Energy Statement

19-37 Highgate Road
Kentish Town
London
NW5 1JY

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Prepared for:

GM London

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1.0 Executive Summary

The proposed development at Highgate Road has been designed to achieve the highest of environmental performance standards following the Energy Hierarchy as set down by London Plan (2021) and London Borough of Camden's Local Plan (2017)..

The project consists of the redevelopment of the site to generate a residential lead scheme of 47 flats, small commercial space with associated, bin, bike storage and plant space.

The project has an extant permission from 2013; It is understood that the 2013 proposals included the potential CHP connection from the Greenwood Place Community centre which is now not being provided.

Accordingly, this document seeks to support a Section 73 application for minor amendments to the scheme, including a change of HVAC strategy - moving away from the use of communal CHP systems and aligning the project with the latest GLA guidance (April 2020) and incorporating the use of heat pump technology and removing the use of fossil fuels.

A 'Lean, Clean, Green' approach to assessing energy and thermal comfort needs and appropriate solutions has been adopted following the current guidance and policies as noted above and the development achieves an overall improvement (BER/TER) in regulated emissions of >**63.85%** over the Part L 2013 standard and a reduction in overall emissions of >**43.36**% when taking into account unregulated energy use, through the adoption of high standards of insulation, efficient heating and hot water generated by heat pump systems and a roof mounted PV array.

The reduction in regulated emissions achieved through the use of renewable and energy generating technologies is over **55.94%.**

2.0 The Site & Proposal

The site is located on Highgate Road, Kentish Town in the London Borough of Camden.

The site is bounded by industrial and commercial uses westerly, Highgate road to the north east and the commercial centre of Kentish Town to the south east.

The amended proposal is for a new 7 storey development with 47 new flats, a small commercial unit, amenity space, bin and bike storage and a new basement level plant space.

2.1 Planning Policy

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 Highgate Road project has been completed in line with the above London Plan and Local Plan requirements for a major scheme utilising SAP10 emissions data in line with the latest GLA guidance.

This report also take on board the recommendations within the Camden Planning Guidance document - Energy efficiency and adaptation (January 2021).

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 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 emissions data in then converted to SAP10 emissions via the use of the GLA SAP10 conversion spreadsheet – attached at **Appendix D**.

3.2 Commercial Space

The energy requirements for space heating, water heating and ventilation within the proposed new build commercial space have been calculated using the National Calculation Method (NCM) in line with AD L2A of the Building Regulations 2013 and the Non-Domestic Heating Compliance Guide.

The Government approved assessment methodology is the Simplified Building Energy Model (SBEM), eb7 Sustainability 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.

To consider the subject building performance against The Building Regulations (Approved Document L2A) SBEM first creates the notional reference building, the characteristics of which are defined in within NCM and the minimum fabric values and fixed services efficiencies set down by AD L2A and the Non-domestic Compliance Guide.

This creates the target Emission Rate (TER) 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 Building Emissions Rate (BER).

As noted above, SAP10 emissions data has been used for gas and electrical consumption; mains gas at 0.210kg/kWh and electricity at 0.233kg/kWh.

In line with the GLA guidance the assessment will assume centralised plant and mechanical cooling at the baseline stage.

The commercial unit will assumed to be a shell and core delivery with capped off LTHW and electrical supply for tenant fit-out.

3.3 Unregulated Energy Use

The baseline un-regulated energy use for cooking and 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 X N)$^{0.4714}$

Cooking = (119 + 24N)/TFA

N= no of occupant SAP table 1B

TFA – Total Floor Area

The unregulated energy use for the commercial unit can be derived from the BRUKL outputs under section "Energy Consumption by End Use" - Equipment

The unregulated energy use per sqm is summarised in Table 5 below

Table 1 – Unregulated Energy Use

Unit	Unregulated Energy Use Kg/sqm
00 - A	6.95
00 - B	6.97
00 - C	6.98
00 - D	6.94
00 - E	6.96
01 - A	7.05
01 - B	7.02
01 - C	6.97
01 - D	6.96
01 - E	6.92
01 - F	6.91
01 - G	7.04
01 - H	6.95
01 - I	6.97
02 - A	7.05
02 - B	7.02
02 - C	6.90
02 - D	7.01
02 - E	6.92
02 - F	6.91
02 - G	7.04
02 - H	6.95
02 - I	6.97
03 - A	7.05
03 - B	7.02

