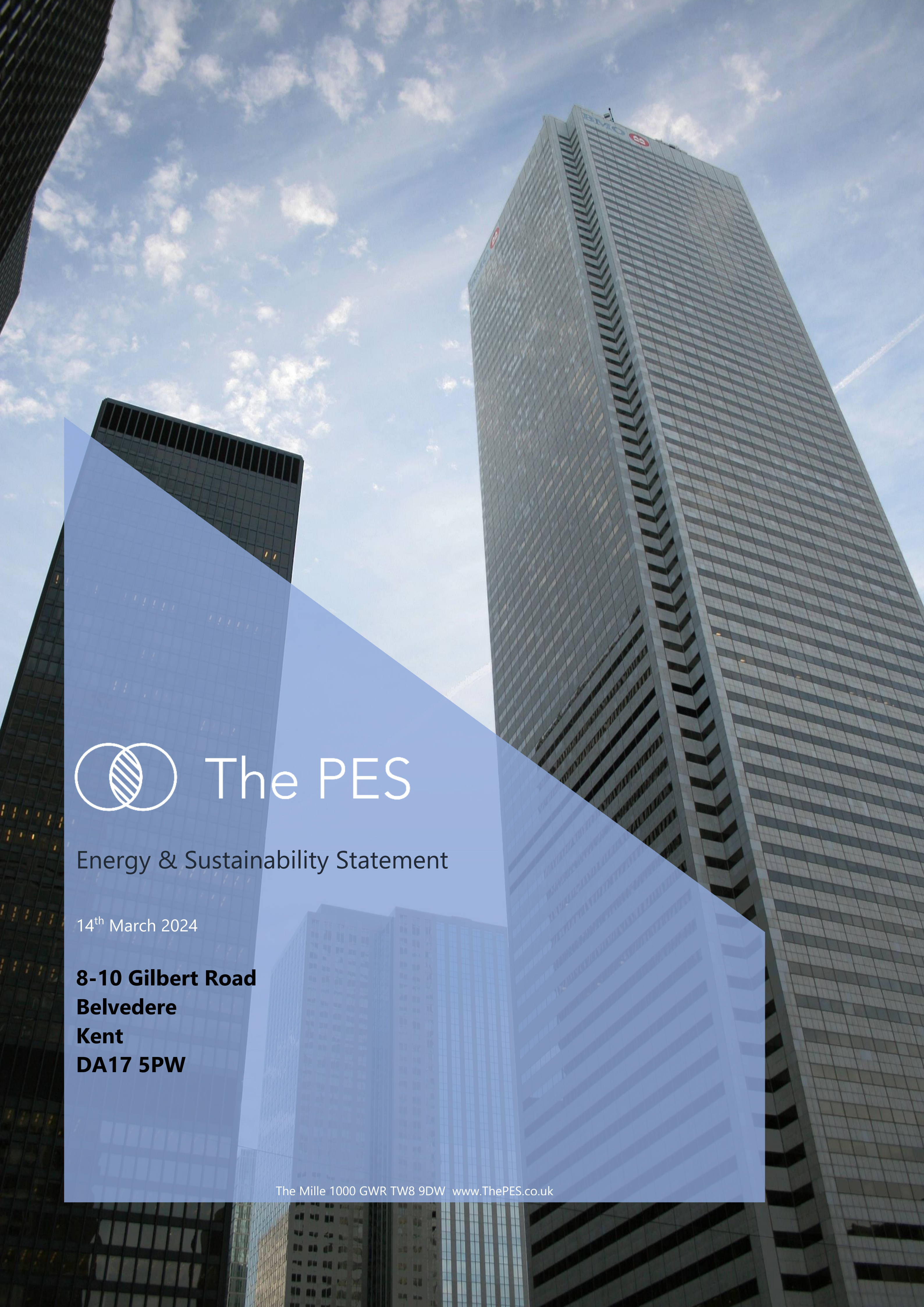

The PES

Energy & Sustainability Statement

14th March 2024

8-10 Gilbert Road
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1.0 Executive Summary

The proposed conversion project at the 8-10 Gilbert Road 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 Bexley's relevant Policy documents.

