table 5)	77.26	75.37	71.45	66.13	62.67	57.80	53.66	58.96	60.85	66.36	72.59	75.39	(72)
Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m	322.87	321.03	309.94	292.16	274.30	256.94	245.57	250.83	259.88	277.84	298.47	313.76	(73)

6. Solar gains

	Access factor Table 6d		Area m²		Solar flux W/m²		g specific data or Table 6b		FF specific data or Table 6c		Gains W	
SouthWest	0.77	x	7.52	x	36.79	x 0.9 x	0.50	x	0.80	=	76.70	(79)
SouthEast	0.77	x	2.31	x	36.79	x 0.9 x	0.50	x	0.80	=	23.56	(77)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains in watts ∑(74)m...(82)m	100.26	170.78	233.67	289.52	324.29	321.94	310.39	284.45	253.01	188.75	120.09	85.80	(83)
Total gains - internal and solar (73)m + (83)m	423.13	491.80	543.61	581.69	598.59	578.89	555.96	535.28	512.89	466.59	418.56	399.56	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1(˚C) 21.00 (85)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area n1,m (see Table 9a)	0.96	0.94	0.91	0.87	0.80	0.69	0.57	0.60	0.76	0.88	0.94	0.96	(86)
Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)	18.02	18.32	18.80	19.42	20.03	20.53	20.79	20.75	20.37	19.59	18.69	17.96	(87)
Temperature during heating periods in the rest of dwelling from Table 9, Th2(˚C)	19.66	19.67	19.67	19.68	19.68	19.69	19.69	19.69	19.69	19.68	19.68	19.67	(88)
Utilisation factor for gains for rest of dwelling n2,m	0.95	0.93	0.90	0.84	0.75	0.61	0.44	0.48	0.69	0.86	0.93	0.96	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

15.77	16.20	16.89	17.78	18.62	19.27	19.56	19.53	19.09	18.03	16.75	15.69	(90)

Living area fraction — Living area ÷ (4) = 0.59 (91)

Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2

17.10	17.46	18.02	18.75	19.45	20.01	20.28	20.25	19.85	18.95	17.90	17.03	(92)

Apply adjustment to the mean internal temperature from Table 4e where appropriate

16.95	17.31	17.87	18.60	19.30	19.86	20.13	20.10	19.70	18.80	17.75	16.88	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, ηm	0.93	0.91	0.87	0.82	0.74	0.62	0.49	0.52	0.69	0.83	0.91	0.94	(94)
Useful gains, ηmGm, W (94)m x (84)m	393.45	445.46	473.99	476.23	442.36	359.77	272.50	278.47	352.53	388.09	379.49	374.29	(95)
Monthly average external temperature from Table U1	4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m]	1170.31	1145.35	1048.07	886.48	693.30	476.47	319.92	334.56	508.11	748.10	974.63	1164.74	(97)
Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m	577.98	470.32	427.12	295.38	186.70	0.00	0.00	0.00	0.00	267.85	428.50	588.09	

∑(98)1...5, 10...12 = 3241.94 (98)

Space heating requirement kWh/m²/year — (98) ÷ (4) = 53.67 (99)

9a. Energy requirements - individual heating systems including micro-CHP

Space heating

Fraction of space heat from secondary/supplementary system (table 11)		0.00	(201)
Fraction of space heat from main system(s)	1 - (201) =	1.00	(202)
Fraction of space heat from main system 2		0.00	(202)
Fraction of total space heat from main system 1	(202) x [1- (203)] =	1.00	(204)
Fraction of total space heat from main system 2	(202) x (203) =	0.00	(205)
Efficiency of main system 1 (%)		90.50	(206)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating fuel (main system 1), kWh/month	638.66	519.69	471.95	326.39	206.29	0.00	0.00	0.00	0.00	295.96	473.48	649.83

∑(211)1...5, 10...12 = 3582.25 (211)

Water heating

Efficiency of water heater	89.70	89.65	89.55	89.37	89.03	87.30	87.30	87.30	87.30	89.27	89.57	89.72	(217)
Water heating fuel, kWh/month	207.41	183.18	193.22	174.45	172.26	157.91	152.57	166.17	165.49	181.07	189.71	202.67	

