



Energy & Sustainability Statement

20th July 2022

43 Belmont Avenue

London

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Contents

1	Executive Summary	3
2	Site, Proposal & Planning Policy	4
3	Baseline Energy results	8
4	Design for Energy Efficiency "Be Lean"	11
5	Supplying Energy Efficiently "Be Clean"	15
6	Renewable Energy Options "Be Green"	17
7	Sustainable Design and Construction	22
8	Conclusions	24

Appendices

A	SAP TER Outputs – Baseline Energy Use
B	SAP DER Outputs – "Be Lean"
C	SAP DER Outputs - Final Emissions – "Be Green"
D	GLA SAP10 Emissions Conversion Spreadsheet
E	TM59 Overheating Analysis

Version 1 – Draft	Neil Ingham	20-07-2022
Version 2	George Farr	22-07-2022

1.0 Executive Summary

The proposed development at 43 Belmont Avenue comprises of 5 No new C3 residential units on unoccupied land between existing 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 Haringey's local plan policies.

The report takes on board the latest GLA guidance on writing energy statements (April 2020) as well as taking into account matters raised with the adopted London Plan.

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

A 'Lean, Clean, Green' approach has been adopted and the development achieves an overall improvement (DER/TER) in regulated emissions at over **81.64%** above Part L 2013 standard, through the adoption of high standards of insulation, heat pump driven heating and hot water systems to the flats and a roof mounted PV array.

2.0 The Site & Proposal

The application site is located at the junction of two terraces set at angles to each other on Belmont Avenue, a residential street comprising two storey Victorian houses.

The development proposal subject of this report is for the redevelopment of the site, providing a 3-storey block of 5 x new flats.

2.1 Local Planning Context

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

Haringey's Development Management DPD was adopted in July 2017

The key policy is Policy DM21: Sustainable Design, Layout and Construction

A All new development, including building and landscape works, will be expected to consider and implement sustainable design, layout and construction techniques.

Proposals should:

a Apply the energy hierarchy to minimise energy use in order to meet, and if possible, exceed, minimum carbon dioxide reduction requirements.

b Apply the cooling hierarchy to reduce the potential for overheating and limit reliance on mechanical air conditioning systems.

c Maximise opportunities to enhance biodiversity on-site, including through appropriate landscaping, Sustainable Drainage Systems, living roofs and green walls

d Wherever possible, use building materials with high environmental performance ratings; and

e Seek opportunities for locally sourced labour.

B The Council will support appropriate measures to sustainably retrofit existing homes and non-residential buildings.

C Proposals that fail to demonstrate adequate consideration for sustainable design, layout and construction techniques will be resisted.

D Consideration will be given to the use of carbon offset payments, to be secured by planning obligations, where it can be demonstrated that proposals are unable to meet carbon dioxide emission reduction targets on-site.

2.3 The London Plan

Chapter 9 deals with Sustainable Infrastructure:-

Policy S11 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 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.

Despite its status as a non-major development scheme, the project at Belmont Avenue will comply with the requirements of the London Plan utilising SAP10 methodology in line with the GLA guidance on the preparation of Energy Statements.

This guidance extends to the continued use of Part L 2013 software pending software updates for the newly introduced Part L 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 – SAP10; The new Part L Building Regulations 2021 will introduce a completely new notional dwelling as detailed below:-

