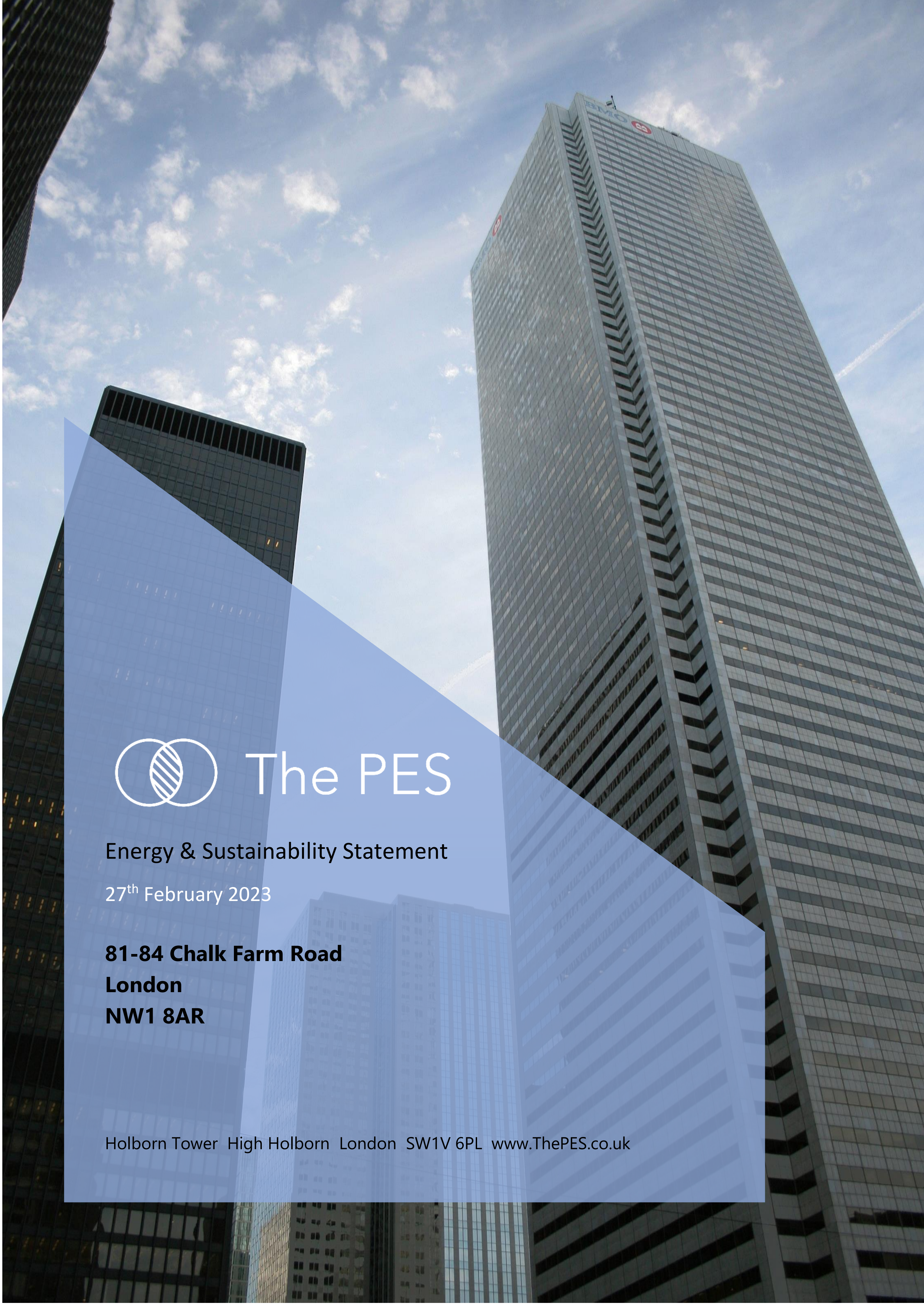


The PES

Energy & Sustainability Statement

27th February 2023

81-84 Chalk Farm Road
London
NW1 8AR

Holborn Tower High Holborn London SW1V 6PL www.ThePES.co.uk

The PES

Contents

Appendices

1.0 Executive Summary

The proposed development project at 81-84 Chalk Farm Road involves the reconfiguration and refurbishment and change of use at the above site from a gym to a higher educational centre (British Academy of Jewellery).

It has been designed to achieve the highest of environmental performance standards following the Energy Hierarchy as set down by the London Plan and the London Borough of Camden's Local Plan policies.

A 'Lean, Clean, Green' approach to assessing energy and thermal comfort needs and appropriate solutions has been adopted following the guidance under Chapter 9 of the London Plan and the latest GLA guidance on the preparation of energy statements (June 2022) the development achieves an overall improvement (BER/TER) in regulated emissions of **70.44**% over the Part L 2021 standard and a reduction in overall emissions at **61.12%** when taking into account unregulated energy use, through the adoption of high standards of insulation, super-efficient variable refrigerant flow heating/cooling, domestic hot water generated by heat pump technology and localised ventilation with heat recovery within an air tight fabric.

The above strategy if further supplemented by a 29 panel/12.76kWp PV array accommodated at the existing roof level - generating some 13,000kWh per annum.

2.0 The Site & Proposal

The application site is a detached building located on the northern side of Chalk Farm Road. The building is a three-storey building set back from the main frontage of Chalk Farm Road.

The proposals under consideration within this report seeks full-planning permission for the change of use of the full building from Gym (Class E(d)) to Education (Class F1(a)). The change of use will facilitate the use of the building for the British Academy of Jewellery.

The LPA, Camden have confirmed that:-

Applicants must submit an Energy Statement for each scheme showing how the development will meet the following policy requirements:

Follow the hierarchy of energy efficiency, decentralised energy and renewable energy technologies set out in the London Plan (2021) Chapter 9 (particularly Policy SI 2) to achieve the fullest contribution to CO2 reduction. GLA guidance on preparing energy assessments and CPG 'Energy Efficiency and Adaptation' (here) should be followed. In particular, improvements should be sought on the minimum building fabric targets set in Part L of the building regulations

Policy CC1 requires all developments to achieve a 20% reduction in CO2 emissions through renewable technologies (the 3rd stage of the energy hierarchy) wherever feasible, and this should be demonstrated through the energy statement. The reduction is to be calculated against emissions at the previous hierarchy stage and NOT against the baseline emissions.

