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Eight Associates
Ground Floor
57a Great Suffolk Street
London
SE1 0BB

+44 (0) 20 7043 0418

www.eightassociates.co.uk
info@eightassociates.co.uk

Low and Zero Carbon Feasibility Study
Nido West Hampstead

Document information

Prepared for:
WH Student Accommodation SARL
c/o Paul Terry
Buro Four
1 Naoroji Street
London, WC1X 0GB

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Assessment information

Prepared by:
Panayiota Paraskeva

Quality assured by:
Chris Hocknell

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Introduction

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Nido West Hampstead

Introduction	Eight Associates has been appointed by WH Student Accommodation SARL to identify and assess the renewable and low carbon energy options available for the proposed development. The proposed project involves extension works to the Nido West Hampstead student accommodation building, located in West Hampstead, which is part of the London Borough of Camden. The works involve a single storey roof extension at 5th and 7th, and a side extension of 3 storeys, providing an additional 65 studio rooms. The new extension has a total gross internal area of approximately 960 m^2. Please note that only the proposed extension has been assessed in this report.
Aims and objectives	The scheme is required to make carbon emission reductions in accordance with the BREEAM New Construction 2014 Ene 04 credit.
Methodology	A summary review of all LZC technologies was conducted to determine the most suitable technologies for the development.

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BREEAM Requirements
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Detailed BREEAM 2014 requirements

This low and zero carbon report will follow the BREEAM 2014 requirements set out in BREEAM 2014 credit Ene 04 (one available credit). These requirements are as follows;

A feasibility study is to be carried out by an energy specialist[1] at RIBA stage 2 or equivalent to establish the most appropriate local (on site or near site) LZC energy source for the building/development. The study is required as a minimum to cover:

- Energy generated from LZC energy source per year
- Carbon dioxide savings from LZC energy source per year
- Life cycle cost of the potential specification, accounting for payback
- Local planning criteria
- Feasibility of exporting heat/electricity from the system
- Any available grants
- All technologies appropriate to the site and energy demand of the development
- Reasons for excluding other technologies
- Where appropriate to the building type, connecting the proposed building to an existing local community CHP system or source of waste heat or power or specifying a building/site CPH system or source of waste heat or power, with the potential to export excess heat or power via a local community energy scheme

Figures used within the report to calculate the percentage carbon dioxide reduction provided by the LZC technology are to be based on the output from approved energy modelling software[2].

Renewable technologies

The following renewable technologies are considerate to be appropriate and would be applicable for this scheme:

- Solar Thermal
- Solar Photovoltaic
- Biomass boiler
- Wind Turbines
- Ground Source Heat Pumps
- Air Source Heat Pumps

[1] **Energy Specialist:** An individual who has acquired substantial expertise or a recognised qualification for undertaking assessments, designs and installations of low or zero carbon solutions in the commercial buildings sector; and is not professionally connected to a single low or zero carbon technology or manufacturer. *Typically a licenced Non-Domestic Energy Assessor.*

[2] **Approved Software:** Software approved by local Communities and Local Government to produce Energy Performance Certificates (EPC) for non-domestic buildings and check compliance with Building Regulations.

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Review of Energy and Carbon Profile
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Overview	The scheme is entirely new build. Energy modelling using the national calculation methodology (NCM) has been undertaken with Design Builder software for non-the domestic area, to estimate the likely energy demands and carbon emissions of the benchmark.

U-values

Element	Minimum Building Regulations U value W/m²K	Proposed U value W/m²K
External wall	0.28	0.14
Roof	0.18	0.12
Windows	1.80	1.60

Air-tightness an thermal bridging	A high performance building with good air tightness levels is to be achieved such that the proposed scheme should not exceed an air permeability level of 5 $m^3/hr/m^2$ at 50 Pascal.
Windows	The windows will be double glazed and have a U-value of 1.6 and a G-value of 0.45 in order to reduce solar gain.
Lighting	High efficiency lighting has been specified for the development with a minimum lumen efficacy of 95lm/W.
Ventilation	Mechanical extract ventilation will be provided to wet rooms, with a maximum flow of $5l/s/m^2$ and an SFP of 0.3W/l/s.
Space heating	50% of the space heating and DHW will be provided by the CHP of the existing building. The remaining 50% will be provided by a gas boiler, featuring time and temperature zone control, delayed thermostat and a weather compensator. The heat will be distributed via radiators. The gas boiler will have a minimum efficiency of 91%.
Domestic Hot Water	Water will be heated from the main heating system (see above).
Cooling	No cooling system has been specified for the scheme. Natural ventilation through openable windows will be used as a passive cooling measure.