Element or system	Reference value for target setting
Opening areas (windows, roof windows, rooflights and doors)	Same as for actual dwelling not exceeding a total area of openings of 25% of total floor area ⁽²⁾
External walls including semi-exposed walls	$U = 0.18 \text{ W/(m}^2\text{K)}$
Party walls	$U = 0$
Floors	$U = 0.13 \text{ W/(m}^2\text{K)}$
Roofs	$U = 0.11 \text{ W/(m}^2\text{K)}$
Opaque door (less than 30% glazed area)	$U = 1.0 \text{ W/(m}^2\text{K)}$
Semi-glazed door (30–60% glazed area)	$U = 1.0 \text{ W/(m}^2\text{K)}$
Windows and glazed doors with greater than 60% glazed area	$U = 1.2 \text{ W/(m}^2\text{K)}$ Frame factor = 0.7
Roof windows	$U = 1.2 \text{ W/(m}^2\text{K)}$, when in vertical position (for correction due to angle, see specification in SAP 10 Appendix R)
Rooflights	$U = 1.7 \text{ W/(m}^2\text{K)}$, when in horizontal position (for correction due to angle, see specification in SAP 10 Appendix R)
Ventilation system	Natural ventilation with intermittent extract fans
Air permeability	$5 \text{ m}^3/(\text{h}\cdot\text{m}^2)$ at 50 Pa
Main heating fuel (space and water)	Mains gas
Heating system	Boiler and radiators Central heating pump 2013 or later, in heated space Design flow temperature = 55 °C
Boiler	Efficiency, SEDBUK 2009 = 89.5%
Heating system controls	Boiler interlock, ErP Class V Either: – single storey dwelling in which the living area is greater than 70% of the total floor area: programmer and room thermostat – any other dwelling: time and temperature zone control, thermostatic radiator valves
Hot water system	Heated by boiler (regular or combi as above) Separate time control for space and water heating
Wastewater heat recovery (WWHR)	All showers connected to WWHR, including showers over baths Instantaneous WWHR with 36% recovery efficiency utilisation of 0.98
Hot water cylinder	If cylinder, declared loss factor = $0.85 \times (0.2 + 0.051 V^{2/3}) \text{ kWh/day}$ where V is the volume of the cylinder in litres
Lighting	Fixed lighting capacity (lm) = $185 \times \text{total floor area}$ Efficacy of all fixed lighting = 80 lm/W
Air conditioning	None
Photovoltaic (PV) system	For houses: kWp = 40% of ground floor area, including unheated spaces / 6.5 For flats: kWp = 40% of dwelling floor area / (6.5 x number of storeys in block) System facing south-east or south-west

NOTE:
1. For a dwelling connected to an existing district heat network, an alternative notional building is used. See paragraph 1.8 and SAP 10.
2. See SAP 10 for details.

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 SAP12

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.

3.4 Baseline Assessment Strategy

In order to establish the baseline, the HVAC solution has been assumed as a low temperature hot water (LTHW) heating system, via local gas fired boilers and natural ventilation. Domestic Hot Water (DHW) will be supplied from the same boilers system.

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.

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

$$\text{Cooking} = (119 + 24N)/\text{TFA}$$

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 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/sqm
UNIT 01	15.43	6.94
UNIT 02	15.41	6.94
UNIT 03	15.43	6.94
UNIT 04	15.41	6.94
UNIT 05	15.31	6.89

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

3.3 Baseline Results

The baseline building results have been calculated and are presented in Table 2 below.

The Baseline SAP outputs (which summarise the key data) are attached at **Appendix A**. the SAP10 conversion is attached at **Appendix D**.

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
UNIT 01	17.77	6.94	24.71	1603.18
UNIT 02	16.93	6.94	23.87	1570.57
UNIT 03	19.65	6.94	26.59	1725.33
UNIT 04	18.80	6.94	25.74	1693.88
UNIT 05	18.55	6.89	25.44	1891.97
Development Total				8485

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 CO₂ produced by the building after the energy efficiency measures have been included. From these figures the overall reduction in CO₂ 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, the project at Belmont Avenue 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.

Other energy efficiency measures that will reduce the potential for the flats to overheat include the use of LED lighting and EU rated white goods – all utilising less energy and thereby lower internal gains.

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 within a relatively low-rise townscape, with 2/3 storey dwellings in all directions.

The site does not have any particular benefit from topographical shading.

The proposed development design has triple aspect, with generally south-western living rooms with larger, glazed areas to harvest useful solar gain.

Design and size of windows are a result of maximising internal daylight levels in accordance with BRE requirements whilst limiting overheating from solar gains

Secondary accommodation - bedrooms and bathrooms - have reduced glazed areas to limit heat losses, as does any accommodation to the northerly aspect.

Glazing specification has been a significant consideration as part of the overheating risk mitigation and the new glazing will have a solar control specification to further assist in reducing overheating risk from excessive solar gain.

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

All flats are designed with floor-to-floor heights at circa 2.6m & 2.4m.

The new build structure is expected to be a traditional brick and block with slab 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.

All the flats are able to cross ventilate.

5. mechanical ventilation

Given the strategy outlined above, there is no design need to introduce mechanical ventilation, and all units will be naturally ventilated.

4.2 Heating System

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

- High efficiency boiler – (96%+ 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 weather compensation and delayed start thermostats.