2.1 Local Planning Context

The project sits within the London Borough of Camden (Camden).

Camden's Local Plan was adopted in July 2017

Chapter 8 deals with matters of sustainability and climate change:-

Policy CC1 Climate change mitigation

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

We will:

a. promote zero carbon development and require all development to reduce carbon dioxide emissions through following the steps in the energy hierarchy;

b. require all major development to demonstrate how London Plan targets for carbon dioxide emissions have been met;

c. ensure that the location of development and mix of land uses minimise the need to travel by car and help to support decentralised energy networks;

d. support and encourage sensitive energy efficiency improvements to existing buildings;

e. require all proposals that involve substantial demolition to demonstrate that it is not possible to retain and improve the existing building; and

f. expect all developments to optimise resource efficiency.

Policy CC2 Adapting to climate change

The Council will require development to be resilient to climate change.

All development should adopt appropriate climate change adaptation measures such as:

a. the protection of existing green spaces and promoting new appropriate green infrastructure;

b. not increasing, and wherever possible reducing, surface water runoff through increasing permeable surfaces and use of Sustainable Drainage Systems;

c. incorporating bio-diverse roofs, combination green and blue roofs and green walls where appropriate; and

d. measures to reduce the impact of urban and dwelling overheating, including application of the cooling hierarchy.

Any development involving 5 or more residential units or 500 sqm or more of any additional floorspace is required to demonstrate the above in a Sustainability Statement.

2.2 The London Plan

Chapter 9 deals with Sustainable Infrastructure:-

Policy SI2 Minimising greenhouse gas emissions

A Major development should be net zero-carbon. This means reducing carbon dioxide emissions from construction and operation, and minimising both annual and peak energy demand in accordance with the following energy hierarchy:

1) Be lean: use less energy and manage demand during construction and operation.
2) Be clean: exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly. Development in Heat Network Priority Areas should follow the heating hierarchy in Policy SI3 Energy infrastructure.
3) Be green: generate, store and use renewable energy on-site.

B Major development should include a detailed energy strategy to demonstrate how the zero-carbon target will be met within the framework of the energy hierarchy and will be expected to monitor and report on energy performance.

C In meeting the zero-carbon target a minimum on-site reduction of at least 35 per cent beyond Building Regulations is expected. Residential development should aim to achieve 10 per cent, and non-residential development should aim to achieve 15 per cent through energy efficiency measures. Where it is clearly demonstrated that the zero-carbon target cannot be fully achieved on-site, any shortfall should be provided:

1) through a cash in lieu contribution to the relevant borough's carbon offset fund, and/or
2) off-site provided that an alternative proposal is identified and delivery is certain.

Policy SI3 Energy infrastructure

D Major development proposals within Heat Network Priority Areas should have a communal heating system

1) the heat source for the communal heating system should be selected in accordance with the following heating hierarchy:

a) connect to local existing or planned heat networks
b) use available local secondary heat sources (in conjunction with heat pump, if required, and a lower temperature heating system)
c) generate clean heat and/or power from zero-emission sources
d) use fuel cells (if using natural gas in areas where legal air quality limits are exceeded all development proposals must provide evidence to show that any emissions related to energy generation will be equivalent or lower than those of an ultra-low NOx gas boiler)
e) use low emission combined heat and power (CHP) (in areas where legal air quality limits are exceeded all development proposals must provide evidence to show that any emissions related to energy generation will be equivalent or lower than those of an ultra-low NOx gas boiler)
f) use ultra-low NOx gas boilers.

2) CHP and ultra-low NOx gas boiler communal or district heating systems should be designed to ensure that there is no significant impact on local air quality.
3) Where a heat network is planned but not yet in existence the development should be designed for connection at a later date.

Policy SI4 Managing heat risk

A Development proposal should minimise internal heat gain and the impacts of the urban heat island through design, layout, orientation and materials.

B Major development proposals should demonstrate through an energy strategy how they will reduce the potential for overheating and reliance on air conditioning systems in accordance with the following cooling hierarchy:

1) minimise internal heat generation through energy efficient design
2) reduce the amount of heat entering a building through orientation, shading, albedo, fenestration, insulation and the provision of green roofs and walls

3) manage the heat within the building through exposed internal thermal mass and high ceilings
4) provide passive ventilation
5) provide mechanical ventilation
6) Provide active cooling systems.

Policy SI5 Water infrastructure

C Development proposals should:

1) minimise the use of mains water in line with the Optional Requirement of the Building Regulations (residential development), achieving mains water consumption of 105 litres or less per head per day (excluding allowance of up to five litres for external water consumption)
2) achieve at least the BREEAM excellent standard (commercial development)
3) be encouraged to incorporate measures such as smart metering, water saving and recycling measures, including retrofitting, to help to achieve lower water consumption rates and to maximise future proofing.

Policy SI12 Flood risk management

C Development proposals which require specific flood risk assessments should ensure that flood risk is minimised and mitigated, and that residual risk is addressed. This should include, where possible, making space for water and aiming for development to be set back from the banks of watercourses.

E Development proposals for utility services should be designed to remain operational under flood conditions and buildings should be designed for quick recovery following a flood.

F Development proposals adjacent to flood defences will be required to protect the integrity of flood defences and allow access for future maintenance and upgrading. Where possible, development proposals should set permanent built development back from flood defences to allow for any foreseeable future upgrades.

Policy SI13 Sustainable Drainage

A Lead Local Flood Authorities should identify – through their Local Flood Risk Management Strategies and Surface Water Management Plans – areas where there are particular surface water management issues and aim to reduce these risks.

B Development proposals should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible in line with the following drainage hierarchy:

1) rainwater harvesting (including a combination of green and blue roofs)
2) infiltration techniques and green roofs
3) rainwater attenuation in open water features for gradual release
4) rainwater discharge direct to a watercourse (unless not appropriate)
5) rainwater attenuation above ground (including blue roofs)

6) rainwater attenuation below ground
7) rainwater discharge to a surface water sewer or drain
8) rainwater discharge to a combined sewer.

C Development proposals for impermeable paving should be refused where appropriate, including on small surfaces such as front gardens and driveways.

