ENERGY & SUSTAINABILITY STATEMENT

77 Avenue Road

Produced by XCO2 for Montagu Evans

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EXECUTIVE SUMMARY

The energy strategy for the proposed development at 77 Avenue Road has been developed in line with the energy policies of the London Plan and of the London Borough of Camden's Local Plan. The three-step Energy Hierarchy has been implemented and the estimated regulated CO_2 savings on site are 28% against a Part L 2013 compliant scheme.

This report assesses the predicted energy performance and carbon dioxide emissions of the proposed development at 77 Avenue Road, located in the London Borough of Camden.

The proposed development comprises the redevelopment of the site at 77 Avenue Road to provide a new family home, of a similar size to the original, with additional accommodation and services provided below ground.

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's Local Plan, CPG3 Sustainability and 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 77 Avenue Road. The development will be compared to a notional building constructed to Part L1A standards. 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 28%. 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 beyond the Building Regulations Part L Baseline through the incorporation of an efficient fabric with low U values, low air permeability rate and a thermal bridging y-value in line with the Accredited Construction Details.

Camden's CPG3 sets a 20% CO_2 reduction target from renewables for all schemes over 500m^2, and 19% reduction from baseline for all new residential developments, which the proposed development at 77 Avenue Road meets through energy efficiency measures and use of renewable technologies. This demonstrates the client and design team's commitment in adopting a range of sustainability measures for the life-cycle of the development.

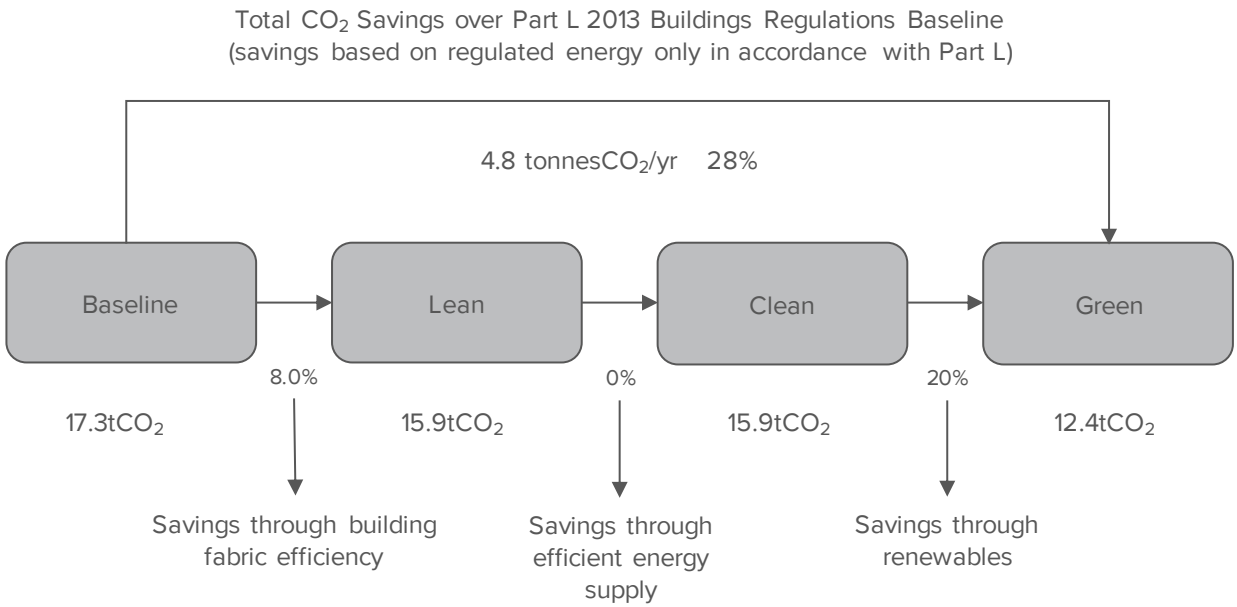


Figure 1: Energy Hierarchy

SITE

Avenue Road is a residential street to the south of Swiss Cottage that runs to Regent's Park. The proposed new development is located at 77 Avenue Road, close to the intersection with Queen's Grove.

The proposed development includes the demolition of the existing dwelling and construction of a replacement dwelling of a similar size to the original one, with additional accommodation and services provided at basement level.

Figure 2: Location of the application site.

PLANNING POLICIES

The proposal will seek to respond to the energy and sustainability policies within the London Plan, Camden's Local Plan and CPG3 Sustainability.

The most relevant applicable energy and sustainability 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.

