ENERGY STATEMENT

551-557 Finchley Road

Produced by XCO2 for Hampstead Properties Ltd c/o Delta Properties

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CONTENTS

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EXECUTIVE SUMMARY

The energy strategy for the 551-557 Finchley Road development has been developed in line with the energy policies of the London Plan and of the London Borough of Camden Local Plan. Energy efficiency measures have been implemented and the regulated CO2 savings have been estimated for the new build and refurbishment areas of the proposal. The proposed energy strategy for the estimated regulated CO2 savings on site are 26.1% against a pre-refurbishment baseline.

This report assesses the predicted energy performance and carbon dioxide emissions of the proposed development at 551-557 Finchley Road, located in the London Borough of Camden.

The proposed development comprises the refurbishment of an existing under-performing building on a prominent site looking for a better integration into the wider public realm to benefit the area as a whole. This will include 33 apart-hotel rooms and commercial space on the lower ground and ground floors including B1/A3 and A1-A5/D1/D2 uses.

The proposed development includes a series of measures to reduce the energy demand and ensure an efficient supply of energy.

Reduction of energy demand has been implemented through the adoption of passive and active design measures, including improved levels of insulation, low air tightness levels, efficient lighting as well as energy saving controls for space conditioning and lighting.

A centralised system of high efficiency gas boilers is proposed to provide hot water and heating to the apart-hotel section of the development, cooling has not been proposed for the guestrooms. The commercial section at lower ground and ground floor level includes a retail unit, café, gym and co-working space which will utilise highly efficient air source heat pumps for heating and cooling. Hot water will be supplied to the café, gym and co-working space through the use of the communal gas boilers, and to the retail unit using local electric water heaters.

The methodology used to determine the expected operational CO_2 emissions for the development followed the GLA Guidance on preparing energy assessments and the London Plan's three-step Energy Hierarchy (Policy 5.2A) approach to develop an energy strategy and establish the CO_2 savings achieved with the refurbishment project.

The development has also been designed in line with Camden Planning Guidance: Energy efficiency and adaptation where feasible. The guidance document includes a requirement of 20% reduction in carbon dioxide emissions from on-site renewables, including refurbishments.

SITE CONSTRAINTS

The project being of a refurbishment nature has some site constraints which limit any alteration to the character of the building. Communal gas boilers have been proposed to provide heating and hot water for the apart-hotel considering the size limitations. Air source heat pumps (ASHP) require more plant space, noise attenuation measures and should be properly ventilated. These are usually located on the roof, however due to the nature of the building, these were not found to be suitable for the development.

Photovoltaic panels were not considered in the development as these would alter the character of the building.

The shortfall from 20% reduction from low and zero carbon technologies is due to spatial limitations and the project being of a refurbishment nature with alteration to the character of the building being unsuitable.

However, high-performance thermal envelope and passive design measures have been implemented to improve the carbon savings through demand reduction measures. The carbon savings from the demand reduction exceeds the new efficiency target set by the GLA of 15% for non-domestic developments.

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.

By means of energy efficiency measures alone, regulated CO_2 emissions are shown to reduce by 19.8% (31.6 tonnes/yr).

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; high efficiency gas boilers are instead proposed to provide heat to the guestrooms. The carbon savings from installing boilers with efficiencies of 91% is 5.4% (8.6 tonnes/yr).

BE GREEN – USE RENEWABLE ENERGY

The renewable technologies feasibility study carried out for the development identified air source heat pumps (ASHP) as suitable technologies for the development.

The incorporation of improved efficiencies in the ASHP compared to pre-refurbishment efficiency values will further reduce CO_2 emissions by a further 1.0% (1.5 tonnes/yr)

CUMULATIVE ON SITE SAVINGS

In summary, the overall regulated CO2 savings on site are 41.7 tonnes per annum, equivalent to 26.1% savings against a pre-refurbishment baseline.

