ENERGY & SUSTAINABILITY STATEMENT

33 Belsize Avenue

Produced by XCO2 for Vikki Done

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EXECUTIVE SUMMARY

The energy strategy for the proposal at 33 Belsize Avenue has been developed in line with the energy policies of the London Plan and the London Borough of Camden Local Plan. The three-step Energy Hierarchy has been implemented and the estimated regulated CO_2 savings on site are 20.9%, in comparison to the existing building baseline.

This report assesses the predicted energy performance and carbon dioxide emissions of the proposed development at 33 Belsize Avenue, located in the London Borough of Camden.

The proposed development comprises an extension to the existing lower ground level to provide a games room, gym and steam room, as well as a full glass façade on the rear ground floor replacing the current brick wall structure and bay window.

This document is divided into three parts:

- Planning policies
- Proposed sustainability measures incorporated into the scheme
- Energy Strategy

The Planning Policy section provides an overview of the site and planning policies applicable to this development in accordance with the London Borough of Camden Local Plan as well as the London Plan.

The second section on proposed sustainability measures section outlines the sustainability measures that have been adopted in the team's aim to maximise sustainability within the site.

The third section describes the predicted energy performance and carbon dioxide emissions of the proposed development at 33 Belsize Avenue. The development will be compared to the existing building with the existing building systems, with the baseline building including Part L1B compliant fabric parameters.

Figure 1 summarises the regulated CO_2 savings achieved by the proposed development in comparison to the baseline building at each stage of the energy hierarchy. In total, the development is expected to achieve regulated CO_2 savings of 20.9%. This reduction reflects regulated energy use only, as unregulated energy use (e.g. plug-in appliances) is not taken into account in Part L of the Building Regulations.

The regulated CO_2 saving has been achieved by maximising fabric efficiency. The team aims to improve the building fabric of the new build elements beyond the Building Regulations Part L1B Baseline through the incorporation of an efficient fabric with low U values, a good air permeability rate and a thermal bridging y-value in line with the Accredited Construction Details at the new build portion of the scheme.

The London Plan (2016) does not set specific CO_2 reduction targets for minor developments such as that at 33 Belsize Avenue. However, CO_2 emissions have been reduced as far as is feasible.

The 20.9% reduction in regulated CO_2 emissions is a notable achievement for a development of this nature, and demonstrates the client and design team's commitment in adopting a range of sustainability measures for the life-cycle of the development.

It will not be feasible to achieve the 20% CO_2 reduction target through renewable technologies set out by Camden policies due to the extension and refurbishment nature of this minor scheme.

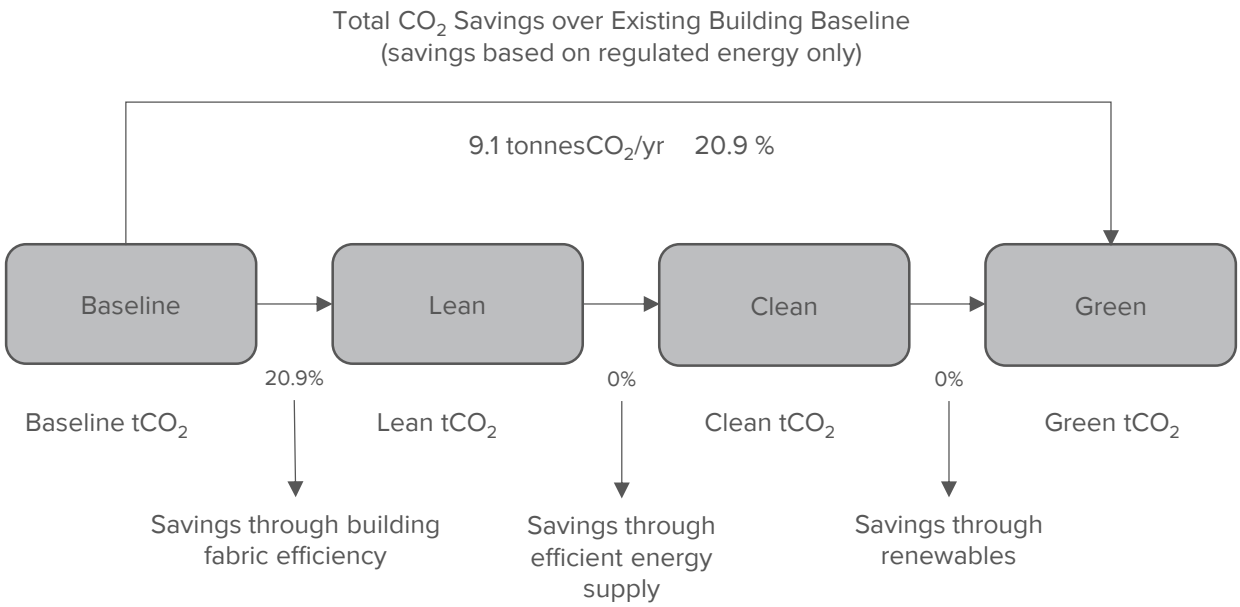


Figure 1: Estimated energy savings at each step of the energy hierarchy for the outline scheme

INTRODUCTION

This Chapter presents the description of the site and of the development proposal, the energy policy framework and the methodology employed for the energy assessment.

SITE & PROPOSAL

The proposed development is a detached residential dwelling located at 33 Belsize Avenue within the London Borough of Camden, approximately 250m south-west of Haverstock Hill (Figure 2). The scheme is located within the Belsize Park Conservation area but does not have listed status. The approximate site boundary and location, as well as adjacent roads are illustrated in the figure below.

The proposed development consists of an extension to the existing lower ground level to provide a games room, gym and steam room facilities. Furthermore, the development will also involve the replacement of the existing brick wall and bay window to the rear of the ground floor with a full width glass façade.

