MHA London Ltd

20-26 Lamb’s Conduit Street

Energy and Sustainability Statement

Job No: 1014398

Doc No: 1014398-RPT-SU001

Latest Revision: C

Date: 19/12/2016

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Project name	20-26 Lamb's Conduit Street	**Job Number**
Report Name	Energy and Sustainability Statement	1014398

Document Revision History

Revision Ref	Issue Date	Purpose of issue / description of revision
-	22/11/2016	Draft Issue for Comment
A	23/11/2016	Planning Issue
B	16/12/2016	Updated with external plant details
C	19/12/2016	Updated with new site plan, floor plan and internal plant enclosure drawing

Document Validation (latest issue)

Revision	Issue Date	Purpose of issue / description of revision / version			
C	19/12/2016	Updated with new site plan and new internal plant enclosure			
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Executive Summary

Low environmental impact will be an essential feature of the design of the proposed 20-26 Lamb's Conduit Street redevelopment. This Energy and Sustainability Statement outlines the development's approach to sustainability, energy efficiency and renewable energy strategies in order to meet the targets set out in the guidance from Camden Council.

The size of the assessed development qualifies it as a minor development under GLA definition. As the development is a change of use from basement car parking to Class B1/B8/D1/D2 and Sui Generis speculative space, there is no requirement to achieve the London Plan targets. However, the energy strategy has been used as guidance to deliver a sustainable and high quality environment.

As the development also falls below Camden Council's threshold for BREEAM assessment, a pre-assessment has not been included for the planning submission. However, the BREEAM process has also been used to inform the sustainability measures for the development.

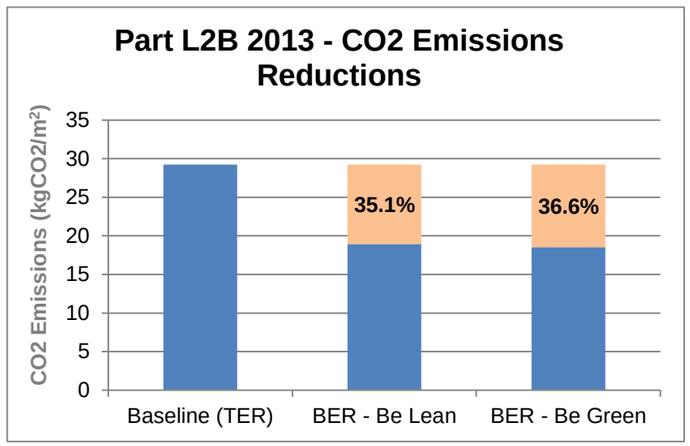
Good practice energy efficiency measures have been incorporated in the design, including:

- Thermal insulation levels for all building elements will be increased beyond the Building Regulation Part L2B requirements, thereby substantially reducing the building's heat losses through conduction;
- Mechanical Ventilation with Heat Recovery will be provided to office spaces, reducing the heating loads associated with providing fresh air;
- Domestic hot water will be supplied via electric point of use instant heaters;
- All light fittings will be low energy fittings with a minimum efficacy of 85 lm/W;
- All energy supplies will be metered using smart meters, with energy display devices located in a visible place to enable the tenants to monitor and therefore take actions to reduce their CO_2 emissions;
- The combination of proposed energy efficient measures (Be Lean) result in a reduction in CO_2 emissions of 35.1%;
- The London heat map indicates that there are currently no opportunities to connected to an existing or proposed district heating network in the immediate vicinity;
- The limited size of the development's thermal load and the mismatch with its electrical profile suggest that CHP is not viable for this development (Be Clean);
- An extensive range of low and zero carbon technologies have been considered in terms of providing a proportion of the development's energy demand in line with planning policy (Be Green);
- The analysis indicates that an air source heat pump could replace the conventional plant arrangement, providing both heating and cooling, which could provide a further 1.5% reduction in the site's CO_2 emissions;
- Analysis of the location of plant indicates that a purpose built insulated and acoustically treated internal enclosure within the office space could house the external split of the air source heat pump, with an open façade to the external lightwell promoting ventilation to the system. This ensures that all plant is located within the development demise.

This combination of passive design measures, energy efficient systems and renewable technologies results in the design achieving a 36.6% improvement over the Target Emission Rate (TER), thus complying with Policy 5.2 of the London Plan.

Sustainable measure incorporated into the building's design include:

- All timber used on site will be purchased from responsible sources such as FSC approved vendors;
- New materials will be selected to take into account their overall environmental impacts;
- The existing structure of the basement car park will be reused, reduced the embodied carbon emission associated with new structural elements;
- Recycling facilities will be provided for the tenants to reduce waste during operation;
- All construction on site will be managed in an environmentally sound manner in terms of resource use, storage, waste management, and potential sources of nuisance or pollution.



Carbon Emission Reduction for 20-26 Lamb's Conduit Street

Table 3: Carbon Dioxide Emissions after each stage of the Energy Hierarchy	Carbon dioxide emissions (tonnes)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations	7.9	5.4
Be Lean' - After energy demand reduction	5.2	5.4
Be Clean' - No additional measures	5.2	5.4
Be Green' - After VRF systems	5.0	5.4

Table 4: Regulated carbon dioxide savings from each stage of the Energy Hierarchy	Regulated Carbon dioxide savings	
	Tonnes CO_2 per annum	%
Savings from energy demand reduction	2.8	35.1%
Savings from decentralised energy	0.0	0.0%
Savings from low carbon technology (ASHP - VRF system)	0.1	1.4%
Total Cumulative Savings	**2.9**	**36.6%**
Total Target Savings	3	35%
Annual Surplus	0	-1.6%

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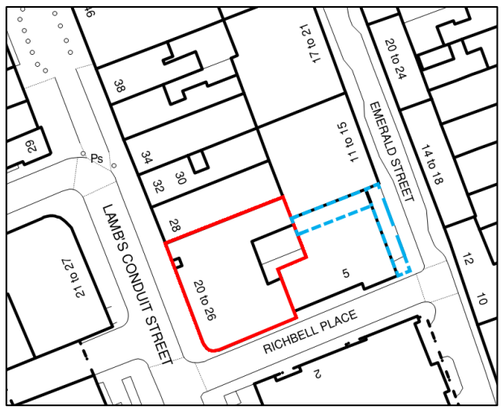
Proposed Site Location



20-26 Lamb's Conduit Street site plan

1. Introduction

The London Borough of Camden set out their approach to sustainable development through their Local Plan.