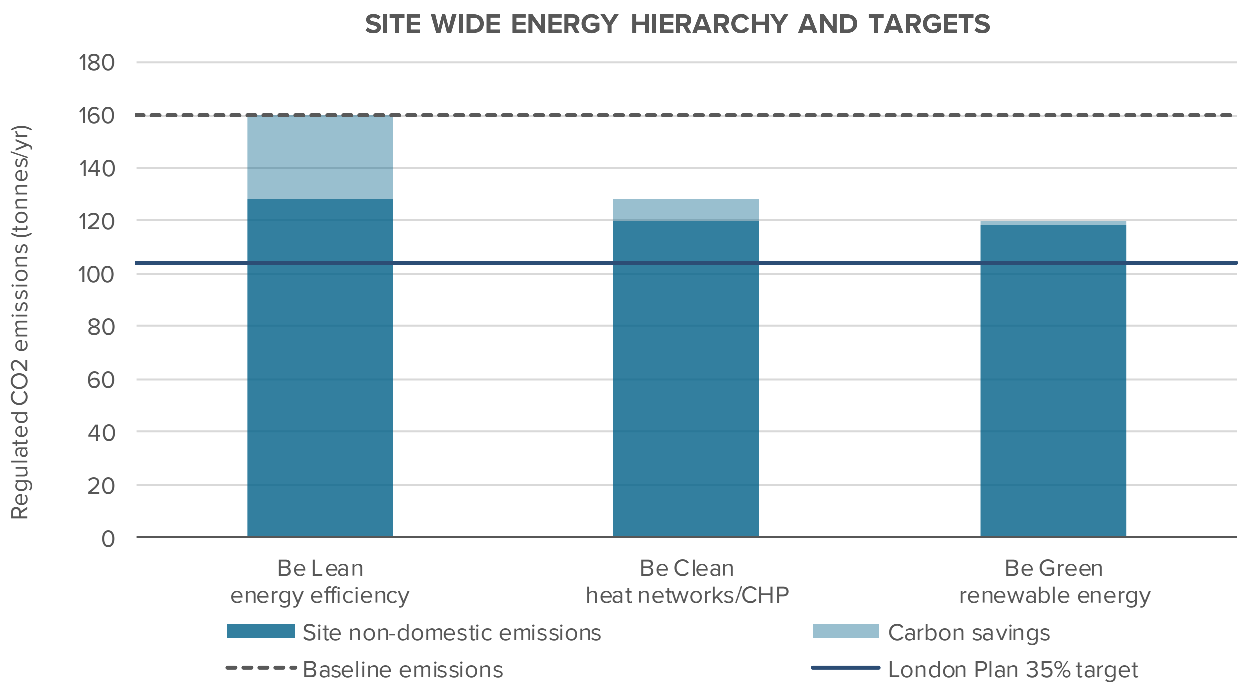


Figure 1: The Site Wide Energy Hierarchy (SAP 2012 carbon factors)

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 site is located on Finchley Road Hampstead in the London Borough of Camden.

The site is bound by Finchley Road to the east, and mansion housing blocks to the west. The terrace of buildings continues to the north of 551-557, with detached three storey houses to the south.

The existing site at 551-557 Finchley Road comprises 4 four storey terraced buildings. The ground floor of 551-557 and the upper floors of three (553-557) are currently used as a Language school and the use will revert to B1a/B1C/A1 and D1 when they vacate the property in February 2020 as they have a personal planning permission.

The proposal is for change of use from Use Classes B1a/B1c/A1/D1 and remodelling of the existing building to provide apart-hotel (C1) and co-working/café (B1/A3) and a flexible retail / non-residential institution / assembly and leisure unit (A1-A5 / D1/D2), alterations including partial demolition and extensions at the rear at lower ground, ground and first floor levels, extension to provide an additional storey at roof level, levelling of the lower ground floor level, remodelling and restoration of front façade, cycle parking and all associated works.

Figure 2: Location of the application site.

POLICY FRAMEWORK

The proposal will seek to respond to the energy policies of the London Plan and of the policies within the London Borough of Camden.

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.

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 5.6 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).*

DRAFT LONDON PLAN

The current 2016 consolidation Plan is still the adopted Development Plan. However, the Draft London Plan, last updated in July 2019, is a material consideration in planning decisions. The New London Plan is scheduled to be adopted in March 2020.

The following paragraphs highlight the key changes and additional requirements stemming from emerging policies.

GREENHOUSE GAS EMISSIONS

Policy GG6 (Increasing efficiency and resilience) sets a positive direction for the new draft Plan in terms of ambitious new greenhouse gas emission targets. This policy references London's target to become zero carbon by 2050 and the need to design buildings and infrastructure for a changing climate. To drive this change both residential and non-residential schemes will need to be net zero-carbon (via offset payments). At least 35% of this reduction must be made on site for major developments, with residential developments expected to achieve at least a 10% and non-residential at least a 15% reduction in emissions through energy efficiency measures alone (Policy SI2).

In a major departure from the previous London Plan, calculations will be required to include both regulated and unregulated emissions at each stage of the energy hierarchy. Furthermore, major developments will have to submit details of the method with energy performance and carbon dioxide emissions monitored post-construction for at least the first five years of building operation.