03 - C	6.90
03 - D	7.01
03 - E	6.92
03 - F	6.91
03 - G	7.04
03 - H	6.95
03 - I	6.97
04 - A	6.76
04 - B	6.96
04 - C	6.90
04 - D	7.01
04 - E	6.91
04 - F	7.04
04 - G	6.95
04 - H	6.97
05 - A	6.76
05 - B	6.96
05 - C	6.90
05 - D	7.01
05 - E	6.83
06 - A	6.76
06 - B	6.67
Commercial	20.45

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 CO2 emissions

Unit	Target Emission Rate (regulated energy use) Kg/sqm	Unregulated Energy Use Kg/sqm	Total baseline emissions Kg/sqm	Total baseline emissions Kg
00 - A	19.3	6.95	26.21	1673.41
00 - B	20.1	6.97	27.04	1633.80
00 - C	19.5	6.98	26.50	1569.51
00 - D	18.2	6.94	25.10	1616.46
00 - E	18.2	6.96	25.21	1559.77
01 - A	19.3	7.05	26.35	1290.12
01 - B	18.1	7.02	25.08	1340.73
01 - C	18.5	6.97	25.46	1550.21
01 - D	18.3	6.96	25.23	1564.02
01 - E	14.7	6.92	21.61	1500.25
01 - F	14.77	6.91	21.69	1509.49
01 - G	17.41	7.04	24.45	1237.42
01 - H	15.64	6.95	22.59	1443.89
01 - I	15.98	6.97	22.95	1384.70
02 - A	17.06	7.05	24.11	1180.49
02 - B	15.94	7.02	22.95	1227.03
02 - C	16.47	6.90	23.37	1697.21
02 - D	17.09	7.01	24.10	1300.57
02 - E	14.69	6.92	21.61	1500.25
02 - F	14.77	6.91	21.69	1509.49
02 - G	17.41	7.04	24.45	1237.42
02 - H	15.64	6.95	22.59	1443.89
02 - I	15.98	6.97	22.95	1384.70
03 - A	17.06	7.05	24.11	1180.49
03 - B	15.94	7.02	22.95	1227.03
03 - C	16.47	6.90	23.37	1697.21
03 - D	17.09	7.01	24.10	1300.57
03 - E	14.69	6.92	21.61	1500.25
03 - F	14.77	6.91	21.69	1509.49
03 - G	17.41	7.04	24.45	1237.42
03 - H	15.64	6.95	22.59	1443.89
03 - I	15.98	6.97	22.95	1384.70
04 - A	13.64	6.76	20.40	2117.97
04 - B	16.55	6.96	23.50	1470.22
04 - C	16.47	6.90	23.37	1697.21
04 - D	17.09	7.01	24.10	1300.57

04 - E	16.47	6.91	23.38	1627.69
04 - F	19.14	7.04	26.18	1324.98
04 - G	17.25	6.95	24.20	1546.87
04 - H	17.61	6.97	24.58	1482.89
05 - A	13.64	6.76	20.40	2117.97
05 - B	16.55	6.96	23.50	1470.22
05 - C	16.47	6.90	23.37	1697.21
05 - D	18.78	7.01	25.79	1391.82
05 - E	16.19	6.83	23.02	1997.42
06 - A	15.28	6.76	22.04	2288.14
06 - B	15.64	6.67	22.31	2968.09
Commercial	6.40	20.45	26.85	4196.66
Total				**77785**

The baseline SAP & BRUKL TER outputs (which summarise the key data) are attached at **Appendix A**. The SAP10 emissions data spreadsheet 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 London Plan, requests that buildings be constructed 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 construction 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 construction of the building:

4.1 Passive Design

London Plan policies place great emphasis on the need to incorporate passive design 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 constructed to be comfortable in higher temperatures, without resorting to energy intensive air conditioning.