This report outlines the proposed sustainability and energy strategy for the proposed speculative office development at 20-26 Lamb's Conduit Street. Each of the proposed initiatives has been assessed on the relative sustainability potential, in addition to a "rule of thumb" financial pay back implication.

The principal objectives are to reduce the site's contribution to the cause of climate change by minimising the emissions of CO_2, by reducing the site's needs for energy and by providing some of the requirement by renewable/sustainable means.

Issues such as water and waste, biodiversity, etc. have also been addressed in the present study. This Energy and Sustainability Statement will aim to address the aspirations of both the London Borough of Camden's Local Plan and the Greater London Authority (GLA).

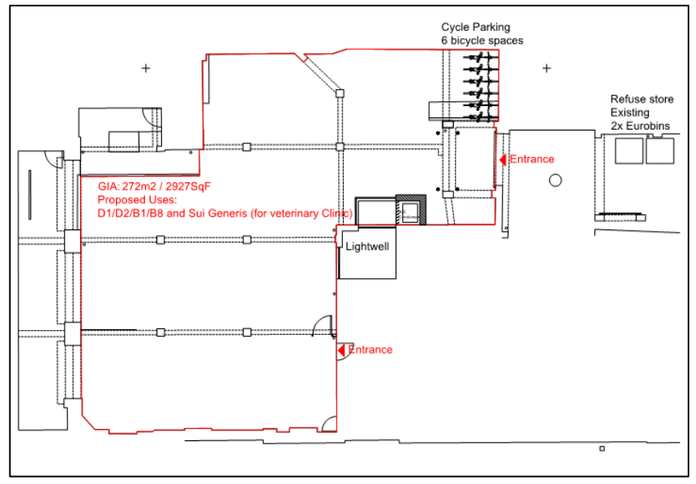
The GLA London Plan and GLA Energy Strategy are considered to be the benchmark for local planning regulation. Together they provide a useful tool against which to undertake energy and sustainability assessment. They have been used in an advisory nature secondary to the requirements of the London Borough of Camden, to help incorporate a number of energy efficiency measures into the proposed development.

This Energy and Sustainability Statement forms a checklist of the sustainable initiatives considered for the proposed development. Each of the proposed initiatives is assessed on the relative sustainability potential, in addition to a "rule of thumb" financial/pay back implication, and suitability to this particular site.

Description of Development

The proposal for the redevelopment of 20-26 Lamb's Conduit Street concerns the change of use of the existing basement car park (ancillary residential Class C3) to a flexible B1/B8/D1/Gym (D2)/veterinary clinic (sui generis) use.

20-26 Lamb's Conduit Street is a 4 storey building located within the central London area. It was originally built as offices (Class B1) and converted to residential (Class C3) in 1996. The building is located outside of the Bloomsbury conservation area, but is located next to a listed building to the north. The floorplan footprint of the office development will be 272m^2, therefore qualifying as a minor development.



Proposed floor plan

2. Planning Policy

The National Planning Policy Framework (NPPF) was published in March 2012, which states a clear presumption in favour of sustainable development. The NPPF supports the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change, and encourage the reuse of existing resources, including conversion of existing buildings, and encourages the use of renewable resources.

The NPPF replaces PPS22 and in Section 10 outlines its energy and climate change policies. To support the move to a low carbon future, local planning authorities should:

- Plan for new development in locations and ways which reduce greenhouse gas emissions;
- Actively support energy efficiency improvements to existing buildings; and
- When setting any local requirement for a building's sustainability, do so in a way consistent with the Government's zero carbon buildings policy and adopt nationally described standards.

In determining planning applications, local planning authorities should expect new developments to:

- comply with adopted Local Plan policies on local requirements for decentralised energy supply unless it can be demonstrated that this is not feasible or viable; and
- take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption;
- have a positive strategy to promote energy from renewable and low carbon sources;
- consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure the development of such sources;
- Identify opportunities where development can draw its energy supply from decentralised, renewable, or low carbon energy supply systems and for co-locating potential heat customers and suppliers.

The key focus of the NPPF is to support local and regional planning authorities.

2.1 The London Plan

The GLA London Plan 2015 and the GLA's Guidance on Preparing Energy Assessments March 2016 document are considered to be the benchmark for local planning regulation. Together they provide a useful tool against which to undertake energy and sustainability assessments. For the purpose of this assessment they have been used in an advisory way secondary to the requirements of the Camden Council, to help incorporate a number of energy efficiency measures into the proposed development.

The London Plan sets out a number of core policies for major developments with regards reducing CO_2 emissions and providing energy in a sustainable manner. As this is as a minor redevelopment it does not technically have to comply with these requirements, but the design team have used them as guidance and sought to achieve them, where possible within the limitations of the existing constrained site.

Policy 5.2: Minimizing Carbon Dioxide Emissions - requires that major developments achieve a 35% improvement over the 2013 Building Regulation CO_2 Emission Target.

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

Policy 5.6: Decentralised Energy - requires all major developments to evaluate the feasibility of connecting to existing or proposed district heating networks and where no opportunity existing consider a site wide Combined Heat and Power (CHP) system.

Policy 5.7: Renewable Energy - requires that all major developments seek to reduce their CO_2 emissions by at least 20% through the use of onsite renewable energy generation wherever feasible. Individual development proposals will also help to achieve these targets by applying the energy hierarchy in Policy 5.2.

20-26 Lamb's Conduit Street is a redevelopment so does not need to meet any of these requirements. However, the Be Lean, Be Clean, Be Green approach will be still be adopted for best practice design.

2.2 London Borough of Camden

The London Borough of Camden set out their approach to sustainable development through their Core Strategy, Development Policies and Supplementary Planning Documents. Core Strategy Policy 13 sets out the overarching approach to sustainability in the borough, with the aims of mitigating and adapting to climate change, promoting local energy generation, managing water resources and reducing carbon dioxide emissions.

The Development Policies provide further detail as to how the Core Strategy policies can be achieved. In this instance *"Development Policy 22 – Promoting Sustainable Design and Construction*" provides the details as to how the targets of CS13 will be meet and states:

"The council will require development to incorporate sustainable design and construction measures. Schemes must:

- Demonstrate how sustainable development principles, including relevant measures set out in paragraph 22.5 below, have been incorporated into the design and proposed implementation; and
- Incorporate green or brown roofs and green walls wherever suitable."

The council will promote and measure the sustainable design and construction by:

- Expecting non-domestic developments of 500sq m of floor space or above to achieve *"very good"* in BREEAM assessments and *"excellent"* from 2016 and encouraging zero carbon from 2019.