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 5.9 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:

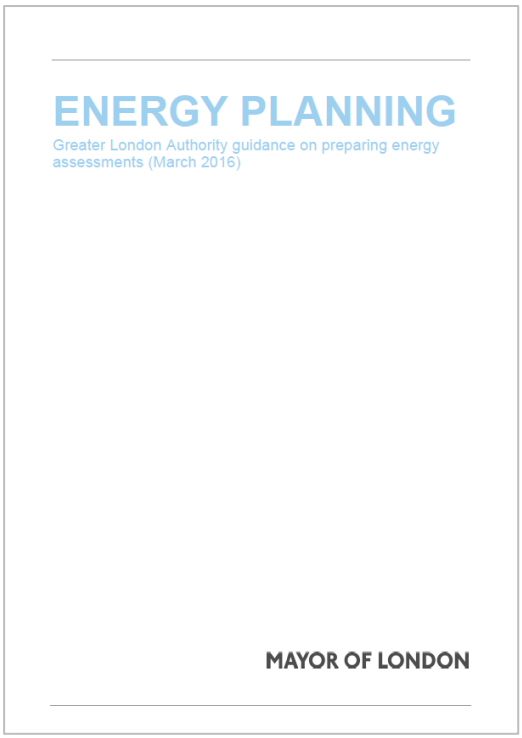
> *Stage 1 schemes received by the Mayor on or after the 1st October 2016: Zero carbon for residential development and 35% below Part L 2013 for commercial development.*

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. It is worth noting that this policy only applies to major developments, i.e. over 10 dwellings.

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



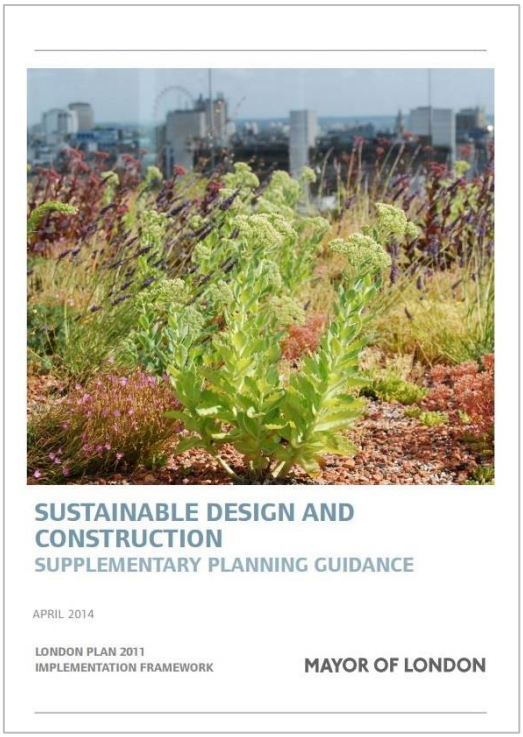
SUSTAINABLE DESIGN AND CONSTRUCTION SPG

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.

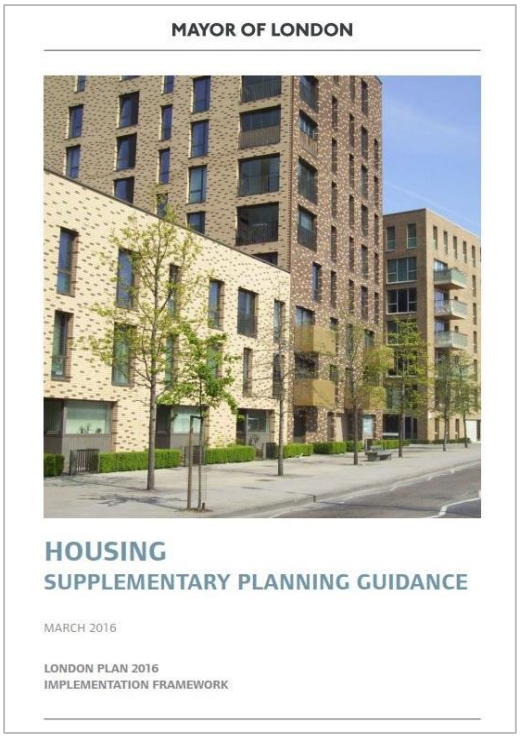


HOUSING SPG

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 adopted in 2017 sets out the following policies for energy and sustainability:

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;

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

g) 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) *ncorporate water efficiency measures;*

b) *avoid harm to tihe 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.

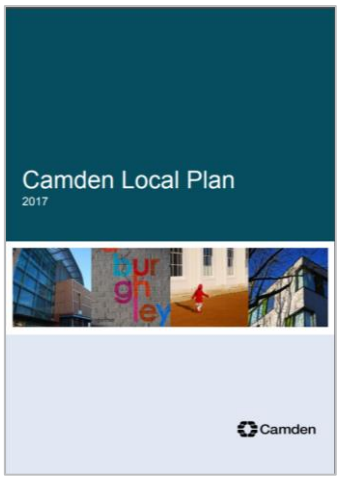
We will:

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 (JULY 2015, MARCH 2018 UPDATE)

The Camden Planning Guidance support the policies set out in the Local Development Framework (LDF). While the Camden LDF contains policies relating to sustainability in their Core Strategy and Development Policies documents, the Council also as a separate planning guidance specific to sustainability.