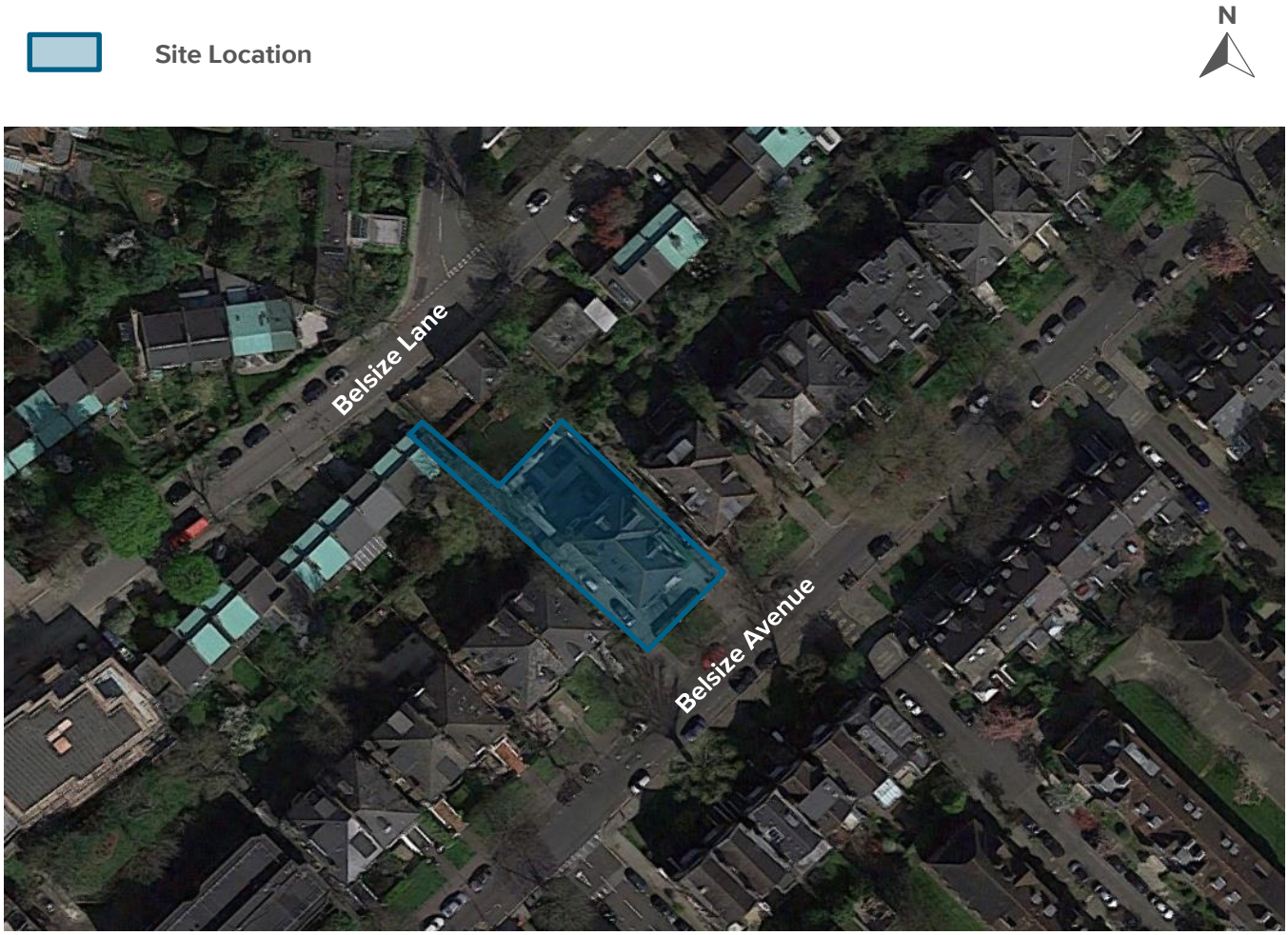


Figure 2: Location of the application site

PLANNING POLICIES

The proposal will seek to respond to the energy and sustainability policies of the London Plan (2016) and of the policies within the London Borough of Camden's Local Plan.

The most relevant applicable energy policies in the context of the proposed development are presented below.

THE LONDON PLAN

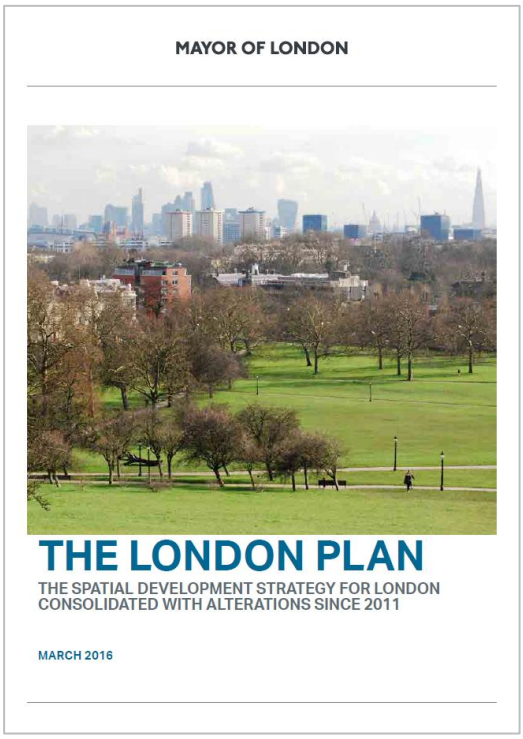
The London Plan (2016) is the overall strategic plan for London, setting out an integrated economic, environmental, transport and social framework for the development of London over the next 20–25 years.

The overarching energy policies of the London Plan are included in Chapter Five *London's Response to Climate Change* and include Policies 5.2 to 5.9:

- Policy 5.2: Minimising carbon dioxide emissions;
- Policy 5.3: Sustainable Design and Construction;
- Policy 5.4: Retrofitting;
- Policy 5.4A: Electricity and gas supply;
- Policy 5.5: Decentralised energy networks;
- Policy 5.6: Decentralised energy in development proposals;
- Policy 5.7: Renewable energy;
- Policy 5.8: Innovative energy technologies, and,
- Policy 5.9: Overheating and cooling.
- Policy 5.15: Water Use and Supplies.

Extracts of Policies 5.2, 5.6, 5.7 and 5.9 are presented below as these are considered most relevant to the proposed scheme.

The London Plan also consists of a suite of guidance documents, most relevant of which are the Sustainable Design and Construction SPG (April 2014) & Energy Planning – GLA Guidance on preparing energy assessments (March 2016).



POLICY 5.2 MINIMISING CARBON DIOXIDE EMISSIONS

A. Development proposals should make the fullest contribution to minimising carbon dioxide emissions in accordance with the following energy hierarchy:

Be lean: use less energy
Be clean: supply energy efficiently
Be green: use renewable energy

B. The Mayor will work with boroughs and developers to ensure major developments meet the following targets for carbon dioxide emissions reduction in buildings. These targets are expressed as minimum improvements over the Target Emission Rate (TER) outlined in the national Building Regulations leading to zero carbon residential buildings from 2016 and zero carbon non-domestic buildings from 2019.

Table 1: CO_2 emissions improvement targets against the current Building Regulations

Residential Buildings	
Year	**Minimum improvement over Building Regulations 2013**
2016 - 2031	Zero Carbon
Non-domestic Buildings	
Year	**Minimum improvement over Building Regulations 2013**
2016 - 2019	35%
2019 - 2031	Zero Carbon

POLICY 5.3 SUSTAINABLE DESIGN AND CONSTRUCTION

"Planning decisions:
B. 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.
C. 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 this 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."*

POLICY 5.6 DECENTRALISED ENERGY IN DEVELOPMENT PROPOSALS

A. Development proposals should evaluate the feasibility of Combined Heat and Power (CHP) systems, and where a new CHP system is appropriate also examine opportunities to extend the system beyond the site boundary to adjacent sites.
B. Major development proposals should select energy systems in accordance with the following hierarchy:

Connection to existing heating or cooling networks;
Site wide CHP network;
Communal heating and cooling.

C. Potential opportunities to meet the first priority in this hierarchy are outlined in the London Heat Map tool. Where future network opportunities are identified, proposals should be designed to connect to these networks.

POLICY 5.7 RENEWABLE ENERGY

B. Within the framework of the energy hierarchy (see Policy 5.2), major proposals should provide a reduction in expected carbon dioxide emissions through the use of on-site renewable energy generation, where feasible.
D. All renewable energy systems should be located and designed to minimise any potential adverse impacts on biodiversity, the natural environment and historical assets, and to avoid any adverse impacts on air quality.

