JAW

30 Leighton Road, London Borough of Camden

Energy and Sustainability Strategy

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Version 03

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JAWSustainability

Contents

1 Introduction

This report summarises the proposed energy and sustainable strategy for development at 30 Leighton Road in order to meet the sustainability requirements of the London Borough of Camden and the London Plan.

The proposal consists of the refurbishment and minor alterations to a listed postman building, as well as the demolition of rear buildings and construction of a two-storey replacement building to the rear to be used as offices (B1).

Figure 1-1 – Leighton Road Location

2 Policy

The following policies from the Approved Document PartL2B, the London Plan and the London Borough of Camden's Local Plan have been identified as having requirements most relevant to the sustainability strategy of the development.

2.1 Approved Document Part L2B

Buildings exempt from the energy efficiency requirements

3.5 Building work in most existing buildings other than dwellings will need to comply with the energy efficiency requirements of the Building Regulations where the buildings are roofed constructions having walls and use energy to condition the indoor climate. Regulation 21 of the Regulations, however, grants an exemption from compliance with the energy efficiency requirements to certain classes of buildings:

a. buildings which are:

  i. Listed in accordance with section 1 of the Planning (Listed Buildings and Conservation Areas) Act 1990
  ii. In a conservation area designated in accordance with section 69 of that Act; or
  iii. Included in the schedule of monuments maintained under section 1 of the Ancient Monuments and Archaeological Areas Act 1979

where compliance with the energy efficiency requirements would unacceptably alter their character or appearance

As the existing postman office development is a Grade II listed building, energy efficiency measures will be prioritised which do not alter the character or appearance of the development.

Extensions

4.1 Under regulation 28 of the Building Regulations, the construction of an extension triggers the requirement for consequential improvements in buildings with a total useful floor area greater than 1000m2.

Large extensions

4.2 Where the proposed extension has a total useful floor area that is both:

a. Greater than 100m2
b. Greater than 25% of the total useful floor area

The work should be regarded as a new building and the guidance in Approved Document L2A should be followed

As the existing building is less than 1000m2, the development of an extension does not trigger the requirement of consequential improvements. As the extension is both 100m2 and greater than 25% of the total useful floor area, it will be regarded as a separate new building and the guidance in Approved Document L2A will be followed.

2.2 London Plan

Policy 5.2: Minimising Carbon Dioxide Emissions

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

As the new build extension section has a GIFA under 1000m2, it is classed as a minor development. Therefore, further requirements with respect to the London Plan Policy 5.2 are not applicable.

Policy 5.3 Sustainable Design and Construction Strategic

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.

Policy 5.6 Decentralised Energy in Development Proposals

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.

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

Within the framework of the energy hierarchy, major development proposals should provide a reduction in expected carbon dioxide emissions through the use of on-site renewable energy generation, where feasible.

Policy 5.13 Sustainable Drainage

Development should utilise sustainable urban drainage systems (SUDS) unless there are practical reasons for not doing so, and should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible in line with the following drainage hierarchy: store rainwater for later use; use infiltration techniques, such as porous surfaces in non-clay areas; attenuate rainwater in ponds or open water features for gradual release; attenuate rainwater by storing in tanks or sealed water features for gradual release; discharge rainwater direct to a watercourse; discharge rainwater to a surface water sewer/drain; discharge rainwater to the combined sewer.

Drainage should be designed and implemented in ways that deliver other policy objectives of this Plan, including water use efficiency and quality, biodiversity, amenity and recreation.

2.3 Camden Local Plan

Policy CC1 Climate change mitigation

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

We will:

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

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

g. working with local organisations and developers to implement decentralised energy networks in the parts of Camden most likely to support them;
h. protecting existing decentralised energy networks (e.g. at Gower Street, Bloomsbury, King's Cross, Gospel Oak and Somers Town) and safeguarding potential network routes; and
i. requiring all major developments to assess the feasibility of connecting to an existing decentralised energy network, or where this is not possible establishing a new network.

To ensure that the Council can monitor the effectiveness of renewable and low carbon technologies, major developments will be required to install appropriate monitoring equipment.

The Council will expect developments of five or more dwellings and/or more than 500 sqm of any gross internal floorspace to achieve a 20% reduction in carbon dioxide emissions from on-site renewable energy generation.

The development is required to follow the energy hierarchy and meet the energy targets set by the London Plan. The development is more than 500 sqm, as such must achieve a 20% reduction in carbon emission from renewable energy.

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.

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.

3 Energy Strategy

An energy strategy has been developed following the energy hierarchy 'Be Lean, Be Clean, Be Green'. Energy calculations for the new build extension have been undertaken using Building Regulations approved and accredited software, to calculate the savings associated with the measures incorporated.

