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Energy Assessment
20 John Street

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Executive Summary
20 John Street

Introduction	The proposed residential scheme at 20 John Street is required to make carbon emission reductions in accordance with the London Plan's energy hierarchy. The Borough of Camden requires the scheme to achieve a BREEAM Domestic Refurbishment VERY GOOD rating, and target an EXCELLENT rating.
Aim of this Study	The aim of this study is to assess feasible carbon emissions reductions through energy efficiency and zero carbon technologies and the potential to reach a BREEAM Domestic Refurbishment EXCELLENT rating. 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 way and by using on-site renewable energy systems to further reduce the overall carbon emissions of the development.
Methodology	The methodology followed 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 Team Guidance on Planning Energy Assessments", Version 1, 2009. In particular, the London Plan's Energy Hierarchy has been observed (see page 8). Energy consumption figures are based on SAP modelling data produced under NHER Building Regulations software and the BREEAM Domestic Refurbishment methodology. These findings are subject to detailed analysis from a services engineer and quantity surveyor.
Site description	The proposed scheme comprises five flats and one mews house within a Grade II listed building in a Camden conservation area located on John Street, Camden. The scheme is predominantly oriented North / South and is predominantly of heavy-weight brickwork and stone construction.
Planning Requirement	The scheme will meet the mandatory requirement for a BREEAM Domestic Refurbishment VERY GOOD, and target an EXCELLENT rating. The target carbon emission reductions from energy efficiency measures that do not compromise the character of the building.

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Executive Summary
20 John Street

Recommendation

The proposed scheme will implement energy efficiency measures to achieve significant carbon emission reductions. The measures within this report have followed the GLA's Energy Hierarchy and meet a 52.7% carbon emissions saving through energy efficiency measures alone, and a further 14.3% saving from the installation of photovoltaic panels.

The baseline carbon emissions for the scheme are 26,876 $kgCO_2/yr$. Following implementation of the measures within this report a total saving of 15,976 $kgCO_2/yr$ will be made. These measures include:

- Be Lean: (52.7% savings over baseline) Energy efficiency measures to improve the building fabric and services:
  - Roof 0.20 W/m^2K,
  - Ground floor slab 0.25 W/m^2K,
  - External walls 0.35 W/m^2K,
  - Secondary and double glazing will be added to the to windows where shown on the plans, and new rooflights will be installed, all openings to target 2.00 W/m^2K
- Target improved air-tightness of 10 $m^3/m^2/hr$ at 50 Pa
- High efficiency condensing gas boiler upgrade with time and temperature zone controls
- Low energy light fitting throughout scheme

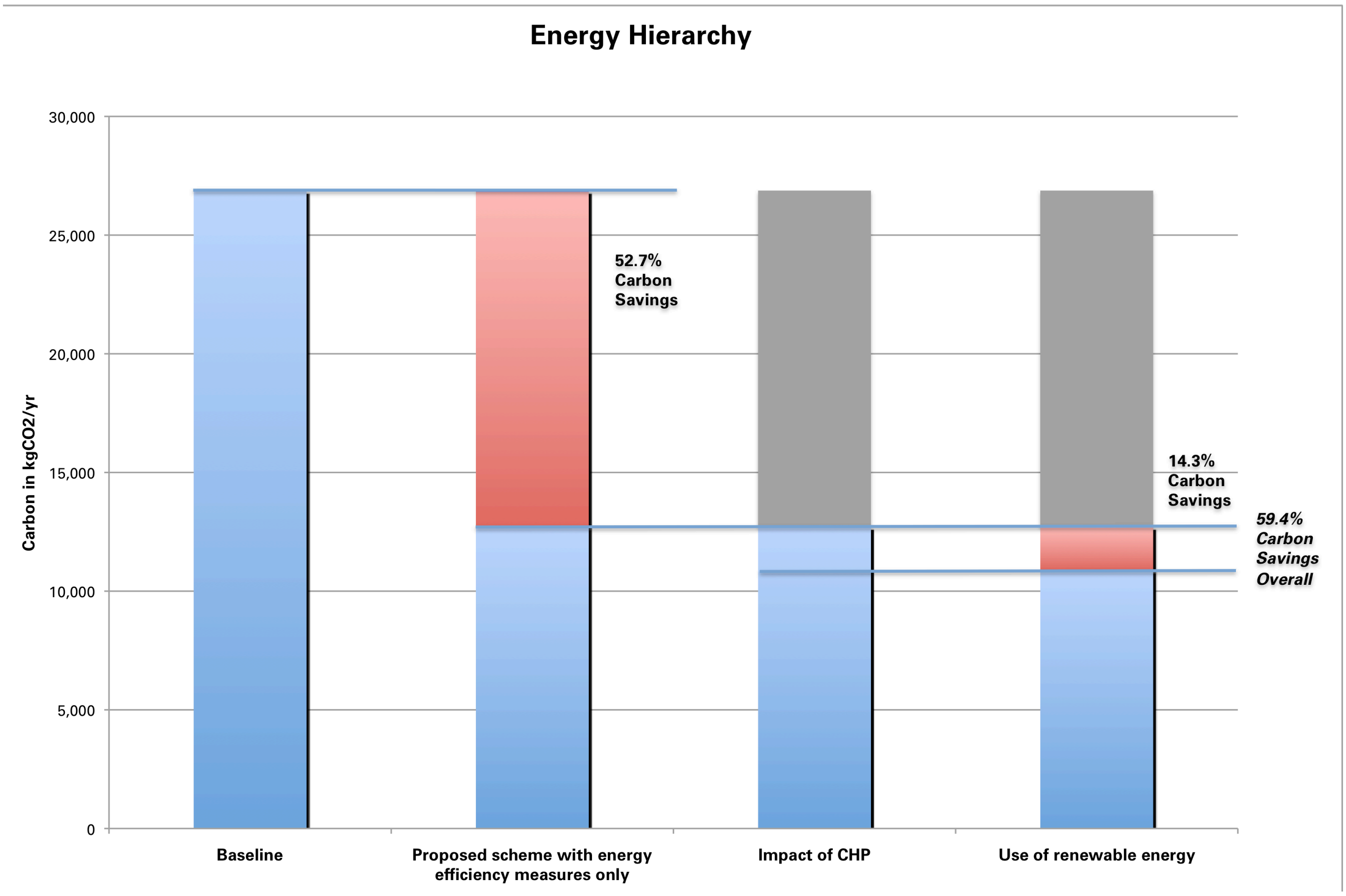
- Be Clean: CHP and CCHP have not been deemed feasible as a result of scheme's low energy demand and lack of community infrastructure in the area.