∑(219a)1...12 = 2146.10 (219)

Annual totals

Space heating fuel - main system 1		3582.25	
Water heating fuel		2146.10	
Electricity for pumps, fans and electric keep-hot (Table 4f)			
central heating pump or water pump within warm air heating unit	30.00		(230c)
boiler flue fan	45.00		(230e)
Total electricity for the above, kWh/year		75.00	(231)

Electricity for lighting (Appendix L)				278.33	(232)
Total delivered energy for all uses			(211)...(221) + (231) + (232)...(237b) =	6081.69	(238)

10a. Fuel costs - individual heating systems including micro-CHP

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	3582.25	x	3.48	x 0.01 =	124.66	(240)
Water heating	2146.10	x	3.48	x 0.01 =	74.68	(247)
Pumps and fans	75.00	x	13.19	x 0.01 =	9.89	(249)
Electricity for lighting	278.33	x	13.19	x 0.01 =	36.71	(250)
Additional standing charges					120.00	(251)
Total energy cost			(240)...(242) + (245)...(254) =		365.95	(255)

11a. SAP rating - individual heating systems including micro-CHP

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	1.46	(257)
SAP value	79.66	
SAP rating (section 13)	80	(258)
SAP band	C	

12a. CO_2 emissions - individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO_2/kWh		Emissions kg CO_2/year	
Space heating - main system 1	3582.25	x	0.216	=	773.77	(261)
Water heating	2146.10	x	0.216	=	463.56	(264)
Space and water heating			(261) + (262) + (263) + (264) =		1237.32	(265)
Pumps and fans	75.00	x	0.519	=	38.93	(267)
Electricity for lighting	278.33	x	0.519	=	144.46	(268)
Total CO_2, kg/year				(265)...(271) =	1420.70	(272)
Dwelling CO_2 emission rate				(272) ÷ (4) =	23.52	(273)
EI value					81.94	
EI rating (section 14)					82	(274)
EI band					B	

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

	Energy kWh/year		Primary factor		Primary Energy kWh/year	
Space heating - main system 1	3582.25	x	1.22	=	4370.35	(261)
Water heating	2146.10	x	1.22	=	2618.24	(264)
Space and water heating			(261) + (262) + (263) + (264) =		6988.59	(265)
Pumps and fans	75.00	x	3.07	=	230.25	(267)
Electricity for lighting	278.33	x	3.07	=	854.48	(268)
Primary energy kWh/year					8073.32	(272)
Dwelling primary energy rate kWh/m2/year					133.66	(273)

Appendix D

Indicative Heat Pump Specification

Heating

Product Information

PUHZ-(H)W50-140VHA(2)/YHA2(-BS)
Ecodan Monobloc Air Source Heat Pumps

Making a World of Difference

Designed to meet the demands of today's heating needs

Our range of Ecodan monobloc air source heat pumps includes 5, 8.5, 11.2 and 14kW sizes. Now with the ability to cascade up to six units of the same output, Ecodan monobloc systems offer a capacity range from 5 through to 84kW. Designed to suit a wide number of applications, these models offer a viable solution for the varying requirements that domestic and small commercial applications demand.

Key Features

- Self-contained unit, only requiring water and electric connections
- No need for gas supply, flues or ventilation
- Single phase power supply with a low starting current (3 phase available for 14kW)
- Low maintenance and quiet operation
- Operates with outside temperatures as low as -25°C
- Multiple unit connection
- Hybrid function, for use with conventional boilers
- 2-zone energy efficient space heating control
- Available as a standalone, packaged or semi packaged system
- Energy monitoring as standard
- Coastal protection models available (-BS)

Application Examples

- The vast majority of UK homes
- Small Retail Outlets
- Dental / Doctor's Surgeries
- Public Sector / Commercial Buildings

Manufactured in the UK
PUHZ-W85VHA2

MELCloud

Qualified for Energy Technology List www.eca.gov.uk

QUIET MARK

APPROVED PRODUCT
MCS
BRE GLOBAL CERTIFICATION

Certificate Number: MCS HP0002
Product Type: Heat Pumps
Product Reference: PUHZ-W50VHA2-(BS), PUHZ-W85VHA2-(BS)
PUHZ-W112VHA-(BS), PUHZ-HW140VHA2/YHA2-(BS)