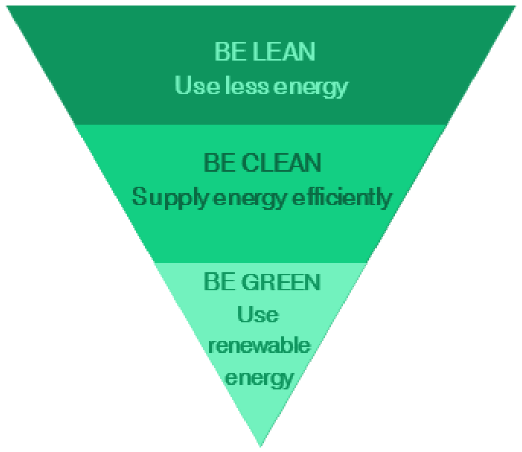

Figure 3-1 The Energy Hierarchy

3.1 Energy Targets

The energy strategy has been split into two separate approaches, one for the refurbishment of the existing postman office, and one for the proposed extension. As part of the sustainability strategy of the development, the energy strategy has been developed to target the highest saving that can be reasonably achieved.

Existing Postman Office

The refurbishment of the postman office has no specific energy targets, but it should demonstrate improvements over the existing building. New thermal elements and retained thermal elements will be installed and upgraded in line with the guidance of Part L2B.

New Extension

The extension is required to be treated as a new development and must meet the requirements outlined in the London Plan. As the new build is under 1000m2 it is a minor new build development, so it is required to meet the baseline energy targets outlined by Part L2A and follow the energy hierarchy to make a reduction at each stage.

Camden requires new developments to make a 20% reduction at the be green stage

As recommended by the GLA, energy targets have been set based on a gas base case. All calculations have been conducted using the proposed SAP 10 emission factors for mains gas (0.210 kg CO_2e/kWh) and electricity (0.233 kg CO_2e/kWh).

3.2 Be Lean

As part of the Be Lean approach, passive design measures have been considered throughout the pre-planning stage to reduce initial energy demand.

Site Conditions

The development is part refurbishment and part new build located in the London Borough of Camden. The climate in London is mild in winter and temperate in summer. The site is located in a low density urban area, so may suffer slightly from the urban heat island effect.

The building layout is largely restricted by the site shape and existing postman office, but the new build sections have been designed in order to allow all occupied spaces to maximise natural daylight and natural ventilation. A ground floor plan is shown in Figure 3-2.