- Be Green: (14.3% savings over Lean) green energy generation to include a 4 kWp of photovoltaic panels to generate electricity.

The size of the PV array has been optimised to give the greatest saving in carbon emissions whilst being discretely located on the main roof.

Executive Summary
20 John Street

GLA's Energy Hierarchy				
	Baseline	Be Lean: Energy Efficiency Measures	Be Clean: CHP	Be Green: Renewable
Carbon emissions in kgCO_2/yr	26,876	12,716	12,716	10,900
Carbon emission savings in kgCO_2/yr	-	14,160	-	1,816
Percentage reduction in carbon emissions over the previous stage	-	52.7%	-	14.3%
BREEAM Domestic Refurbishment				
% Reduction in CO_2 Emissions over Baseline: 59.4% total savings				



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Planning Requirement
20 John Street

Planning Requirement	The London borough of Camden requires the scheme to target a BREEAM Domestic Refurbishment EXCELLENT rating, and carbon emissions reduction from energy efficiency measures.
Energy Statements	Applications for 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 of regulated emissions (i.e. space heating, hot water, fixed electricity), and non-regulated emissions (i.e. those not covered by the Building Regulations, lamps and appliances etc). - Baseline carbon emissions should include emissions from gas and electrical energy consumption and should be calculated from a gas baseline, unless an electrical baseline can be justified. - A demonstration of how the Mayor's energy hierarchy has been followed (i.e being 'lean, clean, green') including consideration of passive design and decentralised energy options (including CHP/CCHP). Description of proposed energy efficiency measures includes details of these measures (e.g. U-values, air permeability, percentage of energy efficient light fittings, heating efficiencies, etc). - 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 building whilst balancing the need to preserve the historic character of the building. Calculations were carried out using NHER software Building Regulations compliant software.

Energy Hierarchy
20 John Street

London Plan Energy Hierarchy Taken from GLA Energy Team Guidance on Planning 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.
Baseline calculations Section 5.0	The baseline calculations are based on the existing building's construction and service provisions, using the NHER u-value calculator and RdSAP data within the NHER software. This has identified the building to have the energy profile outlined in the following pages.
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.
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 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 are 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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Energy Profile
20 John Street