The sections that will be covered by the following sections of this Sustainability Statement are listed below:

The energy hierarchy

- *All developments are to be designed to reduce carbon dioxide emissions*
- *Energy strategies are to be designed following the steps set out by the energy hierarchy*

Energy efficiency: new buildings

- *All new developments are to be designed to minimise carbon dioxide emissions.*
- *The most cost-effective ways to minimise energy demand are through good design and high levels of insulation and air tightness.*

Decentralised energy networks and combined heat and power

- *Decentralised energy could provide 20% of Camden's heating demand by 2020.*
- *Combined heat and power plants can reduce carbon dioxide emissions by 30-40% compared to a conventional gas boiler.*
- *Where feasible and viable your development will be required to connect to a decentralised energy network or include CHP.*

Renewable Energy

- *There are a variety of renewable energy technologies that can be installed to supplement a development's energy needs.*
- *Developments are to target a 20% reduction in carbon dioxide emissions from on-site renewable energy technologies.*

Water Efficiency

- *At least 50% of water consumed in homes and workplaces does not need to be of drinkable quality re-using water.*
- *All developments are to be water efficient.*

Sustainable use of materials

- *Reduce waste by firstly re-using your building, where this is not possible you should implement the waste hierarchy.*
- *The waste hierarchy prioritises the reduction, re-use and recycling of materials.*
- *Source your materials responsibly and ensure they are safe to health.*

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

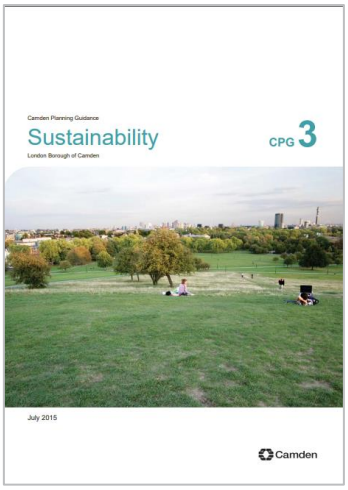
- *All developments should incorporate green and brown roofs.*
- *The appropriate roof or wall will depend on the development, the location and other specific factors.*
- *Specific information needs to be submitted with applications for green/brown roofs and walls.*

Flooding

- *All developments are required to prevent or mitigate against flooding.*
- *All developments are expected to manage drainage and surface water.*
- *There is a hierarchy you should follow when designing a sustainable drainage system.*

Adapting to climate change

- *All development should consider how it can be occupied in the future when the weather will be different.*
- *The early design stage is the most effective time to incorporate relevant design and technological measures.*



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. Sustainability measures will include reduction in water use, waste and pollution as well as improvements in occupant health & wellbeing and ecology.

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

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 Part L Building Regulations 2013, amounting to a 28% reduction in regulated CO_2 emissions for the scheme.

The energy demand of the proposed dwelling at 77 Avenue Road will be reduced through the adoption of high levels of insulation, accredited thermal bridging details and good levels of air tightness to improve the building's fabric efficiency. SAP calculations were based on a building fabric with low U-values and an air permeability rate of $3m^3/m^2.h$ at 50 Pa.

DRYING SPACE

The proposed dwelling 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 energy efficient white goods where to help reduce energy consumption.

EXTERNAL LIGHTING

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

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

LOW OR ZERO CARBON TECHNOLOGIES

A feasibility study was carried out to determine the energy strategy for the proposed development. The proposed strategy has surpassed Part L Building Regulations due to the reduction in the demand by a highly efficient shell, the use of highly efficient ASHP for both cooling and heating, mechanical ventilation with heat recovery and incorporation of PV panels.

CYCLE STORAGE

Cycle storage spaces will be provided within the garage at ground floor level, for use by the occupants to reduce the frequency of short car journeys. The cycle storage will be adequately sized and secure.

WATER

INDOOR WATER USE

The development at 77 Avenue Road aims to reduce water consumption to below 105 litres per person per day, in line with the new target set out within the London Plan (Minor Alterations to the London Plan 2016), through the use of water efficient fittings, and these are listed below.

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

REUSE OF EXISTING BUILDINGS

The existing building has been deemed to provide poor quality accommodation, and thus will be demolished to provide a higher quality, efficient dwelling which will incorporate several energy and sustainability features to ensure a longer building life. Efforts will be undertaken to utilise existing material resources to the extent feasible. A pre-demolition audit will be completed to determine the potential of existing structures in delivering reusable materials for the new building.

LIFE CYCLE IMPACTS

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.

All timber used during site preparation and construction to be FSC certified, and all non-timber materials to be certified with Environmental Management Systems (ISO 14001 OR BES 6001) where possible.

WASTE

HOUSEHOLD WASTE

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

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 systems with inherently low NOx emissions.

HEALTH AND WELLBEING

DAYLIGHTING

The dwelling has been designed with daylight in mind and measures have been taken to maximise daylight where possible.

SOUND INSULATION

The development proposes that airborne sound insulation will comply or exceed current Building Regulations Part E standards.

PRIVATE SPACE

A private garden will be provided with the aim of improving the quality of life of the occupants.