4.3 Fabric heat loss

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

- New wall constructions will have full fill PIR board within the cavities and will target a U-Value of $0.17\text{W/m}^2\text{k}$ or better.
- New flat and pitched roof constructions are to be of a warm-roof type, achieving a U-Value of $0.12\text{W/m}^2\text{k}$.
- New ground floor construction will be insulated to achieve a U-Value of $0.14\text{W/m}^2\text{k}$.

Glazing

- The new glazing for windows and doors will be triple glazed with an area weighted average U-Value of $1.2\text{W/m}^2\text{K}$ or better.

Air Tightness

- The project be tested to $4\text{m}^3/\text{hr/m}^2$ 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.

4.4 Ventilation

As noted above, the project is to be 100% naturally ventilated, via trickle (background) ventilation, purge ventilation via opening windows and wet rooms extraction.

4.5 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.

4.6 Energy efficiency results

The above data has been used to update the SAP models, the outputs of which are attached at **Appendix B**.

The SAP 10 emission calculations are attached at **Appendix D**.

Table 3 – Energy Efficient emission levels

Unit	Emission Rate (regulated energy use) Kg/sqm	Unregulated Energy Use Kg/sqm	Total emissions Kg/sqm	Total emissions Kg
UNIT 01	15.64	6.94	22.58	1465.04
UNIT 02	14.58	6.94	21.52	1415.92
UNIT 03	18.12	6.94	25.06	1625.76
UNIT 04	17.05	6.94	23.99	1578.75
UNIT 05	15.78	6.89	22.67	1686.39
Development Total				7772

The results show that the energy efficiency measures introduced have resulted in the reduction in CO₂ emissions from the development of **8.40%**.

Regulated emissions have been reduced by **11.58%** via the passive design measures highlighted above.

5.0 Supplying Energy Efficiently

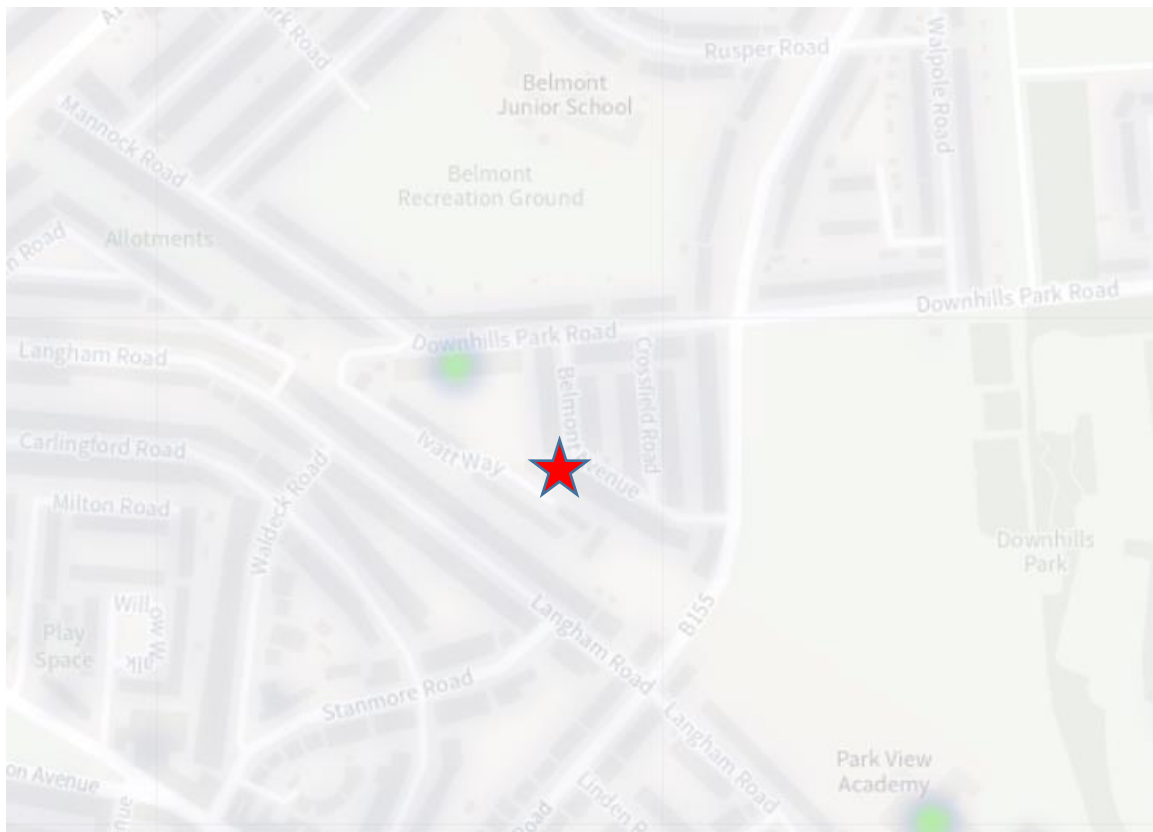
5.1 Community Heating/Combined Heat and Power (CHP)

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 Haringey area.