MITSUBISHI ELECTRIC

Air Conditioning | Heating
Ventilation | Controls

ecodan®
Renewable Heating Technology

Heating

Product Information

PUHZ-(H)W50-140VHA(2)/YHA2(-BS)
Ecodan Monobloc Air Source Heat Pumps

Making a World of Difference

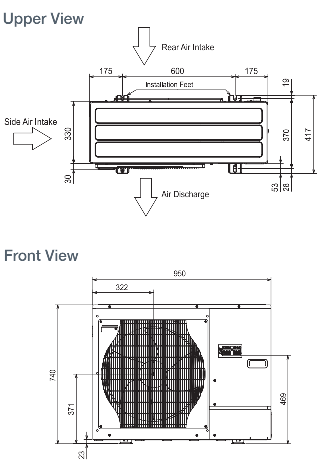
OUTDOOR UNIT		PUHZ-W50VHA2(-BS)	PUHZ-W85VHA2(-BS)	PUHZ-W112VHA(-BS)	PUHZ-HW140VHA2(-BS)	PUHZ-HW140YHA2(-BS)
HEAT PUMP SPACE HEATER - 55°C	ErP Rating	A++	A++	A++	A++	A++
	η_s	127%	128%	125%	126%	126%
	SCOP	3.17	3.18	3.11	3.12	3.12
HEAT PUMP SPACE HEATER - 35°C	ErP Rating	A++	A++	A++	A++	A++
	η_s	162%	162%	164%	157%	157%
	SCOP	4.03	4.01	4.06	3.87	3.87
HEAT PUMP COMBINATION HEATER - Large Profile[*1]	ErP Rating	A	A	A	A	A
	η_{wh}	99%	97%	100%	96%	96%
HEATING[*2] (A-3/W35)	Capacity (kW)	4.8	8.3	11.0	14.0	14.0
	Power Input (kW)	1.63	2.96	3.65	4.81	4.81
	COP	2.95	2.80	3.01	2.91	2.91
OPERATING AMBIENT TEMPERATURE (°C DB)		-15 ~ +35°C	-20 ~ +35°C	-20 ~ +35°C	-25 ~ +35°C	-25 ~ +35°C
SOUND PRESSURE LEVEL AT 1M (dBA)[*3*4]		45	48	53	53	53
LOW NOISE MODE (dBA)[*3]		40	42	46	46	46
WATER DATA	Pipework Size (mm)	22	22	28	28	28
	Flow Rate (l/min)	14.3	25.8	32.1	40.1	40.1
	Water Pressure Drop (kPa)	12	13.5	6.3	9	9
DIMENSIONS (mm)[*7]	Width	950	950	1020	1020	1020
	Depth	330+30[*5]	330+30[*5]	330+30[*5]	330+30[*5]	330+30[*5]
	Height	740	943	1350	1350	1350
WEIGHT (kg)		64	77	133	134	148
ELECTRICAL DATA	Electrical Supply	220-240v, 50Hz	220-240v, 50Hz	220-240v, 50Hz	220-240v, 50Hz	380-415v, 50Hz
	Phase	Single	Single	Single	Single	3
	Nominal Running Current [MAX] (A)	5.4 [13]	10.3 [23]	11.2 [29.5]	14.9 [35]	5.1 [13]
	Fuse Rating - MCB Sizes (A)[*6]	16	25	32	40	16

*1 Combination with EHPT20X-MHCW Cylinder
*2 Under normal heating conditions at outdoor temp: -3°CDB / -4°CWB, outlet water temp 35°C, inlet water temp 30°C.
*3 Under normal heating conditions at outdoor temp: 7°CDB / 6°CWB, outlet water temp 35°C, inlet water temp 30°C as tested to BS EN14511.
*4 Sound power level of the PUHZ-W50VHA2 is 61dBA, PUHZ-W85VHA2 is 62.5dBA, PUHZ-W112VHA is 65dBA, PUHZ-HW140VHA2 is 65.5dBA, PUHZ-HW140YHA2 is 67.5dBA. Tested to BS EN12102.
*5 Grille.
*6 MCB Sizes BS EN60898-2 & BS EN60947-2.
*7 Flow Temperature Controller (FTC) for standalone systems PAC-IF062B-E Dimensions WxDxH (mm) - 520x150x450

