Energy Efficiency Statement

46 Avenue Road
London
NW8 6HS

24th February 2017

Prepared for:

Brightwood Ltd

Contents

Appendices

1.0 The Site & Proposal

The proposal at 46 Avenue Road is for the demolition of the existing dwelling, retention of the main façade, and the construction of a new build dwelling and basement area behind the retained façade.

Overall, the new dwelling will provide circa 1,300sqm of accommodation, including a basement level swimming pool and leisure facilities, staff accommodation as well as family accommodation at ground, first and second floors.

1.1 Planning Context

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

Camden's key planning policy documents are:-

- Core Strategy 2010
- Development Policies 2010
- Camden Planning Guidance (CPG) 3 - Sustainability
- Camden's Drat Local Plan 2015

Core Strategy Policy CS13 - Tackling climate change through promoting higher environmental standards - requires:-

The Council will require all development to take measures to minimise the effects of, and adapt to, climate change and encourage all development to meet the highest feasible environmental standards that are financially viable during construction and occupation by:

a) ensuring patterns of land use that minimise the need to travel by car and help support local energy networks;

b) promoting the efficient use of land and buildings;

c) minimising carbon emissions from the redevelopment, construction and occupation of buildings by implementing, in order, all of the elements of the following energy hierarchy:

- ensuring developments use less energy,
- making use of energy from efficient sources, such as the King's Cross, Gower Street, Bloomsbury and proposed Euston Road decentralised energy networks;
- generating renewable energy on-site; and

d) ensuring buildings and spaces are designed to cope with, and minimise the effects of climate change.

The Council will have regard to the cost of installing measures to tackle climate change as well as the cumulative future costs of delaying reductions in carbon dioxide emissions

Development Policy DP22 - Promoting sustainable design and construction – requires:-

The Council will require development to incorporate sustainable design and construction measures. Schemes must:

a) demonstrate how sustainable development principles, including the relevant measures set out in paragraph 22.5 below, have been incorporated into the design and proposed implementation; and

b) incorporate green or brown roofs and green walls wherever suitable.

(Para 22.5) Developments of 5 or more dwellings or 500sqm of any floor space should address sustainable development principles in their Design and Access statements or in a separate Energy Efficiency Statement

The Council will require development to be resilient to climate change by ensuring schemes include appropriate climate change adaptation measures, such as:

f) summer shading and planting;

g) limiting run-off;

h) reducing water consumption;

i) reducing air pollution; and

j) not locating vulnerable uses in basements in flood-prone areas.

The Draft Local Plan further emphasises the need for:-

" all development proposals of five or more dwellings and/or 500m sqm of any floor space to show in an energy statement how the energy hierarchy has been applied"

"incorporate green roofs, combination green and blue roofs and green walls where appropriate; and measures to reduce the impact of urban and dwelling overheating"

To "promote and measure sustainable design and construction by ensuring development schemes demonstrate how adaptation measures and sustainable development principles have been incorporated into the design and proposed implementation"

Further guidance on Camden's sustainability requirements are included in the CPG 3.

1.2 The London Plan

On 10 March 2015, the Mayor published (i.e. adopted) the Further Alterations to the London Plan (FALP). From this date, the FALP are operative as formal alterations to the London Plan (the Mayor's spatial development strategy) and form part of the development plan for Greater London;

Policy 5.2 Minimising Carbon Dioxide Emissions, requires:-

Development proposals should make the fullest contribution to minimising carbon dioxide emission in accordance with the following energy hierarchy:

1 Be lean: use less energy

2 Be clean: supply energy efficiently

3 Be green: use renewable energy

As part of this assessment, it must consider unregulated energy use not covered under the Building Regulations at each stage of the Energy Hierarchy i.e. cooking and appliances and use of equipment within the commercial element.

In March 2016, the Mayor's office published "Energy Planning - Greater London Authority guidance on preparing energy assessments"

This document formally introduces the principle of zero carbon hoes from 1st October 2016 and confirmed that "the London Plan policy seeking 'zero carbon' homes remains in place and was not changed by the recent Minor Alterations to the London Plan."