The extract from the London Heat Map (reproduced below) identifies that the site is within the Heat Network Priority Area.



Extract from London Heat Map

There is longer term opportunity for the Belmont Avenue project to connect to a DEN, however, as a non-major scheme in a low-rise environment, it is considered inappropriate to make the project DEN connection ready – with the associated small-scheme inefficiencies and heat losses.

In the meantime, consideration must be given to an on-site network/community heating.

5.2 On-site CHP/Community Heating

A community heating network comprises a series of insulated pipes used to deliver heat, in the form of hot water or steam, to a number of different locations or dwellings. They range from small, providing heat to a house and a couple of holiday cottages for example, to large scale systems supplying housing estates or blocks of Houses.

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

CHP 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.

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 baseline 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 small-scale domestic development, with only the limited year-round DHW demand to support a CHP installation (only 2-4 hours per day in the May – October period), the economy of scale, in terms of year-round demand, simply isn't present and as such the potential use of on-site CHP is very limited 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 sun's 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.

Payments are made against metered exports only.

The expectation for the project at Central Street is that the vast majority of the PV output will be utilised within the building during the week, so a metered export of weekend energy would enable a further return to the building owners.

6.1.2 Renewable Heat Incentive

The Renewable Heat Incentive (RHI) was formally withdrawn to all applications in March 2022.

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. 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 proposed project at Belmont Avenue itself, standing some 20m + above ground floor level.

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

6.3 Solar Energy

The proposed development has areas of pitched roof that could accommodate solar panels orientated to the south-westerly aspect.

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.

6.3.1 Solar water heating

Solar water heating panels come in two main types: flat plate collectors and evacuated tubes. Flat plate collectors feed water, or other types of fluid used specifically to carry heat, through a roof mounted collector and into a hot water storage tank. Evacuated tube collectors are slightly more advanced as they employ sealed vacuum tubes, which capture and harness the heat more effectively.

Both collector types can capture heat whether the sky is overcast or clear. Depending on location, approximately 900–1100 kWh of solar energy falls on each m² of unshaded UK roof surface annually. The usable energy output per m² of solar panel as a result of this amount of insolation ranges from between 380 – 550 kWh/yr.

Solar hot water systems tend to have a very poor pay back model unless there is a reliable and consistent demand for hot water; a medium size residential scheme simply does not provide this.

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

6.3.2 Photovoltaics (PV)

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

Despite the withdrawal of the Feed in Tariff, the returns on PV installations are still able to achieve 6-7% returns via the reduction in electricity consumption - the cost of which is rising very quickly.

Accordingly, the design team are proposing to utilise the available roof space to accommodate 17 x 330W PV panels per dwelling – a total array at 5.61kWp.

The array will produce some 4,836.25kWh/annum, offsetting a further 1.13tonnes of CO₂/annum (SAP10.1 emission levels).

6.4 Biomass heating

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

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

Additionally, a boiler of this type would replace the need for a conventional gas boiler and therefore offset all the gas energy typically used for space and water heating. However, biomass releases high levels of NO_x emissions and particulate matters, as well as other pollutants and would therefore have to be considered carefully against the high standard of air quality requirements within Haringey's Borough wide AQMA. Accordingly, the use of biomass is not considered appropriate for this project.

6.5 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°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, in the case of the proposed development with very limited external space, there is very limited scope for the locating of the ground collector devices and as such, ground source heating cannot be considered.

6.6 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 CO₂ emissions by approximately 60%. The table below demonstrates, on the assumption of a demand of 1000kWh/year for heating and hot water.

Table 4 – Air Source Heat Pump Performance

Type of Array	Energy Consumption (kWh/yr.)	Emission factor (SAP10) (kgCO ₂ /h)	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 62%

Accordingly, the design team are proposing to utilise air to water heat pumps, mounted in the rear terraces, to supply the heating and hot water to the individual flats, via internally mounted hydrobox units.