SURFACE WATER RUN-OFF

The Environment Agency flood map (below) shows the proposed development to be located within an area at low risk of flooding.

Attenuation storage features, such as permeable paving, green roofs and underground storage tank have been proposed to limit and control discharge to the local sewer system. Further information on the proposed strategy can be found in the accompanying SUDS drainage report prepared by GeoSmart in support of the application.

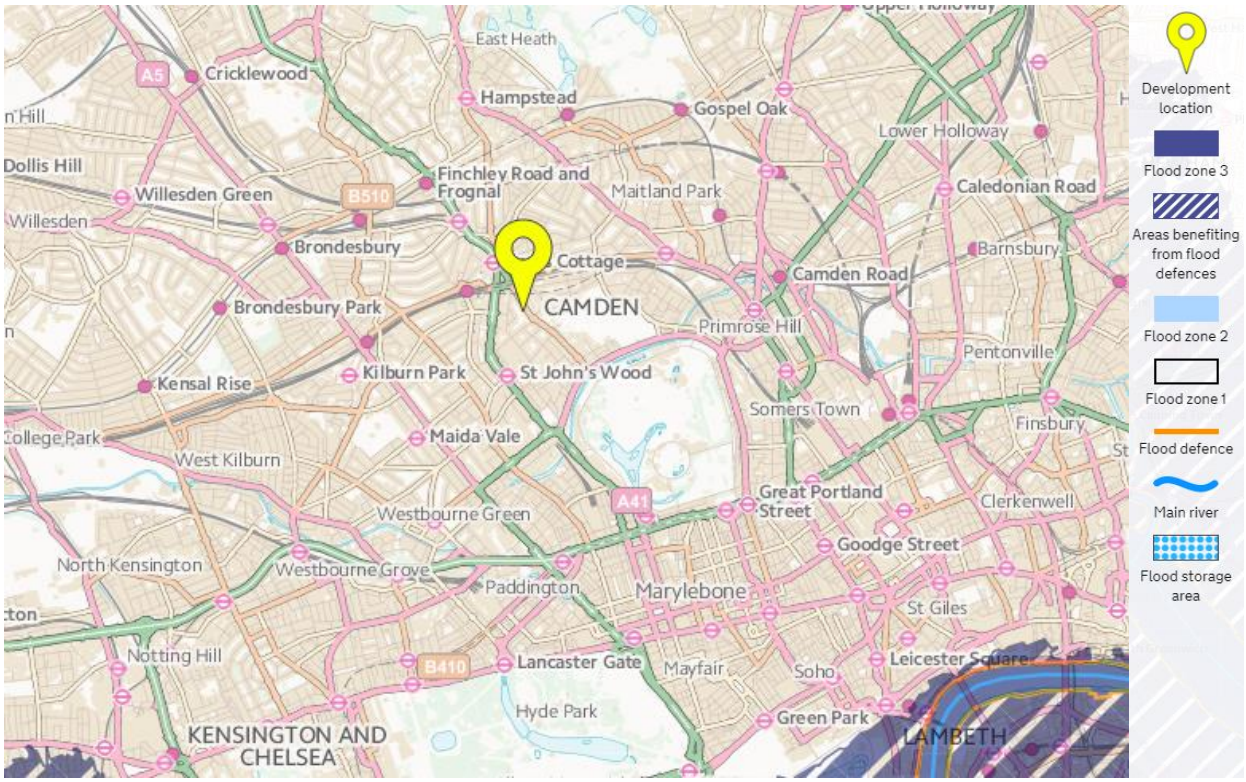


Figure 3: Flood map for local area

MANAGEMENT

CONSTRUCTION SITE IMPACTS

Where feasible, to minimise the construction impacts of the site, the contractor will strive to monitor, report and set targets for:

- 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. All timber will be sourced following the Government's Timber Procurement Policy.

ECOLOGY

ECOLOGICAL VALUE OF SITE & PROTECTION OF ECOLOGICAL FEATURES

Native species will be incorporated within the both the sedum green roof over the garage and landscaping at the rear of the site, over the basement, to maximise ecological improvement on site.

ECOLOGICAL MITIGATION AND ENHANCEMENT

Details of soft landscaping including species for new planting will seek to enhance the exiting biodiversity on site.

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 dwelling will be designed to reduce the lateral pipework lengths within corridors, reducing heat loss.

Heat sources and pipework will be sufficiently insulated (following CIBSE CoP1 guidelines).

REDUCING THE AMOUNT OF HEAT ENTERING THE BUILDING IN SUMMER

Internal blinds or curtains 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.

VENTILATION

MVHR will be capable of operating in summer bypass mode allowing for the dissipation of any heat build-up during peak summer conditions. Windows will also be openable for purge ventilation during the warmer months.

OVERHEATING RISK ASSESSMENT

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

A slight overheating risk was found for the dwelling. The SAP overheating risk assessment output can be found in Appendix A – Overheating Risk Assessment. Comfort cooling is proposed for main habitable areas of the dwelling.