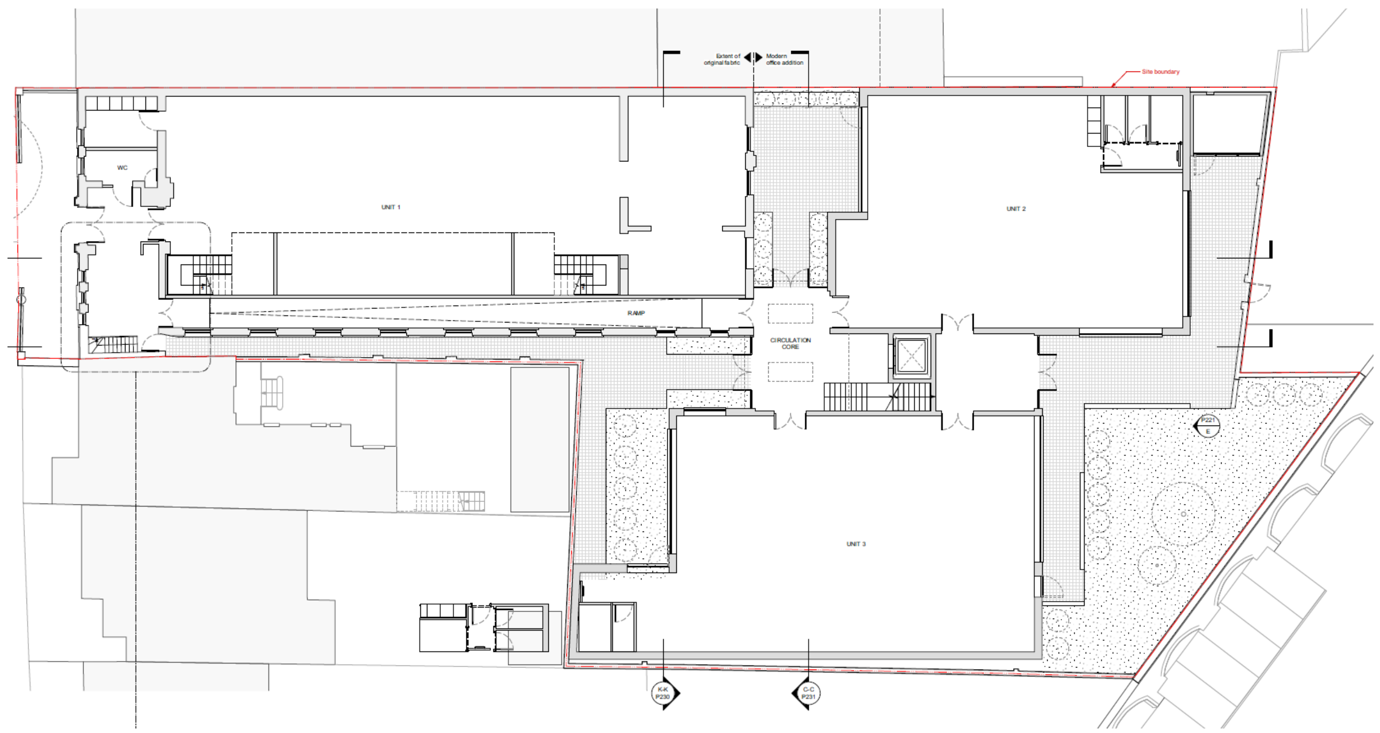

Figure 3-2 – Ground Floor Plan

Building Fabric

Designing an efficient thermal envelope will greatly reduce the need for space heating and cooling as heat transmittance through the thermal elements is reduced.

Existing Postman Office

As the building is an existing listed building, there are limited opportunities to make improvements. Measures have been prioritised that do not alter the character or appearance of the development

The existing ground floor in the main hall has a historic timber flooring and as such is being retained, so does not trigger any requirement for improvement. Some areas of the existing building floor will be entirely new, with a new insulated slab laid. Where this occurs, new flooring will meet the requirements in Part L2B for new thermal elements.

The existing external walls will have plaster repairs, with around 15% of the external walls being internally lined, however this does not constitute a renovation so does not trigger the requirement for a thermal performance upgrade.

The roof will be insulated between the rafters. It is anticipated this will provide a U-value of 0.25 W/m^2K. Windows and rooflights that are not protected as part of the buildings listed status will be replace will new slimline double glazed units, targeting a U value of 1.8 W/m^2K, subject to approval by the conservation officer.

Fabric Component	Assumed existing performance	Requirement under Part L2B	Proposed specification
Existing External Walls	1.5 W/m^2K	-	1.5 W/m^2K
Existing Ground Floor[1]	0.35 W/m^2K	-	0.35 W/m^2K
New Ground Floor[1]	-	0.22 W/m^2K	0.22 W/m^2K
Roof	1.5 W/m^2K	0.18 W/m^2K	0.25 W/m^2K
Windows	5.7 W/m^2K	1.8 W/m^2K	1.8 W/m^2K
Rooflights	5.7 W/m^2K	1.8 W/m^2K	1.8 W/m^2K
External Doors	2.2 W/m^2K	-	2.2 W/m^2K
Air Tightness	25 $m^3/m^2/h$	-	25 $m^3/m^2/h$
1. Corrected for ground contact			

Table 3-1 Proposed Be Lean passive design measures

New Build Extension

Low air permeability rates will also reduce heating and cooling energy demand by reducing the volume of air that can penetrate the building.

As part of a ‘fabric first’ approach, the building fabric has been carefully considered and specified to meet or exceed current Building Regulations minimum requirements, as detailed in Table 3-2 below.

Fabric Component	Requirement under Part L2A	Proposed specification
External Walls	0.35 W/m^2K	0.20 W/m^2K
Ground Floor[1]	0.25 W/m^2K	0.14 W/m^2K
Roof	0.18 W/m^2K	0.18 W/m^2K
Windows	2.2 W/m^2K	1.5 W/m^2K, G=0.55
Glazed External Doors	2.2 W/m^2K	1.5 W/m^2K, G=0.55
External Doors	2.2 W/m^2K	1.4 W/m^2K
Air Tightness	10 $m^3/m^2/h$	5 $m^3/m^2/h$
1. Corrected for ground contact, 0.25 W/m^2K before ground contact correction		

Table 3-2 Proposed Be Lean passive design measures

Building Services

Individual systems have been identified as being the most appropriate for the site. These have been specified to maximise efficiency therefore reducing energy used to deliver services. Similar systems will be installed throughout the refurbishment and new build section of the development.

For the Be Lean case heat and hot water is supplied by a gas boiler with an efficiency of 91%. The proposed specification for heating and hot water systems is outlined in the Be Green section of this report.

Table 3-3 shows the proposed services strategy and energy efficiency measures for the development.