ENERGY INFRASTRUCTURE

In addition to upgrades to the lean and green stages of the energy hierarchy the clean stage has also been enhanced. A "be seen" stage has also been introduced so the development energy performance is monitored and reported. Most notably, all major developments within Heat Network Priority Areas will need to utilise a communal low-temperature heating system.

Policy SI3 (Energy infrastructure) recommends zero-emission or local secondary heat sources technology as step on the heating hierarchy but prioritises a connection to local existing or planned heat networks where feasible, for selecting communal heating systems. Where developments are utilising low-emission CHP this policy requires them to demonstrate that the CHP will *enable the delivery of an area-wide heat network, meet the development's electricity demand and provide demand response to the local electricity network*.

MATERIALS, WASTE & LIFE-CYCLE CARBON

Policy SI2 (Minimising greenhouse gas emissions) mentions the requirement for Energy Strategies to include a *whole life-cycle carbon emissions assessment and actions to reduce life-cycle carbon emissions*. This is to fully capture the development's carbon impact: unregulated and embodied emissions, and emissions associated with maintenance, repair and demolition will be considered. This may result in more sustainable material choices at design stage and could lead to straw, bamboo, clay and recycled materials alongside the more widely recognised cross-laminated timber becoming more commonplace in the capital. This section also links with Policy SI7 (Reducing waste and supporting the circular economy), whereby materials are retained in use at their highest value for as long as possible to minimise waste. All referable applications will be required to submit a Circular Economy Statement, intended to cover the whole life cycle of development.

AIR QUALITY

The new draft Plan addresses this crucial area by requiring large-scale development proposals to demonstrate how they maximise benefits to air quality and the measures or design solutions they will implement to minimise exposure to air pollution.

In practice this will mean that a preliminary Air Quality Assessment (AQA) will need to be carried out for all major developments prior to any design work taking place, with a full AQA submitted in support of the planning application. In addition, the new draft London Plan supports electric vehicle charging points and other transport alternatives to achieve carbon-free travel by 2050.

It should be noted that, as the policies in the draft London Plan are not yet adopted, the following sections demonstrate compliance with the current plan.

GLA GUIDANCE ON PREPARING ENERGY ASSESSMENTS

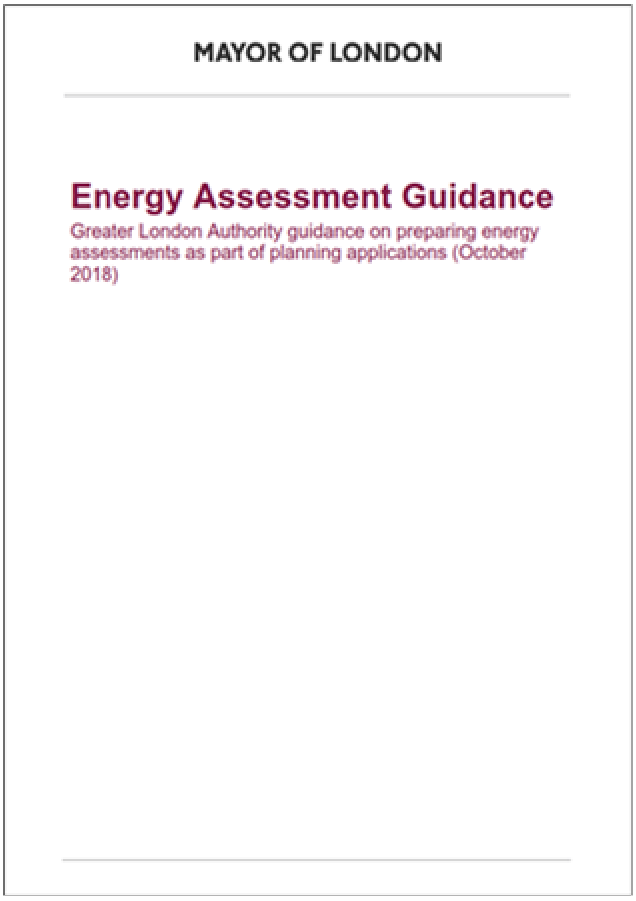
This document (last updated in October 2018) provides guidance on preparing energy assessments to accompany strategic planning applications; it contains clarifications on Policy 5.2 carbon reduction targets in the context of zero carbon policy, as well as detailed guidelines on the content of the Energy Assessments undertaken for planning.

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

The regulated carbon dioxide emissions reduction target for major domestic development is zero carbon and for non-domestic development it is 35 per cent beyond Part L 2013 of the Building Regulations.

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.