The council will require developments to be resilient to climate change by ensuring scheme include appropriate climate change adaption measures, such as:

- Summer shading and planting;
- Limiting run-off;
- Reducing water consumption;
- Reducing air pollution;
- No locating vulnerable uses in basements in floor-prone areas.

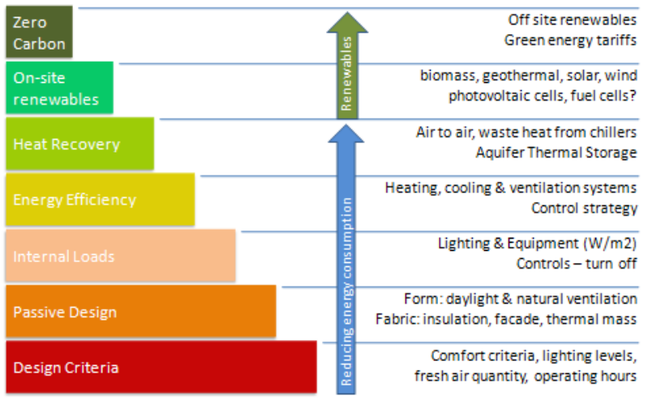
In addition to this policy, the Supplementary Planning Document *"Camden Planning Guidance 3 – Sustainability"* provides greater detail on the targets for developments and the approach that should be adopted in meeting these targets.

As the non-domestic development is less than 500m^2 in area, a BREEAM pre-assessment will not be required as part of the planning submission.

3. Energy Strategy

The design has been developed to reduce its annual energy consumption, whilst providing energy in the most environmentally friendly manner to reduce its annual CO_2 footprint.

The initial focus is on passive building measures such as high levels of insulation and air tightness, followed by energy efficiency. In order to achieve this, a “Steps to Low Carbon” methodology has been applied.



Steps to Low Carbon

3.1 Passive Design

Substantial reductions in energy usage for the scheme can be achieved through the consideration of the passive elements of the design, together with improved occupant comfort. The aim is to optimise the passive building elements and hence reduce the energy consumption associated with the mechanical systems. As this is an existing building the opportunities for passive design elements are limited.

Passive Solar Design – Day Lighting vs. Solar Control

As this is a redevelopment of the basement car park to an office space, there is no opportunity for maximizing daylighting potential.

Building Envelope

Improving the thermal insulation standards beyond the minimum Building Regulation standards will help to reduce the annual CO_2 emissions associated with all of the building’s heating and cooling systems, by limiting the heat loss through the building’s fabric.

Air Permeability

Since the thermal insulation of the external envelope will be improved, an air permeability test will be required. An air leakage rate of $5m^3/hr/m^2$ at 50Pa is targeted. This will be achieved through the addition of new insulation, accredited construction details and approved construction practices on site.

3.2 Energy Efficient Systems & Appliances

After assessing the contribution of the passive elements to the overall energy balance, the aim is to further reduce CO_2 emissions by selecting efficient mechanical and electrical systems and efficient controls to manage the energy used during operation. On the basis of good practice, the following principles will be adopted throughout the proposed development where possible:

Low-Energy Lighting

To reduce the energy consumption associated with artificial lighting, 100% of internal lighting fittings will be energy efficient with a target luminous efficacies in excess of 85 luminaire lumens/circuit Watt in all areas.

Due to the office being located in the basement floor, the use of daylight dimming was not an applicable energy saving measure. Passive infra-red sensors will be used to detect occupancy, with Man On/Auto Off strategy applied to the open office space and an Auto On/Off strategy applied to ancillary areas.

Ventilation – Mechanically Ventilated

Toilets have mechanical extract only, while the office areas will have supply and return air via the air handling units (AHUs). The air handling unit will utilise a plate heat exchanger to recover sensible heat from the exhaust air, preheating incoming fresh air and reducing the heating load associated with it.

HVAC System Plant Efficiencies

The design team will specify all equipment and plant to exceed the minimum requirements of the Non-Domestic Building Services Compliance Guide. This provides guidance on the means of complying with the requirements of Part L2B of the Building Regulations for conventional space heating systems, hot water systems and cooling systems.

Variable Speed Pumps and Drives

All fans and pumps will be specified with variable-speed drives, which can reduce their energy consumption by more than two-thirds compared with equivalent non-variable speed alternatives, by only supplying the required flow rate to meet the demand.

Energy Metering

Metering of the energy uses within the development separately will help the office users identify areas of increased consumption and highlight potential energy-saving measures for the future, hence reducing the associated annual CO_2 emissions from these systems. All electrical supplies will be metered to enable office users to be responsible for their own consumption and hence CO_2 emissions.

3.3 Estimated Annual Energy Consumption

In accordance with the NPPF and London Borough of Camden, the estimated energy consumption for the development has been based on the National Calculation Methodology (NCM).

As the development is a change of use, the proposed design has been assessed against a base case which was modelled with backstop Part L2B fabric and system efficiencies.

The energy assessment has been carried out for the proposed scheme using the approved software IES VE (2016), with the aforementioned passive and energy efficient measures.

The analysis indicates that the proposed Class B1/B8/D1/D2 and Sui Generis speculative space development will perform better than the minimum requirements of the Building Regulations, achieving an improvement of **35.1%.**

In order to improve further the CO_2 emissions, a proportion of the development's energy requirements will need to be meet by on-site energy generation and/or renewable energy technologies.

The following tables indicate the proposed fabric performance and building services data for the Be Lean case.

Building Fabric Performance

Detail	Basecase	Be Lean
Ground floor average area weighted U-value W/m2K	0.7	0.25
External wall average area weighted U-value W/m2K	0.7	0.3
Roof average area weighted U-value W/m2K	N/A	N/A
Air permeability @ 50 Pascals	15 m3/hr/m2	5.0m^3/hr/m^2

Fixed Building Services

Detail	Basecase	Be lean
AHU Specific Fan Power (SFP)	1.7 W/ls	1.60W/l/s
AHU heat recovery sensible efficiency	75%	75%
Dedicated extract SFP	0.4 W/l/s	0.4 W/l/s
WC (arch)	10	10
kitchen - tea making (arch)	10	10
Store room - circulation (ach)	5 (circulation) -6 (store)	5 (circulation) -6 (store)
Heating type	gas-fired boiler - FCUs	heat pump - FCUs
Heating seasonal efficiency	82%	82%
cooling SEER (offices)	4.00	4.00
heating SCoP (offices)	N/A	N/A
FCUs SFP (W/ls)	0.5	0.25
Metering with 'out of range' warnings present	Yes	Yes