The projects has a predominantly an east/east orientation, with little exposure to the key southern elevation.

The main living areas have the benefit of large glazed areas providing natural daylight and reducing the reliance upon artificial lighting, whilst those same glazed areas are protected from the peak sun via the balcony above.

Bathroom and bedrooms have reduced glazed areas to reduce heat losses.

The glazing specification will introduce solar control glazing with a g value at circa 0.39.

All glazing will be openable to provide natural ventilation and purge ventilation to further assist in a natural cooling strategy.

4.2 Heating system

For the energy efficient model, the "notional" primary heating system for the dwellings will consist of high efficiency communal condensing gas boilers providing DHW and LTHW heating via heat interface units:-

- A-Rated gas condensing boiler – (96% seasonal efficiency)

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

The LTHW distribution network will be highly insulated to prevent excessive heat losses and the potential overheating impact in the common areas.

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 concrete frame with brick insulated cladding systems and will target a U-Value of 0.18W/m^2k or better.
- New flat roof constructions are to be of a warm-roof type, achieving a U-Value of 0.13W/m^2k
- The newly laid floors will achieve a minimum u value of 0.13W/m^2k

Glazing

- The new glazing for windows and doors will be double glazed with an area weighted average U-Value of 1.4W/m^2K or better.

Air Tightness

- The project be tested to 3m^3/hr/m^2 in line with best practice for mechanically 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

The MEP proposals are for the use of mechanical ventilation with heat recovery in order to achieve an appropriate high quality indoor environment; heat recovery efficiency to meet 89%.

4.6 Lighting

A 100% of internal light fittings throughout the development are dedicated low-energy LED lighting.

4.7 Energy efficiency results

The following table shows a comparison between the baseline scheme assessed under the SAP methodology Part L minima and the as-built scheme following the introduction of energy efficiency measures (not including energy from renewable sources), based upon the SAP10 assessment methodology.

Table 3 – Energy consumption and CO2 reductions

Unit	Building Emission Rate (regulated energy use) Kg/sqm	Unregulated Energy Use Kg/sqm	Total emissions Kg/sqm	Total emissions Kg
00 - A	16.1	6.95	23.00	1468.29
00 - B	16.7	6.97	23.69	1431.39
00 - C	16.4	6.98	23.34	1382.34
00 - D	15.1	6.94	22.05	1420.13
00 - E	15.0	6.96	21.98	1360.28
01 - A	16.0	7.05	23.10	1130.80
01 - B	15.0	7.02	22.05	1178.78
01 - C	15.6	6.97	22.57	1374.44
01 - D	15.1	6.96	22.02	1365.03
01 - E	11.9	6.92	18.78	1304.14
01 - F	11.92	6.91	18.83	1311.03
01 - G	13.97	7.04	21.01	1063.55
01 - H	13.09	6.95	20.03	1280.62
01 - I	13.16	6.97	20.13	1214.78
02 - A	13.98	7.05	21.04	1029.90
02 - B	12.99	7.02	20.00	1069.41
02 - C	13.30	6.90	20.19	1466.54
02 - D	13.81	7.01	20.82	1123.43
02 - E	11.87	6.92	18.78	1304.14
02 - F	11.92	6.91	18.83	1311.03
02 - G	13.97	7.04	21.01	1063.55
02 - H	13.09	6.95	20.03	1280.62
02 - I	13.16	6.97	20.13	1214.78
03 - A	13.98	7.05	21.04	1029.90
03 - B	12.99	7.02	20.00	1069.41
03 - C	13.30	6.90	20.19	1466.54
03 - D	13.81	7.01	20.82	1123.43
03 - E	11.87	6.92	18.78	1304.14
03 - F	11.92	6.91	18.83	1311.03