Review of Energy and Carbon Profile

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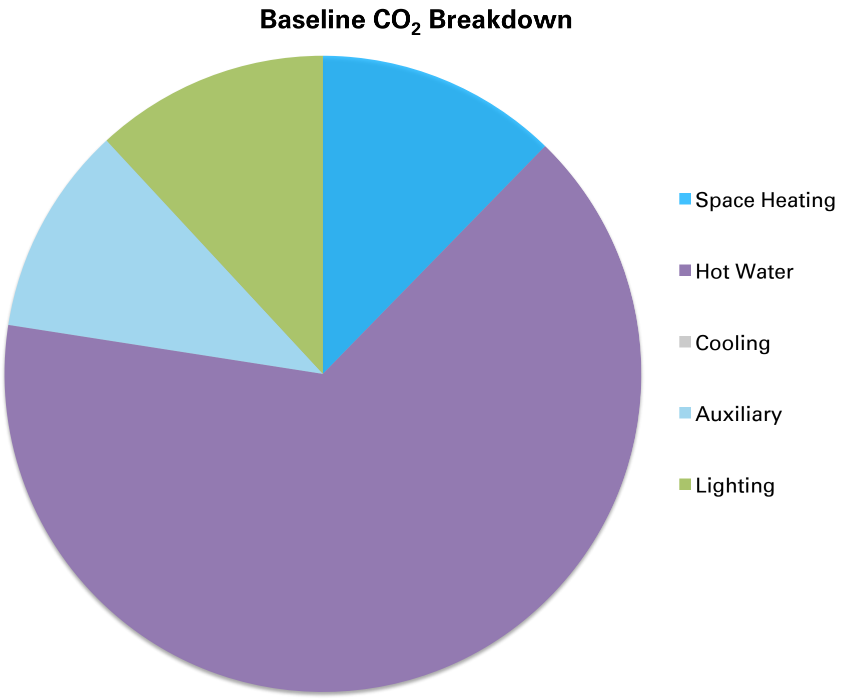
CO_2 Emissions Tonnes CO_2/yr	Heating	Cooling	Hot Water	Fans and Pumps	Lighting	Total
	4.65	24.62	0.00	4.02	4.49	4.65

Graph showing the scheme's CO_2 emissions breakdown



Review of energy demand

The chart above shows that hot water is the primary source of carbon emissions, and space heating is the second largest.

Target carbon emissions reduction

BREEAM New Construction 2014 requires the proposed installation should contribute at least 5% of the overall building energy demand and/or CO_2 emissions.

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Review of LZC Technologies
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Feasibility Renewable Energy Technologies

A reduction in carbon emissions, through the use of on-site renewable energy, can be achieved by several technologies that 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 emission reductions. The renewable energy options for the proposed scheme are provided in the table below. Each technology is 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 any other additional issues.

Technology and feasibility	Rationale
Biomass Rejected	This technology will require greater plant space, as the boilers are larger than conventional boilers and storage space will be needed for the fuel stores. Also regular deliveries of fuel may cause disruption to daily site operations and will result in noise.
Wind Turbine Rejected	A large external area will be required for the installation of a wind turbine. There is a risk of noise pollution during operation. There are also higher capital and maintenance costs involved relative to other renewable options.
Ground Source Heat Pump Rejected	A ground source heat pump could provide heating and hot water for the development. There is a small risk of undesirable temperature degradation in the ground and potential impacts on the water quality. There will be some impact on the building design as it is ideal to install this technology in rural areas with large areas of available space and with under-floor heating. This option will also be capital intensive.
Air Source Heat Pump Rejected	An air source heat pump could provide heating and hot water for the development. External space will be required and there will be minimal noise impact from the pump. There will be some impact on the building design as it is ideal to install this technology with under-floor heating. There are medium capital costs.
Solar Photovoltaic Feasible	This technology will make a small impact on the building design, as the panels will need to be located on a roof – with a southerly orientation. There will be low annual maintenance costs although this technology will incur high capital costs. This technology would provide high carbon emissions reductions from displacing grid electricity.
Solar Thermal Rejected	This technology will make a small impact on the building design, as the panels will need to be located on a roof – with a southerly orientation. There will be low annual maintenance costs and lower capital costs relative to Photovoltaic panel system. The hot water demand for the scheme is relatively high, however, a significant reduction in carbon dioxide would not be feasible with this technology. PV would provide a higher carbon reduction.