The new residential conversion will provide 1 x new dwelling.

The report takes on board the latest GLA guidance on writing energy statements (June 2022) as well as taking into account matters raised within the London Plan.

The PES Ltd have been appointed to develop a strategy and advise how the proposed development of newly created flats will comply with these requirements.

A 'Lean, Clean, Green' has been adopted and the development achieves an improvement in build fabric at over **13%** at the "Be Lean" stage and an overall improvement (BER/TER) in regulated emissions at **74%** above Part L 2021 standard, through the adoption of very high standards of insulation and heat pump driven heating and hot water systems.

2.0 The Site & Proposal

The existing block is located on the north side of Gilbert Road.

The proposals involve the conversion of a ground floor garage space to create 1 x new 1 bed flat.

2.1 Local Planning Context

The Gilbert Road site sits within the London Borough of Bexley (Bexley).

Bexley adopted their Local plan in April 2023, the key sustainability policies being

OLICY SP14 Mitigating and adapting to climate change

1. The Council will actively pursue the delivery of sustainable development by:

a. supporting developments that achieve zero-carbon and demonstrate a commitment to drive down greenhouse gas emissions to net zero;

b. administering the borough's carbon offset fund, ring-fencing payments to implement projects that deliver greenhouse gas reductions;

c. investigating opportunities for the funding and development of decentralised energy networks in the borough; and, supporting the provision of infrastructure, including safeguarding routes and land for such use, where necessary;

POLICY DP30 Mitigating climate change

Energy reduction in new buildings

1. Major development proposals must meet London Plan requirements and calculate whole life-cycle carbon emissions through a nationally recognised Whole Life-Cycle Carbon Assessment and demonstrate actions taken to reduce life-cycle carbon emissions.

2. Minor development proposals should aim to achieve net zero carbon; reducing greenhouse gas emissions in operation and minimising annual and peak energy demand in accordance with the London Plan energy hierarchy.

Sustainable design standards for all development

3. The Council expects that, where possible:

a. new homes be designed to achieve:

i. BREEAM Home Quality Mark (HQM), or

ii. BREEAM Communities standards (for major housing-led mixed-use development), or

iii. Passivhaus, or

iv. other appropriate sustainability measures.

b. residential conversions, refurbishment, extensions and changes of use should be designed to achieve BREEAM Domestic Refurbishment Excellent or other appropriate sustainability measure.

c. new non-residential development, refurbishment of existing buildings, and conversions, over 500m2 floor space (gross) must meet or exceed BREEAM 'excellent' rating; and

d. minor non-residential development achieves a BREEAM 'Very Good' rating.

Water efficiency

4. Development must be designed to be water efficient and reduce water consumption. Residential development must not exceed a maximum water use of 105 litres per head per day (excluding the allowance of up to 5 litres for external water consumption). Refurbishments and other non-domestic development will be expected to meet BREEAM water-efficiency credits.

2.3 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 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.

As a non-major development scheme, the project at Gilbert Road will comply with the requirements of the London Plan utilising SAP10.2/Part L2021 methodology in line with the GLA guidance on the preparation of Energy Statements.

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 Dwelling Created via Refurbishment/Extension

For dwellings created via change of use, the SAP methodology is used, but the notional baseline dwelling is set following the GLA guidance within appendix 4, Table 12 – as set out below:-

Table 12: *Residential notional specification for existing buildings*

Element	Unit	Specification[3]
External Wall – cavity insulation	W/m²K	0.55
External Wall – internal or external insulation	W/m²K	0.30
Roof	W/m²K	0.16
Floor	W/m²K	0.25
Glazing	W/m²K	1.60
Vision element	g-value	0.63
Air permeability	(m³/h m² @ 50 Pa)	Default - determined by fabric element types
Thermal Bridging	W/m²K	Default
HVAC type	-	As per final building specification
Heating and Hot Water	Per cent	Efficiencies to match the applicable notional values for existing dwellings (see section 6 of Approved Document L1)
Cooling (air-condition)	SEER	None
Lighting	Per cent	100 per cent low energy lighting with a minimum luminous efficacy of 75 light source lumens per circuit-watt.

