Energy & Sustainability Statement

11-12 Grenville Street
London
WC1N 1LZ

24th November 2021

Prepared for:

Hoze Investments

Contents

Appendices

1.0 Executive Summary

The proposed development project at 11-12 Grenville Street involves the change of use and refurbishment/redevelopment of the site to create 6 new dwellings

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.

The report takes on board the latest GLA guidance on writing energy statements as well as taking into account matters raised within the new London Plan.

eb7 Sustainability Ltd have been appointed to develop a strategy and advise how the proposed development of a new dwellings will comply with these requirements.

A 'Lean, Clean, Green' has been adopted and the development achieves an overall improvement (DER/TER) in regulated emissions at over **58.36%** above Part L 2013 standard, through the adoption of high standards of insulation, heat pump driven heating and hot water systems; assessed against the SAP10 methodology.

As such, this non-major domestic development will achieve the energy reduction targets in line with London Plan major scheme requirements.

2.0 The Site & Proposal

The site is currently occupied by a 4 storey building with restaurant use at ground floor and office space above.

The proposal for the site includes the change of use/refurbishment to the upper floors to create 5 x new flats and the demolition of an existing rear garage and erection of a new build 2 storer dwelling, with basement.

The project is located within the Bloomsbury Conservation area and has grade II listed building to the rear, either side of the Colonnade.

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 SI1 Improving air quality

A London's air quality should be significantly improved and exposure to poor air quality, especially for vulnerable people, should be reduced:

Development proposals should not:

a) lead to further deterioration of existing poor air quality

b) create any new areas that exceed air quality limits, or delay the date at which compliance will be achieved in areas that are currently in exceedance of legal limits

c) reduce air quality benefits that result from the Mayor's or boroughs' activities to improve air quality

d) create unacceptable risk of high levels of exposure to poor air quality.

5) Air Quality Assessments (AQAs) should be submitted with all major developments, unless they can demonstrate that transport and building emissions will be less than the previous or existing use.

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 proposals 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.

The project at Grenville Street– at 6 new dwellings – would be considered a non-major scheme and this report is informed accordingly.

However, the design team are electing to use SAP10 emissions data, in line with the latest GLA guidance.

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.

3.1 New Dwellings created via Change of Use

The project at Grenville Street involves a change of use/conversion and as such will be considered against the Building Regulations AD L1B; Accordingly, the energy requirements for space heating, water heating and ventilation within the residential dwellings within the project have been calculated using the Standard Assessment Procedure 2012 (SAP) in line with Part L1B of the Building Regulations 2013 and the Domestic Heating Compliance Guide 2nd Edition.

The Baseline emissions have been calculated in line with the latest GLA guidance (Table 12 within the guidance), as reproduced below.

Table 12: *Domestic notional specification for existing buildings*

Element	Unit	Specification[3]
External Wall	W/m^2K	0.55
Roof	W/m^2K	0.18
Floor	W/m^2K	0.55
Glazing	W/m^2K	1.60
Vision element	g-value	0.63
Air permeability	($m^3/h\ m^2$ @ 50 Pa)	Default - determined by fabric element types
Thermal Bridging	W/m^2K	Default
HVAC type	-	Gas boiler, naturally ventilated
Heating and Hot Water	%	89.5%
Cooling (air-condition)	SEER	None
Lighting	%	75% low energy lighting

The baseline building results have been calculated and are presented in Table 2 below, with the assumption of single glazing at baseline, as this will need to be carried through to the final design due to the conservation area status.

3.2 New Build Dwellings

The baseline emission levels – the Target Emission Rate (TER) - is obtained by applying the design to a reference 'notional' building the characteristics of which are set by regulations – SAP2012; The new Part L Building Regulations 2013 came into force on April 2014 and introduced a completely new notional dwelling as detailed below:-

Table 4 Summary of concurrent notional dwelling specification

Element or System	Values
Opening areas (windows and doors)	Same as actual dwelling up to a maximum proportion of 25% of total floor area [1]
External Walls (including opaque elements of curtain walls) [6]	0.18 W/m²K
Party Walls	0.0 W/m²K
Floor	0.13 W/m²K
Roof	0.13 W/m²K
Windows, roof windows, glazed rooflights and glazed doors	1.4 W/m²K [2] (Whole window U-value)
	g-value = 0.63 [3]
Opaque doors	1.0 W/m²K
Semi glazed doors	1.2 W/m²K
Air tightness	5.0 m³/hr/m²
Linear thermal transmittance	Standardised psi values – See SAP Appendix R, except use of y=0.05 W/m²K if the default value of y=0.15 W/m²K is used in the actual dwelling
Ventilation type	Natural (with extract fans) [4]
Air conditioning	None