Services Component	Proposed specification
Cooling	Office spaces - ASHP, SEER 6.52 Comms room cooling - ASHP, SEER 6.76
Ventilation	New office space - hybrid ventilation, SFP 0.28 W/l/s New office WC – Extract, SFP 0.4 W/l/s Existing Postman office spaces – Natural Ventilation Entrance WC, basement WC & Kitchenettes – Extract, SFP 0.3 W/l/s
Lighting & Controls	LED Lighting Luminous Efficiency 100 lm/W in office and toilet zones Daylight dimming and manual switching in offices, presence detection within toilets Luminous Efficiency 140 lm/W in plant areas, manual control

Table 3-3 Proposed energy efficient design measures

Solar Gain Control and Daylight

Solar gains are a passive form of heating from the sun’s radiation and are beneficial to a building during winter months as they provide an effective source of heat and reduce internal heating requirements. However, during summer months, they must be controlled in order to mitigate the risk of overheating. They can be controlled through glazing and shading design in order to allow low level winter sun to enter the building and to limit access to high level summer sun.

The glazing strategy of the existing postman office is largely dictated by the existing structure of the development and the requirements of the conservation officer. Windows will be replaced with slimline double glazing where possible. In the new development, window setting out has been designed to maximise daylight to occupants internally.

New glazing throughout the development will incorporate low emissivity coatings to limit overheating without compromising light transmittance.

Overheating

The cooling hierarchy has been followed to minimise overheating and energy use within the development

Highley efficient LED lighting will be installed internally to minimise internal heat gains

The new build section of the development will incorporate a highly insulated external fabric, with green sedum roofs being installed on the new flat roof sections to minimise the amount of heat entering the building. New glazing has will also incorporate low emissivity coatings to reduce solar gain.

Storey heights are restricted by the overall development height; however, ceiling height has been maximized internally through the removal of ceiling voids.

The new build section of the development will be ventilated using a hybrid ventilation system installed above glazed panelling. The hybrid system operates in three modes; passive, mixing and cooling dependant on internal/external conditions providing an energy efficient system. A full mechanical ventilation distribution system was not deemed feasible due to restrictions of storey heights.

The existing postman office will be naturally ventilated using openable windows and existing roof turrets. Mechanical damper control will be provided below roof turrets and linked with window provided control based on internal/external conditions

Due to the use type of the building, the split system heat pump proposed will also provide the capability to provide active cooling in necessary spaces, in order to futureproof the development from future climate scenarios. Highly efficient systems have been specified in order the minimise energy use.

3.3 Be Clean

As part of the Be Clean approach, the use of energy efficient equipment, heat networks and community heating have been considered.

District Energy Systems

With reference to the London Heat Map, there are no potential heat networks running in the vicinity of the site. The closest proposed network is around 1.8km away, which would not be feasible to connect to.