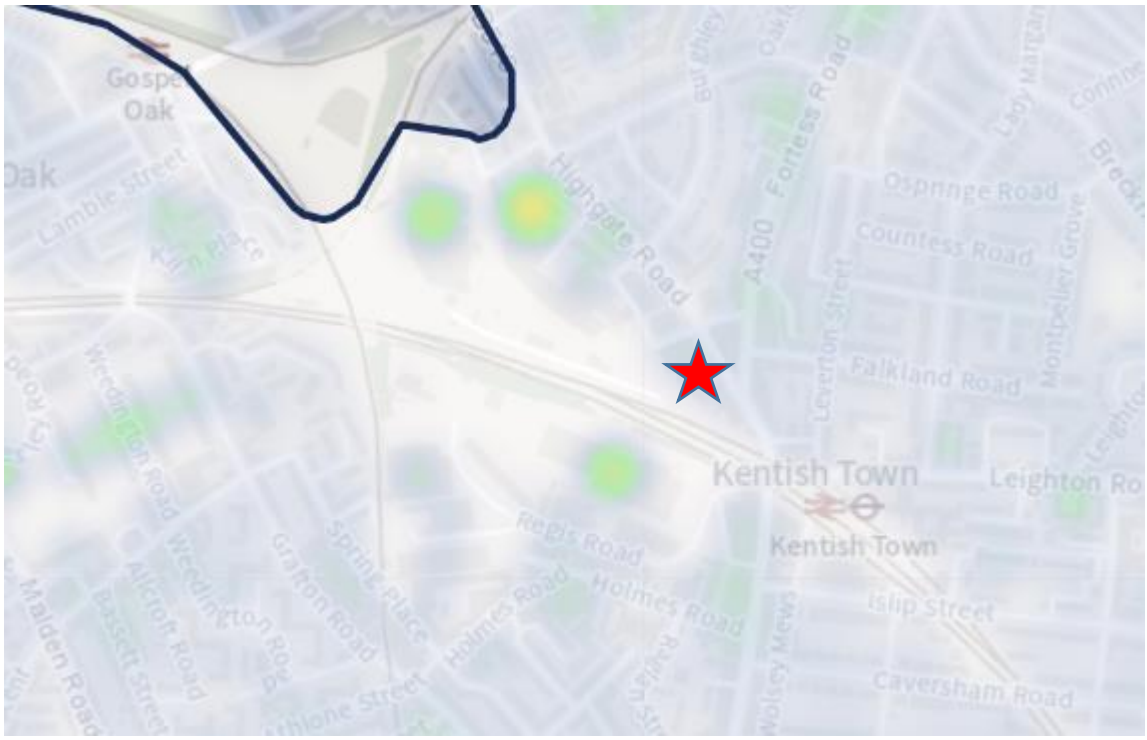
03 - G	13.97	7.04	21.01	1063.55
03 - H	13.09	6.95	20.03	1280.62
03 - I	13.16	6.97	20.13	1214.78
04 - A	10.86	6.76	17.62	1829.09
04 - B	13.73	6.96	20.68	1293.89
04 - C	13.30	6.90	20.19	1466.54
04 - D	13.81	7.01	20.82	1123.43
04 - E	13.60	6.91	20.52	1428.15
04 - F	15.71	7.04	22.75	1151.64
04 - G	14.68	6.95	21.63	1382.55
04 - H	14.81	6.97	21.78	1314.29
05 - A	10.86	6.76	17.62	1829.09
05 - B	13.73	6.96	20.68	1293.89
05 - C	13.30	6.90	20.19	1466.54
05 - D	15.50	7.01	22.51	1214.55
05 - E	13.71	6.83	20.54	1782.26
06 - A	12.47	6.76	19.24	1996.85
06 - B	12.92	6.67	19.59	2606.07
Commercial	5.30	20.45	25.75	4024.73
Total				**68311**

The results show that, for the new development with the energy efficiency measures, the reduction in CO_2 emissions is **12.18%.** The SAP Dwelling Emission Rate outputs and commercial BRUKL are attached at **Appendix B.**

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.

The extract from the London Heat Map confirms that the Highgate Road site is located within the heat network priority area:-



It is with this in mind, that the scheme has been designed with a communal heating system based upon the principles of a low temperature ambient loop to enable a connection to a energy network in the future, whilst minimising distribution heat losses in the short/medium term.