'Zero carbon homes are defined as homes forming part of major development applications where the residential element of the application achieves at least a 35 per cent reduction in regulated carbon dioxide emissions (beyond Part L 2013) on-site. The remaining regulated carbon dioxide emissions, to 100 per cent, are to be off-set through a cash in lieu contribution to the relevant borough to be ring fenced to secure delivery of carbon dioxide savings elsewhere.

Although, not to be considered a major project, the applicants seek to achieve the highest levels of environmental performance in line with London Plan and Camden policies and this report will be guided accordingly.

2.0 Baseline Energy Results

In order to consider the project against the London Plan Energy Hierarchy, this report will first establish the “Baseline” energy consumption.

2.1 New Build Properties

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 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 sets the benchmark for the worst performing, but legally permissible, development.

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

Cooking = (119 + 24N)/TFA

N= no of occupant SAP table 1B

TFA – Total Floor Areas

The unregulated energy use per sqm is summarised in Table 3 below

Table 1 – Unregulated Energy Use

Unit	Unregulated Energy Use Kg/sqm
46 Avenue Road	13.08

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

Table 2 – Baseline energy consumption and CO_2 emissions

Unit	Baseline Emission Rate (regulated energy use) Kg/sqm	Unregulated Energy Use Kg/sqm	Total baseline emissions Kg/sqm	Total baseline emissions Kg
46 Avenue Road	12.66	13.08	25.74	33085.83
Total				33085.83

The baseline SAP DER outputs are attached at **Appendix A**

3.0 Design for energy efficiency

The first step in the Mayor's 'Energy Hierarchy' as laid out in Section 5 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 dwellings, 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 subject building after the energy efficiency measures have been included.

To achieve reductions in energy demand the following measures have been included within the design and specification of the building:

3.1 Orientation & Passive Design

The project has a south westerly orientation – with the vast majority of the glazing having either a south west of north east orientation.

The retained façade immediately dictates the opening areas of glazing to the south west; that said, glazed area are limited in size for the exposed upper floors, while the ground floor patio-style glazing is fully openable providing high levels of purge ventilation.

The dwelling will also have solar shading installed in the form of vertical blinds- able to respond to the sun's position, and new glazing will be specified to have a low g-value (circa 0.45), to further control unwanted solar gain.

3.2 Heating system

For the energy efficient model, the primary heating system for the dwellings will consist of a high efficiency condensing gas boilers in a cascade system offering very high net efficiencies. Domestic hot water (DHW) will be supplied via highly insulated unvented DHW cylinders to ensure sufficient DHW flow for the bathrooms and en-suites.

- High efficiency gas boiler – (>94% efficiency)
- Load compensation

To increase the efficiency in the use of the heating system, the following controls will be used in a 'boiler interlock' system to eliminate needless firing of the boiler.

- Time and temperature zone control
- Boiler fitted with delayed start thermostats

3.3 Fabric heat loss

Fabric

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 external and basement walls to meet u = 0.18
- Roof structures to meet u = 0.12
- New basement floor to meet u = 0.12

Glazing

New glazing for windows and doors and have area weighted average u-values of 1.4w/m^2 K or better.

It is assumed that conservation style glazing will be utilised in the retained façade, with a u value at circa 2.4.

Air Tightness

The project will target an air tightness rating at 5.00 (m3/h.m2 at 50 Pa).

3.4 Ventilation

It is not expected that poor air quality and noise pollution will not be significant for this suburban project and therefore a low energy natural ventilation strategy is suitable.

However, in order to comply with Building Regulations AD Part F, mechanical ventilation will be required in the basement area. This will incorporate heat recovery which will work very well in conjunction with the proposed swimming pool, much reducing the heating load in the basement areas.

3.5 Lighting

A 100% of internal light fittings throughout the development will be dedicated low-energy/compact fluorescent fittings, with extensive use of LED lighting.

LED lighting also minimises internal heat gains when compared to the use of traditional fluorescent fittings.

3.6 Energy efficiency results

The following table shows a comparison between the baseline scheme assessed under the SAP methodology Part L1A minima and the scheme following the introduction of energy efficiency measures (not including energy from renewable sources).