ENERGY STRATEGY SUMMARY

This section describes the predicted energy performance and carbon dioxide emissions of the proposed dwelling at 77 Avenue Road 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 a Building Regulations Part L 2013 baseline.

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. These measure have the potential to reduce CO_2 emissions by 8.0% (1.4 tonnes per annum) over Part L 2013.

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.

ASHP and high efficiency gas boiler are proposed to provide heating and hot water.

BE GREEN - USE RENEWABLE ENERGY

The renewable technologies feasibility study carried out for the development identified photovoltaics and air source heat pumps as suitable technologies for the development.

The incorporation of renewable technologies will further reduce CO_2 emissions by 20% (3.4 tonnes per annum).

CUMULATIVE ON SITE SAVINGS

The overall regulated CO_2 savings against a Part L 2013 compliant scheme are therefore 28% (4.8 tonnes per annum) for the development.

The total regulated CO_2 savings for the site are 4.8 tonnes, equivalent to 20.5% of the baseline emissions.

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.

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 L 2013 targets and notional building specifications, in order to reduce the demand for space conditioning (heating and/or cooling).

The tables to the right demonstrate the improved performance of the proposed building fabric beyond the Building Regulations requirements.

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 development will aim to improve upon the Part L 2013 minimum standards for air tightness by targeting air permeability rates of $3m^3/m^2$ at 50Pa.

Table 2: Thermal Envelope U-values

Element	Building Regulations	Proposed	Improvement
Walls	0.30	0.15	50%
Floor	0.25	0.10	60%
Roof	0.20	0.10	50%
Windows	2.00	1.30	35%

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 main 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.

ACTIVE DESIGN MEASURES

HIGH EFFICACY LIGHTING

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

HEAT RECOVERY VENTILATION

Mechanical ventilation heat recovery (MVHR) is proposed for the dwelling. The mechanical ventilation system will include heat recovery in order to achieve ventilation in the most energy-efficient way.

COMFORT COOLING

Air source heat pumps with high energy efficiency ratios may be used for both heating and cooling, therefore the impact of active cooling in terms of energy use and carbon emissions will be minimised.

MONITORING

Apart from the above design measures, the development will incorporate monitoring equipment and systems to enable occupiers to monitor and reduce their energy use.

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

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, i.e. the sum of the demand for both the domestic and non-domestic parts of 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	3,270	710	0.6	3,550	770	0.6
Space Heating	71,800	15,510	12.8	65,590	11,700	9.7
Cooling	0	0	0.0	0	0	0.0
Auxiliary	80	40	0.0	5,160	2,680	2.2
Lighting	1,930	1,000	0.8	1,930	1,000	0.8
Equipment	12,220	6,340	5.2	12,220	6,340	5.2
Total Part L	77,080	17,260	14.3	76,230	16,150	13.3
Total (incl. equipment)	89,300	23,600	19.5	88,450	22,490	18.6

BE CLEAN – SUPPLY ENERGY EFFICIENTLY

The application site is located in an area where district heating is not expected to be implemented in the near future. In addition, a site heating network is not considered feasible for a single dwelling development, and high efficiency gas boiler and air source heat pumps are being proposed. No carbon savings have been achieved in this step 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 which shows the energy demand for different areas. Darker shades of red signify areas where energy demand is high. The map also highlights any existing and proposed district heating networks within the vicinity of the development.

A review of the map shows that there are no existing or planned district heating networks within close proximity of the site.