The basement plant space will enable access to/from the public highway and any DEN located within, whilst the design of the plant space and distribution will follow the relevant guidance in terms of the space available for the required heat exchange equipment and flanged connections to the ambient loop.

The designed on the basis that any realistic future energy network would likely be in the nature of an ambient loop with a balance of commercial buildings rejecting heat and residential buildings drawing heat.

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.

At the planning stage, the project considered 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.

As result of the assessment, the project includes the installation of air source heat pump systems to provide renewable energy to the LTHW heating circuit.

An ambient loop system is proposed. Air source heat pumps at roof level provide heat to a central water loop within building.

Water loop operates at 25°C to mitigate overheating in corridors from traditional LTHW systems.

Local heat pumps within each apartment provide hot water and heating.

Water source VRF condenser within commercial space provides heating, cooling & hot water. Heat rejected through cooling is recovered to provide heating & hot water to apartments. Overall system efficiency is assumed at 280%.

In addition to the above, a 5.94kWp roof mounted PV array is proposed; this will produce circa 5,114.54Kwh per annum, saving an additional 1.19tonnes of CO_2/annum

6.1 Final Emissions Calculation

The final table – Table 6 – summarises the final SAP and BRUKL outputs; attached at **Appendix C.**

Table 4 – "Be Green" emission levels

Unit	Emission Rate (regulated energy use) Kg/sqm	Unregulated Energy Use Kg/sqm	Total emissions Kg/sqm	Total emissions Kg
00 - A	6.7	6.95	13.69	874.28
00 - B	7.1	6.97	14.06	849.41
00 - C	6.9	6.98	13.87	821.35
00 - D	6.4	6.94	13.35	860.07
00 - E	6.4	6.96	13.35	826.20
01 - A	6.7	7.05	13.71	671.21
01 - B	6.3	7.02	13.32	712.10
01 - C	6.6	6.97	13.58	827.17
01 - D	6.4	6.96	13.34	826.52
01 - E	5.2	6.92	12.14	843.32
01 - F	5.25	6.91	12.17	846.84
01 - G	5.89	7.04	12.92	654.24
01 - H	5.61	6.95	12.56	802.93
01 - I	5.62	6.97	12.59	759.94
02 - A	5.86	7.05	12.91	632.17
02 - B	5.51	7.02	12.53	669.78
02 - C	5.77	6.90	12.67	920.32
02 - D	5.83	7.01	12.85	693.15
02 - E	5.23	6.92	12.14	843.32
02 - F	5.25	6.91	12.17	846.84
02 - G	5.89	7.04	12.92	654.24
02 - H	5.61	6.95	12.56	802.93
02 - I	5.62	6.97	12.59	759.94
03 - A	5.86	7.05	12.91	632.17
03 - B	5.51	7.02	12.53	669.78
03 - C	5.77	6.90	12.67	920.32
03 - D	5.83	7.01	12.85	693.15
03 - E	5.23	6.92	12.14	843.32
03 - F	5.25	6.91	12.17	846.84
03 - G	5.89	7.04	12.92	654.24
03 - H	5.61	6.95	12.56	802.93
03 - I	5.62	6.97	12.59	759.94
04 - A	4.87	6.76	11.64	1208.08
04 - B	5.90	6.96	12.86	804.26

04 - C	5.77	6.90	12.67	920.32
04 - D	5.83	7.01	12.85	693.15
04 - E	5.90	6.91	12.82	892.16
04 - F	6.56	7.04	13.60	688.32
04 - G	6.23	6.95	13.18	842.37
04 - H	6.26	6.97	13.23	798.44
05 - A	4.87	6.76	11.64	1208.08
05 - B	5.90	6.96	12.86	804.26
05 - C	5.77	6.90	12.67	920.32
05 - D	6.49	7.01	13.50	728.41
05 - E	5.96	6.83	12.80	1110.39
06 - A	5.50	6.76	12.26	1272.99
06 - B	5.67	6.67	12.34	1641.30
Commercial	5.30	20.45	25.75	4024.73
Total				**44061**

The data at Table 4 confirms that overall emissions – including unregulated energy use - have been reduced by **43.36%** over and above the baseline model, with a **35.50%** 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 reduction equates to **63.85%.**

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 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 **77785Kg/year**.