Domestic Hot Water - Fixed Building Services

Detail	Basecase	Be Lean
DHW distribution delivery efficiency **(instant heating)**	100%	100%
DHW storage tank factory insulation (Kwh/(l.dia))	N/A	N/A
DHW storage tank volume(l)	N/A	N/A

Lighting - Fixed Building Services

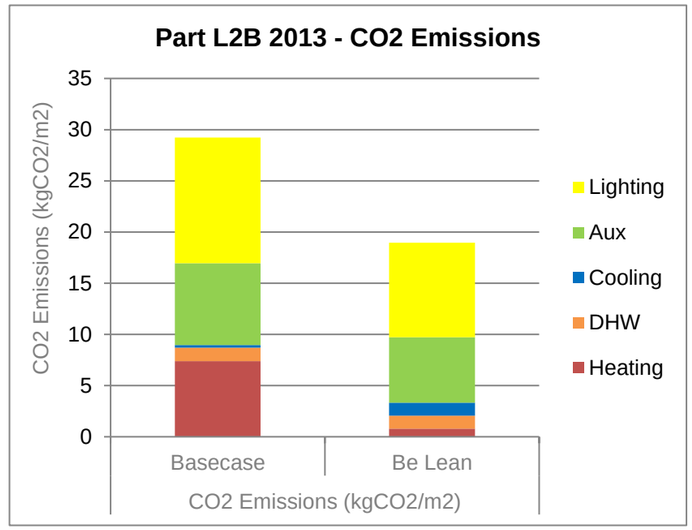
Detail	Basecase	Be lean
Office lighting efficacy	60 lm/W	85 lm/W
Stairs, Toilets and Circulation effiucacy	60 lm/W	85 lm/W
Light switching - Offices - Manual On/Auto off		
Light switching - Circulation - Auto On/Off		
Light switching - Toilets - Auto On/Off		
Provision for metering and ability to draw attention to out of range values		
Constant illuminance control on all luminaires		

Building Details

Detail	Basecase	Be lean
Whole site electrical power factor	<0.9	>0.95
Full BEMS system with the ability to draw attention to 'out of range' values		
All fans & pumps will be fitted with variable speed equipment		

Part L2B Results

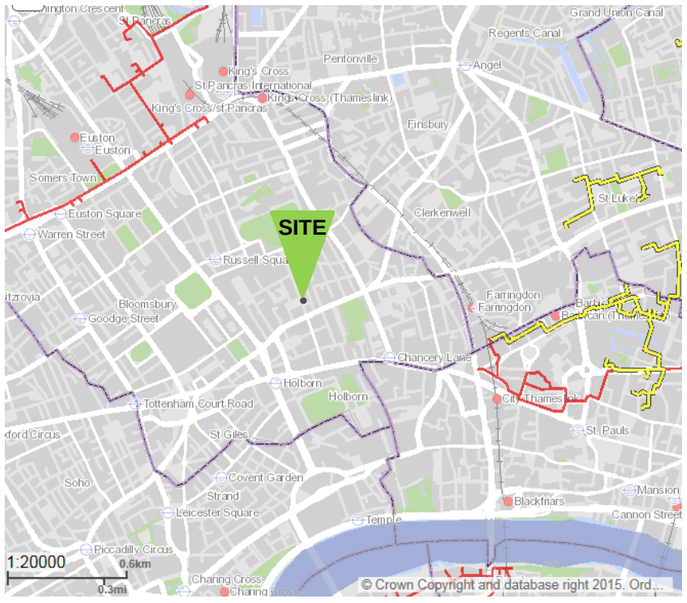
	CO_2 Emissions ($kgCO_2/m^2$)	
System	Basecase	Be lean
Heating	7.39	0.80
DHW	1.31	1.27
Cooling	0.25	1.27
Aux	8.01	6.39
Lighting	12.26	9.22
Renewables	0.00	0.00
Total (kgCO2/m²)	29.22	18.95
CO2 reduction from baseline		**35.1%**
		PASS



4. Decentralised Energy Networks

The feasibility of connecting to an existing or proposed district network has been investigated for the site in accordance with Policy 5.6 of the London Plan.

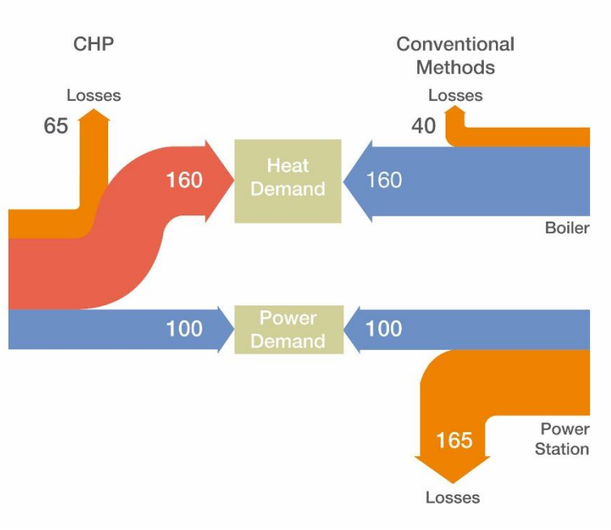
The London Heat Map indicates that the nearest district heating network is more than 900m away, which is considered financially and technically unviable for connection. In addition, it is not practical to provide space for future connection due to the small scale of this development and its low heat demand due to the improvements already being made to the fabric and building services systems.



District Heating Networks in Proximity to the site (yellow = potential, red = installed)

5. Combined Heat & Power (CHP)

In accordance with the Decentralised Energy Hierarchy in Policy 5.6 (Be Clean) the feasibility of a CHP network has been investigated. However, the minor size of the development and its predicted energy demands are insufficient to support the efficient operation of a CHP unit.



CHP Efficiency Diagram

The Domestic Hot Water (DHW), which normally provides the base load for a CHP, is a very small proportion of the overall heat load with heating being the predominate requirement. This is to be expected given the size and type of use. As such, the operational hours of a CHP in an office type development, will not be suited to the efficient operation of CHP units.

Furthermore, the development is located within an Air Quality Management Area and therefore the NOX emissions off any heat generation plant is tightly regulated. Any CHP would require expensive and bulky catalytic converters which would not be feasible considering the scale of the development.

Therefore, CHP is not considered viable for the proposed development.