POLICY 5.8 INNOVATIVE ENERGY TECHNOLOGIES

A The Mayor supports and encourages the more widespread use of innovative energy technologies to reduce use of fossil fuels and carbon dioxide emissions. In particular the Mayor will seek to work with boroughs and other partners in this respect, for example by stimulating:

- *a. the uptake of electric and hydrogen fuel cell vehicles*
- *b. hydrogen supply and distribution infrastructure*
- *c. the uptake of advanced conversion technologies such as anaerobic digestion, gasification and pyrolysis for the treatment of waste.*

POLICY 5.9 OVERHEATING AND COOLING

B. Major development proposals should reduce potential overheating and reliance on air conditioning systems and demonstrate this in accordance with the following cooling hierarchy:

1. *Minimise internal heat generation through energy efficient design*
2. *Reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and walls*
3. *Manage the heat within the building through exposed internal thermal mass and high ceilings*
4. *Passive ventilation*
5. *Mechanical ventilation*
6. *Active cooling systems (ensuring they are the lowest carbon options).*

POLICY 5.15 WATER USE AND SUPPLIES

"...setting an upper limit of daily domestic water consumption to 105 litres/head for residential developments (excluding a maximum allowance of 5 litres/head/day for external water consumption)."

GLA GUIDANCE ON PREPARING ENERGY ASSESSMENTS

This document (last updated in March 2016) provides guidance on preparing energy assessments to accompany strategic planning applications; it contains clarifications on Policy 5.2 carbon reduction targets in the context of zero carbon policy, as well as detailed guidelines on the content of the Energy Assessments undertaken for planning.

The guidance document specifies the emission reduction targets the GLA will apply to applications as follows:

> *Stage 1 schemes received by the Mayor on or after the 1st October 2016: Zero carbon for residential development and 35% below Part L 2013 for commercial development.*

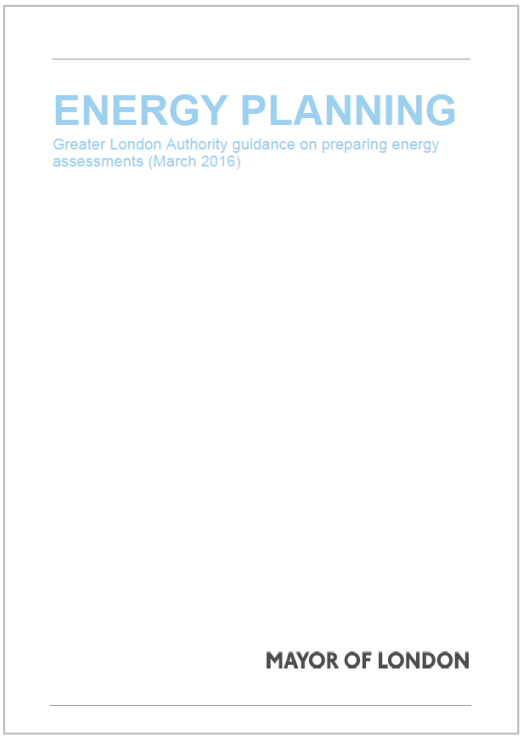
The definition of zero carbon homes is provided in section 5.3 of the guidance:

> *'Zero carbon' homes are homes forming part of major development applications where the residential element of the application achieves at least a 35 per cent reduction in regulated carbon dioxide emissions (beyond Part L 2013) on-site. The remaining regulated carbon dioxide emissions, to 100 per cent, are to be offset through a cash in lieu contribution to the relevant borough to be ring fenced to secure delivery of carbon dioxide savings elsewhere.*

The new guidance also includes changes to technical requirements relating to presenting carbon information separately for domestic and non-domestic elements of developments and the provision for cooling demand data where active cooling is required.

The structure of this report and the presentation of the carbon emission information for the development follows the guidance in this document.

It should be noted that for a minor extension development of this scale, the 35% regulated CO_2 reduction target and the zero carbon homes policy will not be applicable to the scheme at 33 Belsize Avenue.



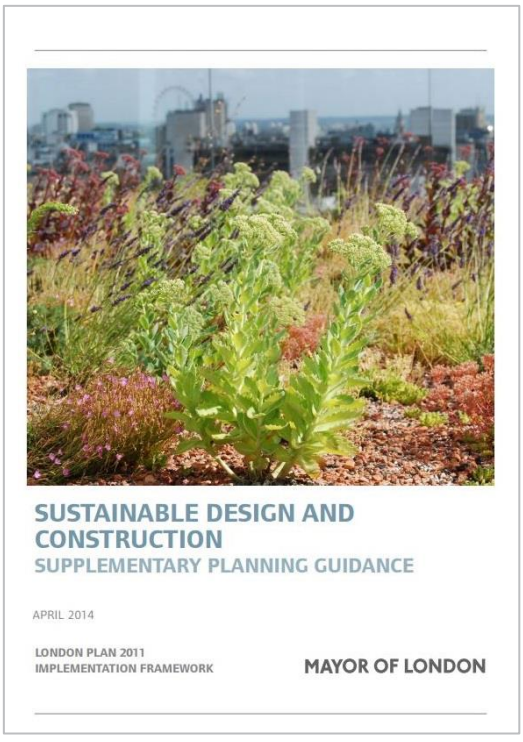
SUSTAINABLE DESIGN AND CONSTRUCTION SPG

The Sustainable Design and Construction SPG, adopted in April 2014, provides additional information and guidance to support the implementation of the Mayor's London Plan. The SPG does not set new policy, but explains how policies in the London Plan should be carried through into action.

It is applicable to all major developments and building uses so it is not technically applicable to this development, however in line with the developer's intention to implement the requirements of the London Plan it has been used to guide the design. It covers the following areas:

- Resource Management
- Adapting to Climate Change and Greening the City
- Pollution Management

This SPG provides a basis for sustainable design in London and is used as the overarching structure of this report. Where additional local policies are addressed by these areas this has also been indicated.

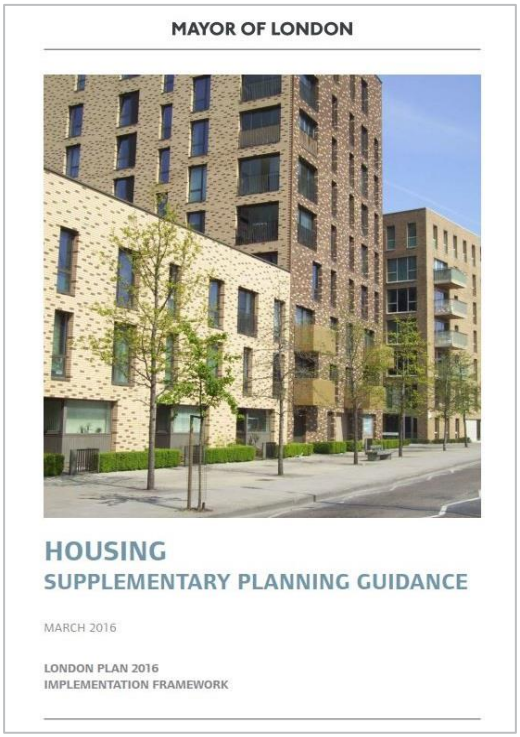


HOUSING SPG

This document provides guidance on the implementation of housing policies in the London Plan and it replaces the 2012 Housing SPG.

Part 2 covers housing quality and updates London housing standards to reflect the implementation of the government's new national technical standards through the Minor Alterations to the London Plan (2015-2016).

As design affects the quality of life, health & wellbeing, safety and security of users and neighbours, this guidance is integral to sustainable development and will be cross-referenced as relevant in the subsequent sections.



CAMDEN LOCAL PLAN -2017

The Camden Local Plan sets out the Council's planning policies and replaces the Core Strategy and Development Policies planning documents (adopted in 2010). The Local Plan in particular will help deliver the objectives of creating the conditions for harnessing the benefits of economic growth, reducing inequality and securing sustainable neighbourhoods.

