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6 Erskine Road
Energy strategy
Planning Statement

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Introduction	The proposed development at 6 Erskine Road is required to make carbon emission reductions in accordance with the London Plan's Energy Hierarchy. More specifically, Camden Council requires the scheme to achieve carbon reductions of 20% after energy efficiency measures through the use of renewable energy technologies.
Aim of this Study	The aim of this study is to review feasible carbon emissions reductions through low and zero carbon technologies, with a target of a 20% reduction, as set out in the London Renewables Toolkit. This report demonstrates how the site has followed the London Plan's Energy Hierarchy by reducing energy demand through passive design, energy-efficiency measures, generating heat in a clean and efficient system and by using on-site renewable energy systems to further reduce the overall carbon emissions of the development.
Methodology	The methodology used in this report follows the guidance set out by the Greater London Authority (GLA) for developing energy strategies as detailed in the following; "GLA Energy Planning - Guidance on Energy Assessments", September 2011. In particular, the London Plan's Energy Hierarchy has been observed. Energy consumption figures for this commercial scheme are based on data from SBEM modelling produced using Integrated Environmental Solutions (IES) software. Energy consumption figures, for the residential part of the scheme are based on SAP modelling data produced under NHER Building Regulations software. Data regarding renewable energy technologies and carbon saving calculations have been made using NHER SAP software, which is accredited by the BRE. These findings are subject to detailed analysis from a services engineer and quantity surveyor.
Site description	The proposed scheme is located in Camden, London, and comprises three office blocks and one new residential block (Leeder House). Two other blocks will have new services retrofitted and building fabric improvements undertaken such as new glazing, insulation and a new roof. One block will be demolished and entirely newly built.

Executive Summary
6 Erskine Road

Performance	It is the suggestion of this report that a 25.84% reduction in carbon dioxide emissions after the implementation of energy efficiency measures can be achieved through the installation of an Air Source Heat Pump (ASHP) for space heating and cooling, 24 kWp (135 m^2, 92 panels) of monocrystalline/amorphous hybrid photovoltaic panels to supply a proportion of the electricity demand, and 9.6 m^2 of solar thermal panels to supply a proportion of the hot water demand of the proposed scheme. The requirement of meeting a 20% reduction in carbon emissions through the use of on-site renewables will be achieved on this site. The location of solar PV and thermal panels has been maximised to include all applicable areas and beyond the ASHP system there are no alternative sources of renewable energy that are feasible on this scheme. In relation to the London Plan, the site carbon reduction from renewable technologies achieves a 38.26%, (this excludes the unregulated carbon emissions). In addition, energy efficiency measures have been fully explored and implemented on this part refurbishment, part new build. The energy strategy will meet the requirements for achieving 60% of the energy credits under BREEAM for Offices 2008, in line with Camden Council requirements. The apartments will achieve a 25% carbon reduction to meet the minimum Code for Sustainable Homes Level 4 requirements.

Planning Requirement
6 Erskine Road

Planning Conditions	The development falls under the London Borough of Camden. Amongst the planning policies imposed by the Council, the development will follow the energy hierarchy approach with a view to reducing carbon energy emissions by a target of 20% by using renewable energy.
Energy Statements	Applications for major developments should be accompanied by an energy statement, which provides information as set out below: - A calculation of the baseline energy requirements and CO_2 emissions including regulated emissions (i.e. space heating, hot water, fixed electricity) and unregulated emissions (i.e. the emissions associated with energy use not covered under Part L of Building Regulations (appliances, cooking)). - Baseline regulated emissions should equal the scheme with energy efficiency measures using SAP (Standard Assessment Procedure) or SBEM (Simplified Building Energy Model) modelling. - Unregulated emissions can be estimated using a methodology such as CIBSE Guide F benchmarks. - Calculation of the 'energy efficient' baseline (i.e. the reduced energy demand and CO_2 emissions after the application of energy efficient measures and decentralised energy provision) and predicted target for CO_2 reduction through renewables. - An assessment of the feasibility of different renewable technologies on the site and the potential contribution to CO_2 reduction from each option, explaining which technologies have been investigated and why any technologies have been ruled out (i.e. technical limitations, costs, etc). -
Remit of this report	This report aims to provide cost-effective options to meet carbon emission reductions for the development, through renewable sources. Calculations were carried out using IES software, which is compliant with Building Regulations.