MAYOR OF LONDON

Energy Assessment Guidance

Greater London Authority guidance on preparing energy assessments as part of planning applications (October 2018)

CAMDEN LOCAL PLAN (2017)

Policy CC1 Climate change mitigation

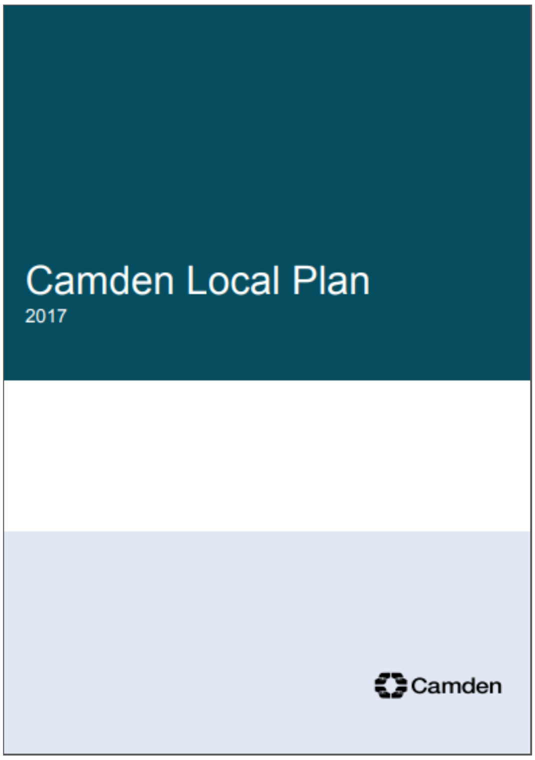
Camden Council will:

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, the council 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.



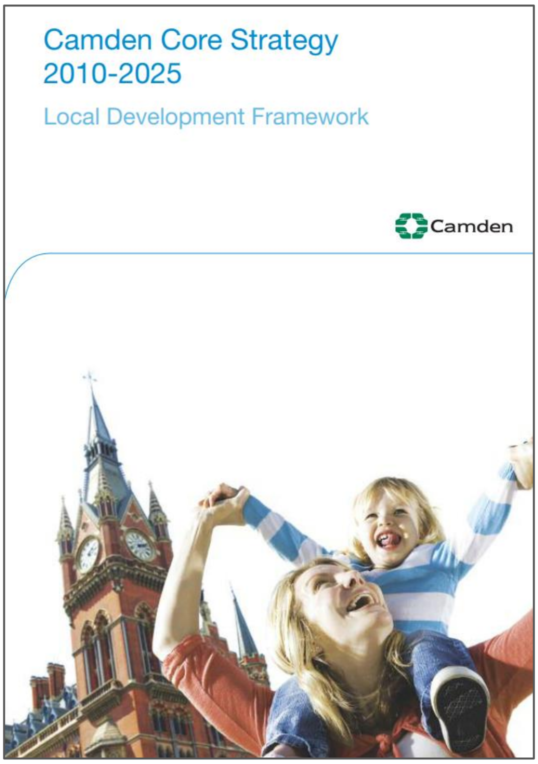
CAMDEN CORE STRATEGY (2010-2025)

CS13 – Tackling climate change through promoting higher environmental standards

Reducing the effects of and adapting to climate change
The Council will require all development to take measures to minimise the effects of, and adapt to, climate change and encourage all development to meet the highest feasible environmental standards that are financially viable during construction and occupation by:

a) ensuring patterns of land use that minimise the need to travel by car and help support local energy networks;
b) promoting the efficient use of land and buildings;
c) minimising carbon emissions from the redevelopment, construction and occupation of buildings by implementing, in order, all of the elements of the following energy hierarchy:
    1. ensuring developments use less energy,
    2. making use of energy from efficient sources;
    3. generating renewable energy on-site; and
d) ensuring buildings and spaces are designed to cope with, and minimise the effects of, climate change.

The Council will have regard to the cost of installing measures to tackle climate change as well as the cumulative future costs of delaying reductions in carbon dioxide emissions.



CAMDEN PLANNING GUIDANCE: ENERGY EFFICIENCY AND ADAPTATION (2019)

Making buildings more energy efficient

Energy efficient design requires an integrated approach to solar gain, access to daylight, insulation, thermal materials, ventilation, heating and control systems. It is important that these aspects are considered in relation to each other when designing a scheme.

Energy efficient (passive) design measures should be considered prior to the inclusion of any active measures to ensure that the energy demand for developments is reduced as far as possible.

Developments should avoid electric heating systems unless there is no access to a gas connection, or where heating is required for very short periods in isolated locations.