The policies relevant to energy and sustainability are outline below:

Policy CC1 Climate change mitigation

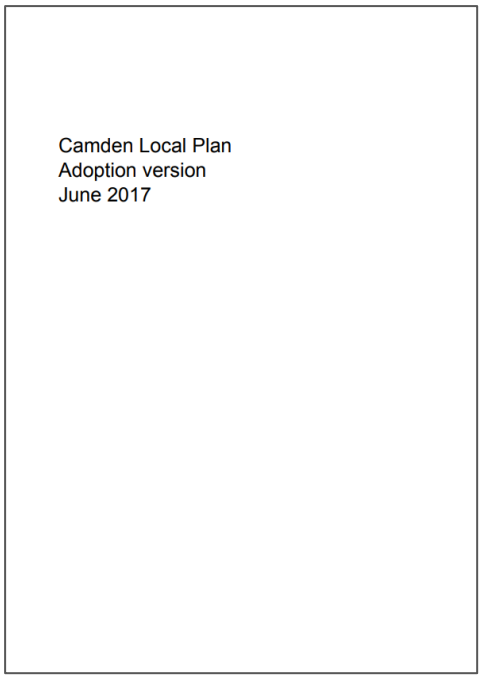
The Council will require all development to minimise the effects of climate change and encourage all developments to meet the highest feasible environmental standards that are financially viable during construction and occupation.

We will:

a. *promote zero carbon development and require all development to reduce carbon dioxide emissions through following the steps in the energy hierarchy;*
b. *require all major development to demonstrate how London Plan targets for carbon dioxide emissions have been met;*
c. *ensure that the location of development and mix of land uses minimise the need to travel by car and help to support decentralised energy networks;*
d. *support and encourage sensitive energy efficiency improvements to existing buildings;*
e. *require all proposals that involve substantial demolition to demonstrate that it is not possible to retain and improve the existing building; and*
f. *expect all developments to optimise resource efficiency.*

For decentralised energy networks, we will promote decentralised energy by:

g. *working with local organisations and developers to implement decentralised energy networks in the parts of Camden most likely to support them;*
h. *protecting existing decentralised energy networks (e.g. at Gower Street, Bloomsbury, King's Cross, Gospel Oak and Somers Town) and safeguarding potential network routes; and*
i. *requiring all major developments to assess the feasibility of connecting to an existing decentralised energy network, or where this is not possible establishing a new network. To ensure that the Council can monitor the effectiveness of renewable and low carbon technologies, major developments will be required to install appropriate monitoring equipment.*



Policy CC2 Adapting to climate change

The Council will require development to be resilient to climate change.

All development should adopt appropriate climate change adaptation measures such as:

a. *the protection of existing green spaces and promoting new appropriate green infrastructure;*
b. *not increasing, and wherever possible reducing, surface water runoff through increasing permeable surfaces and use of Sustainable Drainage Systems;*
c. *incorporating bio-diverse roofs, combination green and blue roofs and green walls where appropriate; and*
d. *measures to reduce the impact of urban and dwelling overheating, including application of the cooling hierarchy.*

Any development involving 5 or more residential units or 500 sqm or more of any additional floorspace is required to demonstrate the above in a Sustainability Statement.

Sustainable design and construction measures

The Council will promote and measure sustainable design and construction by:

- *e. ensuring development schemes demonstrate how adaptation measures and sustainable development principles have been incorporated into the design and proposed implementation;*
- *f. encourage new build residential development to use the Home Quality Mark and Passivhaus design standards;*
- g. *encouraging conversions and extensions of 500 sqm of residential floorspace or above or five or more dwellings to achieve "excellent" in BREEAM domestic refurbishment; and*
- h. *expecting non-domestic developments of 500 sqm of floorspace or above to achieve "excellent" in BREEAM assessments and encouraging zero carbon in new development from 2019.*

Policy CC3 Water and flooding

The Council will seek to ensure that development does not increase flood risk and reduces the risk of flooding where possible.

We will require development to:

- *a. incorporate water efficiency measures;*
- *b. avoid harm to the water environment and improve water quality;*
- *c. consider the impact of development in areas at risk of flooding (including drainage);*
- *d. incorporate flood resilient measures in areas prone to flooding;*
- *e. utilise Sustainable Drainage Systems (SuDS) in line with the drainage hierarchy to achieve a greenfield run-off rate where feasible; and*
- *f. not locate vulnerable development in flood-prone areas.*

Where an assessment of flood risk is required, developments should consider surface water flooding in detail and groundwater flooding where applicable.

The Council will protect the borough's existing drinking water and foul water infrastructure, including the reservoirs at Barrow Hill, Hampstead Heath, Highgate and Kidderpore.

Policy CC4 Air quality

The Council will ensure that the impact of development on air quality is mitigated and ensure that exposure to poor air quality is reduced in the borough.

The Council will take into account the impact of air quality when assessing development proposals, through the consideration of both the exposure of occupants to air pollution and the effect of the development on air quality.

Consideration must be taken to the actions identified in the Council's Air Quality Action Plan.

Air Quality Assessments (AQAs) are required where development is likely to expose residents to high levels of air pollution. Where the AQA shows that

- *a. development would cause harm to air quality, the Council will not grant planning permission unless measures are adopted to mitigate the impact. Similarly, developments that introduce sensitive receptors (i.e. housing, schools) in locations of poor air quality will not be acceptable unless designed to mitigate the impact.*

Development that involves significant demolition, construction or earthworks will also be required to assess the risk of dust and emissions impacts in an AQA and include appropriate mitigation measures to be secured in a Construction Management Plan.

Policy CC5 Waste

The Council will seek to make Camden a low waste borough.

We will:

- *a. aim to reduce the amount of waste produced in the borough and increase recycling and the reuse of materials to meet the London Plan targets of 50% of household waste recycled/composted by 2020 and aspiring to achieve 60% by 2031;*
- b. *deal with North London's waste by working with our partner boroughs in North London to produce a Waste Plan, which will ensure that sufficient land is allocated to manage the amount of waste apportioned to the area in the London Plan;*

c. *safeguard Camden's existing waste site at Regis Road unless a suitable compensatory waste site is provided that replaces the maximum throughput achievable at the existing site; and*
d. *make sure that developments include facilities for the storage and collection of waste and recycling.*

CAMDEN PLANNING GUIDANCE - SUSTAINABILITY CPG3 - 2013

It is expected that this Guidance would be updated as the new Local Plan has been adopted in June 2017.

While the Camden LDF contains policies relating to sustainability within their Core Strategy and Development Policies documents, the Council also has a separate planning guidance specific to sustainability – Camden Planning Guidance CPG3. This document's strategies support the policies set out in the Local Development Framework (LDF).

The key sections outlined in the Camden Planning Guidance CPG3 are summarised below:

The energy hierarchy

All new developments are to be designed to minimise carbon dioxide emissions by being as energy efficient as is feasible and viable.

Energy efficiency: new buildings

All new developments are to be designed to minimise carbon dioxide emissions by being as energy efficient as is feasible and viable.

Energy efficiency: existing buildings

All buildings, whether being updated or refurbished, are expected to reduce their carbon emissions by making improvements to the existing building. Work involving a change of use or an extension to an existing property is included. As a guide, at least 10% of the project cost should be spent on the improvements.

Decentralised energy networks and combined heat and power

Development should follow the Energy Hierarchy

1. use less energy
2. *supply energy efficiently*
3. *use renewable energy*

Renewable Energy

All developments are to target at least a 20% reduction in carbon dioxide emissions through the installation of on-site renewable energy technologies. Special consideration will be given to heritage buildings and features to ensure that their historic and architectural features are preserved.