Table 3 – Energy consumption and CO_2 reductions

Unit	Building Emission Rate (regulated energy use) Kg/sqm	Unregulated Energy Use Kg/sqm	Total emissions Kg/sqm	Total emissions Kg
46 Avenue Road	11.53	13.08	24.61	31633.48
Total				31633.48

The results show that, the new development with the energy efficiency measures, the reduction in CO_2 emissions is **4.39%**

The SAP Building Emission Rate output is attached at **Appendix B**

4.0 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.

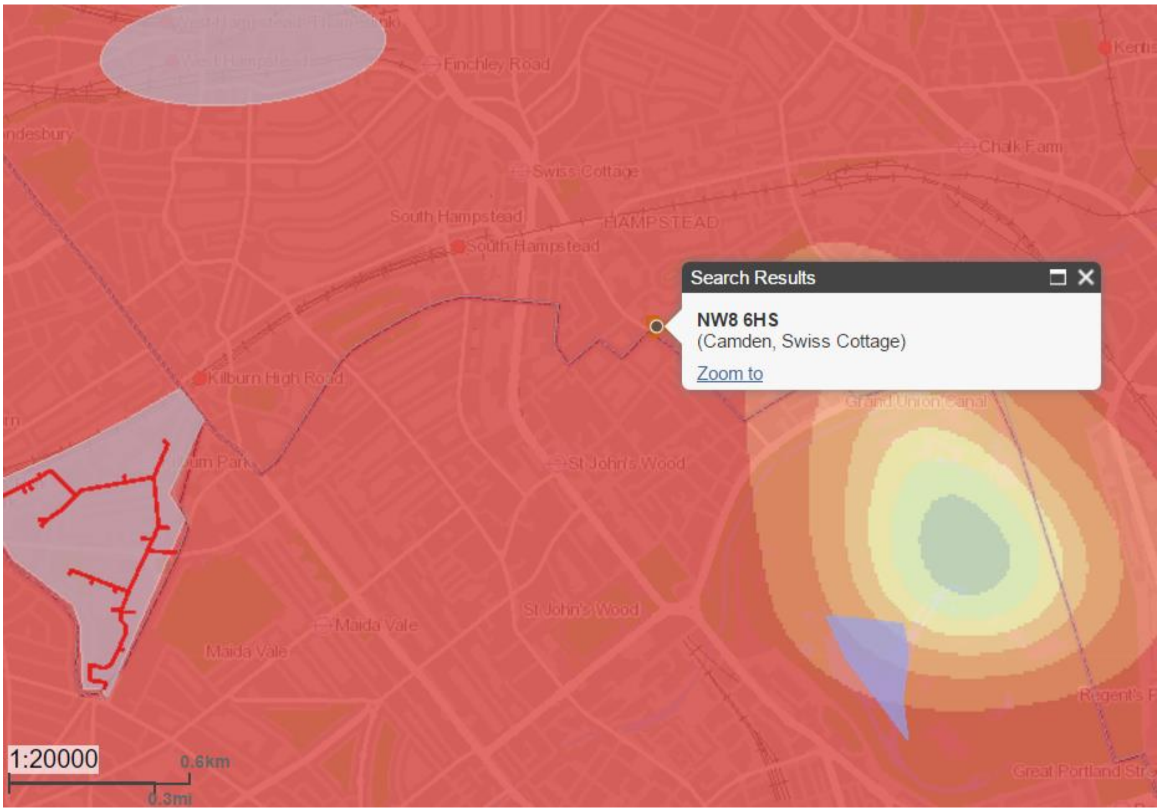
4.1 Community heating/Combined Heat and Power (CHP)

Combined heat and power systems are essentially biomass or fossil fuel fired electricity generators that use the heat by-product to provide space and water heating. The electricity generated can be used directly within the host buildings or sold to electricity suppliers on the national grid. These systems can be employed on a large scale for community schemes or at the micro scale for individual dwellings. However, at present micro scale domestic CHP systems are in their infancy.

Alternatively larger scale systems operated as a standalone entity can be used to provide heat and power to the local neighbourhood.

The London Heat map has been consulted to look at the potential to connect to a DEN now, or in the future. As can be seen from the extract below, the development site at 46 Avenue Road is remote from any potential area of decentralised energy potential.

Extract from the London Heat Map – Potential Networks



Clearly, the potential for any future connection to a DEN can be dismissed.

There is also the need to consider the provision of on-site centralised heating and/or CHP.