Decentralised energy

The 'Be Clean' stage of the energy hierarchy aims to ensure that developments have an efficient supply of heat and power. It is the local supply of heat and energy which optimises supply to demand so is much more efficient. Until now, this step has typically been achieved through the installation of combined heat and power units (CHP) or connection to a Decentralised Energy Network (DEN) often powered by CHP and gas boilers.

Local Plan Policy CC1 requires all major developments to assess the feasibility of connecting to an existing decentralised energy network, and where this is not possible establishing a new network (see paragraph 8.25 Local Plan).

Renewable energy technologies

All developments should consider the feasibility of on-site renewable energy generation. Renewable energy generation should only be considered once the earlier stages of the energy hierarchy have been followed and energy demand has been reduced as far as possible.

Energy reduction

The following energy reduction requirements are set out in the Camden Planning Guidance report:

- All development in Camden is expected to reduce carbon dioxide emissions through the application of the energy hierarchy.
- All new build major development to demonstrate compliance with London Plan targets for carbon dioxide emissions.
- Deep refurbishments (i.e. refurbishments assessed under Building Regulations Part L1A/L2A) should also meet the London Plan carbon reduction targets for new buildings.
- Developments of five or more dwellings and/or more than 500sqm of any gross internal floorspace to achieve 20% reduction in carbon dioxide emissions from on-site renewable energy generation

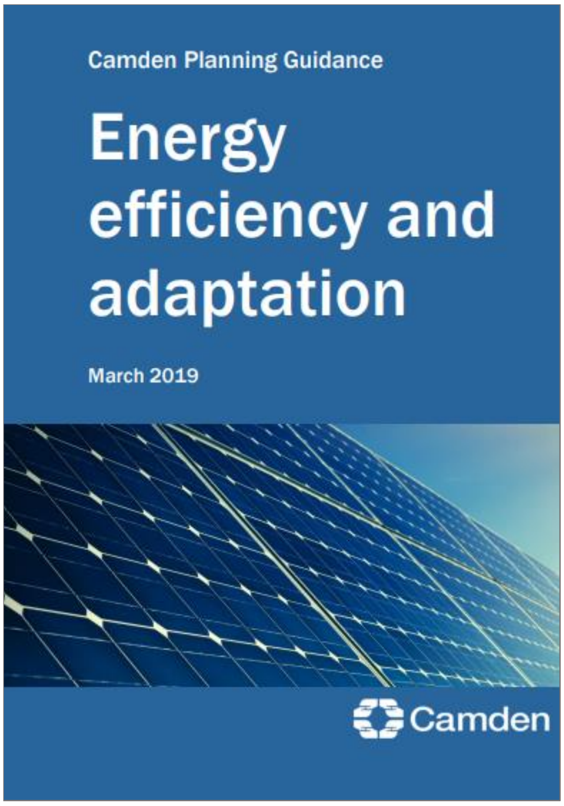
Energy efficiency in existing buildings

There are many opportunities for reducing energy, the design, fixtures, and materials used can make a significant contribution. Installing condensing boilers, heating controls and energy saving light bulbs and appliances reduce energy use and carbon dioxide emissions significantly.

Heating and Hot water

Heating and hot water carbon emissions can be improved through:

- Replacing an old boiler (more than 10 years old) with a high efficiency condensing boiler and heating controls to provide heating and hot water could significantly cut energy consumption.
- New/upgraded central heating – if a new boiler is installed the rest of the central heating system may need upgrading, for example large, old radiators could be replaced with smaller, more efficient radiators that are better suited to the new boiler.
- Upgrading heating controls - install heating controls that allow control of the temperature in different parts of a building. These can be included as an electronic timer control.


Camden Planning Guidance
Energy efficiency and adaptation
March 2019
Camden

METHODOLOGY

The sections below present the methodology followed in determining the on-site carbon savings for the proposed scheme.

ON-SITE CARBON SAVINGS – THE ENERGY HIERARCHY

The methodology employed to develop the energy strategy for the scheme and achieve on-site carbon savings followed the GLA's Guidance on preparing Energy Assessments for refurbishments and is as follows:

Given that the development is a major refurbishment project it is expected that an estimate of the CO_2 savings from the refurbishment of the building is provided.

For this, a pre-refurbishment regulated CO_2 emissions 'baseline' should be modelled to determine a baseline Building Emission Rate (BER), estimating fabric and services performance based on available existing information.

For the new-built area, a regulated CO_2 emissions baseline is established by determining the Target Emission Rate (TER) multiplied by the floor area.

The IESVE software used to model and calculate the energy performance and carbon emissions is SBEM compliant.