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Connecting to Existing and Planned Networks
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Existing and planned networks

Because of the location of the site, the possibility of connecting to a local community CHP system or source of waste heat and power has been rejected. There are currently no district heating systems in place or planned to be installed for the scheme. Therefore, it has been decided not to follow the route of preparing the development for connection.

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Photovoltaic Panels
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Roof-mounted solar photovoltaic panels (PV)	Photovoltaic systems convert energy from the sun into electricity through semi conductor cells. Systems consist of semi-conductor cells connected together and mounted into modules. Modules are connected to an inverter to turn the direct current (DC) output into alternating current (AC) electricity for use in buildings. Photovoltaic panels supply electricity to the building and are attached to electricity gird or to any other electrical load. Excess electricity can be sold to the National Grid when the generated power exceeds the local need. PV systems require only daylight, not sunlight to generate electricity (although more electricity is produced with more sunlight), so energy can still be produced in overcast or cloudy conditions. The cost of PV cells is heavily dependent on the size of the array. There are significant cost reductions available for larger installations. The most suitable location for mounting photovoltaic panels is on roofs as they usually have the greatest exposure to the sun. The proposed site has a potential useable roof area of approximately 295 m^2.
Site-specific considerations	A total of 18.9 kWp (approximately 64 PV panels) will be suitably accommodated on the roof. The panels have indicative dimensions of 1m x 1.6m (1.6 m^2) and would be fixed on rails. PV panels will be oriented south, with 30 degrees tilt, covering 105m^2 of the roof. PV area on the roof has been utilised and no further renewable technology is considered practically appropriate for the site.
Grants	The current "Feed-in-tariff" generation rate for systems of the order >10 - 50 kW is 4.32 p per kWh of electricity generated.
Planning restrictions	There are no planning restrictions with respect to solar collectors.
Feasibility of exporting	As the overall electrical demand for the scheme is expected to be lower than the output of the solar photovoltaic panels, it will generally be feasible to export electricity from the system in periods of low demand.

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Photovoltaic Panels
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Estimated capital expenditure and lifecycle cost	Costs have been taken as approximates. • Photovoltaic panels install cost: £30,240 • Maintenance costs: £2,000 • Operational costs: £1,800 • Total site wide extra over: £34,040
Revenue and payback	The cost of electricity to be displaced is 14p/kWh. The 18.9 kWp system is estimated to generate 14,826 kWh/yr. Based on the assumption that 50% of the electricity will be used on site, an offset saving of £1,038/yr will be achieved. With the current Feed in Tariff, a tariff of 4.32p/kWh will be received for generation, and 4.91p/kWh will be received for export, which gives an additional saving of £1,004. Therefore, the simple payback for the proposed system is 16.1 years.

Summary performance calculations for PV

Predicted Annual Energy Produced	14,826 kWh/yr
Annual Carbon Emissions Reductions	7,672 kgCO_2/yr
% CO_2 Emissions Reduction	20.3 %

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Conclusion
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Summary – Photovoltaic Panels

System Installed	Photovoltaic Panels
Size of unit installed	18.9 kWp (approximately 64 panels)
Total Cost Over Life Cycle	£34,040
Predicted Annual Savings	£2,042 /year
Payback Period	16.1 years
Predicted Annual Energy Production	14,826 kWh/yr
Annual Carbon Emissions Reductions	7,672 $kgCO_2$/yr
% CO_2 Emissions Reduction	20.3 %