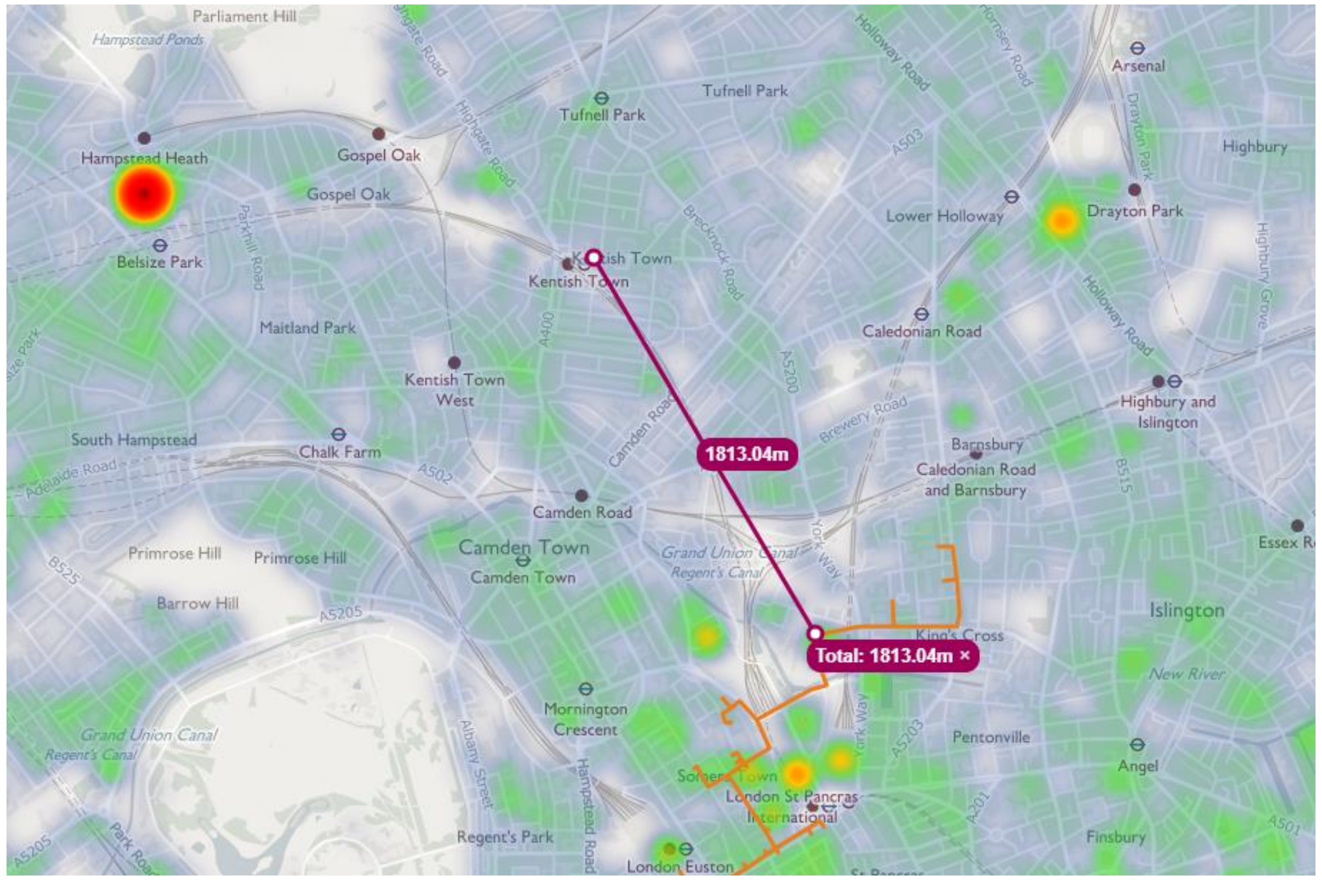

Figure 3-3 London Heat Map

Community Heating & CHP

Efficient systems for energy delivery have also been investigated. At the scale of this development, Combined Heat and Power (CHP) systems are not viable. CHP requires a high base energy demand load in order to operate efficiently. It is usually more suited to hotel or hospital schemes which have a high hot water demand, or very large residential schemes incorporating hundreds of units.

3.4 Be Green

At the Be Green stage, low and zero carbon (LZC) technologies are investigated. Table 7-1 in the Appendix considers the feasibility of low carbon and renewable energy technologies for the scheme.

Air Source Heat Pumps

The assessment identified Air Source Heat Pumps (ASHP) as the most appropriate LZC technology for the development. A highly efficiency system has been identified to provide space heating to the office areas. This will be paired with a small amount of direct electric heating in circulation areas, and instantaneous hot water due to the low demand.

Table 3-4 shows the proposed LZC services strategy for the development.

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Services Component	Proposed specification
Space Heating	Office spaces - ASHP, SCOP 4.16 Communal circulation spaces – Direct electric heating
Hot Water	Instantaneous hot water

Table 3-4 - Proposed low carbon design measures

3.5 Energy and Carbon Savings

Energy Use

The breakdown of carbon and energy use has been identified for the new build sections of the development. Table 3-5 shows the breakdown of carbon and energy use once the strategies proposed in this report are incorporated. All calculations have been conducted using the SAP 10 emission factors.

	Gas (kWh/yr)			Gas CO2 (kg/yr)	Electricity (kWh/yr)						Electricity CO2 (kg/yr)	Total Energy (kWh/yr)	Total CO2 (kg/yr)
	Space Heating	Hot Water	Total		Space Heating	Hot Water	Cooling	Pumps & Fans	Lighting	Total			
Baseline	19,197	2,150	21,347	4,483	0	0	3,604	1,885	11,774	17,262	4,022	38,609	8,505
Be Lean	15,385	2,267	17,652	3,707	0	0	3,338	1,304	8,071	12,712	2,962	30,364	6,669
Be Clean	15,385	2,267	17,652	3,707	0	0	3,338	1,304	8,071	12,712	2,962	30,364	6,669
Be Green	0	0	0	0	5,140	2,067	3,338	1,304	8,071	19,919	4,641	19,919	4,641

Table 3-5 Estimated regulated energy demand and carbon emissions per energy source

Carbon Saving

Table 3-6 and Figure 3-4 demonstrate the percentage improvement over the notional baseline levels for the new build sections of the development. All calculations have been conducted using the SAP 10 emission factors. A 45% reduction has been achieved for the new build sections of the development. A 24% saving has been achieved at the Be Green stage, therefore the development complies with the requirement of a 20% reduction at through the incorporation on renewable and low carbon technology outlined Camden's Climate change mitigation policy.