6. Low and Zero Carbon Energy Sources

Policy 5.7 of the London Plan requires that all major developments seek to reduce their CO_2 emissions by at least 20% through the use of onsite renewable energy generation wherever feasible. Despite this not being a major development, the following technologies have been investigated to determine the feasibility of delivering a reduction in the CO_2 emissions through renewables. The feasibility of each of the energy sources listed has been assessed with regards to the potential contribution each could make to supply a proportion of the development's delivered energy requirement, whilst considering the technical, planning, land use and financial issues.

6.1.1 GSHP (Ground Source Heat Pumps)

Ground sourced heat pumps differ from air source heat pumps in that they extract heat from the ground and pump it into a building to provide space heating and to pre-heat domestic hot water. In the summer months this process can be reversed, rejecting heat to the ground, to meet the cooling requirements of a building.

The site has an imbalance in the heating and cooling requirements meaning that a large ground collector array would be required to meet the annual heating load without depleting the resource available. A ground collector of the size required is not viable given the scale of the development and the constrained nature of the site.

6.1.2 Wind Turbines

The output from wind turbines are highly sensitive to wind speed. Hence it is essential that turbines should be sited away from obstructions, with a clear exposure or fetch for the prevailing wind.

The location of the site in a densely populated area, coupled with the likely reduced output available due to turbulent wind flow across the site means that wind turbines are not considered appropriate for this development.

6.1.3 Solar Thermal

Solar thermal collectors utilises solar radiation to heat water for use in water heating of a building. The optimum orientation for a solar

collector in the UK is a south facing surface, tilted at an angle of 30º from the horizontal.

Solar thermal collectors are not considered to be an appropriate solution for 20-26 Lamb's Conduit Street due to the low domestic hot water demand and therefore the limited energy savings that could be achieved if this system was to be installed. Furthermore, a solar thermal collector system is not easily compatible with the proposed electric point of use water heater system.

6.1.4 Biomass Heating

Biomass in the form of logs, wood chips and wood pellets are classified as a renewable source of energy due to the fact that the carbon dioxide emitted when the biomass is burned has been taken out of the atmosphere by the growing plants. Even allowing for emissions of carbon dioxide in planting, harvesting, processing and transporting the fuel they will typically reduce net CO_2 emissions by over 90%.

Biomass boilers have high particulate emissions which typically raises concerns as central London suffers from poor air quality. Additionally, the location of the building makes the delivery of fuel on site very difficult. Therefore, given the location of the site, biomass boilers are not being considered appropriate.

6.1.1 Photovoltaics

Photovoltaic solar cells convert solar energy directly into electricity. The cells consist of two layers of silicon with a chemical layer between. The incoming solar energy charges the electrons held within the chemical. The energised electrons move through the cell into a wire creating an electrical current.

The adjacent buildings, located to the south side of 20-26 Lamb's Conduit Street building provides shading to a significant proportion of the roof area, therefore there are limitations on roof space availability for the installation of PVs. Therefore, the installation of photovoltaic panels on the roof is not considered an appropriate solution in this case.

6.1.2 ASHP (Air Source Heat Pump)

Air source heat pumps exchange heat between the outside air and a building to provide space heating in winter and cooling in the summer months. The efficiency of these systems are inherently linked to the ambient air temperatures.

Heat pumps supply more energy than they consume, by extracting heat from their surroundings. Heat pumps can supply as much as 3kW of heat output for just 1kW of electrical energy input. They can also be used to provide cooling.

They are most efficient when they work at lower temperatures, typically around 40ºC. As the output temperature increases above this the efficiency of the system drops off.

Replacing the conventional boiler and chiller arrangement with a split unit air source heat pump is the preferable solution for this project.

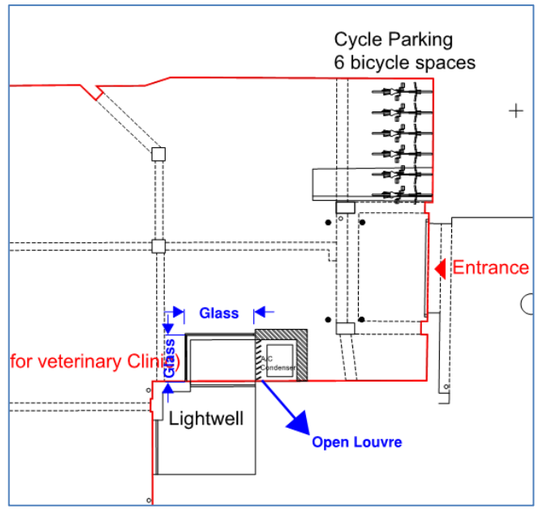
A feasibility study shows that up to 1.5% additional reduction in CO_2 emissions could be achieved with the installation of an ASHP.

An ASHP system can operate efficiently in 20-26 Lamb's Conduit Street and therefore is considered an appropriate solution in this case. ASHPs also avoid the NOx emission issues that preclude the inclusion of CHP or biomass as heating solutions.

The external split units will be located in an acoustically treated enclosure to limit visual and acoustic disturbance. One constraint to the site is that there is no external space available for any plant. As the air source heat pumps have an external element that needs to be located in the ambient environment, this enclosure must be open to the elements.

The proposed solution is to create an internal enclosure, as per adjacent drawing, along the line of insulation and acoustically treated, that will house the split unit whilst also having a perforated façade to the lightwell, allowing air flow.

This solution means that all HVAC plant for the development is located internally.



Location of Internal Plant Enclosure

7. Energy Strategy

7.1 Proposed Energy Strategy

Although the proposed development is not a major development, we have followed the methodology of the Mayor's Energy Hierarchy and the London Borough of Camden's policy, with the estimated energy consumption for the development based on the National Calculation Methodology (NCM) calculated with the approved software IES VE (2016).

The basement area will be well insulated ensuring heat losses are kept to a minimum with enhanced fabric U-values and improved detailing making the development significantly more air tight. Energy efficient lighting and metering will be used to ensure that the tenants will be informed on the performance of the development.

A mechanical ventilation system with heat recovery will provide fresh air for the occupants and further reduce the heat demand on the heating system. Domestic hot water will be supplied via instant heaters at point of use. For the Be Lean case, the calculations were based on a conventional boiler and chiller arrangement serving fan coil units.

The combination of passive and energy efficiency measures result in this office development achieving an area weighted improvement of **35.1%** over the Building Regulations target (Baseline).

Renewable and low-carbon energy strategy

Analysis of the London Heat Map indicates that there are no district heat networks within a feasibly connectable distance to the development. Furthermore, the minor heat load of the office would not justify the extension of any existing network.