D Drainage should be designed and implemented in ways that address issues of water use efficiency, river water quality, biodiversity, amenity and recreation.

It is noted that the proposed non-domestic development is less than 1,000m^2 and would be considered non-major development.

In line with the latest GLA guidance, the design team have progressed this assessment based upon the recently introduced Part L 2021 calculation methodology following the latest GLA guidance.

The GLA Part L 2021 reporting tool is attached at **Appendix D**.

3.0 Baseline energy results

The first stage of the Mayor's Energy Hierarchy is to consider the baseline energy model.

The following section details the baseline energy requirements for the development – the starting point when considering the energy hierarchy.

3.2 Commercial Space - Change of Use/Conversion/Extension

The energy requirements for space heating, water heating and ventilation within the converted basement space have been calculated using the National Calculation Method (NCM) in line with AD L2 of the Building Regulations 2021.

The Government approved assessment methodology is the Simplified Building Energy Model (SBEM), The PES Ltd use an advanced modelling software - Design Builder - which enables accurate SBEM models to be created, as well as heat loss and cooling load calculations and full M&E design to be undertaken.

As the new build upper floor extension are less than 25% of the GIA of the host building, the whole project is considered as a change of use/extension.

To consider the subject building performance against The Building Regulations (Approved Document L2) SBEM first creates the notional reference building, the characteristics of which are defined within the latest GLA Guidance (June 2022) Appendix 3 and reproduced below.

In order to establish the baseline, the HVAC solution has been assumed as a low temperature hot water (LTHW) heating system, via gas fired boilers and mechanical cooling/ventilation. Domestic Hot Water (DHW) will be supplied from the same boilers via appropriately sized calorifiers and a secondary circulation loop.

This creates the notional Building Emission Rate (BER) and should be considered as stage 'zero' of the energy hierarchy as described earlier and sets the benchmark for the worst performing, but legally permissible, development against which, SBEM assesses the "actual" design, fabric values, heating lighting and ventilation systems and creates the "actual" Building Emissions Rate (BER).

Element	Unit	Specification[1]
External Wall	W/m²K	0.55
Roof	W/m²K	0.18
Floor	W/m²K	0.0.25
Glazing	W/m²K	1.80
Vision element	g-value	0.40
Air permeability	(m^3/h m^2 @ 50 Pa)	• Less than 10 – only with an accredited air pressure test result • 10 – buildings > 500 m^2 built to 2002 Building Regulations (or later) • 15 – buildings <= 500 m^2 built to 2002 Building Regulations (or later) • 15 – Buildings built to 1995 Building Regulations • 25 – buildings built to Building Regulations pre 1995
Thermal Bridging	W/m²K	Default
HVAC System	Type	System type as per actual building and heating provided by Gas boiler
Heating and Hot Water	%	84% gross efficiency gas boiler
Cooling (air-condition)[2]	SEER	• 2.60 – for packaged air conditioners, split/multi-split air conditioners & variable refrigerant flow • 3.90 – Vapour compression cycle chillers, water cooled < 750 kW • 4.70 – Vapour compression cycle chillers, water cooled > 750 kW
Central ventilation SFP	W/l/s	2.20
Terminal Unit SFP	W/l/s	0.50
Heat Recovery	%	70%
Lighting	Lm/Watt	51

GLA Guidance 2022 - Appendix 3

3.2 Unregulated Energy Use

The unregulated energy use for the refurbished spaces can be derived from the BRUKL outputs under section “Energy Consumption by End Use” - Equipment.

Table 1 – Unregulated Energy Use

Unit	Unregulated Energy Use Kg/sqm
Chalk Farm Road	2.36

The un-regulated emission rates are added to the baseline regulated emission rates (as calculated under 3.1 above) in order to set the total baseline emission rates before then applying the energy hierarchy in line with The London Plan and Westminster policies.

3.3 Baseline Results

The baseline building results have been calculated and are presented in Table 2 below. The Baseline BRUKL BER outputs, which summarise the key data are attached at **Appendix A**.

Table 2 – Baseline energy consumption and CO_2 emissions

Unit	Total Regulated Emissions Kg/Annum	Total Unregulated Emissions Kg/Annum	Total Baseline Emissions Kg/Annum
Chalk Farm Road	14,202	2,166	16,368
Development Total	**14,202**	**2,166**	**16,368**

The GLA Part L 2021 reporting spreadsheet is attached at **Appendix D.**

4.0 Design for energy efficiency

The first step in the Mayor's 'Energy Hierarchy' as laid out in Chapter 9 of The New London Plan, requires that buildings be designed to use improved energy efficiency measures – Be Lean. This will reduce demand for heating, cooling, and lighting, and therefore reduce operational costs while also minimizing associated carbon dioxide emissions.

This section sets out the measures included within the design of the development, to reduce the demand for energy, both gas and electricity (not including energy from renewable sources). The table at the end of this section details the amount of energy used and CO_2 produced by the building after the energy efficiency measures have been included. From these figures the overall reduction in CO_2 emissions, as a result of passive design measures, can be calculated. To achieve reductions in energy demand the following measures have been included within the design and specification of the building:

4.1 Passive Design

Local and London Plan policy requires designers to introduce measures to control heat gain and deliver passive cooling.