Water Efficiency

The Council expects all developments to be designed to be water efficient by minimising water use and maximising the re-use of water. This includes new and existing buildings.

Sustainable use of materials

Major developments are anticipated to be able to achieve 15-20% of the total value of materials used to be derived from recycled and reused sources.

Sustainability assessment tools

Developments are anticipated to be able to achieve BREEAM 'Excellent' from 2013 onwards and at least 60% of Energy and Water credits and 40% of Materials credits.

Brown roofs, green roofs and green walls

The Council will expect all developments to incorporate brown roofs, green roofs and green walls unless it is demonstrated this is not possible or appropriate. This includes new and existing buildings. Special consideration will be given to historic buildings to ensure historic and architectural features are preserved.

Flooding

Developments must not increase the risk of flooding, and are required to put in place mitigation measures where there is known to be a risk of flooding.

Adapting to climate change

All development is expected to consider the impact of climate change and be designed to cope with the anticipated conditions.

Biodiversity

Proposed schemes should demonstrate how biodiversity considerations have been incorporated into the development, as well as any mitigation measures that will be included and what positive measures for enhancing biodiversity are planned.

PROPOSED SUSTAINABILITY MEASURES

The proposals incorporate a range of passive and active design measures that will reduce the energy demand for space conditioning, hot water and lighting.

The following subsections detail the sustainability measures that will be incorporated into the design of the proposed dwelling.

All of the sustainability measures associated with the proposed scheme are in accordance with, and have in some cases seen to surpass the initiatives outlined in the *London Plan*, the *Camden Local Plan* and the *Camden Planning Guidance 3* document, discussed hitherto.

ENERGY

DWELLING EMISSION RATE AND FABRIC ENERGY EFFICIENCY

The methodology set out by the Department of Energy and Climate Change (DECC) for assessing the energy use of dwellings is the Standard Assessment Procedure (SAP). The current version is SAP 2012.

Preliminary SAP calculations were carried out to assess the potential CO_2 savings achieved through

- Energy efficiency measures
- The efficient supply of energy and
- Renewable systems

The preliminary calculations showed an improvement over the existing building, amounting to a 20.9% reduction in regulated CO_2 emissions for the scheme.

The energy demand of the extension will be reduced through the adoption of high levels of insulation, accredited thermal bridging details and good levels of air tightness of the new build portion to improve the building fabric efficiency. SAP calculations were based on a building fabric with low U-values and an average air permeability rate of 15m^3/m^2.h at 50 Pa.

DRYING SPACE

The proposed extension development will include provisions for internal or external clothes drying where appropriate, thereby reducing the amount of electricity consumed through the use of tumble dryers.

ENERGY LABELLED WHITE GOODS

The dwelling will be supplied with an EU Energy Efficiency Labelling Scheme Leaflet to help the tenants choose energy efficient white goods or energy efficient white goods where the dwelling has been fitted out.

EXTERNAL LIGHTING

Energy efficient light fittings will be installed throughout the extension and refurbishment spaces where appropriate. In addition, external lights will be fitted with controls to reduce the energy consumption of the building during periods of infrequent use where feasible:

- External space lighting will include energy efficient fittings
- Security lighting will include daylight cut-off devices, with a maximum wattage of 150W and PIR.

WATER

INDOOR WATER USE

Water efficient fittings will be installed at the extension and refurbishment portion of the building at 33 Belsize Avenue. The fittings will be based on those presented in the following table where feasible, which reflects the GLA's water consumption target of 105 litres/person/day. Although water efficiency will be improved as far as possible, it will not be feasible to achieve this target across the entire dwelling as the fittings from first floor onwards will not be updated as part of this development.

Fitting	Consumption per use
WC (full flush)	6 litres per flush
WC (half flush)	3 litres per flush
Kitchen sink tap	6 litres per min
Wash basin tap	3 litres per min
Bath	180 litres to overflow
Shower	8 litres per min
Washing machine	8.17 litres per kilogram
Dishwasher	1.25 litres per place setting

MATERIALS

Embodied energy is the energy that is used in the manufacture, processing and the transportation of the materials to site.

The construction build-ups for each of the main building elements are rated from A+ to E. Each element to be used in the building has been rated according to the BRE Green Guide to Specification whereby:

- A+ rated elements are least likely to affect the environment
- E rated elements are most likely to affect the environment

It is assumed that most of the main building elements within this development will achieve between an A+ to C rating where possible.

WASTE

HOUSEHOLD WASTE

Dedicated external waste storage will be provided to meet the Local Authority requirements.

Adequate internal storage for recyclable waste will be provided to the dwelling in a dedicated position. The Local Authority provides recyclable household waste collection and sorting.

CONSTRUCTION SITE WASTE MANAGEMENT

The development will minimise the impact of construction waste on the environment through a Resource Management Plan or Strategy. This plan will include information such as:

- Benchmarks for resource efficiency
- Procedures and commitments to reduce hazardous and non-hazardous waste
- Monitoring hazardous and non-hazardous waste

POLLUTION

GLOBAL WARMING POTENTIAL (GWP) OF INSULANTS

Global warming potential (GWP) is a measure of how effective a gas is at preventing the passage of infrared radiation. Blowing agents, used in the production of insulation, are a common source of gases with high GWPs.

The development will aim to specify insulation materials that have a low Global Warming Potential (GWP).

NO_x EMISSIONS

Space heating and hot water requirements are to be met through high efficiency gas boilers with low NOx emissions currently present within the building.

HEALTH AND WELLBEING

DAYLIGHTING

The proposed scheme has been designed with daylight in mind and measures have been taken to maximise daylight where possible. For additional information refer to the Daylight and Sunlight report accompany the application.

LIFETIME HOMES

The extension portion of the scheme will be designed in line with Lifetime Homes principles where possible, ensuring that it is easily adaptable for future use.

SURFACE WATER RUN-OFF

The Environmental Agency Flood Map below shows that the development is located in an area with a low probability of flooding as it is in Flood Zone 1 (Refer to Figure 3).

The building footprint of the proposed scheme will remain unchanged and is therefore not considered to increase the risk of flooding on site or in the surrounding area.