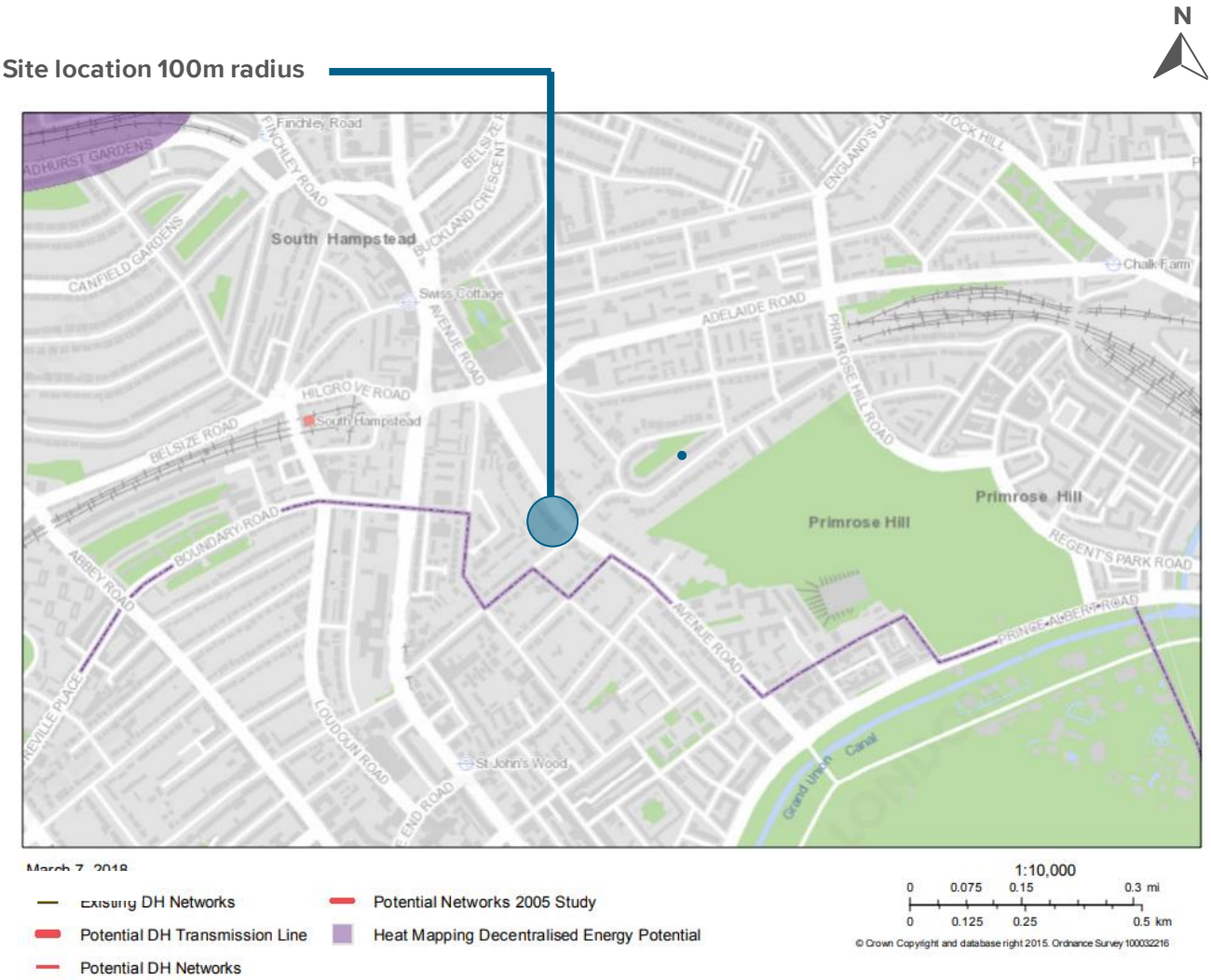


Figure 4: Excerpt from the London Heat Map. Existing district networks outlined in red, proposed networks in yellow.

INDIVIDUAL HEATING AND COOLING

Due to the location and size of the development, individual systems have been proposed. Air source heat pumps have been proposed to provide space heating and cooling and high efficiency gas boiler to provide DHW.

BE CLEAN CO_2 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.

BE GREEN – USE RENEWABLE ENERGY

The renewable technologies feasibility study carried out for the development identified photovoltaics and air source heat pumps as suitable technologies for the development. The regulated carbon saving achieved in this step of the Energy Hierarchy is 20% over the baseline level.

RENEWABLE TECHNOLOGIES FEASIBILITY STUDY

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

The dwelling at 77 Avenue Road 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:

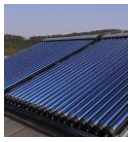
- CO_2 savings achieved;
- Site constraints; and
- Any potential visual impacts.

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 photovoltaics and ASHP would be the most feasible renewable technologies for the proposed dwelling. Detailed assessments for the proposed technologies can be found in the following sections.

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	2
PV		Adopted	25 yrs.	Low	Med	8
Solar thermal		Not adopted – PV panels provide a higher contribution towards CO_2 savings with a similarly sized array	25 yrs.	Low	Med	5
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	4
ASHP		Adopted	20 yrs.	Med	Med	9
Wind		Not adopted - Wind turbines located at the site will have a significant visual impact.	25 yrs.	Med	High	2

DETAILED ASSESSMENT OF PHOTOVOLTAIC PANELS

Four types of solar cells are available on the market at present and these are mono-crystalline, poly-crystalline, thin film and hybrid panels. Although mono-crystalline and hybrid cells are the most expensive, they are also the most efficient with an efficiency rate of 12-20%. Poly-crystalline cells are cheaper but they are less efficient (9-15%). Thin film cells are only 5-8% efficient but can be produced as thin and flexible sheets.

Photovoltaics are considered a suitable technology for this development for the following reasons:

- The development provides an extent of roof space for the installation of PV panels;
- PV arrays are relatively easy to install when compared to other renewable systems; and
- PV panels provide a significant amount of CO_2 savings.

The PV shall comprise 2.85kWp (15m^2) of horizontal roof mounted arrays. The PV array will be directly connected to the dwelling.

The table below summarises the technical data for the proposed PV array and estimated CO_2 savings from the application of this technology. In total the PV installation would produce regulated CO_2 savings of 6.4% for the development.

An indicative area for the installation of the PV panels on the roof can be found in the following page.