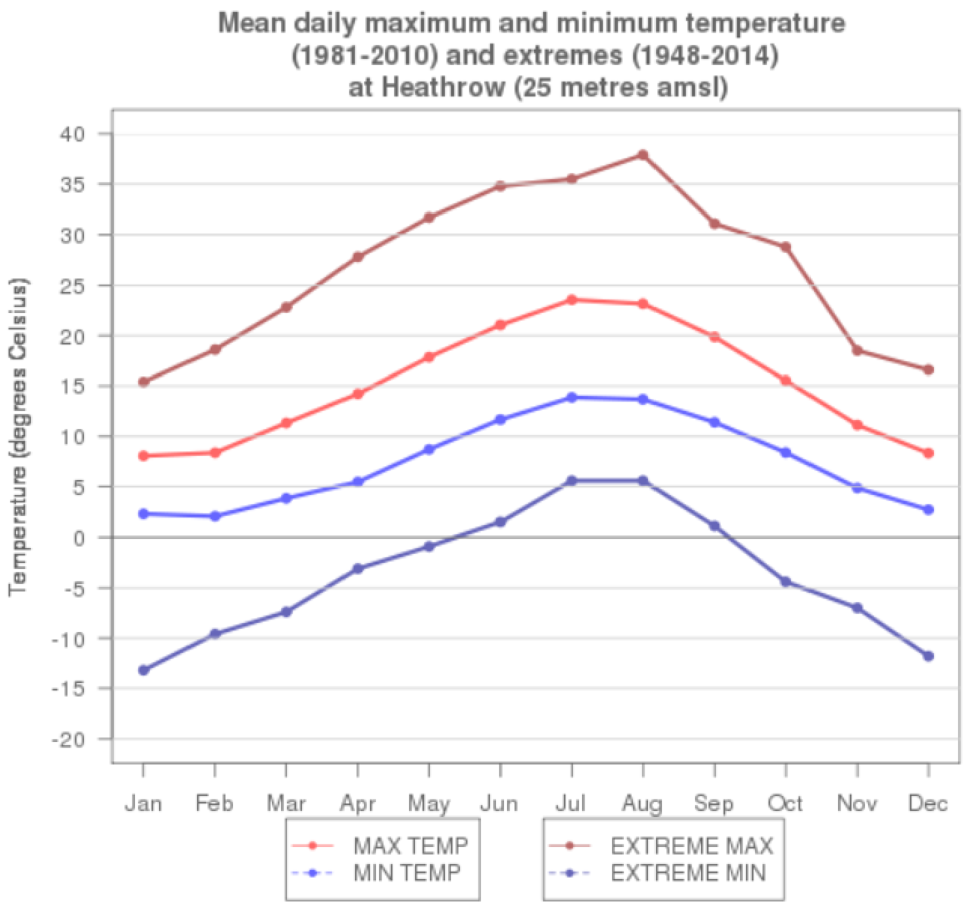
It is further explained that; "the NPPF emphasises the need to take account of climate change over the longer term and plan new developments to avoid increased vulnerability to the range of impacts arising from climate change. The UK Climate Impacts Programme 2009 projections suggest that by the 2080's the UK is likely to experience summer temperatures that are up to 4.2°C higher than they are today."

Accordingly, designers are to ensure buildings are designed and constructed to be comfortable in higher temperatures, without resorting to energy intensive air conditioning.

Accordingly, careful consideration of this issue has been undertaken as part of the application for renewal. The applicants will seek to follow the guidance within CIBSE Guide A and KS03 – Sustainable Low Energy Cooling; An Overview in order, where practical and feasible, to deliver a passive cooling strategy.

4.1.1 Local Environment

The project is located in London. Mean daily maximum temperatures range from just over 6 °C to 8 °C during the winter months and from 20 °C to 23 °C in the summer. These are comparable with typical values found in the summer in the London area which tends to be the warmest part of the UK. Thus, the area is not vulnerable to temperature extremes.



Across the region, sunshine annual averages 1600 hours in the London area, just above the UK average, while much of southern England receives less than 700 mm per year and includes some of the driest areas in the country.

The location in a high rise area of Westminster suggest that the project may well be affected by heat island effect and wind tunnels effects.

4.1.2 Passive Design

Clearly, the are limited passive design measures available to a conversation/extension project, with fixed orientations, but the design team have identified key opportunities;

- The project is relatively enclosed from all side, so exposure to excessive solar gain will be limited via local topographical shading.
- Additional planting to the southern elevations at ground floor level will offer additional shading.
- Replacement glazing to have a low g value to minimise interna heat gains from the key southern elevation.
- New glazing will be openable to enable the occupants to incorporate additional fresh air to further mitigate overheating risk.
- Rooms will have semi-reflective blinds installed to assist in reducing unwanted solar gains.

- Taking advantage of the existing brick/block structure and solid floors – exposing soffits and thermal mass to assist in the regulation of heat within the internal spaces.
- The use of low energy LED lighting will be significant in reducing internal heat gains.
- Internal equipment will also be selected in order to limit internal gains.

4.1.3 Services

The new educational spaces will require the need to introduce mechanical ventilation into the refurbished areas.

The team are proposing the use of localised systems, reducing duct runs, over specification of MEP and to enable systems to employ SFPs.

The building will be tested for air tightness, seeking to achieve a $10m^3/hr/m^2$ or better enables better control of the air balance into the space.

The design team has confirmed that the use of variable refrigerant flow heat pumps is proposed to provide heating and cooling in a superefficient manner as part of "be green" HVAC solution, the justification for which will be confirmed as this report progresses through the Energy Hierarchy.

Finally, a low energy lighting system – utilising linear surface mounted or suspended direct/indirect, LED luminaires in all newly created rooms and other occupied areas - controlled via reactive lighting switches and absence detectors - will ensure a/ minimal internal gains, b/ low energy consumption and c/ much reduced running costs.

4.2 Heating System

The "notional" heating system considered under the "be lean – use less energy" section of the Energy Hierarchy, will consist of high efficiency gas fired LTHW heating with the assumption of mechanical cooling as set out in the GLA Guidance (June 2022).

The toilet lobbies and other back of house areas with be assumed to utilise electric panel radiators

Domestic hot water will also be provided by the above noted boiler systems via appropriately size calorifiers and a secondary return loop.

- High efficiency boiler – (92%+ SEDBUK efficiency) & load compensation.
- Insulated primary pipework

To increase the efficiency in the use of the heating system, the following controls will be used to eliminate needless cycling of the heat pumps.

- Energy management systems enabling load compensation and delayed start thermostats.

4.3 Fabric heat loss

Insulation measures will be utilised to ensure the calculated U-values exceed the Building Regulations minima, with specific guidance taken from the design team:-

- Wall constructions will be internally lined and will target a U-Value of 0.28W/m^{2}k or better.
- The existing roof will be retro-insulated and will target a U-Value of 0.15W/m^{2}k or better.
- The heat loss floors will be retro-insulated and will target a U-Value of 0.25W/m2k or better.

Air Tightness

- The newly refurbished spaces will be air tested to rating at circa 10m^3/hr/m^2.

Glazing

- New glazing systems will achieve a U-Value of 1.4W/m^{2}k, with a g value at 0.40 or betters on the southern façade and roof lights.