4.2 On-site CHP/District Heating

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.

CHP is, as a rule of thumb, is only operated as a base load as, depending on the technology, it may be difficult and/or inefficient to operate according to daily variations in demand. In a well-designed district heating network heat from CHP will provide between 60% and 80% of the annual heat (heating and hot water) requirement with heat-only boiler plants providing the peak load and back-up. To maximise efficiency of the engine it needs to run for at least 17 hours a day; therefore, the heat load needs to be present for this period.

Clearly, as a domestic development, with only the limited DHW demand to support a CHP installation, the economy of scale, in terms of year-round demand simply isn’t present and as such the potential use of on-site CHP can be dismissed.

5.0 Renewable Energy Options

The final element of the Mayor's 'Energy Hierarchy' requires development proposals to achieve 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, waves/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 London Plan stipulates a target for major development to reduce CO_2 emissions by at least 35% improvement over Part L 2013 through energy efficiency and the use of renewable technologies. Although the proposed scheme at 46 Avenue Road is a non-major scheme, there is clearly opportunity to introduce renewable technologies and seek to meet the London Plan standards.

The Energy Efficiency measures outlined under 3 above have the most significant impact on the heating and hot water energy requirements for the dwelling, and the associated reduction in gas consumption.

It should be noted that each Kwh of gas energy saved reduces emissions by 0.216kgCO_2/kwh, whereas, grid based electrical energy has a emissions factor of 0.519kgCO_2/kwh and accordingly, emphasis will be placed upon "off-setting" grid based electricity in order to achieve the optimum use of renewable technologies.

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.

5.1 Government incentives

5.1.1 Feed in Tariff

Feed in Tariffs (FiTs) replaced ROCs for renewable energy generators rated at less than 5MW in April 2010. FiTs are payments made for every kilowatt-hour kWh of renewable electricity generated and the level of the payment is laid down by the government, and varies for different renewable energy sources and at different scales. Unlike the flat rates paid for ROCs, FiTs are designed to compensate for less efficient/more expensive sources of renewable energy – and for the first time – make the investment in low and zero carbon technologies viable for both domestic generators and larger companies alike.

Recent reviews of Feed in Tariff rates will lead to lower returns on such technologies in 2016, but the expectation is that system capital costs and enhanced efficiencies will compensate for this over the medium term.

5.1.2 Renewable Heat Incentive

The Renewable Heat Incentive (RHI) was formally launched by the UK Government on 10th March 2011. The RHI will pay a tariff payment to renewable technologies that provide heat energy from a renewable source, with the payment relating to the KWh of heat energy provided e.g. if a property has a heat load of 20,000 KWh per annum, and it is 100% provided from a renewable source, then the tariff is paid against the 20,000KWh.

The Government decided on a two stage delivery - the first stage being for non-domestic schemes, which commenced in July 2011, with domestic scheme having come on stream in April 2014

The residential development at 46 Avenue Road would be able to qualify for the domestic tariff as part of the scheme if they install the appropriate technology.

5.2 Wind turbines

Wind turbines come in two main types'- horizontal axis and vertical axis. The more traditional horizontally 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 has buildings in the immediate vicinity, the scale of which has a significant effect in terms of the selection of any renewable technologies as is noted below.

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 new dwelling itself.

It is clear that a wind turbine of this size would be considered unacceptable in this location and is therefore dismissed as an option.

5.3 Solar Energy

5.3.1 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.

Solar energy can be delivered in 2 formats as noted above, each system requiring an appropriate area in which to install panels.

Solar thermal systems are off-setting the use of gas with its lower carbon emissions, accordingly, it is proposed that to maximise the use of PV – off setting electricity - would be a more environmentally sound solution.

Accordingly, this technology is dismissed as being inappropriate for the development.

5.3.2 Photovoltaics (PV)

Solar panel electricity systems, also known as solar photovoltaics (PV), capture the sun's energy using photovoltaic cells. These cells will be accumulated on a PV panel, usually about 2.0m x 1.0m. These panels are then wall, roof or floor mounted and are connected directly to the electricity grid via the properties meter. In this way, the electrical generation can be fully exported and is not related to the consumption of the proposed dwelling.

PV panels also offer a much more attractive return from the Feed in Tariff still achieving 6% returns or better.