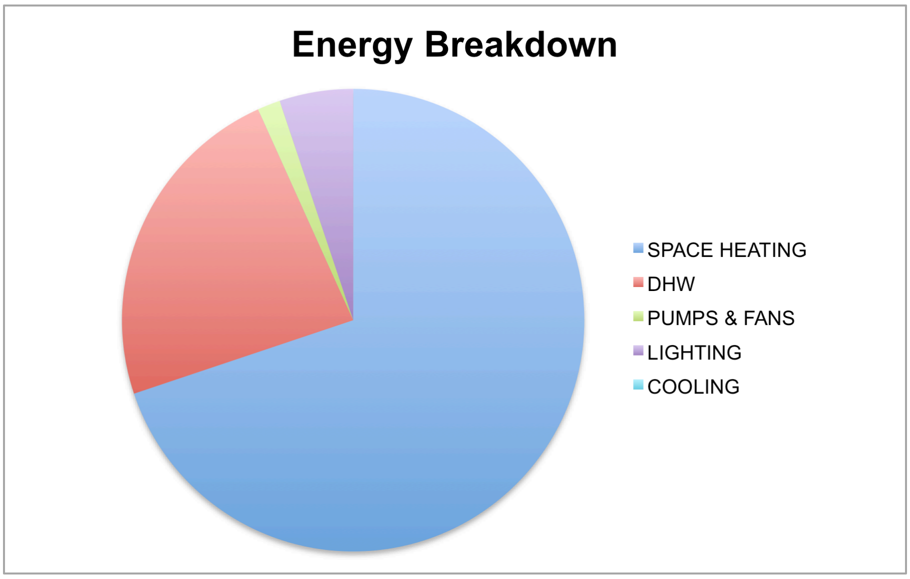
Introduction

Energy modelling allows designers to explore the performance of a scheme in terms of the likely energy usage and related carbon emissions. Through this understanding it is possible to reduce energy usage, use renewable energy and supply energy efficiently.

The modelling of the dwelling has been undertaken with NHER software to estimate the likely energy demands and carbon emissions of the proposed scheme.

Carbon Emissions in $kgCO_2/yr$	Heating	Cooling	Hot Water	Fans and Pumps	Lighting
Baseline	14,652	0	4,907	336	1081

Graph showing the dwelling's carbon emissions breakdown in terms of heating, hot water, cooling, lighting and fans over one year



'Be Lean': Energy Efficiency Measures
20 John Street

Energy Efficiency Targets	Energy efficiency measures such as optimising the building fabric will be incorporated to significantly reduce the energy demand and carbon footprint of the proposed scheme. The indicative measures outlined below result in an annual carbon emission saving of 52.7% or 14,160 kgCO_2/yr over baseline.
U-Values Modelled	

Element	Building Regulations Part L1B minimum U-Value (W/m^2K)	Proposed U-Value (W/m^2K) Indicative build-up
Roof	0.35	0.20
Walls	0.70	0.35
Floors	0.70	0.25
Windows	3.30	2.00

Air-Tightness and Thermal Bridging	An air-tightness of 10 $m^3/hr/m^2$ at 50 Pascals will be targeted post refurbishment. Default thermal bridging 0.15 W/m^2K is used.
Ventilation	Natural ventilation will be used throughout the dwelling, with mechanical extract to wet rooms and kitchens.
Cooling	No cooling is specified.
Heating	An efficient condensing gas boiler system, with a SEDBUK 2009 efficiency of 89% will provide space heating and domestic hot water. Space heating will be provided by underfloor heating, and will be controlled by a programmer, room thermostat and boiler energy manager, an interlock and a weather compensator.

'Be Clean': Use of Combined Heat and Power

20 John Street

Use of Combined Heat and Power

This section demonstrates how decentralised energy generation has been considered in accordance with the Mayor's London Plan section 4A.1. 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
The inclusion of gas combined heat and power (CHP) within the energy strategy has been modelled and considered. However, as CHP units are heat-led they are best suited to dwellings that have a consistent and large heat demand. The dwellings are of a modest size so their heat demand is low, moreover, as a result of the building fabric upgrades their heat demand is reduced further. Consequently, a micro CHP is not suitable in these dwellings.

The most effective solution would be to utilise high efficiency low NOx gas boilers and lower electricity demand by installing energy efficient lighting, white goods and LZC technologies.

Site-wide Combined Heat and Power (CHP) Generation

A communal heating and hot water system will not be provided in this scheme, as the required existing networks are not present. Carbon emissions reductions will be achieved by an individual system.