Element or System	Values
Heating System	Mains gas If combi boiler in actual dwelling, combi boiler; otherwise regular boiler Radiators
	Room sealed
	Fan flue
	SEDBUK 2009 89.5% efficient
Controls	Time and temperature zone control [5] Weather compensation
	Modulating boiler with interlock
Hot water storage system	Heated by boiler (regular or combi as above) If cylinder specified in actual dwelling, volume of cylinder in actual dwelling. If combi boiler, no cylinder. Otherwise 150 litres. Located in heated space. Thermostat controlled Separate time control for space and water heating
Primary Pipework	Fully Insulated
Hot water cylinder loss factor (if specified)	Declared loss factor equal or better than 0.85 x (0.2 + 0.051 V2/3) kWh/day
Secondary Space Heating	None
Low Energy Lighting	100% Low Energy Lighting
Thermal Mass Parameter	Medium (TMP=250)

SAP first creates the notional reference building, based upon the same shape and form as the proposed dwelling and applies the above the characteristics as defined in SAP2012.

Once all of the baseline emission rates have been calculated in line with the above Government approved methodologies, they are considered as stage 'zero' of the energy hierarchy as described earlier and Target Emission Rate sets the benchmark for the worst performing, but legally permissible, development.

All the emissions data as calculated under 3.1 and 3.2 above, are then converted to SAP10 emissions via the use of the GLA SAP10 conversion spreadsheet – attached at **Appendix D**.

3.3 Unregulated Energy Use

The baseline un-regulated energy use for cooking & appliances in the residential units have been calculated using the SAP Section 16 methodology; the same calculation used for Code for Sustainable Homes (CfSH) Ene 7.

Appliances = E_A = 207.8 X $(TFA \times N)^{0.4714}$

Cooking = (119 + 24N)/TFA

N = no of occupant SAP table 1B

TFA – Total Floor Areas

The SAP10 emissions associated with unregulated energy use per sqm is summarised in Table 1 below

Table 1 – Unregulated Energy Use

Unit	CO_2 emissions - Unregulated Energy Use SAP2012 Kg/sqm	CO_2 emissions - Unregulated Energy Use SAP10 Kg/sq
Unit 1	15.06	6.78
Unit 2	15.11	6.80
Unit 3	15.68	7.06
Unit 4	15.68	7.06
Unit 5	15.56	7.00
Unit 6	15.90	7.16

The un-regulated emission rates are added to the baseline regulated emission rates (as calculated under 3.1 and 3.2 above) in order to set the total baseline emission rates before then applying the energy hierarchy in line with The London Plan and Camden policies.

3.3 Baseline Results

The baseline building results have been calculated, converted to SAP10 emission standards and are presented in Table 2 below.

The Baseline SAP outputs (which summarise the key data) are attached at **Appendix A**.

Table 2 – Baseline energy consumption and CO_2 emissions

Unit	Target Emission Rate (regulated energy use) Kg/sqm	Unregulated Energy Use Kg/sqm	Total baseline emissions Kg/sqm	Total baseline emissions Kg
Unit 1	16.20	6.78	22.93	2294.19
Unit 2	34.20	6.80	41.00	3870.53
Unit 3	39.00	7.06	46.09	2225.26
Unit 4	35.90	7.06	42.92	2072.26
Unit 5	36.40	7.00	43.41	2402.62
Unit 6	36.90	7.16	44.07	1646.93
Development Total				**14,512**

4.0 Design for energy efficiency

The first step in the Mayor's 'Energy Hierarchy' as laid out in Chapter 9 of The London Plan, requests 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

The National Planning Policy Framework 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.

In line with current GLA Guidance and Camden Local Plan policy, the project at Grenville Street has had been designed to ensure the building is not vulnerable to overheating; to instigate consideration of the risk of overheating with the proposed development, the design team have followed the guidance within the London Plan, which consider the control of overheating using the Cooling Hierarchy:-

1. **minimise internal heat generation through energy efficient design**

The project will be designed to best practice thermal insulation levels as noted, full details of which are noted under 4.3 below.

Not only does good insulation assist in reducing heat losses in the winter, but it also has a significant impact on preventing heat travelling through the build fabric during the summer.

2. **reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and wall**

The development site is in a relatively high rise suburban townscape, with an east-west orientation. It is part of a north-south running terrace and therefore, has very limited exposure to the southern sun.

To the east is a significant 6/7 storey accommodation building which will offer a significant topographical shading to east facing units.