4.4 Ventilation

As noted above, the proposed mechanical systems will employ heat recovery to maximise energy efficiency within the air tight building fabric to maximise energy efficiency and ensure a high quality indoor working environment. The advised SFP at a maximum of 1.1W/l/s.

4.6 Lighting and appliances

The development will incorporate high efficiency light fittings utilising LED lamps.

The main education areas will employ photocell diming controls to reduce lighting loads

Common/circulation areas and WCs will also have an absence detection system to ensure lights cannot be left on when not in occupation.

4.7 Energy efficiency results

The above data has been used to update the SBEM models the Building Emission Rate outputs of which are attached at **Appendix B**, with the reporting spreadsheet at **Appendix D**.

The following Table 3 shows the emissions levels, as well as the overall emissions from the building.

Table 3 – Energy Efficient emission levels

Unit	Total Regulated Emissions Kg/Annum	Total Unregulated Emissions Kg/Annum	Total Baseline Emissions Kg/Annum
Chalk Farm Road	7,697	2,166	9,863
Development Total	**7,697**	**2,166**	**9,863**

The results show that the energy efficiency measures introduced have resulted in the reduction in CO_2 emissions from the development by **39.74%.**

Further, the GLA reporting spreadsheet confirms that the passive design/"Be Lean" measures have resulted in a reduction in regulated emissions at **45.80%.**

5.0 Supplying Energy Efficiently

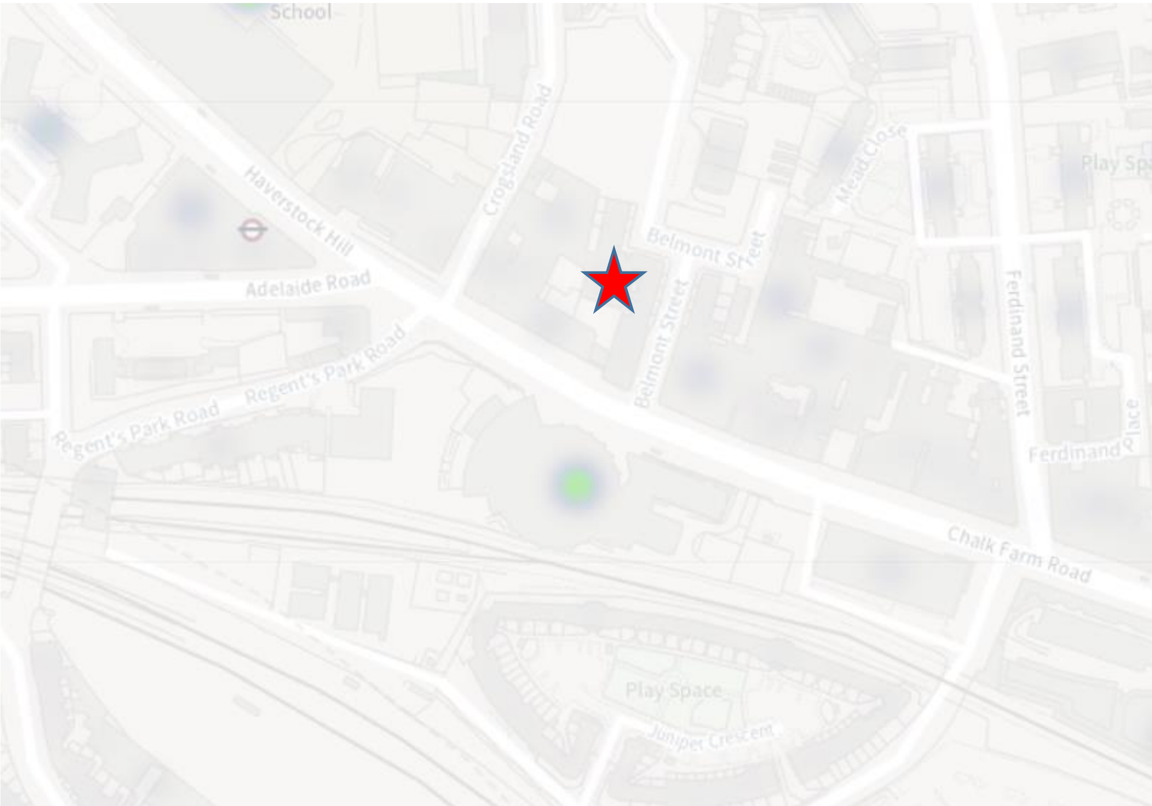
The second stage in the Westminster & Mayor's 'Energy Hierarchy' is to ensure efficient and low carbon energy supply – Be Clean. In particular, this concerns provision of decentralised energy where practical and appropriate.

5.1 Community Heating/Combined Heat and Power (CHP)

The London Plan, Chapter 9, requires that major developments exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly. Development in Heat Network Priority Areas should follow the heating hierarchy in Policy SI3 Energy infrastructure.

Therefore, this report must consider the availability of heat networks in the local area

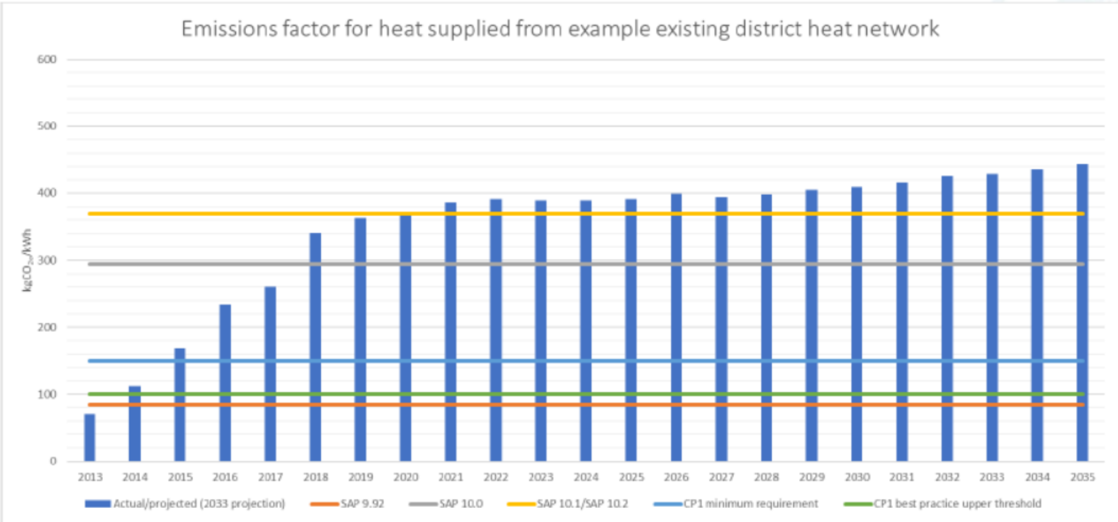
The extract from the London Heat Map (reproduced below) indicates that 81-84 Chalk Farm Road site is within the Heat Network Priority Area, but remote from any existing of proposed DEN.