The overall regulated CO_2 emissions are established by accounting both the existing and new build areas of the development for the pre-existing scenario and the proposed scenario.

The three consecutive steps of the Energy Hierarchy are:

- **Be Lean** whereby the demand for energy is reduced through a range of passive and active energy efficiency measures; as part of this step the Cooling Hierarchy (see Policy 5.9) is implemented and measures are proposed to reduce the demand for active cooling;
- **Be Clean** whereby as much of the remaining energy demand is supplied as efficiently as possible (e.g. by connecting to a district energy network, improving communal boiler efficiency or developing a site-wide CHP network), and,
- **Be Green** whereby renewable technologies are incorporated to offset part of the carbon emissions of the development. The uptake of renewable technologies is based on feasibility and viability considerations, including their compatibility with the energy system determined in the previous step.

The implementation of the energy measures determines the total regulated carbon savings that can be feasibly and viably achieved on site.

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 in both the new build and refurbishment areas of the proposal. The regulated carbon saving achieved in this step of the Energy Hierarchy is 19.8% over the site wide baseline level with SAP 2012 factors.

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 for both the refurbished and new areas of the building in order to reduce the demand for space conditioning (heating and/or cooling).

The refurbishment works in the existing building will comprise the upgrade of the external walls, roof and floors and the replacement of existing windows and doors. The table below demonstrate the improved performance of the proposed and upgraded building fabric. The u-values assumed are consistent with Part L2B 2013 minimum standards.

Table 2: Thermal Envelope U-values

Non-domestic (U-values in W/m².K)				
Element	**Estimate of Existing Fabric Performance**	**Upgrade to Retained Elements**	**Proposed New Elements**	**Improvement to Existing Performance**
Walls	1.69	0.30	0.28	82.2%
Floor	1.62	0.25	0.22	84.6%
Roof	2.44	0.18	0.18	92.6%
Windows	5.59	n/a	1.80	67.8%

AIR TIGHTNESS

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.

Air permeability rates have been assumed to be $15m^3/m^2.h$ at 50Pa for all new build and refurbishment area of the development. As the new built area at lower ground and ground level is a proposed extension with new and refurbished building elements.

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.

ACTIVE DESIGN MEASURES

HIGH EFFICACY LIGHTING

The development intends to incorporate low energy lighting fittings throughout the development. 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 lower ground and ground floor commercial units such as the gym, café, co-working and retail space. The mechanical ventilation system will include heat recovery in order to achieve ventilation in the most energy-efficient way. Mechanical Extract ventilation (MEV) is proposed for the guest rooms.

COMFORT COOLING

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

CONTROLS

Advanced lighting and space conditioning controls will be incorporated, specifically:

- For the areas of infrequent use, occupant sensors will be fitted for lighting.
- Space conditioning will be controlled by room thermostats and timers.

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

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

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.

MECHANICAL VENTILATION

The mechanical ventilation system will allow for the dissipation of any heat build-up during peak summer conditions.

OVERHEATING RISK ASSESSMENT

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

All non-domestic areas have been found to pass Criterion 3 ‘Limiting Solar Gains’ of Part L according to the SBEM output(s).

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 with SAP2012 actors

	Baseline			Lean		
	Energy (kWh/yr.)	$kgCO_2$ /yr.	$kgCO_2/m^2$	Energy (kWh/yr.)	$kgCO_2$ /yr.	$kgCO_2/m^2$
Hot Water	398,790	86,140	54.8	398,790	86,140	54.8
Space Heating	258,840	55,910	35.6	124,700	26,930	17.1
Cooling	5,060	2,560	1.6	5,360	2,710	1.7
Auxiliary	10,200	5,160	3.3	9,330	4,720	3.0
Lighting	19,950	10,100	6.4	15,380	7,780	5.0
Equipment	28,450	14,770	9.4	28,450	14,770	9.4
Total Part L	692,840	159,860	101.8	553,560	128,290	81.7
Total (incl. equipment)	721,290	174,630	111.2	582,010	143,060	91.1

BE LEAN CO_2 EMISSIONS & SAVINGS

By means of energy efficiency measures alone, regulated CO_2 emissions are shown to reduce by 19.8% (31.6 tonnes per annum) across the whole site.

BE CLEAN – SUPPLY ENERGY EFFICIENTLY

The proposed development site is located within an area where there is no existing district heat network within close proximity and an on-site wide CHP network is not feasible or viable for a development of this scale.

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 existing and proposed district heating networks within the vicinity of the development.

A review of the map shows that the site is not in proximity of an existing or proposed district heating network. Due to this it has not been found feasible or viable for the proposed development to incorporate the supply of low carbon heating or cooling through district heating.