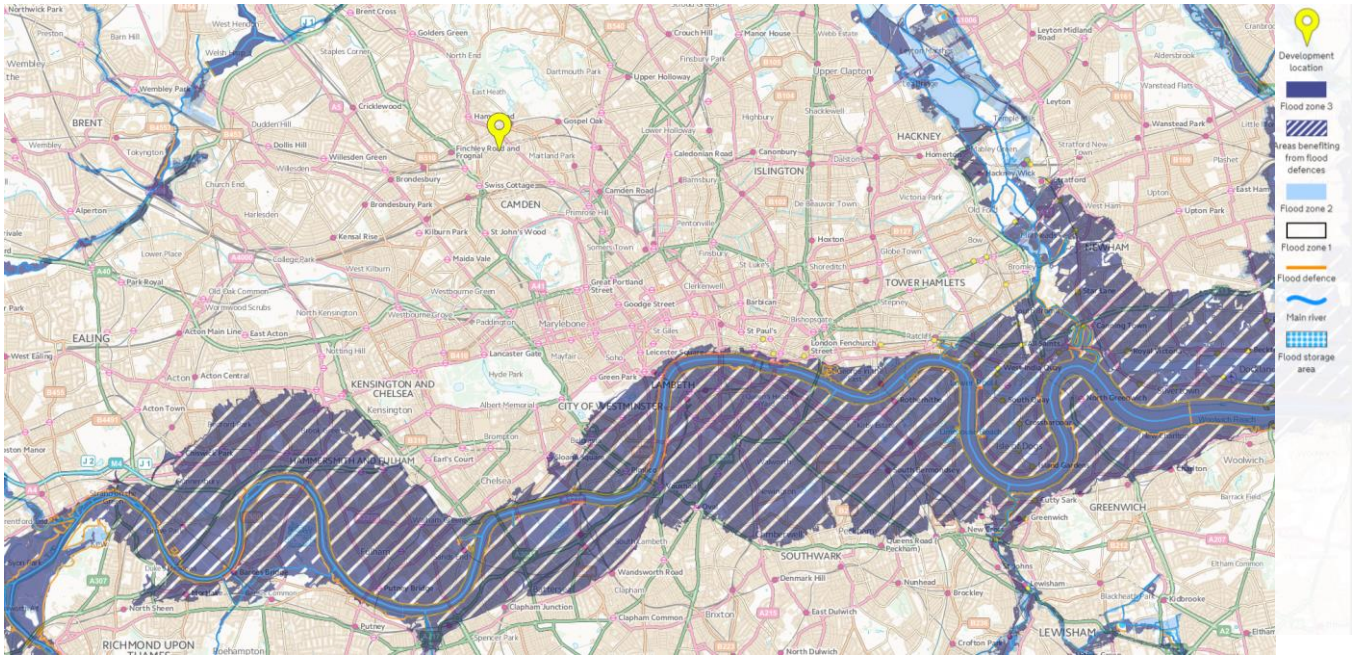


Figure 3: Location of site on flood map (EA Flood Maps)

MANAGEMENT

CONSTRUCTION SITE IMPACTS

To minimise the construction impacts of the site, the contractor will strive to monitor, report and set targets the following items where feasible:

- The production of CO_2 arising from site activities
- Water consumption from site activities

In addition, contractors will strive to adopt best practice policies for air (dust) and water (ground and surface) pollution occurring on site.

ECOLOGY

ECOLOGICAL VALUE OF SITE & PROTECTION OF ECOLOGICAL FEATURES

Native species will be incorporated within the landscaped areas and private gardens, to maximise ecological improvement on site.

ECOLOGICAL MITIGATION AND ENHANCEMENT

The architect/landscape architect will provide recommendations for the planting to enhance the existing biodiversity on site. The development will introduce landscaped areas to increase the biodiversity of the post-developed site where feasible.

ENERGY STRATEGY SUMMARY

This section describes the predicted energy performance and carbon dioxide emissions of the proposed 33 Belsize Avenue development based on the information provided by the design team.

METHODOLOGY - BE LEAN, BE CLEAN, BE GREEN

The methodology used to determine CO_2 emissions is in accordance with the London Plan's three-step Energy Hierarchy (Policy 5.2A) outlined below. The dwelling will be compared to the existing building with the extension in place. The existing fabric parameters have been included in the baseline model for the portion of the building where no changes will be made, and Part L1B compliant fabric parameters have been included for the extension portion of the building to form the baseline condition. The existing space heating and hot water system will be retained.

The reductions made through each step have been outlined here:

BE LEAN - USE LESS ENERGY

The first step addresses reduction in energy demand, through the adoption of passive and active design measures.

The proposed energy efficiency measures include levels of insulation beyond Building Regulation requirements, low air tightness levels, efficient lighting as well as energy saving controls for space conditioning and lighting for the extension and refurbishment portions of the building.

By means of energy efficiency measures alone, regulated CO_2 emissions are shown to reduce by 20.9% (9.1 tonnes per annum).

BE CLEAN – SUPPLY ENERGY EFFICIENTLY

The application site is located in an area where district heating is not expected to be implemented in the future.

A site heat network has not been found to be feasible or viable for a development of this scale. Space heating and hot water will be supplied by the existing boilers at the building.

BE GREEN - USE RENEWABLE ENERGY

The renewable technologies feasibility study carried out for the development indicated that no renewable technologies will be feasible for the proposed scheme.

CUMULATIVE ON SITE SAVINGS

The overall regulated CO_2 savings *on site* in comparison to the existing building used as the baseline reference are therefore 20.9%.

BE LEAN – USE LESS ENERGY

The proposals incorporate a range of passive and active design measures that will reduce the energy demand for space conditioning, hot water and lighting. Measures will also be put in place to reduce the risk of overheating. The regulated carbon saving achieved in this step of the Energy Hierarchy is 20.9% over the site wide baseline level.

PASSIVE DESIGN MEASURES

ENHANCED U-VALUES

The heat loss of different building fabric elements is dependent upon their U-value. A building with low U-values provides better levels of insulation and reduced heating demand during the cooler months.

The proposed development will incorporate high levels of insulation and high-performance glazing beyond Part L1B targets and notional building specifications, in order to reduce the demand for space conditioning (heating and/or cooling) at the new build portion of the scheme.

The table to the right demonstrates the improved performance of the proposed building fabric beyond the Building Regulations requirements for domestic use.

AIR TIGHTNESS IMPROVEMENT

Heat loss may also occur due to air infiltration. Although this cannot be eliminated altogether, good construction detailing and the use of best practice construction techniques can minimise the amount of air infiltration.

The proposed extension will aim to improve upon the current standard for air tightness by targeting average air permeability rates of 15m^3/m^2 at 50Pa.

Table 2: Thermal Envelope U-values

Domestic (U-values in $W/m^2.K$)			
Element	**Building Regulations**	**Proposed**	**Improvement**
Walls	0.30	0.15	50%
Floor	0.20	0.1	50%
Roof	0.18	0.1	44.4%
Windows	1.60	1.3	18.8%

REDUCING THE NEED FOR ARTIFICIAL LIGHTING

The development has been designed to maximise daylight in all habitable spaces as a way of improving the health and wellbeing of its occupants.

All of the habitable areas will benefit from large areas of glazing to increase the amount of daylight within the internal spaces where possible. This is expected to reduce the need for artificial lighting whilst delivering pleasant, healthy spaces for occupants.

HEAT RECOVERY VENTILATION

Natural ventilation is proposed as the main method of passive cooling and fresh air provision to minimise energy demand.

ACTIVE DESIGN MEASURES

HIGH EFFICACY LIGHTING

The development intends to incorporate low energy lighting fittings throughout the extension and refurbishment spaces. All new light fittings will be specified as low energy lighting, and will accommodate LED, compact fluorescent (CFLs) or fluorescent luminaires only.

CONTROLS

Advanced lighting and space conditioning controls will be incorporated, specifically, occupancy sensors for lighting and heating controls in dwelling rooms which will comprise time and temperature programming with TRVs at each heating zone.

Smart meters will be installed to monitor the heat and electricity consumption of the dwelling where feasible; the display board will demonstrate real-time and historical energy use data and will be installed at an accessible location within the dwelling.

MINIMISING OVERHEATING

The potential risk of overheating will be mitigated by incorporating passive and active design measures, in line with the London Plan Policy 5.9 and the Cooling Hierarchy, as follows.

THE COOLING HIERARCHY

MINIMISING INTERNAL HEAT GENERATION THROUGH ENERGY EFFICIENT DESIGN

The distribution of heat infrastructure within the residential parts of the development will be designed to reduce the lateral pipework lengths within the dwelling, reducing heat loss.

REDUCING THE AMOUNT OF HEAT ENTERING THE BUILDING IN SUMMER

Internal blinds will be included to further reduce the amount of heat entering the building.