The minor base heating load also means that a combined heat and power unit is not suited for this development. The CHP unit would struggle to achieve the run hours required to justify it with regards to both CO_2 emissions and financial performance.

In accordance with Policy 5.7 (Be Green) of the London Plan, investigations into providing a proportion of the site's energy requirements through renewables or low-carbon technologies were undertaken.

The feasibility study indicates that a heat pump system is the most appropriate technology for the site and that a system could provide a further **1.5%** reduction in the site's CO_2 emissions. This system would replace the conventional boiler and chiller plant as the source of both heating and cooling.

Design of the heat pump plant means that it is fully located within the demise of the development.

The combination of the measures identified in this report could provide an overall reduction of **36.6%** of the Building Regulations 2013 requirements, as shown in the graph and table below.

Whilst not required under London Plan guidelines, the development has followed the Energy Hierarchy and is achieving Policy 5.2, demonstrating an overall reduction in CO_2 emissions of more than 35% over the Target Emission Rate.

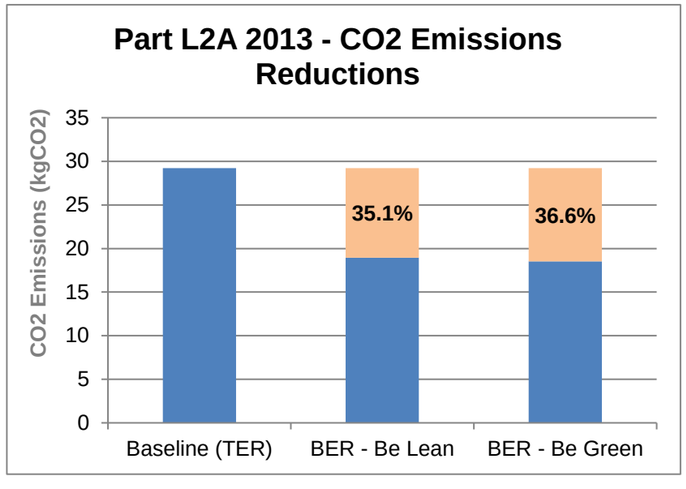


Table 3: Carbon Dioxide Emissions after each stage of the Energy Hierarchy	Carbon dioxide emissions (tonnes)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations	7.9	5.4
Be Lean' - After energy demand reduction	5.2	5.4
Be Clean' - No additional measures	5.2	5.4
Be Green' - After VRF systems	5.0	5.4

Table 4: Regulated carbon dioxide savings from each stage of the Energy Hierarchy	Regulated Carbon dioxide savings	
	Tonnes CO_2 per annum	%
Savings from energy demand reduction	2.8	35.1%
Savings from decentralised energy	0.0	0.0%
Savings from low carbon technology (ASHP - VRF system)	0.1	1.4%
Total Cumulative Savings	**2.9**	**36.6%**
Total Target Savings	3	35%
Annual Surplus	0	-1.6%

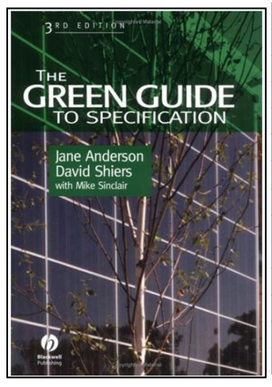
8. Materials

Building and construction activities worldwide consume 3 billion tons of raw material each year, which account for approximately 50% of total global consumption. Using green/sustainable building materials and products promotes conservation of dwindling non-renewable resources. In addition, integrating sustainable building materials into building projects can help reduce the environmental impacts associated with the extraction, transport, processing, fabrication, installation, reuse, recycling, and disposal of these source materials.

The aim for the proposed 20-26 Lamb's Conduit Street redevelopment will be for its overall environmental impact to be minimised through the specification of sustainable materials.

8.1 Environmental Impact of Materials

New materials with low overall environmental impact will be chosen and advice from the Green Guide to Specification will be taken into consideration for the selection. The Green Guide rates the environmental impact of different materials and components, taking into account factors like toxicity, ozone depletion, ease of recycling, waste disposal etc. Where viable, at least 80% (by area) of the new main elements in the building, fabric & building services insulation should be specified to achieve the best performing "A" and "A+" ratings from the Green Guide.



Environmental Issue
Climate Change*
Water extraction
Mineral extraction
Stratospheric ozone depletion*
Human toxicity
Ecotoxicity to freshwater
Higher level nuclear waste
Ecotoxicity to land
Waste disposal
Fossil fuel depletion
Eutrophication*
Photochemical ozone creation*
Acidification*

The 13 Environmental Issues assessed by the Green Guide

8.2 Sustainable Timber

All timber used for basic or finishing building elements will be sourced from responsibly managed and sustainable forests or plantations. Such timber products are the only truly renewable construction material in common use and growing trees also absorb and fix CO_2. Forests can also provide the habitat for a wide variety of plant and animal life, preserving important ecology and promoting biodiversity.

8.3 Locally Sustainable Materials

The GLA's SPG states that 50% of timber and timber products are to be sourced from Forest Stewardship Council (FSC) approved timber and balance from a known temperate source. The design team will commit to at least 50% FSC approved timber and 100% legally sourced timber for the proposed development. Where practicable, materials should be sourced from local suppliers, reducing the environmental impacts and CO_2 emissions associated with transportation to the site.

8.4 Recycled Materials

Scope for increased recycling will be incorporated by specifying recycled materials where possible and ensuring that even where new materials are used, as much as possible can be recycled at the end of the buildings' life.

The design team will also commit to minimising the use of new aggregates thus complying with the Mayor's Essential Standards.

Specifying materials with a high-recycled content is also another method of saving processing or manufacturing energy. The recycled content of a material can be described as either post-consumer or post-industrial to indicate at what point in the life cycle a material is reclaimed.

As the development is a change of use, it is expected to retain the structure of the original car park, reducing the embodied carbon emissions associated with new structural elements.

8.5 Ozone Depletion and Global Warming

Fluorinated greenhouse gases (F-gases), including HFCs, commonly used in insulation materials and refrigerants, can cause long-term damage to the Earth's stratospheric ozone layer, exposing living organisms to harmful radiation from the sun. They also significantly increase global-warming if they leak into the atmosphere. Following the Montreal Protocol, the production of numerous substances that are responsible for ozone depletion (such as the CFCs) had been phased out.