Energy Hierarchy
6 Erskine Road

London Plan Energy Hierarchy Taken from GLA Energy Planning - Guidance on Energy Assessments,	The London Plan's Energy Hierarchy takes a 'whole energy' approach and addresses energy efficiency use, energy supply efficiency and use of renewable energy. The purpose is to demonstrate that climate change mitigation measures are integral to the scheme's design and evolution, and that they are appropriate to the context of the development.
Be Lean	Demand reduction (Be Lean) measures specific to the scheme are encouraged at the earliest design stage of a development and aim to reduce the demand for energy. Measures typically include passive design: both architectural and building fabric measures, and active design: energy efficient services. It is possible to exceed Building Regulations requirements (Part L 2010) through demand reduction (Be Lean) measures alone.
Be Clean	A 'clean' energy supply refers to the energy efficiency of heating, cooling and power systems. Planning applications should demonstrate how the heating, cooling and power systems have been selected to minimise CO_2 emissions in accordance with the order of preference in Policy 5.2, such as through high-efficiency CHP units or low NOx gas boilers.
Be Green	Use of renewable energy in developments is encouraged at the 'Be Green' third stage. Each renewable energy technology in Policy 5.7 of the London Plan is technically feasible in London and each should be considered in the Energy Assessment. An assessment of what is achievable and compatible with the measures implemented in Be Lean and Be Clean is also required.

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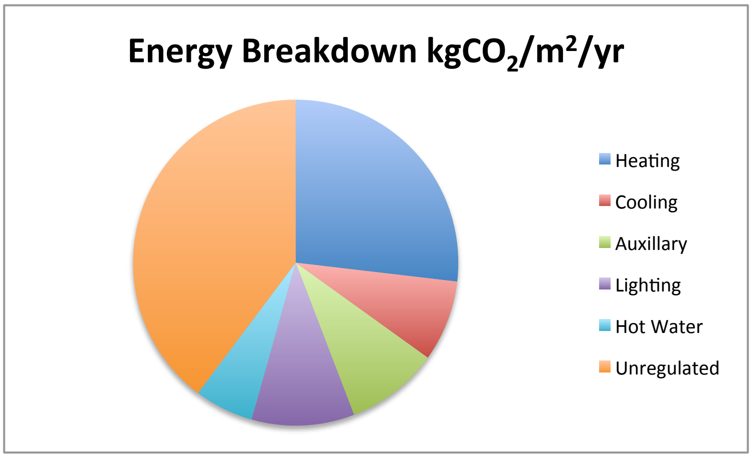
Carbon Emission Profile
6 Erskine Road

Introduction

The scheme comprises three office blocks and one residential block, one of which will be demolished and entirely newly built. The total area is 3,366 m^2. SBEM modelling of the offices has been undertaken using IES and the SAP modelling of the residential units has been undertaken using NHER to estimate the likely energy demands and carbon emissions of the proposed scheme after the implementation of energy efficiency measures (i.e. 'Be Lean' stage). This is shown below.

Carbon Emissions in $kgCO_2/m^2/yr$	Heating	Cooling	Hot Water	Fans and Pumps	Lighting	Unregulated
	10.95	3.28	2.39	3.77	4.17	16.20

Graph showing the site-wide carbon emissions breakdown in terms of heating, hot water, cooling, lighting, fans and pumps and unregulated emissions over the course of a year



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'Be Lean': Energy Efficiency Measures Offices
6 Erskine Road

Energy Efficiency Targets

As mentioned previously, energy efficiency measures through optimising the building fabric will be incorporated to reduce the energy demand and carbon footprint of the proposed scheme. With those measures outlined below, annual carbon emissions from the development are predicted to be 161,454 $kgCO_2$.

U-Values Modelled

Element	Proposed U-Value New Build (W/m^2K)	Proposed U-Value Refurbishment (W/m^2K)
Roof	0.18	0.20
Walls	0.20	0.35
Floors	0.20	0.20
Windows	1.3	1.7

Air-Tightness and Thermal Bridging

A high performance building with good air tightness levels is to be achieved such that the proposed scheme does not exceed air permeability levels during testing of 7.5 $m^3/hr/m^2$ at 50 Pa for the new build sections and 10 $m^3/hr/m^2$ at 50 Pa for the refurbishment sections. This will be achieved through ensuring that sensitive areas are accounted for in the design and construction phases to make certain that a tightly sealed building is constructed and all punctures through the seal are air-tight. In particular, attention will be paid to major openings as well as minor openings such as services and downlighters at roof level.

Lighting

Lighting will meet a targets 2.5 W/m^2 100Lux. The fittings will be in accordance with Part L requirements.

Ventilation

The offices will be mechanically ventilated. The ventilation will include heat recovery and will have a Specific Fan Power of 1.6W/l/s. WC's are included in each office and a mechanical extract will be included in each WC. The mechanical extract will have a flow rate of 10 ach, and a maximum specific fan power of 0.5 W/l/s.

Cooling

Cooling will be provided within the offices the fan coil unit will have a Specific Fan Power of 1.4W/l/s.

Heating

The 'Be Lean' stage assumes space heating and hot water are provided by an efficient gas fired boiler system with an efficiency of 87%.