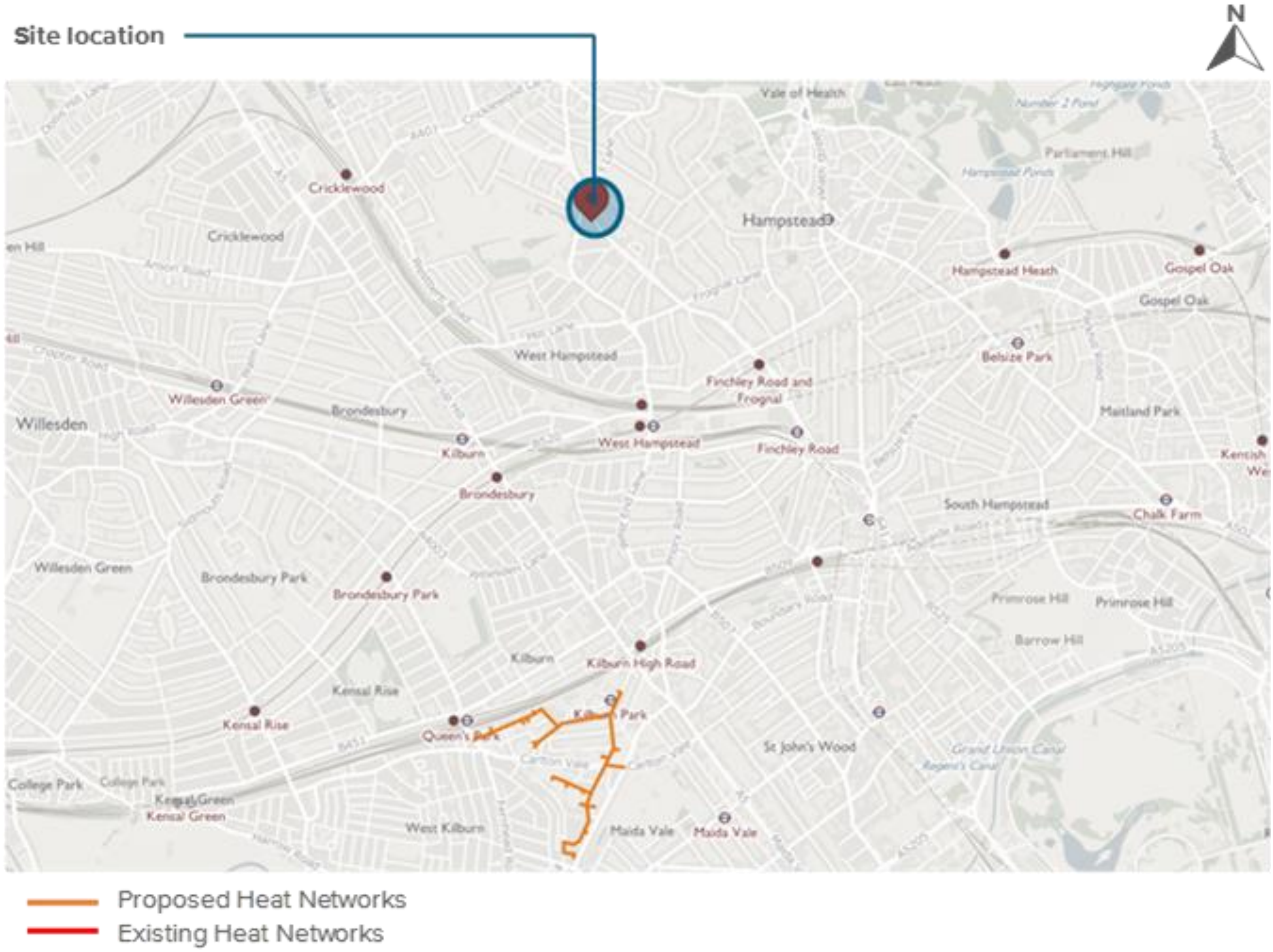


Figure 3: Excerpt from the London Heat Map. Existing district networks outlined in yellow, proposed networks in red.

BE CLEAN CO_2 EMISSIONS & SAVINGS

By means of improving boiler efficiencies alone, regulated CO2 emissions are shown to reduce by 5.4% (8.6 tonnes per annum) across the whole site.

BE GREEN – USE RENEWABLE ENERGY

The renewable technologies feasibility study carried out for the development identified air source heat pumps as suitable technologies for the development. The regulated carbon saving achieved in this step of the Energy Hierarchy is 1.0% over the site wide baseline level with SAP 2012 factors.