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 SAP10.2, prior to applying the actual construction and HVAC solution of the proposed dwellings to generate the Dwelling Emission Rate (DER).

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.

3.2 Unregulated Energy Use

The baseline un-regulated energy use for cooking & appliances in the residential units have been calculated using the SAP10.2 Appendix L.

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

Cooking = (138 + 28N)/TFA

N = no of occupant SAP table 1B

TFA – Total Floor Areas

The 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 SAP10.2 Kg/annum
Flat 3	1490

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: -

3.3 Baseline Results

The baseline building results have been calculated in line with SAP10.2 emission standards and are presented in Table 2 below. The Baseline SAP outputs (which summarise the key data) are attached at **Appendix A**, with the GLA Part L 2021 Reporting Spreadsheet attached at **Appendix D.**

Table 2 – Baseline energy consumption and CO2 emissions

Unit	Target Emission Rate (regulated energy use) Kg/annum	Unregulated Energy Use Kg/annum	Total baseline emissions Kg/annum
Flat 3	1,753	1490	3,243
Development Total	**3,355**	**3,244**	**6,600**

4.0 Design for energy efficiency

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

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

4.1 Passive Design

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

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

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

This section touches on how the proposed design will reduce the potential for overheating and reliance on air conditioning systems, and maximise the incorporation of passive design measures 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, such as cross ventilation.
5. provide low energy mechanical ventilation.

The project is based within an existing 3 storey block with a north-south orientation.

There is no practical topographical shading provided by nearby buildings.

The design proposal offers a good balance of fenestration in terms of glazed area/net internal floor area driven by the existing surrounding townscape - providing sufficient light to reduce reliance on artificial lighting, while at the same time reducing the potential for very high levels of solar gain.

The south facing window and door set have the advantage of local shading from the balcony above

Further thermal control will provided via thermal mass – the existing slab floors – enabling the structure to absorb heat during the day to be released to outside (during summer) or back into the building overnight (during the heating season).

Further protection from unwanted peak solar gain will be provided via low-e glazing, with a low g value.

Finally, a low energy lighting system – utilising LED lighting throughout - will ensure a/ minimal internal gains, b/ low energy consumption and c/ much reduced running costs.

The design team are proposing that the flat with have the ability to naturally ventilate for the purposes of mitigating the potential to overheat.

Both flat offers cross ventilation as part of the design, which will enable occupants to use windows for purge ventilation as required.

Given the passive design measures noted above – the project is proposing a natural ventilation strategy.

The design team has confirmed that there is no intension to introduce any form of mechanical cooling for the residential spaces.

4.2 Heating System

For the “notional” energy efficient model, the primary heating system for the dwellings will consist of high efficiency gas boilers providing domestic hot water and LTHW heating via local combination boilers

Heat emitters in the flats will be radiators.

- A-Rated gas condensing boiler – (92% 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
- Boiler fitted with a weather compensation system

4.3 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: -

Existing walls will be internally lined to deliver a u-value at 0.26W/m^{2}k

The exposed ground floors will target a u value at 0.14W/m^{2}k or better

Glazing

New glazing units for the flats will be triple glazed with an area weighted average u-value of 1.1W/m^2 K or better.

Air Tightness

The project will be tested for air tightness with a target value of 5m^3/hr/m^2 for the new residential units in line with best practice for naturally ventilated buildings.

4.4 Ventilation

As noted above, the flat will have a natural ventilation strategy; trickle vents, opening windows and wet room 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.

External lighting will utilise daylight controls to ensure lights are not active during the day.