	CO_2 Emissions (tonnes /annum)	CO_2 Savings (tonnes /annum)	% Saving
Baseline	8.50		
Be Lean	6.67	1.84	22%
Be Clean	6.67	0.00	0%
Be Green	4.64	2.03	24%
Total Savings		3.86	45%

Table 3-6 improvements over Part L

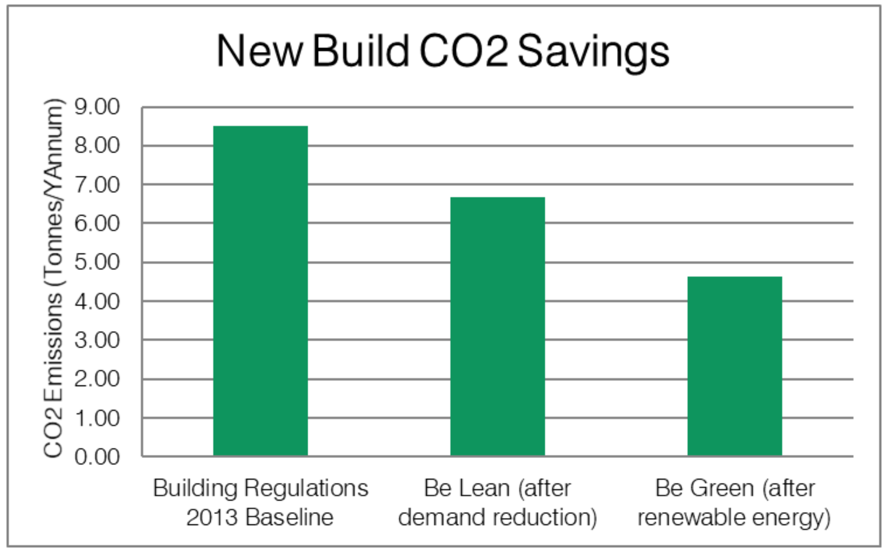


Figure 3-4 New build sections improvement over building regulations gas baseline

4 Sustainability

4.1 Water Efficiency

Water fittings will be specified with low flow rates to minimise water consumption. WC will be dual flush. Water fittings will be specified with the following or similar flow rates if specified:

- WC - 6/4 litre dual flush
- Wash basin taps – 7.5 l/min
- Showers – 8 l/min
- Urinal 4 l/bowl/hour
- Kitchenette tap 7.5 l/min
- Dishwashers (domestic – 13 l/cycle, commercial – 6 l/rack)

Water meters will be installed to encourage building operators to monitor consumption.

4.2 Materials

A key point of this proposed development is to retain and refurbish the existing postman office. This significantly reduces the environmental impact of the development, as the reuse of existing materials considerably reduces the embodied energy associated with the development. It also reduces the amount of waste that will be generated by the project.

The other buildings on site are rendered blockwork outbuildings, which house toilet and kitchen facilities as well as storage, and as such are not suitable for use as an office space. They do not fully utilise the space available on the site and would not be able to support the weight of any significant extension. As they are generally of low quality, demolition and replacement with a new development is the most appropriate action.

Insulating materials will be specified to maximise thermal performance whilst still paying attention to the environmental impact of the materials used. The use low embodied energy products will be further investigated.

Responsible sourcing will also be pursued. All timber used on site during the construction phase and within the building will be from legal sources. Where possible, FSC or equivalent timber will be used. Sourcing of other materials will include products where the manufacturer employs an environmental management system such as ISO 14001 or BES 6001. Where possible, site won reclaimed materials will be reused and materials will be sourced locally.

Non-toxic materials will be used wherever possible, including the specification of products with low VOC content in line with European testing standards.

All the building elements will achieve high ratings on the BRE Green Guide to Specification. Materials will be specified to have a low embodied energy, considering whole life cycle analysis.

4.3 Waste Management and Construction

Construction site waste will be managed in such a way to reduce the amount of waste produced as much as possible, and the waste hierarchy will be followed.

Operational waste will be recycled through a commercial waste contractor. The development will be provided with its own separate waste and recycling bins throughout.

4.4 Nature Conservation and Biodiversity

As the development is an existing building development it is not considered to be of significant ecological value. The development will attempt to increase biodiversity through the provision of green sedum roofs on the new flat roof sections of the development. External areas will incorporate native planting.

Measures will be taken during construction to minimise impact on ecology by timing works appropriately and following best practice guidance.

4.5 Climate Change Adaptation

Tackling Increased Temperature and Drought

The impact of solar gain has assessed under criterion 3 within the BRUKL and all occupied spaces have passed. New glazing will incorporate low emissivity coatings to reduce solar gain. Natural ventilation systems, using a combination of operable windows and roof turrets, have been specified within the new build sections to maximise thermal comfort. The heat pump proposed will also have the capability to provide cooling in necessary spaces.