RENEWABLE TECHNOLOGIES FEASIBILITY STUDY

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

After ensuring that the development of 551-557 Finchley Road will benefit from an energy efficient building fabric and an efficient energy supply strategy method of generating on-site renewable energy (Green) were assessed, once Lean and Clean measures were taken into account.

- 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:

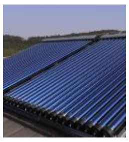
- CO_2 savings achieved;
- Site constraints;
- Any potential visual impacts, and,
- Compatibility with the ‘Clean’ stage proposals where applicable.

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 ASHP would be the most feasible renewable technologies for the proposed development. 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	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	3
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	3
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	2
ASHP		Adopted – The improvement of the efficiencies of the ASHP in the Green stage will further reduce the carbon emissions of the building.	20 yrs.	Med	Med	7
Wind		Not adopted - Wind turbines located at the site will require significant space which is not available.	25 yrs.	Med	High	1

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 the space heating and cooling of the most energy-intensive areas of the proposed development;
- 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,

This technology may be employed to provide the space heating and cooling for future fit-out of the commercial parts of the development.

As required by the Camden Planning Guidance: Energy efficiency and adaptation, ASHP with a COP of more than 4 were considered as to be more efficient than a conventional heating system.

Figure 4: Outdoor unit of an ASHP

BE GREEN CO_2 EMISSIONS & SAVINGS

The improved efficiencies of the renewable technologies will further reduce CO_2 emissions by a further 1.0% (1.5 tonnes per annum) across the whole site.

Shortfall from the 20% reduction set out in the Camden Planning Guidance: Energy efficiency and adaptation is due to the limitations including:

Photovoltaic panels were deemed unsuitable since the building has a pitched roof with limited space for panels and panels would lead to alteration of the character of the building which is undesirable considering the project is a refurbishment by nature.

ASHP's were implemented where feasible, with high efficiencies. Due to limitations for plant space for a communal ASHP system, this was only implemented for the commercial units. ASHPs require more plant space than gas boiler systems as these need to be ventilated, so they tend to be located on the roof, which was not suitable for the development because of the pitched roof. If ASHP's are enclosed, additional space is required, with louvers and a minimum floor to ceiling height of 3m for the system to be properly ventilated.

CONCLUSIONS

Following the implementation of the three-step Energy Hierarchy, the cumulative CO_2 savings on site are estimated at 26.1% for the whole site when compared to a pre-refurbishment baseline.

ON SITE CO_2 SAVINGS

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 pre-refurbishment baseline through on-site measures alone by 26.1% (41.7 tonnes per annum) across the whole site.

The tables in the following pages summarise the implementation of the Energy Hierarchy for the proposed scheme and detail the CO2 emissions and savings against the baseline scheme for each step of the hierarchy; as well as the savings achieved through carbon offset.

Overall, the proposed development has been designed to be in line with 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.

The development has also been designed in line with Camden Planning Guidance: Energy efficiency and adaptation where feasible. The shortfall from 20% reduction from low and zero carbon technologies is due to spatial limitations. The project being of a refurbishment nature has some site constraints which limit any alteration to the character of the building. Communal gas boilers have been proposed to provide heating and hot water for the apart-hotel considering the site constraints. Air source heat pumps (ASHP) require more plant space, noise attenuation measures and should be properly ventilated. These are usually located on the roof, however due to the nature of the building, these were not found to be suitable for the development.

Photovoltaic panels were not considered in the development as these would alter the character of the building. Hence the development is not able to meet the 20% carbon savings from renewables.

However, high-performance thermal envelope and passive design measures have been implemented and the carbon savings through demand reduction measures alone exceeds the new efficiency target set by the GLA of 15% for non-domestic developments.

SITE-WIDE CUMULATIVE SAVINGS

Table 5: CO2 emissions after each step of the Energy Hierarchy for the development with SAP 2012 factors

	Carbon dioxide emissions for the development (tonnes CO_2 per annum)	
	Regulated	Unregulated
Baseline	159.9	14.8
After energy demand reduction	128.3	14.8
After heat network/CHP	119.7	14.8
After renewable energy	118.2	14.8

Table 6: Site wide regulated CO_2 emissions and savings with SAP 2012 factors

	Total regulated emissions (tonnes CO_2/year)	Regulated CO_2 savings (tonnes CO_2/year)	Percentage saving (%)
Baseline	159.9		
Be Lean	128.3	31.6	19.8%
Be Clean	119.7	8.6	5.4%
Be Green	118.2	1.5	1.0%
Total		41.7	26.1%

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