'Be Lean': Energy Efficiency Measures Residential
6 Erskine Road

U-Values Modelled	

Element	Building Regulations Minimum U-Value (W/m^{2}K)	Proposed U-Value Refurbishment (W/m^{2}K)
Roof	0.20	0.15
Walls	0.30	0.15
Floors	0.25	0.12
Windows	2.2	1.5

Air-Tightness and Thermal Bridging	A high performance building with good air tightness levels is to be achieved such that the proposed scheme does not exceed air permeability levels during testing of 3 m^3/hr/m^2 at 50 Pa.
Lighting	All light fitting will be dedicated low energy fitting in accordance with Part L 1A2010 requirements.
Ventilation	A centralised mechanical ventilation without heat recovery will be included in each unit.
Cooling	Cooling will not be provided in the apartments.
Heating	The 'Be Lean' stage assumes space heating and hot water are provided by an efficient condensing gas combi- boiler system with an efficiency of 89%.

'Be Clean': Use of Combined Heat and Power

6 Erskine Road

Use of Combined Heat and Power

Combined Heat and Power (CHP) is not considered a viable option to reduce the carbon emissions of the scheme. This section demonstrates how decentralised energy generation has been considered in accordance with the Mayor's London Plan section 5.6. The following guidance hierarchy was followed:

Option One - Connection to existing CCHP/CHP networks
This option is not deemed feasible in this instance due to the lack of an existing CCHP/CHP network in the vicinity of the proposed development.

Option Two – Site-wide CCHP/CHP generation powered by renewables
CCHP/CHP generation powered through renewables such as biomass is not considered feasible in this instance due to issues relating to air quality.

Option Three - Gas CCHP/CHP accompanied by renewables
A gas CHP is not deemed appropriate, as there is insufficient heat load in summer months to ensure quality CHP and to make the savings and returns from the investment. However, renewable energy technologies will be incorporated into the scheme where feasible (see next page).

Summary

With no CCHP/CHP system specified, annual carbon emissions from the development at the 'Be Clean' stage are predicted to be 137,237 $kgCO_2$.

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'Be Green': Renewable Energy Technologies
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Feasible Renewable Energy Technologies	A reduction in carbon emissions through the use of on-site renewable energy can be achieved through several technologies to generate either heat or power. Following the analysis of the carbon emissions related to the scheme, the objective of this section is to determine the feasible renewable energy options that provide cost-effective and practical emissions reductions. The renewable energy options for the proposed scheme are provided in the table below. Each technology is also assessed as either feasible or rejected based on its implications for the scheme in terms of their implementation, cost-effectiveness, site-related constraints, planning issues or other issues. The following sections will explore the feasible technologies in depth and explain why certain technologies have been rejected.

Technology and feasibility	Rationale
Biomass Rejected	A heating loop would be required to implement this technology across the scheme. There is little space for the plant and fuel store. The number of deliveries of fuel required would significantly disturb traffic on Erskine Road and around Primrose Hill.
Ground Source Heat Pump (GSHP) Rejected	A ground source heat pump is rejected due to the difficulties of using a borehole to tap into the local aquifer and on retrofitting this type of system into existing buildings.
Air Source Heat Pump (ASHP) Feasible	Air Source Heat Pumps are generally compact and require little space, particularly in comparison to Ground Source Heat Pumps, making them well suited to urban sites such as this.
Photovoltaic (PV) Feasible	Roof mounted PV units are a practical solution given the large roof space, particularly on Blocks 2 and 3, and Leeder House. This system is capital intensive, but there are significant subsidies available through the "Feed-in-tariff". It should be noted that Block 4 is not suitable for PV panels, as it is outside the site boundary for this scheme.
Solar Thermal Hot Water (STHW) Feasible	Roof-mounted STHW units could be used to preheat the hot water supply to the showers. As the showers will be located in the basement of Block 5, this block seems the most suitable location for the panels.
Wind Turbine Rejected	Turbulence created from surrounding buildings makes this an inefficient solution and planning issues are likely to be insurmountable or to significantly effect program times.

Variable Refrigerant Flow (VRF) system
6 Erskine Road

VRF System	VRF systems are a form of Air Source Heat Pump which consist of a number of floor, wall or ceiling mounted indoor units connected to a common outdoor unit by refrigerant pipework. They can be used for both heating and cooling.
Site-specific details	Cooling will be provided within the offices via a reversible VRF system, with a COP of 3.5, distribution efficiency of 95% and specific fan power of 0.8 W/l/s. Space heating will be provided via the VRF system, with a COP of 3.0, distribution efficiency of 95% and specific fan power of 0.8 W/l/s. Meanwhile, how water will make use of solar thermal panels backed up by an efficient gas fired boiler system with an efficiency of 91%.