Table 5: Summary of technical/operational data and estimated CO_2 savings for PVs

Photovoltaics		
Module efficiency	19	%
Orientation	Horizontal	
Predicted site solar energy	950.6	kWh/m^2.yr
System losses	20	%
System peak power	2.85	kWp
Array area	15	m^2
Primary energy offset by PV	2,170	kWh/yr.
Total CO_2 savings	1.1	t/yr.
Regulated baseline CO_2 emissions	17.3	t/yr.
Total baseline CO_2 emissions	22.2	t/yr.
% Regulated CO_2 reduction*	6.4	%
% Total CO_2 reduction*	4.9	%

* % reduction from site baseline

Figure 5: Monocrystalline PV arrays

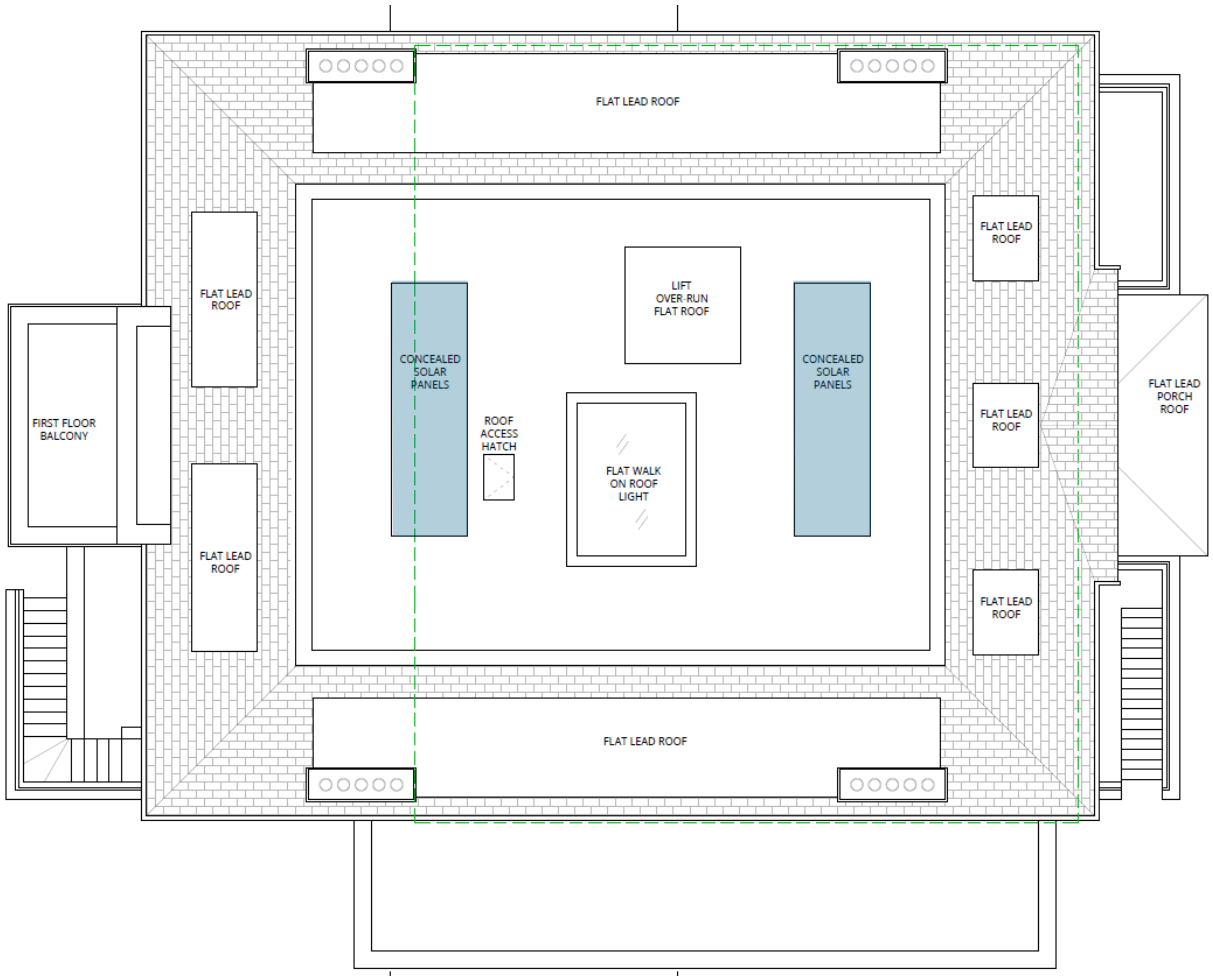


Figure 6. Proposed PV layout for 77 Avenue Road, indicative PV location highlighted in blue

DETAILED ASSESSMENT OF AIR SOURCE HEAT PUMPS

Air source heat pumps (ASHPs) employ the same technology as ground source heat pump (GSHPs). However, instead of using heat exchangers buried in the ground, heat is extracted from the external ambient air.

The efficiency of heat pumps is very much dependent on the temperature difference between the heat source and the space required to be heated. As a result, ASHPs tend to have a lower COP than GSHPs. This is due to the varying levels of air temperature throughout the year when compared to the relatively stable ground temperature. The lower the difference between internal and external air temperature, the more efficient the system.