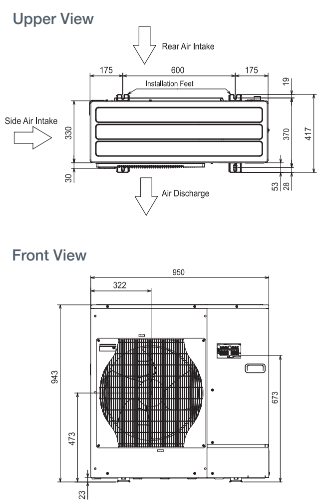
η_s is the seasonal space heating energy efficiency (SSHEE) η_{wh} is the water heating energy efficiency

DIMENSIONS

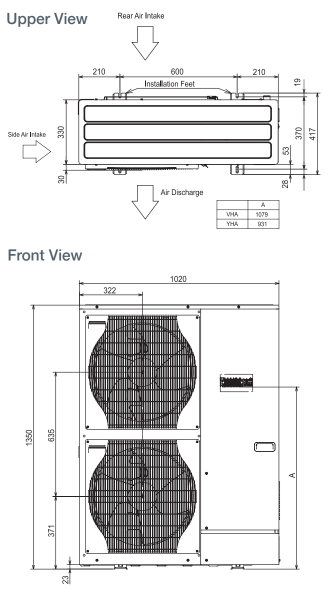
PUHZ-W50VHA2(-BS)



PUHZ-W85VHA2(-BS)



PUHZ-(H)W112-140VHA(2) / YHA2(-BS)



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Travellers Lane, Hatfield, Hertfordshire, AL10 8XB, England General Enquiries Telephone: 01707 282880 Fax: 01707 278881
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Effective as of August 2016 SAP No. 282526

Appendix E

DER Worksheet (Be Green)

This design submission has been carried out using Approved SAP software. It has been prepared from plans and specifications and may not reflect the property as constructed.

Assessor name	Mr Jonathan Peck	Assessor number	10160
Client		Last modified	07/08/2020
Address	66, Camden, NW1 8AN		

1. Overall dwelling dimensions

		Area (m^2)			Average storey height (m)			Volume (m^3)	
Lowest occupied		60.40	(1a)	x	2.40	(2a)	=	144.96	(3a)
Total floor area	(1a) + (1b) + (1c) + (1d)...(1n) =	60.40	(4)						
Dwelling volume					(3a) + (3b) + (3c) + (3d)...(3n) =			144.96	(5)

2. Ventilation rate

				m³ per hour	
Number of chimneys		0	x 40 =	0	(6a)
Number of open flues		0	x 20 =	0	(6b)
Number of intermittent fans		2	x 10 =	20	(7a)
Number of passive vents		0	x 10 =	0	(7b)
Number of flueless gas fires		0	x 40 =	0	(7c)
				Air changes per hour	
Infiltration due to chimneys, flues, fans, PSVs	(6a) + (6b) + (7a) + (7b) + (7c) =	20	÷ (5) =	0.14	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4.00	(17)
If based on air permeability value, then (18) = [(17) ÷ 20] + (8), otherwise (18) = (16)		0.34	(18)
Number of sides on which the dwelling is sheltered		0	(19)
Shelter factor	1 - [0.075 x (19)] =	1.00	(20)
Infiltration rate incorporating shelter factor	(18) x (20) =	0.34	(21)

Infiltration rate modified for monthly wind speed:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Monthly average wind speed from Table U2	5.10	5.00	4.90	4.40	4.30	3.80	3.80	3.70	4.00	4.30	4.50	4.70	(22)
Wind factor (22)m ÷ 4	1.28	1.25	1.23	1.10	1.08	0.95	0.95	0.93	1.00	1.08	1.13	1.18	(22a)
Adjusted infiltration rate (allowing for shelter and wind factor) (21) x (22a)m	0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.34	0.36	0.38	0.40	(22b)

Calculate effective air change rate for the applicable case:

If mechanical ventilation: air change rate through system	N/A	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor from Table 4h	N/A	(23c)

d) natural ventilation or whole house positive input ventilation from loft

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
d) natural ventilation or whole house positive input ventilation from loft	0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(24d)
Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in (25)	0.59	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(25)

3. Heat losses and heat loss parameter

Element	Gross area, m²	Openings m²	Net area A, m²		U-value W/m²K		A x U W/K	κ-value, kJ/m².K	A x κ, kJ/K	
Window			9.83	x	1.24	=	12.15			(27)
Door			2.10	x	1.00	=	2.10			(26)
Ground floor			60.40	x	0.15	=	9.06			(28a)
External wall			91.77	x	0.18	=	16.52			(29a)
Roof			54.24	x	0.16	=	8.68			(30)
Total area of external elements ∑A, m²			218.34							(31)

Fabric heat loss, W/K = ∑(A × U)	(26)...(30) + (32) =	48.50	(33)
Heat capacity Cm = ∑(A x κ)	(28)...(30) + (32) + (32a)...(32e) =	N/A	(34)
Thermal mass parameter (TMP) in kJ/m²K		100.00	(35)
Thermal bridges: ∑(L x Ψ) calculated using Appendix K		15.64	(36)
Total fabric heat loss	(33) + (36) =	64.14	(37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ventilation heat loss calculated monthly 0.33 x (25)m x (5)	28.36	28.19	28.02	27.22	27.08	26.38	26.38	26.26	26.65	27.08	27.38	27.69	(38)
Heat transfer coefficient, W/K (37)m + (38)m	92.50	92.33	92.16	91.36	91.22	90.52	90.52	90.40	90.79	91.22	91.52	91.83	
Average = ∑(39)1...12/12 =												91.36	(39)
Heat loss parameter (HLP), W/m²K (39)m ÷ (4)	1.53	1.53	1.53	1.51	1.51	1.50	1.50	1.50	1.50	1.51	1.52	1.52	
Average = ∑(40)1...12/12 =												1.51	(40)
Number of days in month (Table 1a)	31.00	28.00	31.00	30.00	31.00	30.00	31.00	31.00	30.00	31.00	30.00	31.00	(40)

4. Water heating energy requirement

Assumed occupancy, N	1.99	(42)
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	81.53	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)	89.69	86.42	83.16	79.90	76.64	73.38	73.38	76.64	79.90	83.16	86.42	89.69	
∑(44)1...12 =												978.38	(44)
Energy content of hot water used = 4.18 x Vd,m x nm x Tm/3600 kWh/month (see Tables 1b, 1c 1d)	133.00	116.32	120.03	104.65	100.41	86.65	80.29	92.14	93.24	108.66	118.61	128.80	
∑(45)1...12 =												1282.81	(45)
Distribution loss 0.15 x (45)m	19.95	17.45	18.01	15.70	15.06	13.00	12.04	13.82	13.99	16.30	17.79	19.32	(46)

Storage volume (litres) including any solar or WWHRS storage within same vessel	170.00	(47)
Water storage loss:		
a) If manufacturer's declared loss factor is known (kWh/day)	1.20	(48)
Temperature factor from Table 2b	0.70	(49)
Energy lost from water storage (kWh/day) (48) x (49)	0.84	(50)
Enter (50) or (54) in (55)	0.84	(55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Water storage loss calculated for each month (55) x (41)m	26.11	23.59	26.11	25.27	26.11	25.27	26.11	26.11	25.27	26.11	25.27	26.11	(56)
If the vessel contains dedicated solar storage or dedicated WWHRS (56)m x [(47) - Vs] ÷ (47), else (56)	26.11	23.59	26.11	25.27	26.11	25.27	26.11	26.11	25.27	26.11	25.27	26.11	(57)

Primary circuit loss for each month from Table 3

54.86	49.55	54.86	53.09	54.86	22.51	23.26	23.26	22.51	54.86	53.09	54.86	(59)

Combi loss for each month from Table 3a, 3b or 3c

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(61)

Total heat required for water heating calculated for each month 0.85 x (45)m + (46)m + (57)m + (59)m + (61)m