4.6 Energy efficiency results

The above data has been used to update the SAP models, the Dwelling Emission Rate outputs of which are attached at **Appendix B**, whilst Table 3 sets out the total emissions using SAP10.2 data.

Table 3 – Energy Efficient emission levels

Unit	Target Emission Rate (regulated energy use) Kg/annum	Unregulated Energy Use Kg/annum	Total be lean emissions Kg/annum
Flat 3	1,615	203	1,817
Development Total	**2,919**	**3,244**	**6,163**

The results show that the energy efficiency measures introduced have resulted in the reduction in regulated and unregulated CO_2 emissions from the development of **6.61%.**

Regulated emissions have been reduced by **13.01%** via the passive design measures highlighted above.

The total Part L Fabric Energy Efficiency Standard (FEES) for the development – set out in Table 4 below:-

Table 4 – Residential FEES

	Target Fabric Energy Efficiency (MWh/year)	Design Fabric Energy Efficiency (MWh/year)	Improvement (per cent)
Development Total	62.25	51.53	17%

5.0 Supplying Energy Efficiently

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

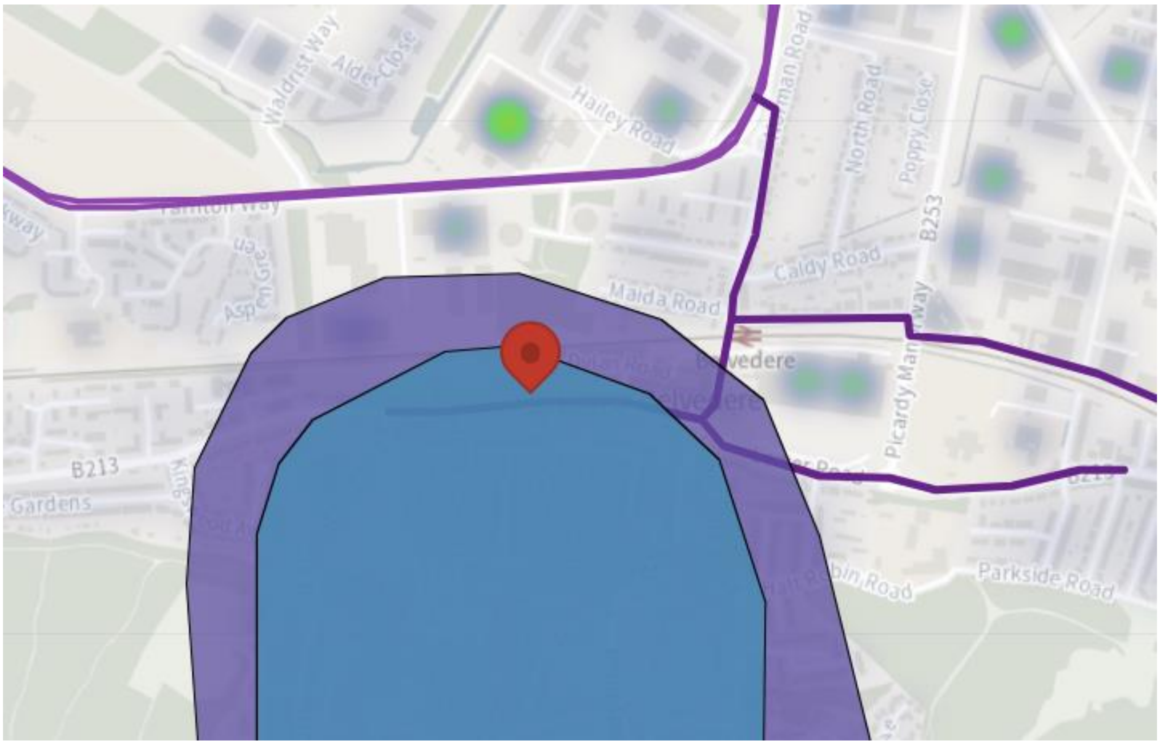
5.1 Community Heating/Combined Heat and Power (CHP)

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.