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'Be Green': Feasible Renewable Energy Technologies
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Carbon emission reductions from renewables	The predicted carbon emissions of the proposed scheme following energy efficiency measures is 12,716 $kgCO_2$/yr. As the scheme is in a conservation area, the installation of many renewable technologies is limited. The only location that would not be detrimental to the building's character and is in a discreet location that is not visible from the surrounding dwellings is the main roof. This is chosen area for a photovoltaic array, the predicted carbon emissions following renewable technologies is 10,900 $kgCO_2$/yr
Feasible Renewable Energy Technologies	A reduction in carbon emissions through the use of on-site renewable energy could 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	Biomass could potentially provide a 20% overall reduction in carbon emissions. However, this technology would have a significant impact on local air quality in the Borough and development access restraints preclude the possibility of biomass pellet delivery.
Ground Source Heat Pump (GSHP) Rejected	A ground source heat pump could supply heating and hot water to the proposed scheme. However, there is in room to allow for horizontal closed loop pipes; therefore, boreholes would be required at a depth of approximately 20-50m. This option is capital intensive, is subject to uncertainty with regards to the ground conditions and would be unacceptable given the conservation status of the area.
Air Source Heat Pump (ASHP) Rejected	Air source heat pump units could supply heating and hot water to each dwelling. However, given the carbon intensity of grid electricity and the efficiency of heat pumps, this technology performs similar to gas-fired boilers. Also, the is not adequate space on site to locate the heat pump units. Therefore, ASHP are being rejected due to gas boilers providing a more efficient solution.
Photovoltaic (PV) Accepted	Roof mounted PV units could be a possible solution on the roof space. This system is capital intensive, but there are significant subsidies for selling electricity back to the grid. As the scheme is in a conservation area the installation of PV must be discrete and not detrimental to the building's character. An access perimeter will exist around the perimeter of the roof, this will provide easily access and will ensure that the PV will not be visible from the street and surrounding dwellings.
Solar Hot Water (SHW) Rejected	Roof-mounted SHW units could be located on the limited roof space. However, this technology will not contribute significantly to carbon reductions as a stand-alone.
Wind Turbine Rejected	Turbulence created from surrounding buildings makes this an inefficient solution. Moreover, the dwelling is in a conservation area.

Solar Photovoltaic
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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 would then be exported to the national grid at times of low demand in order to 'store' the unused 'green' energy and would be credited against the electricity bought from the grid. 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 considerations	A maximum of 4 kWp (19 - 26 m^2) can be accommodated on the roof. The panels have indicative dimensions of 1m x 1.6m (1.6 m^2) and would be fixed on rails. Typical rating for PV panels would be 250 - 333W per panel. The panels would lie at the roof pitch of 30 degrees and would be south facing in a discrete location. PV panels would have to be located away from the edge of the roof as they are susceptible to catch up draft of wind. They do not make noise. PV has been maximised to the roof and no further renewable technology is practically appropriate for the site.
Grants	The current "Feed-in-tariff" generation rate for systems of the order <4 kW is 15.44p per kWh of electricity generated.

Performance Calculations for Photovoltaic Panels		Solar PV – 4 kWp
	PV Predicted Annual Energy Production (kWh/yr)	3,434 kWh/yr
	Annual Carbon Emissions Reductions (kgCO2/yr)	1,816 $kgCO_2$/yr
	% CO_2 Emissions Reduction	14.3%
Recommended PV Retailers	MD Use The Sun – 01279 320020 www.usethesun.co.uk	

BREEAM Refurbishment Domestic buildings
20 John Street

Introduction BREEAM Refurbishment Domestic buildings	The BREEAM Refurbishment Domestic buildings assesses energy efficiency of the home through refurbishment. 65% of the total available score relates to energy targets, based on SAP or the EPC. These targets bring a balanced assessment of the impact that the refurbishment has on improving the dwellings energy performance including: - how much the Energy Efficiency Rating has been improved as a result of refurbishment, - the Energy Efficiency Rating that is achieved post refurbishment - the dwellings energy demand post refurbishment - the % of the dwellings demand that is met by renewable technologies. The SAP modelling is used to assess credits based on the Improved Energy Efficiency Rating (Ene 1), the Improved Energy Efficiency Rating Post Refurbishment (Ene 2), the Primary Energy Demand (Ene 3) and Renewable Technologies (Ene 4).
Ene 1 – Improvement in Energy Efficiency	The dwelling's Energy Efficiency Rating (EER) before refurbishment is expected to be approximately 55, and after refurbishment the EER is expected to be 81. This has been calculated from full SAP 2009 modelling. An improvement in Energy Efficiency Rating (EER) of 26 is expected. The refurbishment results in an improvement to the dwellings' EER by greater than or equal to 26, therefore 3 credits can be awarded. Three of six credits currently targeted.
Ene 2 – Energy Efficiency Rating Post Refurbishment	The dwelling's Energy Efficiency Rating (EER) after refurbishment is expected to be 81. This has been calculated from full SAP 2009 modelling. This meets the BREEAM EXCELLENT minimum requirement of EER of 70. Three of four credits currently targeted.
Ene 3 – Primary Energy Demand	Full SAP 2009 modelling has been undertaken and has been used to calculate the Primary Energy Demand post refurbishment. The primary energy demand as a result of refurbishment of dwelling is expected to be 110 kW/m^2/year, less than 120 kW/m^2/year, therefore seven credits can be targeted. Seven of seven credits currently targeted.
Ene 4 – Renewable Technologies	The services strategy will incorporate 4 kWp of PV on the main roof of the building. This will provide a 16% reduction in primary energy demand from renewable technologies. Please refer to the Energy Strategy for further information Two of two credits currently targeted.

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Conclusion
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Recommendation

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