Flooding

The peak and volume of surface water run-off rates will not be increased due to the development, as the site is existing hard standing so the impermeable area will not increase. Green sedum roofs on the new flat roof sections of the development, which will help to reduce flooding risk.

The flood risk map is shown in Figure 4-1. The site is located in Flood zone 1 so is not considered to be at risk of.

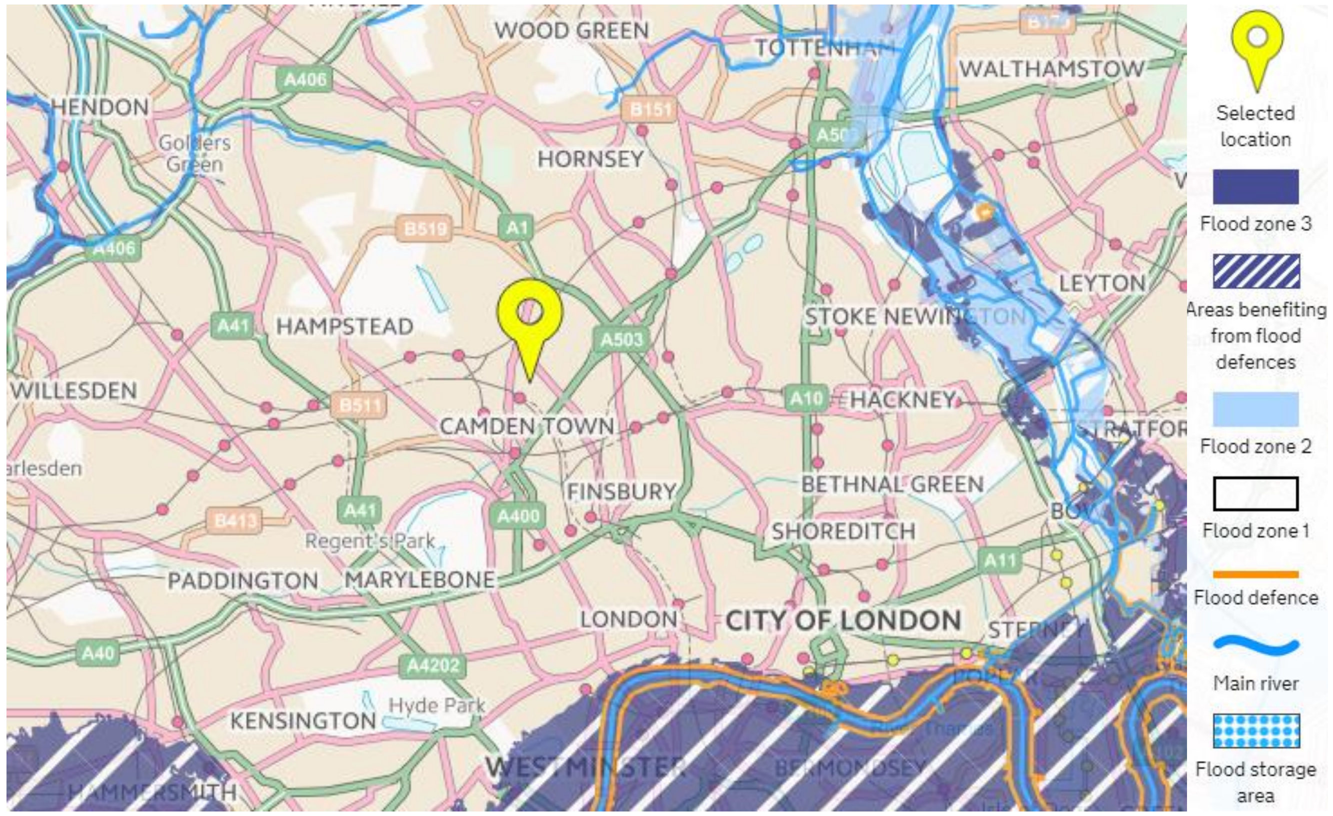


Figure 4-1 Flood Risk Map

4.6 Pollution Management

Air Quality

The construction site will be managed in such a way that the environmental impact is minimised. This includes following best practice policies for dust pollution by using dust sheets, covering skips and damping down where appropriate.

Plant and machinery

Plant and equipment have been selected for efficiency and sized appropriately, in line with the proposed energy strategy of the development, in order to minimise greenhouse gas emissions. The current proposal is for fully electric heating and hot water, as such there will be negligible NO_x emissions. All equipment will be frequently maintained to ensure it continues to run efficiently and cleanly.

Insulating materials and heating systems will be specified to keep pollutants to a minimum. Insulation will have a low Global Warming Potential.

Noise

All new windows will be double glazed to minimise transmission of noise from outside to inside the office.