213.97	189.46	201.01	183.01	181.39	134.43	129.67	141.51	141.02	189.63	196.97	209.78	(62)

Solar DHW input calculated using Appendix G or Appendix H

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(63)

Output from water heater for each month (kWh/month) (62)m + (63)m

213.97	189.46	201.01	183.01	181.39	134.43	129.67	141.51	141.02	189.63	196.97	209.78

∑(64)1...12 = 2111.85 (64)

Heat gains from water heating (kWh/month) 0.25 × [0.85 × (45)m + (61)m] + 0.8 × [(46)m + (57)m + (59)m]

109.00	97.19	104.69	97.48	98.17	67.04	66.20	70.14	69.23	100.91	102.13	107.60	(65)

5. Internal gains

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5)	99.65	99.65	99.65	99.65	99.65	99.65	99.65	99.65	99.65	99.65	99.65	99.65	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	15.76	14.00	11.38	8.62	6.44	5.44	5.88	7.64	10.25	13.02	15.19	16.20	(67)
Appliance gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	173.95	175.76	171.21	161.53	149.30	137.81	130.14	128.33	132.88	142.57	154.79	166.28	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	32.96	32.96	32.96	32.96	32.96	32.96	32.96	32.96	32.96	32.96	32.96	32.96	(69)
Pump and fan gains (Table 5a)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(70)
Losses e.g. evaporation (Table 5)	-79.72	-79.72	-79.72	-79.72	-79.72	-79.72	-79.72	-79.72	-79.72	-79.72	-79.72	-79.72	(71)
Water heating gains (Table 5)	146.51	144.62	140.71	135.39	131.94	93.11	88.98	94.27	96.15	135.63	141.84	144.63	(72)
Total internal gains (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m	389.11	387.27	376.20	358.43	340.58	289.26	277.89	283.14	292.18	344.11	364.72	380.00	(73)

6. Solar gains

	Access factor Table 6d		Area m²		Solar flux W/m²		g specific data or Table 6b		FF specific data or Table 6c		Gains W	
SouthWest	0.77	x	7.52	x	36.79	x 0.9 x	0.50	x	0.80	=	76.70	(79)
SouthEast	0.77	x	2.31	x	36.79	x 0.9 x	0.50	x	0.80	=	23.56	(77)

Solar gains in watts ∑(74)m...(82)m	100.26	170.78	233.67	289.52	324.29	321.94	310.39	284.45	253.01	188.75	120.09	85.80	(83)
Total gains - internal and solar (73)m + (83)m	489.37	558.05	609.87	647.96	664.87	611.20	588.28	567.59	545.19	532.85	484.81	465.80	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1(˚C) 21.00 (85)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains for living area n1,m (see Table 9a)	0.94	0.93	0.90	0.85	0.77	0.67	0.55	0.58	0.74	0.86	0.92	0.95	(86)

Mean internal temp of living area T1 (steps 3 to 7 in Table 9c)

21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	(87)

Temperature during heating periods in the rest of dwelling from Table 9, Th2(°C)

19.66	19.67	19.67	19.68	19.68	19.69	19.69	19.69	19.69	19.68	19.68	19.67	(88)

Utilisation factor for gains for rest of dwelling n2,m

0.94	0.91	0.88	0.82	0.72	0.59	0.42	0.46	0.67	0.82	0.91	0.94	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

19.66	19.67	19.67	19.68	19.68	19.69	19.69	19.69	19.69	19.68	19.68	19.67	(90)

Living area fraction — Living area ÷ (4) = 0.59 (91)

Mean internal temperature for the whole dwelling fLA x T1 +(1 - fLA) x T2

20.45	20.45	20.46	20.46	20.46	20.46	20.46	20.46	20.46	20.46	20.46	20.46	(92)

Apply adjustment to the mean internal temperature from Table 4e where appropriate