The dwellings have only limited south facing glazing and all glazing is limited in scale due to the fenestration pattern within the conservation area

The livings areas are generally arranged to the eastern façade, with the benefit of the above noted shading from the building opposite.

Across the scheme, the glazing to the secondary spaces – the rear bedrooms and bathrooms – is much reduced in keeping with the reduced heat demand associated.

Glazing specification - although single glazed in the conservation area - will have a solar control coating applied.

3. **manage the heat within the building through exposed internal thermal mass and high ceilings**

The flats are designed with floor to floor heights at minimum 2.6m.

The structure is expected to be of traditional block walls with concrete floors, offering significant thermal mass able to absorb heat during the summer months, which can then be ventilated during the evening or overnight.

4. **passive ventilation**

All glazing is designed to have opening areas to introduce high levels of natural levels of "purge" ventilation to further assist in the reduction of overheating risks in appropriate areas.

5. **mechanical ventilation**

Given the strategy outlined above, there is no requirement to introduce mechanical ventilation; the project is to be naturally ventilated in line with AD Part F System 1.

4.3 Heating System

The notional heating system considered under the "be lean – use less energy" section of the Energy Hierarchy, will consist of high efficiency condensing gas boilers providing under floor heating and domestic hot water to the project

- High efficiency boiler – (89%+ 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 firing of the boilers.

- Boilers fitted with load compensation and delayed start thermostats.

4.4 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: -

- New wall constructions will be of a traditional block cavity wall and will target a U-Value of 0.15W/m^{2}k or better.
- Existing walls will be internally lined to achieve a U-Value at 0.30W/m^{2}k.
- Roof constructions are to be insulated optimising the available space, achieving a U-Value of 0.14W/m^{2}k or better.
- The loft spaces will be insulated to meet a U Value at 0.10W/m^{2}k.
- The newly laid floors will achieve a minimum u value of 0.14/0.15W/m^{2}k subject to perimeter/area ratios

Glazing

- The new glazing for windows and doors will be single glazed due to the conservation area status and location adjacent to Grade II listed buildings.

Air Tightness

- Although but required under Part L1B project be tested to 10m^3/hr/m^2, whilst the new build unit will be tested to 5m^3/hr/m^2 in line with best practice for naturally ventilated dwellings.

Construction Details

- Heat loss via non-repeating thermal bridging within the new build elements will be minimised by the use of Accredited Construction Details for these new build units. An overall Y-Value <0.07 is targeted.

4.5 Ventilation

As noted above, the project is to be 100% naturally ventilated in line with AD Part F System 1; background (trickle) ventilation, with purge ventilation via opening windows and intermittent extracts to wet rooms.

4.6 Lighting and appliances

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

The use of LED lighting will also minimise the internal gains commonly associated with tungsten and fluorescent lighting systems and thereby further reduce the potential for the flats to overheat.

4.7 Energy efficiency results

The above data has been used to update the SAP models, the Dwelling Emission Rate outputs of which are attached at **Appendix B**, whilst Table 3 sets out the total emissions using SAP10 data.

Table 3 – Energy Efficient emission levels

Unit	Emission Rate (regulated energy use) Kg/sqm	Unregulated Energy Use Kg/sqm	Total baseline emissions Kg/sqm	Total baseline emissions Kg
Unit 1	20.80	6.78	27.62	2763.22
Unit 2	29.10	6.80	35.85	3384.41
Unit 3	33.30	7.06	40.33	1947.25
Unit 4	31.20	7.06	38.23	1845.70
Unit 5	31.00	7.00	38.00	2103.18
Unit 6	31.50	7.16	38.71	1446.46
Development Total				**13,490**

The results show that the energy efficiency measures introduced have resulted in the reduction in CO_2 emissions from the development of **7.04%.**

Regulated emissions have been reduced by **8.61%** via the passive design measures highlighted above.