New regulation which applies from 1st January 2015 strengthens the existing measures and requires the EU's F-gas emissions to be cut by two-thirds by 2030 compared to 2014 levels. Climate friendly alternatives are readily available for many of the products and equipment in which F-gases are commonly used today.

9. Water Conservation

Water consumption in the UK has risen by 70% over the last 30 years. Trying to meet the increasing demand by locating new sources of water supply is both expensive and damaging to the environment. Therefore, the design team have focused on reducing the demand for water and managing the existing resources.

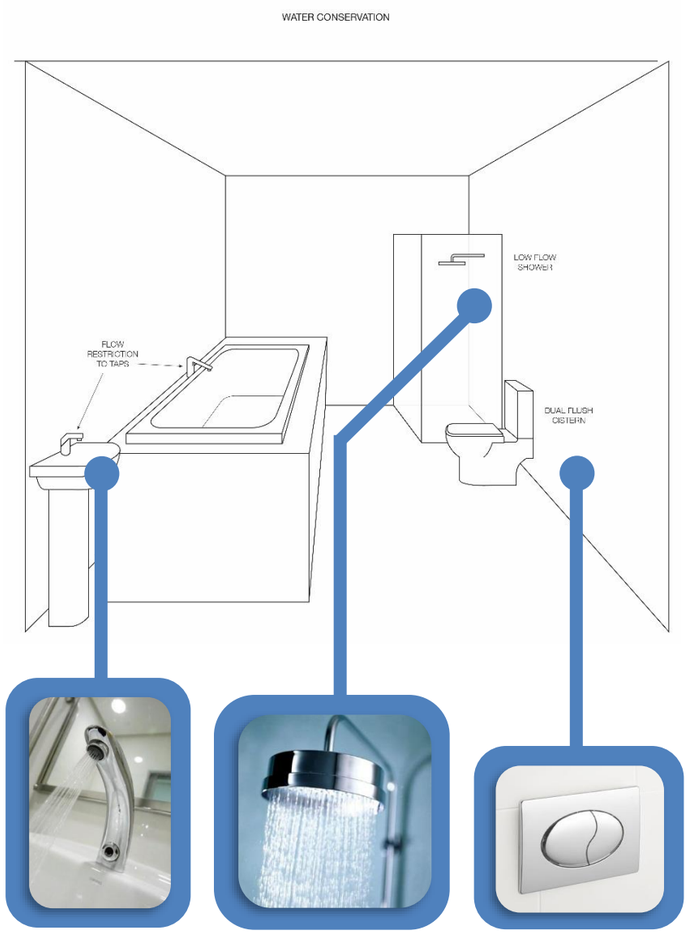
9.1 Demand Reduction and Water Efficiency

The aim is to minimise internal and external potable water use within the development. Good water management can contribute to reducing the overall level of water consumption maintaining a vital resource and having environmental as well as cost benefits in the life-cycle of the building. The following water saving measures are being considered for a range of areas in line with the BREEAM requirements which are good practice benchmarks for consumption:

Dual Flush Cisterns on WC's - These units have the ability to provide a single flush of 4L and/or a full flush of 6L.

Flow Restrictors to Taps - Flow restrictors reduce the volume of water discharging from the tap. Spray taps have a similar effect and are recommended to reduce both hot and cold-water consumption. Low flow taps in one of the above forms will be installed in all of areas.

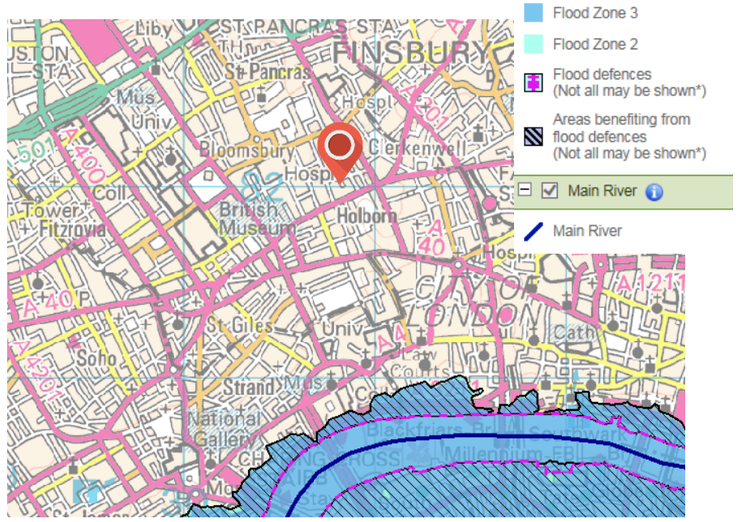
Water Meters - In 1995 approximately 33,200 million litres of water a day were extracted in England and Wales, this increased to 44,130 million litres/day in 2001, and much of this was for domestic water supply. To reduce this figure, accurate information on usage is required for management of a building's consumption. Water meters will be specified on the main supply.



10. Sustainable Urban Drainage

As this project is a minor redevelopment there is no opportunity to incorporate urban drainage techniques.

However, the Flood Map of the Environment Agency was used to assess the risk of flooding from rivers and sea to the area. The map shows that the area of 20-26 Lamb's Conduit Street is outside Zone 2 and 3 and therefore there is less than 0.1 percent annual probability of river or sea flooding.



20-26 Lamb's Conduit Street – EA Flood Map

As a minimum, the design will ensure that the peak rate of runoff into watercourses is no worse than the existing site's run off rate. This will comply with the Interim Code of Practice for Sustainable Drainage systems (SUDS) (CIRIA, 2004) or for at least the 1 year and 100 year return period events. Integrating these with the design will be investigated at the detailed design stage.

11. Waste Management

Buildings and building sites produce a significant amount of waste per year. Most of the waste produced in the UK is disposed of in landfill sites and only a small percentage of it is recycled or reused.

11.1 Waste Targets

Under EU legislation the UK will have to ensure that less than a third of its waste is sent for burial in landfill sites by 2020. To achieve this target a number of measures are implemented, including landfill tax, aiming to discourage disposal of waste to landfill. Good waste management is a key component of sustainable development. Reducing waste is an important means of:

- Reducing unnecessary expenditure
- Reducing the amount of natural resources used for production of new materials
- Reducing energy for waste disposal
- Reducing levels of contamination and pollution arising from waste disposal

The proposed development will minimise the impact of waste in the environment where possible.

11.2 Construction

During the refurbishment phase an amount of waste material will be generated through construction. In building construction, the primary waste products in descending percentages are: wood, asphalt/concrete/masonry, drywall, roofing, metals, and paper products.