Overall system efficiency is expected to be circa 330%, subject to the formal stage 4 design.

6.7 Final Emissions Calculation

Given the outcome of the feasibility study above, the developer is proposing the use the above noted air heat pump system to generate the heating and hot water systems for the flats and a 17-panel roof mounted PV array/dwelling to utilise the whole of the available flat roof space.

The final table – Table 5 – summarises the final outputs from the SAP models; attached at **Appendix C**. The SAP 10 emission calculations are attached at **Appendix D**.

Table 5 – “Be Green” emission levels

Unit	Emission Rate (regulated energy use) Kg/sqm	Unregulated Energy Use Kg/sqm	Total emissions Kg/sqm	Total emissions Kg
UNIT 01	3.09	6.94	10.03	651.00
UNIT 02	2.78	6.94	9.72	639.42
UNIT 03	3.89	6.94	10.83	702.63
UNIT 04	3.57	6.94	10.51	691.62
UNIT 05	3.50	6.89	10.39	772.73
Development Total				3457

The data at Table 5 confirms that overall emissions – including unregulated energy use - have been reduced by **59.26%** over and above the baseline model, with a **55.52%** 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 **81.64%**.

7.0 Sustainable Design & Construction

The Sustainability credentials of the proposed 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.

The retention/re-use of the existing structures are sustainable by default, resulting in a much lower level of embodied carbon in the overall development.

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

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

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

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

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

Energy

The development will incorporate renewables technologies as noted in the main report above, air source heat pumps and PV arrays.

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

This will be further enhanced by the installation of smart energy metering, enabling 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 the former Level 4 of the Code for Sustainable Homes.

Sustainable Urban Drainage (SuDs)

The existing site is currently made up of the rough ground and hard surfaces. Accordingly, the introduction of new landscaping and planted areas will help to reduce the levels of surface water run-off.

Ecology and Biodiversity

Clearly, the existing site is 100% rough ground/hard landscaping, so any improvement on this situation would increase biodiversity.

The development would employ an ecologist to consider the landscaping and planting regime and any other opportunities to achieve an overall improvement in the levels of fauna and flora utilising indigenous species where possible and appropriate.

8.0 Conclusions

This report has detailed the baseline energy requirements for the proposed housing development, the reduction in energy demand as a result of energy efficiency measures and the potential to achieve further CO₂ 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 CO₂ emissions would be **8,485Kg/year**.

Following the introduction of passive energy efficiency measures into the development, as detailed in section 4, the total amount of CO₂ emissions would be reduced to **7,772Kg/year**.

There is also a requirement to reduce CO₂ 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 CO₂ emissions would be via the generation of electricity on site via a 5.61kWp PV array, with the development's heating and hot water generated via air source heat pump technology.

This has been used in the SAP models (reproduced at **Appendix C**) for the development. The SAP 10 emission calculations are attached at **Appendix D**, which have also been detailed above in Table 5, which show a final gross emission level of **3,457Kg/year**, representing a total reduction in emission over the baseline model, taking into account unregulated energy, of **59.26%**.

In addition, the final SAP outputs at Appendix C demonstrate that the building achieves an overall improvement in regulated emissions over the Building Regulations Part L standards for regulated emissions of minimum of 81.64%.

Tables 6 & 7 Demonstrate how the Belmont Avenue 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)	6.16
CO ₂ emissions after energy demand reduction (be lean)	5.45
CO ₂ emissions after energy demand reduction (be lean) AND heat network (be clean)	5.45
CO ₂ emissions after energy demand reduction (be lean) AND heat network (be clean) AND renewable energy (be green)	1.13

Table 7 – Regulated Emissions Savings – domestic Buildings

	Regulated Carbon Dioxide Savings	
	(Tonnes CO ₂ per annum)	%
Savings from energy demand reduction	0.71	11.53
Savings from heat network	0.00	0.00
Savings from renewable energy	4.32	70.13
Total Cumulative Savings	5.03	81.66
	(Tonnes CO ₂)	
Carbon Shortfall	1.13	
Cumulative savings for off-set payment	33.9	
Cash-in-lieu Contribution	N/A	

Appendix A

Baseline/Un-regulated Energy Use:-

SAP Outputs & Target 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

SAP 10 Emissions

GLA Emissions Calculation Spreadsheet

Appendix E

TM59 Overheating Analysis