Following the introduction of passive energy efficiency measures into the development, as detailed in section 4, the total amount of CO_2 emissions has been reduced to **68311Kg/year**, a reduction of **12.18%.**

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 has been the use of heat pump technology to drive the communal heating system and a roof mounted PV array to generate electricity on site

This has been used in the final SAP and SBEM models (reproduced at **Appendix C**) for the as-built development which have also been detailed above in Table 4, which show a final gross emission level of **44061Kg/year**, representing a total reduction in emission over the baseline model, taking into account unregulated energy, of **43.36%.**

In addition, the SAP & BRUKL outputs demonstrate that the building achieves an overall improvement in emissions over the Building Regulations Part L standards for regulated emissions of minimum of **63.85%**.

Accordingly, as part of the S73 application to which this report relates; the project is now fully compliant with London Plan requirements in 2022, utilising zero emission electrically driven heat pump systems to provide the heating and hot water, offering much greater overall efficiency and much reduced CO_2, NO_X and particulate matter emissions.

Tables 5 - 9 Demonstrate how the Highgate Road project has complied with Camden's Local Plan requirements.

Table 5 – Carbon Emission Reductions – Domestic Buildings

Key	Tonnes/annum
Baseline CO_2 emissions (Part L 2013 of the Building Regulations Compliant Development)	52.82
CO2 emissions after energy demand reduction (be lean)	43.35
CO2 emissions after energy demand reduction (be lean) AND heat network (be clean)	43.35
CO2 emissions after energy demand reduction (be lean) AND heat network (be clean) AND renewable energy (be green)	19.10

Table 6 – Regulated Emissions Savings – Domestic Buildings

	Regulated Carbon Dioxide Savings	
	(Tonnes CO2 per annum)	%
Savings from energy demand reduction	9.47	17.93
Savings from heat network	0.00	0.00
Savings from renewable energy	24.25	45.91
Total Cumulative Savings	33.72	63.84
	(Tonnes CO_2)	
Carbon Shortfall	19.10	
Cumulative savings for off-set payment	573	
Cash-in-lieu Contribution	£54,435.00	

Table 7 – Carbon Emission Reductions – Non-domestic Buildings

Key	Tonnes/annum
Baseline CO_2 emissions (Part L 2013 of the Building Regulations Compliant Development)	1.00
CO2 emissions after energy demand reduction (be lean)	0.83
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)	0.83

Table 8 – Regulated Emissions Savings – Non-domestic Buildings

	Regulated Carbon Dioxide Savings	
	(Tonnes CO2 per annum)	%
Savings from energy demand reduction	0.17	17.00
Savings from heat network	0.00	0.00
Savings from renewable energy	0.00	0.00
Total Cumulative Savings	0.17	17.00
	(Tonnes CO_2)	
Carbon Shortfall	0.83	
Cumulative savings for off-set payment	24.9	
Cash-in-lieu Contribution	£2,365.50	

Table 9: Site wide regulated carbon dioxide emissions and savings

	Total regulated emissions (Tonnes CO2/year)	CO2 savings (Tonnes CO2/year)	Percentage Saving (%)
Part L 2013 Baseline	51.77		
Be Lean	42.49	9.28	17.93
Be Clean	0.00	0.00	0.00
Be Green	19.13	32.64	63.05
		CO2 savings off-set (Tonnes CO2)	
Off-Set		**£54,520.50**	

Appendix A

Baseline/Un-regulated Energy Use:-

BRUKL/SAP Outputs & Target Emission Rates

Appendix B

Energy Efficient Design:-

BRUKL/SAP Outputs & Dwelling Emission Rates

Appendix C

Generating energy on-site:-

BRUKL/SAP Outputs & Building Emission Rates

Appendix D

SAP10

GLA SAP10 Emissions Spreadsheet