Prior to commencement on site a Site Waste Management Plan (SWMP) that complies with the requirements of current legislation will be prepared. This plan will identify the local waste haulers and recyclers, determine the local salvage material market, identify and clearly label site spaces for various waste material storage and require a reporting system that will quantify the results and set targets. As a minimum the SWMP will contain:

a. The target benchmark for resource efficiency e.g. m^3 of waste per $100m^2$ or tonnes of waste per $100m^2$;
b. Procedures and commitments for minimising non-hazardous waste in line with the benchmark;
c. Procedures for minimising hazardous waste;
d. Procedures for monitoring, measuring and reporting hazardous and non-hazardous site waste;
e. Procedures for sorting, reusing and recycling construction waste into defined waste groups either on site or through a licensed external contractor;
f. The name or job title of the individual responsible for implementing the above.

11.3 Waste Management & Reporting in Operation

The detailed design phases will identify the potential waste streams that the development will produce. At a minimum, plans will be formulated to handle the separation, collection, and storage of common recyclable materials such as paper, glass, plastics, and metals. The collection points will be easily accessible to all of the users.

The main aim will be to recycle as much waste as possible; this will be achieved by making sure that waste recycling facilities are strategically placed in convenient locations.

The space allocated for waste storage should be able to accommodate containers with at least the minimum volume recommended by British Standard 5906 (British Standards, 2005) based on a maximum collection frequency of once per week.

Dedicated storage space for recyclable materials generated by the site during occupation, will include the following:

- Be clearly labelled for recycling;
- Be placed within accessible reach of the buildings;
- Be in a location with good vehicular access to facilitate collections;

Integrated recycling bins

12. Environmental Management

12.1 Construction

Construction sites are responsible for significant impacts, especially at a local level. These arise from noise, potential sources of pollution and waste and other disturbances. Impacts such as increased energy and water use are also significant. Therefore, attention is being given to site-related parameters with the aim to protect and enhance the existing site and its ecology.

The aim is to have a construction site managed in an environmentally sound manner in terms of resource use, storage, waste management, pollution and good neighbourliness. To achieve this, there will be a commitment to comply with the Considerate Constructors Scheme. As a minimum a score of greater than 35 of out 50 will be targeted with an aspiration to exceed 40, with no individual section achieving a score of less than 7.

Areas that can be taken into consideration in order to minimise the impact of the construction site on its surroundings and the global environment are as follows:

- Monitor, report and set targets for CO_2 or energy usage arising from site activities;
- Monitor, report and set targets for CO_2 or energy usage arising from transport to and from site;
- Monitor, report and set targets for water consumption arising from site activities;
- Monitor construction waste on site, sorting and recycling construction waste where applicable;
- Adopt best practice policies in respect of air and water pollution arising from site activities;
- Operates an Environmental Management System;
- Additionally, all timber used on site should be responsibly sourced.

13. Pollution

Global concern for environmental pollution has risen in recent years, as concentrations of harmful pollutants in the atmosphere are increasing. Buildings have the potential to create major pollution both from their construction and operation, largely through pollution to the air (dust emissions, NOx emissions, ozone depletion and global warming) but also through pollution to watercourses and ground water. The proposed development will aim to minimise the above impacts, both at the design stage and on-site.

13.1 Ozone Depletion

Fluorinated greenhouse gases (F-gases), including HFCs, commonly used in insulation materials and refrigerants, can cause long-term damage to the Earth's stratospheric ozone layer, exposing living organisms to harmful radiation from the sun.

New regulation which applies from 1st January 2015 strengthens the existing measures and requires the EU's F-gas emissions to be cut by two-thirds by 2030 compared to 2014 levels. Climate friendly alternatives are readily available for many of the products and equipment in which F-gases are commonly used today.

Where refrigerants are used for air-conditioning and comfort cooling they will be CFC and HCFC-free.

13.2 Internal pollutants

Volatile organic compounds (VOCs) are emitted as gases (commonly referred to as off-gassing) from certain solids or liquids. VOCs include a variety of chemicals, some of which are known to have short-term and long-term adverse health effects. Concentrations of many VOCs are consistently higher indoors (up to ten times higher) than outdoors.

VOCs are emitted by a wide array of products numbering in the thousands. Examples include: paints and lacquers, paint strippers, cleaning supplies, pesticides, building materials, furnishings, adhesives, Urea-formaldehyde foam insulation (UFFI), pressed wood products (hardwood plywood wall panelling, particleboard, fibreboard) and furniture made with these pressed wood products.

'No' or 'low' VOC paints are available from most standard mainstream paint manufacturers. These 'eco-friendly' paints are made from organic plant sources and also powdered milk based products.

The design team will seek to select internal finishes and fittings with low or no emissions of VOCs and comply with European best practice levels as a minimum.

13.3 NOx emissions from boilers

Nitrous oxides (NOx) are emitted from the burning of fossil fuels and contribute to both acid rain and to global warming in the upper atmosphere. At ground level, they react to form ozone, a serious pollutant and irritant at low level. Burners in heating systems are a significant source of low-level NOx, while power stations (and therefore electric heating) are a significant source of NOx in the upper atmosphere.

The amount of NOx emissions varies between products. New gas boilers vary from 40 NOx/kWh to <70mg NOx/kWh (class 5).

The proposed high efficiency electric point of use water heaters will be used for DHW, while cooling and heating demand will be satisfied by the ASHP system. These HVAC systems emit no local NOx emissions.

14. Green Transport

The transport of people between buildings is the second largest source of CO_2 emissions in the UK after energy use in buildings and remains the main source of many local pollutants. Energy use and emissions from transport are growing at 4% per year, and at the same time, the effects of climate change are becoming more severe; there will be greater pressure to control CO_2 emissions from transport and sites without good access to public transport will be at much greater risk from these controls.

14.1 Site location

The site for the proposed 20-26 Lamb's Conduit Street development is located within the central London area, just outside the Bloomsbury conservation area. The site is also approx. 620m away from Holborn Underground station.

The provision of local bus stops, plus the proximity to the Underground stations at Russell Square and Holborn, plus location with respect to the National Rail station at Farringdon means the site achieves a Transport Accessibility rating of 6b, the highest possible.

14.2 Cycling Facilities

A secure cycling store will be provided for the office in order to encourage the occupants to use this carbon-free mode of transport. Six dedicated bike storage spaces are provided.

14.3 Car Parking Spaces

The proposed redevelopment of the basement space does not include any parking space. This will promote the use of public transport and low carbon transport such as cycling.