The top floor, flat roof with a parapet, facing south-east with PV panels would be the most viable and rewarding option and has therefore been considered within the calculations.

5.4 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. There also needs to be a local source of biomass fuel that can be delivered on a regular basis.

It is not considered appropriate to specify biomass boilers within this residential development; 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 would therefore have to be considered carefully against the high standard of air quality requirements in dense urban development areas and the air quality standards requirements of the London Plan

5.5 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 $45^{o}C$. 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

As the development in question has limited outside space in which to install collector loops (rule of thumb = 2.5 x NIA), the potential for the use of GSHPs can be dismissed.

5.6 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 and the associated emissions, so that actual the reduction in emissions can be limited. 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 25%. The table below demonstrates, on the assumption of a demand of 1000Kwh/year for heating and hot water.

Table 6 – Comparative Heat Pump performance

Type of Array	Energy Consumption (Kwh/yr)	Emission factor ($kgCO_2$/Kwh)	Total CO_2 emissions (kg/annum)
90% efficient gas boiler	9445	0.216	1848
320% efficient ASHP	2390	0.519	1124
100% efficient immersion (back-up)	850	0.519	400

A theoretical carbon saving of 17.5%.

With the above data in mind, clearly an ASHP could be an option, however, heat pump efficiency is directly related to the low flow and return temperatures associated with underfloor heating systems. In this particular case, the proposed use of radiators and the higher required flow and return temperatures would quickly diminish the overall level of performance.

It should be noted, that limited use of mechanical cooling will be employed in some deep-plan area of the building where a risk of overheating has been identified.

5.7 Final Emissions Calculation

The results of the assessment of suitable technologies relative to the nature, location and type of development suggest that the only potential solution would be the installation of a PV array of 12 x 0.310Kwp panels amassing a 3.72Kwp output (the maximum allowed under a G59 installation).

The PV array would generate some 3062.86Kwh per annum, off-setting approximately 1.6 tonnes of carbon per annum.

Accordingly, this has been incorporated into the design and the final SAP DER outputs are attached at **Appendix C**:-

Table 7 – Final energy consumption and CO_2 reductions

Unit	Building Emission Rate (regulated energy use) Kg/sqm	Unregulated Energy Use Kg/sqm	Total emissions Kg/sqm	Total emissions Kg
46 Avenue Road	10.30	13.08	23.38	30052.61
Total				30052.61

The data at Table 7 confirms that overall emissions – including unregulated energy use - have been reduced by **9.17%** over and above the baseline model and **5%** reduction in emissions directly from the use of energy generating technologies, i.e. over and above the energy efficient model.

Excluding the un-regulated use, i.e. considering emissions controlled under the Building Regulations AD L1A 2013, then the reduction equates to **18.64%.**

6.0 Sustainable Design & Construction

BREEAM New Construction 2014 (BREEAM) & The Code for Sustainable Homes (the Code)

The Code was the national standard for the sustainable design and construction of new homes. This has now been formally withdrawn by DCLG, and planning authorities are no longer able to require developments to meet the technical guidance within the Code for Sustainable Homes.

However, the applicants do acknowledge the requirements of Camden's CPG 3 and Draft Local Plan and intend to advance the project as follows:

Energy use, minimising climate change and adapting to climate change

These issues have been dealt with under sections 1.0 – 6.0 above.

Avoiding pollution and environmental nuisance

The land is not known to have had any previous uses that will have led to the potential for contamination, nor is the building proposed to have any uses that may lead to local contamination.

The lead contractor will be required to undertake best practice measures in terms of the construction site impacts and put in place a Construction Management Plan that will consider the use of energy and water and to control the risks of air/dust pollution and ground water pollution throughout the strip-out and construction phases.

Operationally, as noted above, the HVAC solution will utilise gas boilers as the principle heat source in the HVAC system – with the associated low emission levels from gas combustion – and in addition, boilers models will be selected that emit <40mg/Kwh of Nitrous Oxide, again in line with best practices.

The Energy Efficiency considerations have already touched upon the issue of noise pollution from occupation of the proposed building as well as the selection of appropriate HVAC plant to avoid noise impact on neighbouring properties.