USE OF THERMAL MASS AND HIGH CEILINGS TO MANAGE THE HEAT WITHIN THE BUILDING

During peak summer periods the thermal mass of the building will absorb and store excess heat. The building will release its heat in the cooler evenings to allow for cooler internal spaces dampening the peak diurnal weather conditions.

PASSIVE VENTILATION

Passive ventilation will be employed as the main strategy for providing fresh air and dissipating heat across the development.

OVERHEATING RISK ASSESSMENT

The potential risk of overheating was assessed via the Part L Building Regulation compliance tool SAP.

A '*Not Significant'* overheating risk was found for the dwelling after subsequent modelling in SAP. The SAP overheating risk assessment outputs for the dwelling modelled can be found in Appendix A – Overheating Risk Assessment.

ENERGY USE

The table below shows a breakdown of carbon dioxide emissions associated with the proposed development's fossil fuel and electricity consumption for the different uses. The site-wide data are presented for the development. The figures provide a comparison between the baseline condition and the proposed development once energy efficiency measures (Lean) have been applied.

This table demonstrates the energy savings achieved through energy efficiency measures (Lean stage of the Energy Hierarchy).

Table 3: Breakdown of energy consumption and CO_2 emissions for the baseline and the proposed schemes after 'Lean' measures are implemented

	Baseline			Lean		
	Energy (kWh/yr.)	$kgCO_2$ /yr.	$kgCO_2/m^2$	Energy (kWh/yr.)	$kgCO_2$ /yr.	$kgCO_2/m^2$
Hot Water	3,330	720	0.8	3,330	720	0.8
Space Heating	192,650	41,610	46.6	151,140	32,650	36.6
Cooling	0	0	0.0	0	0	0.0
Auxiliary	30	20	0.0	30	20	0.0
Lighting	2,320	1,210	1.4	2,070	1,070	1.2
Equipment	10,160	5,270	5.9	10,160	5,270	5.9
Total Part L	198,320	43,550	48.8	156,570	34,450	38.6
Total (incl. equipment)	208,480	48,820	54.7	166,730	39,730	44.5

BE LEAN CO_2 EMISSIONS & SAVINGS

By means of energy efficiency measures alone, regulated CO_2 emissions are shown to reduce by 20.9% (9.1 tonnes per annum).

BE CLEAN – SUPPLY ENERGY EFFICIENTLY

No existing or proposed district energy network is located within proximity to the proposed development. A communal heating scheme will not be feasible for a minor scheme of this nature. No further CO_2 savings will be achieved at this stage of the Energy Hierarchy.

ENERGY SYSTEM HIERARCHY

The energy system for the development has been selected in accordance with the London Plan decentralised energy hierarchy. The hierarchy listed in Policy 5.6 states that energy systems should consider:

1. Connection to existing heating and cooling networks;
2. Site wide CHP network; and,
3. Communal heating and cooling.

Local heat and power sources minimise distribution losses and achieve greater efficiencies when compared to separate energy systems, thus reducing CO_2 emissions.

In a communal energy system, energy in the form of heat, cooling, and/or electricity is generated from a central source and distributed via a network of insulated pipes to surrounding residences.

CONNECTION TO AN EXISTING NETWORK

The London Heat Map identifies existing and potential opportunities for decentralised energy projects in London. It builds on the 2005 London Community Heating Development Study.

An excerpt from the London Heat Map can be seen on the following page. The map highlights any existing and proposed district heating networks within the vicinity of the development.

A review of the London heat map (figure 4) shows that at this time there is no viable district heat network for the development to utilise.

A communal heat network is also not deemed feasible for this minor scale scheme. Space heating and hot water will be supplied by high efficiency individual boilers within each dwelling.

BE CLEAN CO2 EMISSIONS & SAVINGS

Given that it has not been found feasible or viable for the proposed development to incorporate the supply of low carbon heating or cooling, no carbon savings are achieved for this step of the Energy Hierarchy.

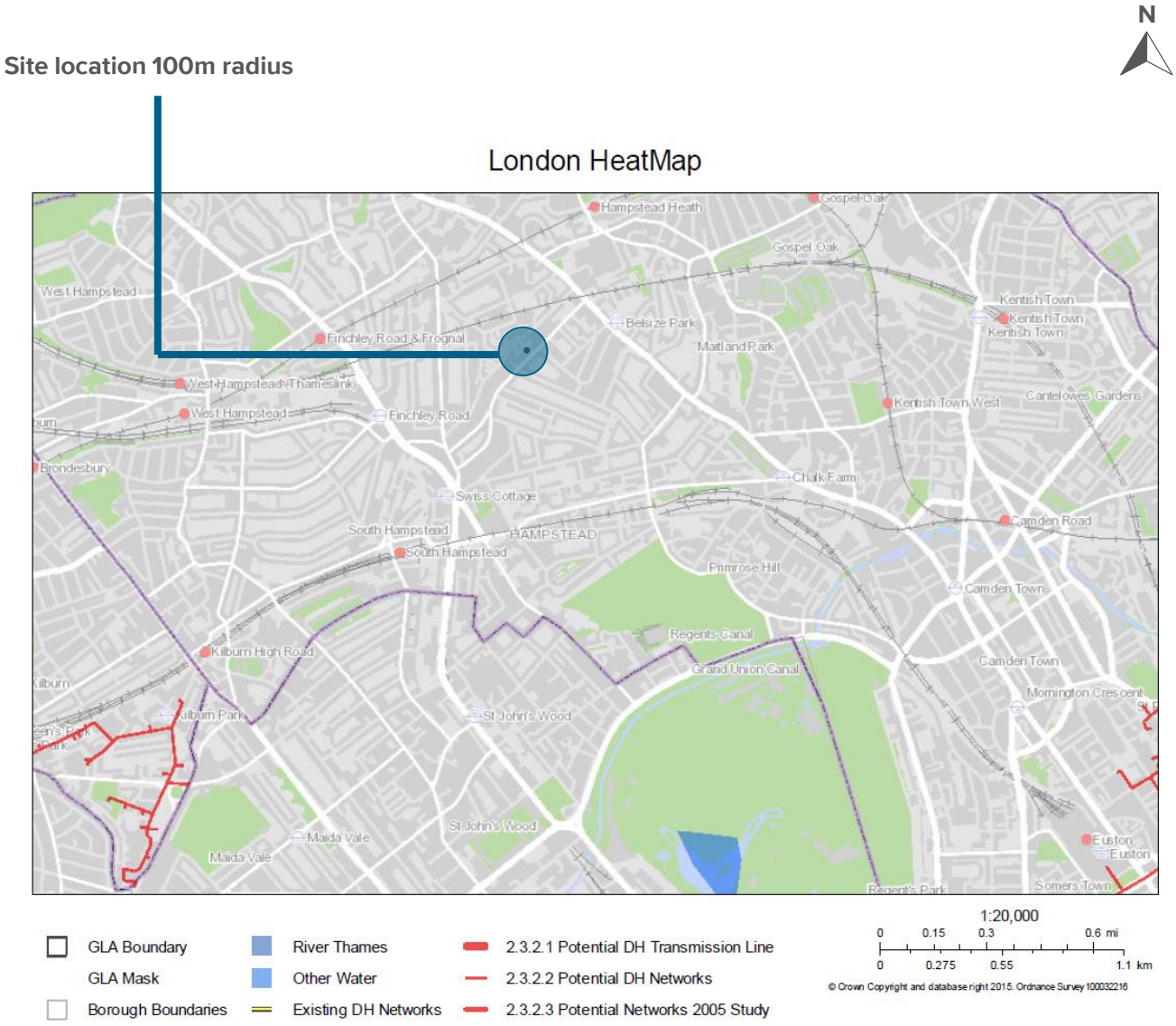


Figure 4: Excerpt from the London Heat Map. Existing district networks outlined in yellow, proposed networks in red

BE GREEN – USE RENEWABLE ENERGY

The renewable technologies feasibility study carried out for the development identified no technologies will be suitable for the development. The 20.9% CO_2 reduction of regulated CO_2 will be achieved by building fabric and system efficiency measures applied at the 'Be Lean' stage.