Extract from London Heat Map

As a non-major scheme, there is no obligation to be DEN connection ready; Indeed, in the case of an education facility, with its limited demand for heat/hot water, combined with intermittent occupation levels – assumed to be vacant during weekend periods, it is not considered appropriate to be “connection ready” in terms of specific on-site arrangements given the lack of any potential timescales for a DEN connection to be available.

Additionally, the decarbonisation of the UK electricity grid (see further commentary below is having a detrimental impact on the carbon efficiency of heat networks, with the current grid based CO2 emissions rending the emission factors for networks some 3 times that of electrical only heat pump systems.



DEN Emission Factors Over Time

So should there be any opportunity to connect to a DEN at any point in the future, this would have to be subject to a further feasibility exercise accounting for DEN heat losses and emission factors to ensure the quality of any such connection.

In the meantime, we consider the potential for on-site CHP.

5.3 On-site CHP

The heat production facility for a district heating scheme is generally considered to include heat only boilers (HOB) and/or the production of both electricity and heat i.e. CHP.

In order to optimise a CHP system, “sizing” is critical to the success of the project. The aim of the process is to maximise the potential financial savings and ensure compliance with current legislation.

The most important factor is to establish the energy profiles – the site’s electrical and thermal characteristics; these can be ascertained by referring to either the site’s utility bills or by following dynamic design data for new build projects.

Typically, to get the full environmental and financial benefits, CHP is sized to the heat load of a site. That will recover all of the heat and give the best overall efficiency. Excess electricity generated can be exported or a shortfall in power can be met through a supplier.

To gain a good level of benefit from operating a CHP system, it is advisable that running hours are at least 4,500 hours a year, whilst having a high and constant demand for heat. However, it could still be worth exploring CHP viability for some sites with a low demand for heat if there is a high demand for electrical output, and thereby off-set peak daytime tariffs.

In the case of the proposed educational facility at Chalk Farm Road, with limited year round DHW, often reducing to zero over weekend and holiday periods, the use of CHP cannot be supported

6.0 Renewable Energy Options

The final element of the Mayor's 'Energy Hierarchy' requires development proposals should provide a reduction in expected carbon dioxide emissions through the use of on-site renewable energy generation, where feasible – Be Green.

Renewable energy can be defined as energy taken from naturally occurring or renewable sources, such as sunlight, wind, wave's tides, geothermal etc. Harnessing these energy sources can involve a direct use of natural energy, such as solar water heating panels, or it can be a more indirect process, such as the use of Biofuels produced from plants, which have harnessed and embodied the suns energy through photosynthesis.

The energy efficiency measures and the sourcing the energy efficiently outlined above have the most significant impact on the heating and hot water energy requirements for the development, and the associated reduction in energy consumption.

It should be noted, that when using SAP10.2 emission factors, each kWh of gas energy saved reduces emissions by 0.21kgCO_2/kWh, whereas, grid based electrical energy has a emissions factor of 0.136kgCO_2/kWh but a much higher cost – some 3.5 that of gas - and accordingly, emphasis will be placed upon "off-setting" grid based electricity in order to achieve the optimum use of renewable technologies, albeit, it should be noted that the emissions reduction impact of renewable technologies actually generating electricity will be considerably reduced.

This section then sets out the feasibility of implementing different energy technologies in consideration of: -

- Potential for Carbon savings
- Capital costs
- Running costs
- Payback period as a result of energy saved/Government incentives
- Maturity/availability of technology
- Reliability of the technology and need for back up or alternative systems.

6.1 Government incentives

6.1.1 Smart Export Guarantee (SEG)

Introduced in 2020, the SEG will enable solar photovoltaic (PV), wind, hydro and anaerobic digestion (AD) installations up to 5MW and micro-combined heat and power (micro-CHP) up to 50kW will be able to receive an export tariff under the policy.

The SEG is a market-led initiative, requiring electricity supply licensees to offer export tariffs to eligible generators. Suppliers are free to set their own SEG compliant tariff price (provided it is above zero pence at all times) and decide how their tariffs work.

Installation owners are able to shop around and select the Licensee of their choice based upon an offer of the most appropriate tariff.

Payment are made against metered exports only.

6.1.2 Renewable Heat Incentive

The Renewable Heat Incentive (RHI) was formally withdrawn for non-domestic application in March 2021.

6.2 Wind turbines

Wind turbines come in two main types'- horizontal axis and vertical axis. The more traditional horizontal axis systems rotate around the central pivot to face into the wind, whilst vertical axis systems work with wind from all directions.

The potential application of wind energy technologies at a particular site is dependent upon a variety of factors. But mainly these are: -

- Wind speed
- Wind turbulence
- Visual impact
- Noise impact
- Impact upon ecology

The availability and consistency of wind in urban environments is largely dependent upon the proximity, scale and orientation of surrounding obstructions. The proposed educational facility is surrounded by buildings of a similar height. To overcome these potential obstructions and to receive practical amounts of non-turbulent wind, the blades of a wind turbine would need to be placed significantly above the roof level of the surrounding buildings and the proposed project at 81-84 Chalk Farm Road itself.

It is inconceivable that any wind turbines of this size would be considered acceptable in this location.

6.3 Solar Energy

The existing building has areas of flat roofed areas - not taken up by terraces and existing plant - that could accommodate solar panels orientated to the south.

general, the roofs will have an unrestricted aspect, so there is scope therefore to site solar photovoltaic (PV) or water heating equipment at roof level.

6.3.1 Solar water heating

Solar water heating panels come in two main types; flat plate collectors and evacuated tubes. Flat plate collectors feed water, or other types of fluid used specifically to carry heat, through a roof mounted collector and into a hot water storage tank.