20.45	20.45	20.46	20.46	20.46	20.46	20.46	20.46	20.46	20.46	20.46	20.46	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, ηm	0.94	0.92	0.89	0.84	0.75	0.64	0.50	0.53	0.71	0.84	0.92	0.95	(94)
Useful gains, ηmGm, W (94)m x (84)m	460.62	513.74	542.24	541.43	499.13	391.77	295.28	302.57	387.25	449.80	445.34	441.02	(95)
Monthly average external temperature from Table U1	4.30	4.90	6.50	8.90	11.70	14.60	16.60	16.40	14.10	10.60	7.10	4.20	(96)
Heat loss rate for mean internal temperature, Lm, W [(39)m x [(93)m - (96)m]	1494.21	1436.11	1286.11	1056.12	799.06	530.80	349.75	367.40	577.64	899.40	1222.53	1492.89	(97)
Space heating requirement, kWh/month 0.024 x [(97)m - (95)m] x (41)m	768.99	619.84	553.44	370.58	223.15	0.00	0.00	0.00	0.00	334.50	559.58	782.60	

∑(98)1...5, 10...12 = 4212.67 (98)

Space heating requirement kWh/m²/year — (98) ÷ (4) 69.75 (99)

9a. Energy requirements - individual heating systems including micro-CHP

Space heating

Fraction of space heat from secondary/supplementary system (table 11)		0.00	(201)
Fraction of space heat from main system(s)	1 - (201) =	1.00	(202)
Fraction of space heat from main system 2		0.00	(202)
Fraction of total space heat from main system 1	(202) x [1- (203)] =	1.00	(204)
Fraction of total space heat from main system 2	(202) x (203) =	0.00	(205)
Efficiency of main system 1 (%)		304.50	(206)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating fuel (main system 1), kWh/month	252.54	203.56	181.75	121.70	73.28	0.00	0.00	0.00	0.00	109.85	183.77	257.01

∑(211)1...5, 10...12 = 1383.45 (211)

Water heating

Efficiency of water heater

178.13	178.13	178.13	178.13	178.13	178.13	178.13	178.13	178.13	178.13	178.13	178.13	(217)

Water heating fuel, kWh/month

120.12	106.36	112.85	102.74	101.83	75.47	72.80	79.45	79.17	106.46	110.58	117.77

∑(219a)1...12 = 1185.60 (219)

Annual totals

Space heating fuel - main system 1	1383.45	
Water heating fuel	1185.60	
Electricity for pumps, fans and electric keep-hot (Table 4f)		
Total electricity for the above, kWh/year	0.00	(231)
Electricity for lighting (Appendix L)	278.33	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =	2847.39	(238)

10a. Fuel costs - individual heating systems including micro-CHP

	Fuel kWh/year		Fuel price		Fuel cost £/year	
Space heating - main system 1	1383.45	x	13.19	x 0.01 =	182.48	(240)
Water heating	1185.60	x	13.19	x 0.01 =	156.38	(247)
Electricity for lighting	278.33	x	13.19	x 0.01 =	36.71	(250)
Additional standing charges					0.00	(251)
Total energy cost				(240)...(242) + (245)...(254) =	375.57	(255)

11a. SAP rating - individual heating systems including micro-CHP

Energy cost deflator (Table 12)	0.42	(256)
Energy cost factor (ECF)	1.50	(257)
SAP value	79.12	
SAP rating (section 13)	79	(258)
SAP band	C	

12a. CO_2 emissions - individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO_2/kWh		Emissions kg CO_2/year	
Space heating - main system 1	1383.45	x	0.519	=	718.01	(261)
Water heating	1185.60	x	0.519	=	615.33	(264)
Space and water heating				(261) + (262) + (263) + (264) =	1333.34	(265)
Electricity for lighting	278.33	x	0.519	=	144.46	(268)
Total CO_2, kg/year				(265)...(271) =	1477.79	(272)
Dwelling CO_2 emission rate				(272) ÷ (4) =	24.47	(273)
EI value					81.21	
EI rating (section 14)					81	(274)
EI band					B	

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

	Energy kWh/year		Primary factor		Primary Energy kWh/year	
Space heating - main system 1	1383.45	x	3.07	=	4247.20	(261)
Water heating	1185.60	x	3.07	=	3639.79	(264)
Space and water heating				(261) + (262) + (263) + (264) =	7886.99	(265)
Electricity for lighting	278.33	x	3.07	=	854.48	(268)
Primary energy kWh/year					8741.48	(272)
Dwelling primary energy rate kWh/m2/year					144.73	(273)