Performance Calculations for VRF	Annual CO_2 emissions reduction ($kgCO_2/yr$)	20,921 $kgCO_2/yr$
	% CO_2 emissions reduction	15.24 %

Solar Photovoltaics
6 Erskine Road

Roof-mounted Solar Photovoltaic	Roof-mounted panels can be used to utilise the sun's energy for conversion into electricity. When exposed to light, the cells generate electrical energy (DC current) that is conducted away to an inverter to create mains electricity (AC current). Power can then be exported to the national grid at times of low demand in order to 'store' the unwanted 'green' energy and can be credited against the electricity bought from the grid at times of low production (i.e. at night). There are several different types of solar panels differentiated by the type of crystalline medium used. They have different efficiencies and relative merits. The panels will need to be connected to an inverter and then to the grid in order to sell electricity when usage on-site is low and power generation is high.
Site-specific details	The flat roofs of the office blocks would be able to accommodate approximately 96 panels of PV. This is based on panels of area 1.39 m^2. If these panels were rated at 250W per panel, this would provide a total of 24 kWp. The panels would lie at a pitch of 30 degrees and be sited in a discrete location on the roof. It is important the PV panels are located away from the edge of the roof as they are susceptible to catch up drafts of wind. This would also help to ensure they are not visible from ground level. The panels do not make any noise. Block 2 would have a total of 78 PV panels, giving an output of 19.25 kWp, Block 3 would have a total of 19 panels, giving an output of 4.75 kWp. As mentioned previously, Block 4 is not suitable for PV panels and solar thermal panels will be utilised on Block 5.
Manufacturer's Details	Sanyo have been identified at this stage as potential PV suppliers. Their HIT range of panels would suit this commercial application and achieve the carbon savings outlined below in addition to a good return.
Estimated Capital Expenditure	The capital cost of PV is approximately £3,500 - £4,000 per 1 kWp of photovoltaic panel. On this basis, initial estimates suggest the PV panels would cost in the region of £80,000 - £90,000. This is subject to full review and specification at detailed design.
Grants	The "Feed-in-tariff" provides a grant of 13.03p per kWh of electricity generated.

Solar Photovoltaics
6 Erskine Road

Performance Calculations for Photovoltaic Panels

Panel	Sanyo HIT-H250E01

Dimensions	1610 mm x 861 mm
Output per panel (W)	250 W
Number of panels	92
Total output (kWp)	24 kWp
Predicted annual energy production (kWh/yr)	25,512 kWh/yr
Annual CO_2 emissions reduction ($kgCO_2$/yr)	13,496 $kgCO_2$/yr
% CO_2 emissions reduction	12.50%
Total capital cost (£)	Approx. £80,000 - £90,000

Solar Thermal Hot Water (STHW)
6 Erskine Road

Roof-mounted STHW	Roof-mounted collectors can be used to utilise the sun's energy for the pre-heating of domestic hot water supplies. Solar radiation is absorbed by the collectors, which either heats the water supply directly or via a heat-transfer fluid. A controller switches on a pump when the difference between the temperature on the roof and the bottom of the hot water cylinder is sufficiently large (~10ºC). The pump then circulates water or the heat transfer fluid around the system and heat is transferred from the roof into the bottom of the tank.
Site-specific details	The flat roof of Block 5 will be able to accommodate approximately 9.6m^2 of solar thermal collectors, such as evacuated tube panels. As with the PV panels, these would lie at a pitch of 30 degrees and be sited in a discrete location away from the edge of the roof.

Performance Calculations for STHW Panels	Annual CO_2 emissions reduction (kgCO_2/yr)	1,045 kgCO_2/yr
	% CO_2 emissions reduction	0.90 %

Conclusion
6 Erskine Road

Explanation of Applicable Renewable Technology Options

The following graph demonstrates the carbon savings achievable through renewable energy technologies applicable to this scheme following implementation of energy efficiency measures.

With the addition of an Air Source Heat Pump, a predicted carbon saving of 15.24% over the 'Be Lean' (use of fabric efficient measures) and 'Be Clean' (CHP) stages can be achieved. This results in annual carbon emissions from the development of 116,315 $kgCO_2$.

With the addition of the PV and solar thermal panels outlined above, a further saving of 12.50% can be achieved, resulting in predicted annual carbon emissions from the development of 101,774 $kgCO_2$.

Overall, this results in total carbon savings of 25.84% through renewable energy technologies alone. As the location of solar PV and thermal panels has been maximised to include all applicable areas and no alternative sources of renewable energy are feasible beyond the use of a VRF system, one must conclude that despite the constraints of this site, the development exceed the 20% target outlined by the Camden Council.

The figures within this report are subject to sizing and calculations produced by M & E service engineers.