Evacuated tube collectors are slightly more advanced as they employ sealed vacuum tubes, which capture and harness the heat more effectively.

Both collector types can capture heat whether the sky is overcast or clear. Depending on location, approximately 900–1100 kWh of solar energy falls on each m^2 of unshaded UK roof surface annually. The usable energy output per m^2 of solar panel as a result of this amount of insolation ranges from between 380 – 550 kWh/yr.

Solar hot water systems are of course, displacing gas or high efficiency heat pumps for DHW provision; accordingly solar thermal systems tend to have a very poor pay back model.

Accordingly, given the limited roof space available and the strategy to off-set the electrical use, solar PV may be a stronger candidate (see below) and offer a greater return in terms of a return on investment.

Accordingly, solar thermal would not be the optimum solution for the proposed development.

6.3.2 Photovoltaics (PV)

A 1kWp (1 kilowatt peak) system in the UK could be expected to produce between 790-800kWh of electricity per year based upon a south east orientation according to SAP2005 methodology used by the Microgeneration Certification Scheme (MCS). The figure given in the London Renewables Toolkit is 783 kWh per year for a development in London.

Despite the withdrawal of the Feed in Tariff, PV panels also offer an attractive return due to the ever increasing cost of grid based electricity.

Accordingly, a 29 panel/12.76kWp PV array is to be accommodated at the existing roof level - generating some 13,000kWh per annum.

6.4 Biomass heating

Biomass is a term given to fuel derived directly from biological sources for example rapeseed oil, wood chip/pellets or gas from anaerobic digestion. It can only be considered as a renewable energy source if the carbon dioxide emitted from burning the fuel is later recaptured in reproducing the fuel source (i.e. trees that are grown to become wood fuel, capture carbon as they grow).

Biomass heating systems require space to site a boiler and fuel hopper along with a supply of fuel – which can be very bulky items. There also needs to be a local source of biomass fuel that can be delivered on a regular basis. There are also issues with fuel storage and delivery which mitigate against this technology.

Additionally, a boiler of this type would replace the need for a conventional gas boiler and therefore offset all the gas energy typically used for space and water heating. However, biomass releases high levels of NO_x emissions and particulate matters, as well as other pollutants and would therefore have to be considered carefully against the high standard of air quality requirements the London boroughs; indeed, the whole of the Camden is a designated air Quality Management Area. Accordingly, the use of biomass is not considered appropriate for this project.

6.6 Ground source heat pump

All heat pump technologies utilise electricity as the primary fuel source – in this case displacing gas, as such, the overall reduction in emissions when using this technology can be less effective when opposed to a technology that is actually displacing electricity.

Ground source heating or cooling requires a source of consistent ground temperature, which could be a vertical borehole or a spread of pipework loops and a 'heat pump'. The system uses a loop of fluid to collect the more constant temperature in the ground and transport it to a heat pump. In a cooling system this principle works in reverse and the heat is distributed into the ground.

The heat pump then generates increased temperatures by 'condensing' the heat taken from the ground, producing hot water temperatures in the region of 45°C. This water can then be used as pre-heated water for a conventional boiler or to provide space heating with an under floor heating system.

The use of a ground source heating/cooling system will therefore require:

- Vertical borehole or ground loop
- Use of under floor heating
- Space for heat pump unit

Clearly, there is very limited land associated with the change of use development and no opportunity to install the required ground collectors, as such, ground source heating cannot be considered.

6.7 Air source heat pump

Air source heating or cooling also employs the principle of a heat pump. This time either, upgrading the ambient external air temperature to provide higher temperatures for water and space heating, or taking warmth from within the building and dissipating it to the outdoor air.

Given the requirement to future proof the development against future overheating potential, the design team are considering the use of variable refrigerant (VRF) flow air-to-air heating and cooling system which incorporates inter-zone heat recovery.

VRF systems can have numerous indoor units, served by a single outdoor unit, in both heating and cooling modes simultaneously. This mixed mode operation leads to energy savings as both ends of the thermodynamic cycle are delivering useful heat exchange. If a system has a cooling COP (Coefficient of Performance) of 3, and a heating COP of 4, then heat recovery operation could yield a COP as high as 7.

VRF typical layout

It should be noted that this perfect balance of heating and cooling demand is unlikely to occur for many hours each year, but whenever mixed mode is used energy is saved. In mixed mode the energy consumption is dictated by the larger demand, heating or cooling, and the lesser demand, cooling or heating is delivered free.

Accordingly, the design team are proposing the use of VRF heating and cooling to services the new educational facility.

This approach will obviate the need to utilise the fossil fuels, and in keeping with this strategy, DHW will also be provided via heat pump technology - generating the buildings DHW requirements at an efficiency of 330%.

As part of the electrical only strategy - back of house areas will utilise electric panel radiators - corridors and WCs.

6.8 Final Emissions Calculation

Given the outcome of the feasibility study above, the developer is proposing the use of VRF heat pump technology, to provide the required heating and cooling to the new classroom and educational spaces, with heat pump technology providing the DHW.

A roof mounted 29 panel/12.76kWp PV array will finalise the renewables mix.

The final table – Table 4 – summarises the final outputs from the SBEM models; the BRUKL output attached at **Appendix C.**

Table 4 – "Be Green" emission levels

Unit	Total Regulated Emissions Kg/Annum	Total Unregulated Emissions Kg/Annum	Total Baseline Emissions Kg/Annum
Chalk Farm Road	4,198	2,166	6,364
Development Total	**4,198**	**2,166**	**6,364**

The data at Table 4 confirms that overall emissions – including unregulated energy use - have been reduced by **61,12%** over and above the baseline model, with a **35.48%** reduction in emissions directly from the use of energy generating and renewable technologies, i.e. over and above the energy efficient model.

Excluding the un-regulated use, i.e. considering regulated emissions controlled under AD L2, then the final reduction in BER/TER equates to **70.44%.**

Energy use intensities are reported below:-

Table 5 – Energy and Heat Demands

Building Type	Energy Use Intensity ($kWh/m^2/year$)	Space Heating ($kWh/m^2/year$)
Commercial	41.72	13.06

7.0 Sustainable Design & Construction

The Sustainability credentials of the proposed educational redevelopment are set out below; based on the assessment criteria developed by the Building Research Establishment, specifically:

Materials

Clearly, the general principal of the refurbishment and re-use of an existing building is sustainable by default – much reducing the embodied carbon content of the overall building.