RENEWABLE TECHNOLOGIES FEASIBILITY STUDY

Methods of generating on-site renewable energy (Green) were assessed, once Lean and Clean measures were taken into account.

The development of 33 Belsize Avenue will benefit from an energy efficient building fabric which will reduce the energy consumption of the proposed development in the first instance. A range of renewable technologies were subsequently considered including:

- Biomass;
- Ground/water source heat pumps;
- Air source heat pump;
- Wind energy;
- Photovoltaic panels, and,
- Solar thermal panels.

In determining the appropriate renewable technology for the site, the following factors were considered:

- CO_2 savings achieved;
- Site constraints;
- Any potential visual impacts, and,
- Compatibility with the 'Clean' stage proposals where applicable.

RENEWABLE ENERGY APPRAISAL SUMMARY

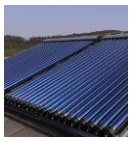
The table below summarises the factors taken into account in determining the appropriate renewable technologies for this project. This includes estimated capital cost, lifetime, level of maintenance and level of impact on external appearance. The final column indicates the feasibility of the technology in relation to the site conditions (10 being the most feasible and 0 being infeasible). It is important to note that the information provided is indicative and based upon early project stage estimates.

The feasibility study demonstrates that none of the technologies are deemed suitable for the development, as noted in the summary below.

BE GREEN CO_2 EMISSIONS & SAVINGS

No further CO2 savings will be achieved at the 'Be Green' stage.

Table 4: Summary of renewable technologies feasibility study

		Comments	Lifetime	Maintenance	Impact on external appearance	Site feasibility
Biomass		Not adopted - Burning of wood pellets releases high NOx emissions and there are limitations for their storage and delivery within an urban location.	20 yrs.	High	High	1
PV		Not adopted - PV panels mounted on the pitched roof would significantly alter the appearance and character of the Building.	25 yrs.	Low	Med	4
Solar thermal		Not adopted - Solar thermal array mounted on the pitched roof would significantly alter the appearance and character of the Building.	25 yrs.	Low	Med	2
GSHP		Not adopted - The installation of ground loops requires significant space, additional time at the beginning of the construction process and very high capital costs.	20 yrs.	Med	Low	1
ASHP		Not adopted - ASHP evaporator units are located externally and produce noise which can be an issue in a residential location, especially at night.	20 yrs.	Med	Med	3
Wind		Not adopted - Wind turbines located at the site will have a significant visual impact on the existing building.	25 yrs.	Med	High	1

CONCLUSIONS

Following the implementation of the three-step Energy Hierarchy, the cumulative CO_2 savings on site are estimated at 20.9% for the development, against in the existing building baseline. The scheme will maximise the application of sustainability measures where feasible.

By implementing the three step Energy Hierarchy as detailed in the previous sections, the Regulated CO_2 emissions for the development have been reduced against the baseline building through on site measures alone by 20.9% (9.1 tonnes per annum).

The tables in the following pages summarise the implementation of the Energy Hierarchy for the proposed scheme and detail the CO_2 emissions and savings against the baseline scheme for each step of the hierarchy. It will not be feasible to achieve the 20% CO_2 reduction target through renewable technologies set out by Camden policies due to the extension and refurbishment nature of this minor scheme.

SUSTAINABILITY

In summary, the proposed development will meet the targets set out by the London Borough of Camden Local Plan and the London Plan policies where feasible, which demonstrates the client and the design team's commitment to enhancing sustainability of the scheme.

Table 5: CO_2 emissions after each step of the Energy Hierarchy for the development

	Carbon dioxide emissions for domestic buildings (tonnes CO2 per annum)	
	Regulated	Unregulated
Baseline	43.6	5.3
After energy demand reduction	34.5	5.3
After heat network/CHP	34.5	5.3
After renewable energy	34.5	5.3

Table 6: Regulated CO_2 savings from each stage of the Energy Hierarchy for the development

	Regulated domestic carbon dioxide savings	
	Tonnes CO_2 per annum	% over baseline
Savings from energy demand reduction	9.1	20.9
Savings from heat network/CHP	0.0	0.0
Savings from renewable energy	0.0	0.0
Cumulative on site savings	9.1	20.9

APPENDIX A – OVERHEATING RISK ASSESSMENT

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 19 December 2017

Property Details: 33_Belsize Ave PROPOSED

Dwelling type:	Detached House
Located in:	England
Region:	Thames valley
Cross ventilation possible:	Yes
Number of storeys:	5
Front of dwelling faces:	South East
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Medium
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	4 (Windows open half the time)

Overheating Details:

Summer ventilation heat loss coefficient:	4309.21	**(P1)**
Transmission heat loss coefficient:	2581.5	
Summer heat loss coefficient:	6890.67	**(P2)**

Overhangs:

Orientation:	Ratio:	Z_overhangs:
North East (NEW NE)	0	1
North West (NEW NW)	0	1
North East (OG NE)	0	1
North West (OG NW)	0	1
South East (OG SE)	0	1
South West (OG SW)	0	1

Solar shading:

Orientation:	Z blinds:	Solar access:	Overhangs:	Z summer:	
North East (NEW NE)	1	0.9	1	0.9	**(P8)**
North West (NEW NW)	1	0.9	1	0.9	**(P8)**
North East (OG NE)	1	0.9	1	0.9	**(P8)**
North West (OG NW)	1	0.9	1	0.9	**(P8)**
South East (OG SE)	1	0.9	1	0.9	**(P8)**
South West (OG SW)	1	0.9	1	0.9	**(P8)**

Solar gains:

Orientation		Area	Flux	g_	FF	Shading	Gains	
North East (NEW NE)	0.9 x	15.3	98.85	0.7	0.8	0.9	685.99	
North West (NEW NW)	0.9 x	38.44	98.85	0.7	0.8	0.9	1723.68	
North East (OG NE)	0.9 x	11.98	98.85	0.85	0.7	0.9	570.57	
North West (OG NW)	0.9 x	18.55	98.85	0.85	0.7	0.9	883.77	
South East (OG SE)	0.9 x	37.04	119.92	0.85	0.7	0.9	2140.71	
South West (OG SW)	0.9 x	13.8	119.92	0.85	0.7	0.9	797.63	
						Total	6802.35	**(P3/P4)**

Internal gains:

	June	July	August	
Internal gains	1392.81	1338.55	1366.34	
Total summer gains	8648.75	8140.9	7268.68	**(P5)**

SAP 2012 Overheating Assessment

Summer gain/loss ratio	1.26	1.18	1.05	**(P6)**
Mean summer external temperature (Thames valley)	16	17.9	17.8	
Thermal mass temperature increment	0.25	0.25	0.25	
Threshold temperature	17.51	19.33	19.1	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Not significant**	**Not significant**	

Assessment of likelihood of high internal temperature: Not significant

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