To avoid the potential for light pollution, all external lighting will comply with the Institute of Lighting Engineers guidance on the reduction in obtrusive light, and timers will be utilised to prevent external lighting been used outside of appropriate hours as well as preventing daytime use.

Avoiding waste and minimising landfill

The principle contractor with be required to produce a site waste management plan, construction management plan and sustainable procure plan, in line with BREEAM requirements; during the construction phase, the lead contractor will put in place a best practice Site Waste Management Plan which will, target a recourse efficiency of

6.5tonnes of waste construction materials/100m^2 of development. Additionally, over 90% of non-hazardous construction waste will be diverted from landfill via an approved waste contractor and transfer station.

Additionally, the contractor will be required to register the site with the Considerate Constructor Scheme and perform to best practice standards under the assessment process

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.

Sustainable Materials

The design team intend to adopt the principles of the Building Research Establishments Green Guide. The Green Guide is part of BREEAM (BRE Environmental Assessment Method) an accredited environmental rating scheme for buildings. The Green Guide contains more than 1500 specifications used in various types of building which are given environmental rankings are based on Life Cycle Assessments (LCA), using BRE's Environmental Profiles Methodology 2008.

This data is set out as an A+ to E ranking system and takes into account the likes of climate change, water extraction, mineral resource extraction, ecotoxicity to freshwater, waste disposal and fossil fuel depletion. The vast majority of the building elements used at 51 Springfield Road will have a Green guide rating at "C" or better.

In addition, the development will source all materials form supplier that can demonstrate that materials are sourced responsibly in line with recognised Environmental Management Systems (FCS, BES6001 etc.)

Protecting and enhancing biodiversity and the natural environment

The grounds will be landscaped using predominantly indigenous specie to the UK, as well as ensuring that where possible, planting is low maintenance to reduce the use of water for irrigation.

The basement area will have a bio-diverse roof planted in line with the above landscaping regime

Conserving water

During the construction phase, the lead contractor will be required to monitor the use of mains water. Internal fitting will be specified to ensure that that internal wholesome water use will be limited to 105 litres/person/day within the dwelling.

Water butts will be installed at several points around the dwelling to enable the use of rainwater for the upkeep of the soft landscaping and bio-diverse basement roof.

7.0 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 new dwelling was built to a standard to meet only the minimum requirements of current building regulations, the total amount of CO_2 emissions would be **33,086Kg/year**.

Following the introduction of passive energy efficiency measures into the development, as detailed in section 3, the total amount of CO2 emissions would be reduced to **31,633Kg/year**, a reduction of **4.39%.**

There is also a requirement to reduce CO_2 emissions across the development using renewable or low-carbon energy sources, where practical and feasible. 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 appropriate solution would be the installation of an 12 panel – 3.72Kwp PV Array

The final SAP models (reproduced at **Appendix C**) for the development which have also been detailed above in Table 7, show a final gross emission level of **30,053Kg/year** representing a total **5%** reduction in emissions over the baseline model.

Overall, regulated emissions for the proposed development achieve a 18.64% reduction in overall DER/TER when considered against AD Part L1A

Tables 8 & 9 Demonstrate how 46 Avenue Road complies with the London Plan requirements (noting that it would not be considered a Major project);

Table 8 – Carbon Emission Reductions – Domestic Buildings

	Carbon Dioxide Emissions (Tonnes CO2 per annum)	
	Regulated	Unregulated
Building Regulations 2013 Part L1A Compliant Development	16.27	16.81
After Energy Demand Reduction	14.82	16.81
After renewable energy	13.24	16.81

Table 9 – Regulated Emissions Savings – Domestic Buildings

	Regulated Carbon Dioxide Savings	
	(Tonnes CO2 per annum)	%
Savings from energy demand reduction	1.45	8.91
Savings from renewable energy	1.58	12.01
Total Cumulative Savings	**3.03**	**18.64**
Annual Savings from off-set payment	**13.24**	
Cumulative savings for off-set payment	**397.2**	

Appendix A

Baseline Energy Use:-

SAP 2012 – Target Emission Rate outputs

“Baseline”

Appendix B

SAP 2012 Dwelling Emission Rate Outputs

“Be Lean”

Appendix C

SAP 2012 Dwelling Emission Rate Outputs

"Be Green"