New build construction techniques will be considered against the BRE Green Guide to ensure that, where practical, the most environmentally friendly construction techniques are deployed.

Construction materials will be sourced from suppliers capable of demonstrating a culture of responsible sourcing via environmental management certification, such as BES6001

Insulation materials will be selected that demonstrate the use of blowing agents with a low global warming potential, specifically, a rating of 5 or less. Additionally, all insulants used will demonstrate responsible sourcing of material and key processes.

The principal contractor with be required to produce a site waste management plan and sustainable procure plan, in line with BREEAM requirements – this will include a pre-demolition audit to identify demolition materials to reuse on-site or salvage appropriate materials to enable their reuse or recycling off-site. The procurement plan will follow the waste hierarchy Reduce; Reuse & Recycle.

A Site Waste Management Plan (SWMP) will be developed prior to commencement of development stage to inform the adoption of good practice waste minimisation in design. This will set targets to minimise the generation of non-hazardous construction waste using the sustainable procurement plan to avoid over-ordering and to use just-in-time delivery policies.

Operational waste and recycling – appropriate internal and external storage space will be provided to ensure that residents can sort, store and dispose of waste and recyclable materials in line with Camden's collection policies.

Pollution

The contractor will also monitor the use of energy and water use during the construction phase and incorporate best site practices to reduce the potential for air (dust) and ground water pollution.

The completed development will use zero emission heat pump systems for heating and hot water.

The main contractor will be required to register the site with the Considerate Constructors Scheme and achieve a best practice score of 25 or more.

To void the issue of noise pollution, the development will comply with Building Regulations Part E, providing a good level of sound insulation between the proposed development and surrounding buildings.

Energy

The development will incorporate renewables technologies as noted in the main report above.

The completed project will be supplied with a Building User Guide offering practical advice on how to run the building economically and efficiently, including specific advice on how to reduce unregulated energy uses.

This will be further enhanced by the installation of smart energy metering, enabling managers to accurately assess their energy usage and thereby, manage it.

Water

The development minimise water use as far as practicable by incorporating appropriate water efficiency and water recycling measures. The educational facility will reduce water use by a minimum of 25% against the BREEAM benchmarks via the use of low flow taps, and dual flush toilets and will avoid the use of urinals – high water consuming items.

Sustainable Urban Drainage (SuDs)

The existing site is currently made up predominantly of hard surfaces. Accordingly, the introduction of attenuation measures will help to reduce the levels of surface water run-off.

A formal flood risk assessment and SuDs strategy is submitted under separate cover

Ecology and Biodiversity

Clearly, the existing site is nearly 100% previously developed, so any improvement on this situation would increase biodiversity.

The development would employ an ecologist to consider the planting regime for the communal landscaped areas and an overall improvement in the levels of fauna and flora utilising indigenous species where possible and appropriate

8.0 Conclusions

This report has detailed the baseline energy requirements for the proposed development, the reduction in energy demand as a result of energy efficiency measures and the potential to achieve further CO_2 reductions using renewable energy technologies.

Throughout the assessment against the energy hierarchy – as set out in The London Plan – SAP10.2 emissions data has been used in line with the very latest GLA guidance on the preparation of energy statements.

The baseline results have shown that if the development was built to a standard to meet only the minimum requirements of current building regulations, the total amount of CO_2 emissions would be **16,368Kg/year**.

Following the introduction of passive energy efficiency measures into the development, as detailed in section 4, the total amount of CO_2 emissions would be reduced to **9,863Kg/year**

There is also a requirement to reduce CO_2 emissions across the development using renewable or low-carbon energy sources. Therefore the report has considered the feasibility of the following technologies:

- Wind turbines
- Solar hot water
- Photovoltaic systems
- Biomass heating
- CHP (Combined heat and power)
- Ground & Air source heating

The results of the assessment of suitable technologies relative to the nature, locations and type of development suggest that the most suitable solution to meeting reduction in CO_2 emissions would be via the use of VRF heat pump technology to service the heat and cooling loads, as well as the DHW demand.

There will also be a12.76kWp PV array at roof level on the existing building.

This has been used in the BRUKL models (reproduced at **Appendix C**) for the development which have also been detailed above in Table 4, which show a final gross emission level of **6,364Kg/year**, representing a total reduction in emissions over the baseline model, taking into account unregulated energy, of **61.12%.**

In addition, the final BRUKL outputs at **Appendix C** demonstrate that the building achieves an overall improvement in emissions over the Building Regulations Part L standards for regulated emissions of minimum of **70.44%**.

Tables 6 & 7 Demonstrate how the 81-84 Chalk Farm Road project complies with the London Plan requirements and the GLA guidance relating to zero carbon development.

Table 6 – Carbon Emission Reductions – Non-domestic Buildings

Key	Tonnes/annum
Baseline CO_2 emissions (Part L 2013 of the Building Regulations Compliant Development)	14.2
CO2 emissions after energy demand reduction (be lean)	7.7
CO2 emissions after energy demand reduction (be lean) AND heat network (be clean)	7.7
CO2 emissions after energy demand reduction (be lean) AND heat network (be clean) AND renewable energy (be green)	4.2

Table 7 – Regulated Emissions Savings – Non-domestic Buildings

	Regulated Carbon Dioxide Savings	
	(Tonnes CO2 per annum)	%
Savings from energy demand reduction	6.5	46%
Savings from renewable energy	3.5	25%
Total Cumulative Savings	**10.00**	**70%**
	($Tonnes\ CO_2$)	
Carbon Shortfall	4.2	
Cumulative savings for off-set payment	**126**	
Cash-in-lieu Contribution	**£11,964.00**	

Appendix A

Baseline/Un-regulated Energy Use:-

BRUKL Outputs & Building Emission Rates

Appendix B

Energy Efficient Design:-

BRUKL Outputs & Building Emission Rate

Appendix C

Generating energy on-site:-

Final BRUKL Outputs & Building Emission Rate

Appendix D

GLA SAP201 Reporting Tool

Appendix E

BREEAM Non-domestic Refurbishment

Pre-assessment Estimator and Report