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

This report must consider the availability – now or in the future – of heat networks in the Bexley area.

The extract from the London Heat Map (reproduced below) suggests that the project is on the route of the Erith Extension DEN, but within an area of low heat network potential.



Extract from London Heat map

As a non-major scheme, there is no requirement to be DEN connection ready; indeed, given the lack of space associated with the internal reconfiguration, such proposals could not be accommodated.

However, the proposed LTHW heating and DHW systems would be compatible with a DEN connection should it become available.

5.2 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 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.

The key benefit from running a CHP engine is that it produces electricity, which can displace grid supplied electricity, which has significant carbon savings. It is for this reason that CHP is designed to run for as many hours of the year as possible.

GLA Guidance states non-domestic developments providing a substantial coincidence of demand for heat and power for the majority of hours in the year (5,000 hours per annum) and the heat to power ratio is low (e.g. 1:1), will still be expected to include on-site CHP as part of their energy strategy to meet the London Plan CO_2 reduction targets.

Clearly, as a small scale residential development, where the only demand for hot water for several months of the year is limited morning and evening demand, an on-site CHP installation cannot be justified.

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.

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

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

6.1 Government incentives

6.1.1 Smart Export Guarantee (SEG)

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

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

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

Payment are made against metered exports only.

6.1.1 Renewable Heat Incentive

The Renewable Heat Incentive (RHI) was formally withdrawn to all projects 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. The site is surrounded by other properties of similar height. 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 project site itself.

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

6.3 Solar Energy

The full block has areas of flat roof that could accommodate solar panels orientated to the south.

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 m^2 of unshaded UK roof surface annually. The usable energy output per m^2 of solar panel as a result of this amount of insolation ranges from between 380 – 550 kWh/yr.

Solar hot water systems are of course, displacing gas or high efficiency heat pumps for DHW provision (as noted above), and due to the low cost of these energies, it would require a very large system to compete with the offsetting of electricity use afforded by PV panels.

Accordingly, the use of solar thermal systems is dismissed.

6.3.2 Photovoltaics (PV)

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

The withdrawal of the Feed in Tariff has now rendered such investments less attractive, however, there is still the benefit and carbon savings derived from the electricity produced – currently some 3.5 x as expensive as mains gas – so returns can still achieve in excess of 8/9%.

Accordingly, the design team are proposing to utilise the roof space to install a 2 panel PV array to the main roof– providing electricity to the new unit

Overall, the 2 x 440w panel array with generate some 750kWh/annum.

6.4 Biomass heating

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

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

Additionally, a boiler of this type would replace the need for a conventional gas boiler and therefore offset all the gas energy typically used for space and water heating. However, biomass releases high levels of NO_x emissions, as well as other pollutants and would therefore have to be considered carefully against the high standard of air quality requirements in Bexley, as the whole borough has been designated as an Air Quality Management Area.

Accordingly, the use of biomass is not considered appropriate for this project.

6.6 Ground source heat pump

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

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

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

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

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

Clearly, there is insufficient land area to install low level collector loops or deep bore GSHP and as such, ground source heating cannot be considered further.

6.7 Air source heat pump

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

It must be remembered that heat pumps utilise grid based electricity, so calculations base the benefits on the current SAP10.2 emissions data.

Assuming a seasonal system efficiency of 320% (Coefficient of Performance of 3.2) and that the air source heat pump will replace 100% of the space heating/hot water demand, then the system would reduce the overall CO_2 emissions by approximately 70%. The table below demonstrates, on the assumption of a demand of 1000Kwh/year for heating and hot water.

Table 5 – Air Source Heat Pump Performance

Type of Array	Energy Consumption (kWh/yr.)	Emission factor ($kgCO_2/h$)	Total CO_2 emissions (kg/annum)
90% efficient gas boiler	11111	0.210	2333
320% efficient ASHP	2813	0.136	383
100% efficient immersion (back-up)	1000	0.136	136

A theoretical carbon saving of 77%

With the above data in mind, clearly an ASHP could be an option and the "be green" proposals include the use of an air source heat pump, located within the dwelling to provide the flats heating and DHW.