ASHP is considered a suitable technology for the development for the following reasons:

- It is a high efficiency system that can cater for space heating and cooling;
- Requires less capital cost than GSHP and other renewable technologies;
- It can be integrated with the proposed ventilation strategy; and,
- It is simple to install when compared to other renewable technologies, and will work well alongside planned PV

The table opposite summarises the technical data for the proposed ASHP and estimated CO_2 savings from the application of this technology. In total the ASHP technology would produce regulated CO_2 savings of 13.6% for the development.

Table 6: Summary of technical/operational data and estimated CO_2 savings for ASHP

ASHP for non-domestic spaces		
COP heating	2.6	
COP cooling	2.9	
Carbon intensity of electricity	0.519	kgCO2/kWh
Proportion of space heating met by ASHP	100	%
Proportion of space cooling met by ASHP	100	%
Energy met by ASHP	58.370	kWh/yr.
Energy used by ASHP	22.780	kWh/yr.
Total CO_2 savings	2.35	t/yr.
Regulated baseline CO_2 emissions	17.3	t/yr.
Total baseline CO_2 emissions	23.6	t/yr.
% Regulated CO_2 reduction*	13.6	%
% Total CO_2 reduction*	10	%

* % reduction from site baseline

Figure 7: Outdoor unit of an ASHP

BE GREEN CO_2 EMISSIONS & SAVINGS

The incorporation of renewable technologies will further reduce CO_2 emissions by a further 20% (3.45 tonnes per annum) for the development.

CONCLUSIONS

Following the implementation of the three-step Energy Hierarchy, the cumulative CO_2 savings on site are estimated at 28% for the development, against a Part L 2013 compliant scheme. Sustainability measures will include reductions in water use, waste and pollution, as well as improvements in occupant health and wellbeing.

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 a Part L 2013 compliant scheme through on site measures alone by 28% (4.8 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.

Overall, the proposed development has been designed to meet energy policies set out by the GLA and the London Borough of Camden, which demonstrates the client and the design team's commitment to enhancing sustainability of the scheme.

In summary, the proposed development at 77 Avenue Road will meet the targets set out by Camden Council and the Greater London Authority (GLA).

The outline key sustainability measures adopted for reflect the client and design team's aspirations in integrating sustainability measures and demonstrates that the project is designed to exceed the planning policy sustainability requirements.

Table 7: 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	17.3	6.3
After energy demand reduction	15.9	6.3
After heat network/CHP	15.9	6.3
After renewable energy	12.4	6.3

Table 8: Regulated CO_2 savings from each stage of the Energy Hierarchy for development

	Regulated domestic carbon dioxide savings	
	Tonnes CO_2 per annum	% over baseline
Savings from energy demand reduction	1.4	8.0
Savings from heat network/CHP	0.0	0.0
Savings from renewable energy	3.4	20.0
Cumulative on site savings	4.8	28.0

Table 9: Summary of regulated CO_2 emissions and savings

	Total regulated emissions (tonnes CO_2/year)	Regulated CO_2 savings (tonnes CO_2/year)	Percentage saving (%)
Baseline	17.3		
Be Lean	15.9	1.4	8.0%
Be Clean	15.9	0.0	0.0%
Be Green	12.4	3.4	20.0%
Total	17.3	4.8	28.0%

APPENDIX A – OVERHEATING RISK ASSESSMENT

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 09 March 2018

Property Details: Gas baseline

Dwelling type:	Detached House
Located in:	England
Region:	South East England
Cross ventilation possible:	Yes
Number of storeys:	5
Front of dwelling faces:	North East
Overshading:	Very Little
Overhangs:	None
Thermal mass parameter:	Indicative Value Medium
Night ventilation:	False
Blinds, curtains, shutters:	
Ventilation rate during hot weather (ach):	1 (Windows slightly open (50 mm))

Overheating Details:

Summer ventilation heat loss coefficient:	1376.42	**(P1)**
Transmission heat loss coefficient:	614	
Summer heat loss coefficient:	1990.43	**(P2)**

Overhangs:

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

Solar shading:

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

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
South West (SW)	1 x	47.42	126.97	0.63	0.7	1	2389.73	
South East (SE)	0.9 x	14.53	126.97	0.63	0.7	0.9	659.02	
North East (NE)	1 x	29.05	105.45	0.63	0.7	1	1215.85	
North West (NW)	0.9 x	11.91	105.45	0.63	0.7	0.9	448.63	
						Total	4713.23	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	1604.41	1537.14	1559.81	
Total summer gains	6605.39	6250.37	5712.61	**(P5)**
Summer gain/loss ratio	3.32	3.14	2.87	**(P6)**
Mean summer external temperature (South East England)	15.4	17.4	17.5	
Thermal mass temperature increment	0.25	0.25	0.25	
Threshold temperature	18.97	20.79	20.62	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

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