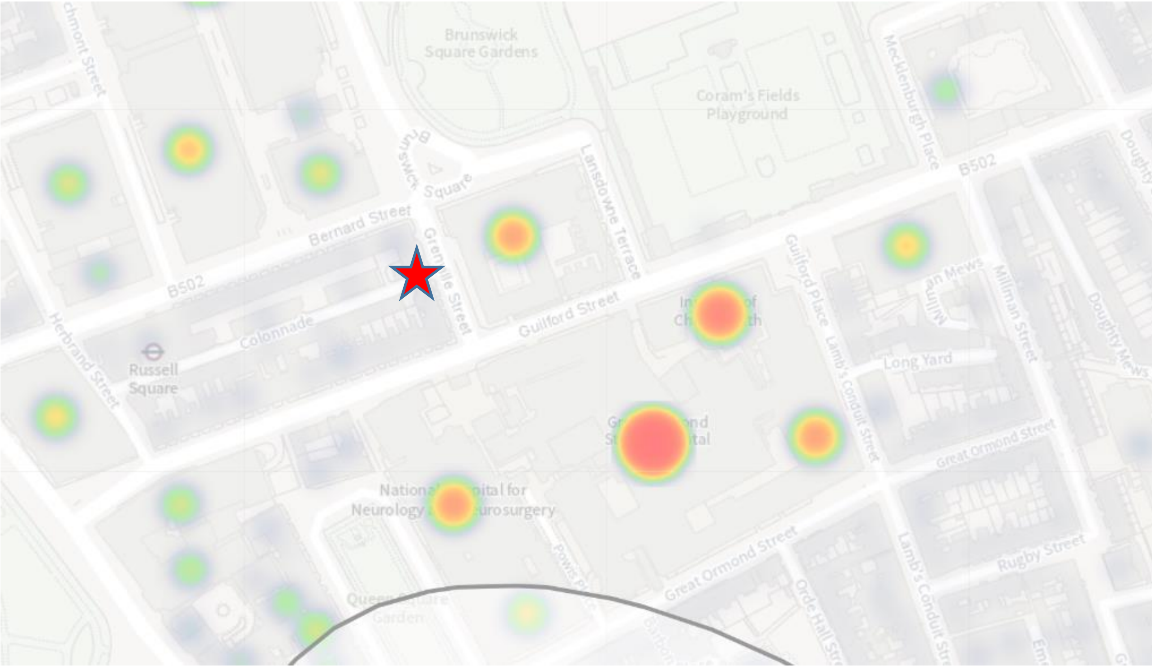
5.0 Supplying Energy Efficiently

The second stage in the 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 Camden area The extract from the London Heat Map (reproduced below) identifies that the site is close to a heat map study area and within the Heat Network Priority Area.



Extract from London Heat Map

Clearly there is some potential for the project site to connect to a DEN at some point in the future

As a non-major scheme, there is no obligation to be designed to be DEN connection ready, however, the chosen wet heating system would be compatible with a DEN connection; in particular, the LTHW heating system would provide the necessary flow and (low) return temperatures compatible with DEN connections.

In the medium term, the design team should consider the potential of a stand-alone communal system, but clearly, as a limited refurbishment project, only 6 new dwelling, the circulation heat losses associated and with very limited space to develop a street level plant space a - the potential for communal heating/CHP systems is clearly not at all practical and will not be considered further.

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 gas consumption.

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 closed to non-domestic application by in March 2021.

Although now closed to non-domestic applications, it is still available to domestic "self-build" developments.

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 site is flanked by other properties at minimum of 2-3 stories in all directions. To overcome these 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 Grenville Street itself.

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

6.3 Solar Energy

The proposed development a small areas of pitched roof at top floor level that could accommodate solar panels orientated to the east or west.

In 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.

However, the sensitive location of the project; within the Bloomsbury Conservation area, it is considered inappropriate to have panels on the eastern roof - overlooking the street scene, or the west - overlooked by Grade II listed buildings to the rear.

Accordingly the use of any form of roof panel is dismissed in favour of alternative technologies.

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. There is inadequate space on site for a fuel store and limited access for delivery lorries.

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 within Camden's Borough wide AQMA. 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 insufficient land area to install low level collector loops or deep bore GSHP as the only potential option.

Clearly, in the case of the proposed development, there is no scope for the locating of the ground collector devices and 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.

It must be remembered that heat pumps utilise grid based electricity, so calculations base the benefits on SAP10 emissions data

Assuming a seasonal system efficiency of 320% (Coefficient of Performance of 3.2) and that the air source heat pump will replace 100% of the space heating/hot water demand, then the system would reduce the overall CO_2 emissions by approximately 60%. The table below demonstrates, on the assumption of a demand of 1000kWh/year for heating and hot water.

Table 4 – ASHP Performance

Type of Array	Energy Consumption (kWh/yr.)	Emission factor ($kgCO_2/kWh$)	Total CO_2 emissions (kg/annum)
90% efficient gas boiler	11111	0.210	2333
320% efficient ASHP	2813	0.233	655
100% efficient immersion (back-up)	1000	0.233	233

A theoretical carbon saving of 60%

Accordingly, the design team are proposing the use of air source heat pump systems; and air to water heat pump, located on the upper floor roof area ear marked for external plant, to service the heating and hot water requirements for the proposed new dwellings.

Individual heat pump units for the 6 units will be located within an acoustic enclosure, with an appropriate design within the conservation area.

Efficiencies are expected to be in excess of 330%.