An external noise and plant noise assessment has been conducted to comply with local authority noise policy, concluding noise mitigation measures will be required to a limited number of plant items in order to meet with the derived noise limits (10dB less than measured noise levels) and as such specification for the noise mitigation measures have been provided.

Light Pollution

External lighting will be adequately controlled to ensure that it does not run unnecessarily. The proposed development is in a highly urbanised location, and therefore will not significantly contribute to increasing the effects of light pollution.

5 Conclusion

This report summarises the proposed energy and sustainable strategy for development at 30 Leighton Road in order to meet the sustainability requirements of the London Borough of Camden and the London Plan.

The property currently consists of a Grade II listed postman office building that is used for office space, as well as a number of structures to the rear that are used as studios and for storage. The proposal would consist of the refurbish the existing postman office, as well as the demolition of the structures at the rear of the property, to create room for the development of a new 2 storey office block extension and external space.

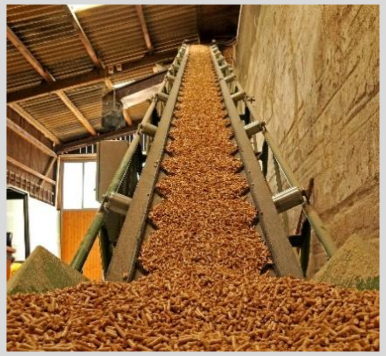
The refurbishment of the postman office has no specific energy targets, but it is required to demonstrate improvements over the existing building. New and renovated thermal elements will be installed and upgraded in line with the guidance of Part L2B, to minimise energy demand and efficient systems will be installed to minimize energy use.

The new build extension has been treated as a new development and follows the energy hierarchy, incorporating passive design measures, energy efficient equipment and low or zero carbon technology, as required by the London Plan. The development employs an efficient building fabric and efficient systems to maximise carbon savings for the site, resulting in a 45% improvement over the building regulations gas baseline. It also achieves a 24% reduction at the Be green stage, due to the incorporation of renewable and low carbon technologies. All calculations have been conducted using the proposed SAP 10 emission factors for mains gas and electricity.

Measures have been incorporated to ensure that sustainability is considered throughout the construction and design process.

The figures within this report are based on preliminary analysis only and further detailed studies will be required at the detailed design stage before specifying any of the proposed systems.

6 Appendix

LZC Technologies	Description	Noise	Visual impact	Internal Space	External Space	Capital Cost	Maintenance	Feasibility	
Solar Thermal Collectors 	Solar thermal collectors can be used to provide hot water using the irradiation from the sun. They can generally provide approx. 50% of the hot water demand	🟢	🟡	🟢	🟡	🔴	🟡	There are areas of roof that can incorporate solar technologies. However, carbon savings are quite low and it is quite a high cost technology	×
Solar Photovoltaic Panels 	Solar PV panels generate electricity from the sun's energy. They should be installed within 90° of due south ideally at a 30° angle. The electricity can be used to supply the landlords load.	🟢	🟡	🟢	🟡	🟡	🟡	There are areas of roof that can incorporate solar technologies, so it may be feasible. However, other energy low carbon technologies have been prioritised, so it has not been proposed.	-
Biomass Heating 	Solid, liquid or gaseous fuels derived from plant material can provide boiler heat for space and water heating A biomass boiler would supplement a standard gas heating system so some of the cost may be offset through money saved on using smaller traditional boilers reliability of fuel access/supply can be a problem	🟡	🟢	🔴	🟡	🔴	🔴	Biomass is not considered feasible for this development due to issues with fuel storage, access for delivery vehicles and local NO_x emissions.	×

Wind Turbines 	Vertical and horizontal axis wind turbines enable electricity to be generated using the power within the wind Not suitable for urban environments due to low wind conditions and obstructions	🔴	🔴	🟢	🔴	🔴	🟡	This development is in an urban environment and so a wind turbine will not generate a significant amount of energy.	×
Ground Source Heat Pumps (GSHP) 	Utilising horizontal loops or vertical boreholes, GSHP make use of the grounds almost constant temperature to provide heating and/or cooling using a heat exchanger connected to a space/water heating delivery system Optimum efficiency with underfloor heating systems	🟡	🟢	🟡	🟡	🔴	🟡	GSHP are not a feasible technology for the site since there is a limited external space available for installation of boreholes.	×
Air Source Heat Pumps (ASHP) 	Air Source Heat Pumps extract latent energy from the external air in a manner similar to ground source heat pumps Optimum efficiency with underfloor heating systems	🟡	🟡	🟡	🟡	🟡	🟡	The current proposal is to use ASHP to provide low carbon heating to the development	✓

Table 7-1 – Renewable and Low or Zero Carbon Technologies feasibility assessment