6.8 Final Emissions Calculation

Given the outcome of the feasibility study above, the developer is proposing the use the above noted air source heat pump system for the heating and DHW requirements.

The final table – Table 5 – summarises the final outputs from the SAP models; attached at **Appendix C.**

Table 5 – "Be Green" emission levels

Unit	Emission Rate (regulated energy use) Kg/sqm	Unregulated Energy Use Kg/sqm	Total baseline emissions Kg/sqm	Total baseline emissions Kg
Unit 1	9.20	6.78	15.96	1596.48
Unit 2	12.90	6.80	19.67	1856.92
Unit 3	15.10	7.06	22.21	1072.11
Unit 4	14.20	7.06	21.28	1027.39
Unit 5	14.00	7.00	20.99	1161.64
Unit 6	16.30	7.16	23.51	878.41
Development Total				**7,593**

The data at Table 5 confirms that overall emissions – including unregulated energy use - have been reduced by **47.68%** over and above the baseline model, with a **43.71%** 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 emissions controlled under AD Part L, then the final reduction in DER/TER equates to **58.36%.**

The GLA SAP10 conversion spreadsheet is attached at **Appendix D.**

7.0 Sustainable Design & Construction

The Sustainability credentials of the proposed refurbishment/residential development are set out below; based on the assessment criteria developed by the Building Research Establishment

Materials

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.

More specifically, the design team have undertaken a pre-demolition audit on the existing structure to confirm the reasoning behind the proposal for demolition and redevelopment, as well as to identify materials that can be re-used/re-purposed within the new construction and utilise same accordingly.

New 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 principle contractor with be required to produce a site waste management plan and sustainable procure plan, in line with BREEAM requirements, which will reference the pre-demolition audit; this will enable 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 dwellings 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 avoid 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.

The heat pump external unit will be housed within an acoustic enclosure.

Energy

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

The new homes will also be supplied with a Home User Guides offering practical advice on how to use the home economically and efficiently, including specific advise on how to reduce unregulated energy uses.

This will be further enhanced by the installation of smart energy metering, enabling occupants 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 applicants will ensure that all dwellings meet the required level of 105 litres maximum daily allowable usage per person in accordance with Level 4 of the Code for Sustainable Homes.

Sustainable Urban Drainage (SuDs)

The existing site is predominantly made up entirely of building and hard surfaces. Accordingly, there will be a neutral impact on surface water run-off.

Ecology and Biodiversity

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

The development will incorporate a new landscaping plan to optimise site ecology.

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.

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 **14,512Kg/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 **13,490Kg/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 heat pump technology for the generation of heating and hot water for the project.

This has been used in the SAP models (reproduced at **Appendix C**) for the development which have also been detailed above in Table 5, which show a final gross emission level of **7,593Kg/year**, representing a total reduction in emission over the baseline model, taking into account unregulated energy, of **47.68%.**

In addition, the final SAP outputs at **Appendix C**, with the associated SAP10 calculations at **Appendix D** demonstrate that the building achieves an overall improvement in regulated emissions over the Building Regulations Part L standards for regulated emissions of minimum of **58.36%.**

Tables 6 & 7 Demonstrate how the Grenville Street project complies with the London Plan requirements and the GLA guidance relating to zero carbon development.

Table 6 – Carbon Emission Reductions – Domestic Buildings

Key	Tonnes/annum
Baseline CO_2 emissions (Part L 2013 of the Building Regulations Compliant Development)	11.86
CO2 emissions after energy demand reduction (be lean)	10.83
CO2 emissions after energy demand reduction (be lean) AND heat network (be clean)	0.00
CO2 emissions after energy demand reduction (be lean) AND heat network (be clean) AND renewable energy (be green)	4.94

Table 7 – Regulated Emissions Savings – domestic Buildings

	Regulated Carbon Dioxide Savings	
	(Tonnes CO2 per annum)	%
Savings from energy demand reduction	1.03	8.68
Savings from heat network	0.00	0.00
Savings from renewable energy	5.89	49.66
Total Cumulative Savings	6.92	58.35
	(Tonnes CO_2)	
Carbon Shortfall	4.94	
Cumulative savings for off-set payment	148.2	
Cash-in-lieu Contribution	N/A	

Appendix A

Baseline/Un-regulated Energy Use:-

SAP Outputs & Target/Dwelling Emission Rates

Appendix B

Energy Efficient Design:-

SAP Outputs & Dwelling Emission Rates

Appendix C

Generating energy on-site:-

Final SAP Outputs & Dwelling Emission Rates

Appendix D

SAP10

GLA SAP10 Conversions Spreadsheet