Overall system efficiency has been advised at circa 330% and this figure has been used within the final energy calculations.

The use of these highly efficient electrically driven HVAC systems also offer the benefit of having a zero contribution to local environment's nitrous oxide and particulate levels; this is considered to be a significant advantage.

6.8 Final Emissions Calculation

Given the outcome of the feasibility study above, the developer is proposing the use the above noted air source heat pump system to deliver the heating and hot water demands to the development, as well as a roof mounted 2 panel PV array, a total 0.88kWp array generating some 750kWh/annum**.**

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

Table 6 – "Be Green" emission levels

Unit	Target Emission Rate (regulated energy use) Kg/annum	Unregulated Energy Use Kg/annum	Total be green emissions Kg/annum
Flat 3	460	203	663
Development Total	**862**	**3,244**	**4,106**

The data at Table 8 confirms that overall emissions – including unregulated energy use - have been reduced by **37.78%** over and above the baseline model, with a **33.38%** 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 equates to **74.32%.**

The GLA reporting spreadsheet is attached at **Appendix D.**

The Energy Use Intensity and space heating demand of the development – Table 7 below

Table 7 – Energy and Heat Demands

Building Type	Energy Use Intensity ($kWh/m^2/year$)	Space Heating ($kWh/m^2/year$)
Residential	57.65	43.41

7.0 Sustainable Design & Construction

The Sustainability credentials of the proposed residential development at 8-10 Gilbert Road are set out below; based on the environmental assessment criteria developed by the Building Research Establishment.

It is noted that Local Plan Policy DP30 requires that; *residential conversions, refurbishment, extensions and changes of use should be designed to achieve BREEAM Domestic Refurbishment Excellent or other appropriate sustainability measure.*

This is contravention of national policy; a Written statement to Parliament Planning update (March 2015) HM Government advised "Steps the government are taking to streamline the planning system, protect the environment, support economic growth and assist locally-led decision-making."

Under the heading "Plan Making", it was confirmed that

"From the date the Deregulation Bill 2015 is given Royal Assent, local planning authorities and qualifying bodies preparing neighbourhood plans should not set in their emerging Local Plans, neighbourhood plans, or supplementary planning documents, any additional local technical standards or requirements relating to the construction, internal layout or performance of new dwellings. This includes any policy requiring any level of the Code for Sustainable Homes to be achieved by new development; the government has now withdrawn the code, aside from the management of legacy cases. Particular standards or requirements for energy performance are considered later in this statement."

The Deregulation Bill received royal ascent on 26th March 2015, accordingly, the above noted condition should not have been applied. Indeed, the written Statement also confirms that:-

Local planning authorities may also need to review their local information requirements to ensure that technical detail that is no longer necessary is not requested to support planning applications.

As such, the above noted Domestic Refurbishment requirements cannot be sought.

However, the applicants will seek to deliver a sustainable development as set out below:-

Materials

The principal issue when considering the environmental impact of new construction materials is the embodied carbon – i.e. the carbon cost extraction of raw material, transport to factory, manufacturing, transport to site and erection on site.

Clearly, the re-use and conversion of an existing building is highly sustainable by default – with a very high reduction in up-front embodied carbon.

Additional carbon costs are occurred through maintenance and repairs as well as end of life (deconstruction/demolition).

The design team will seek out new construction techniques with a lower embodied carbon contents; with the extensive use of sustainably sourced timber for partitions, stairs, new floors etc

Other significant measure considered to reduce the project CO_2e content include:-

- All timbers to be FSC or PEFC certified
- Plasterboard with a significant recycled content – subject to market availability

In addition to the above low carbon strategy, 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.)

The principle contractor with be required to produce a site waste management plan and sustainable procure plan, in line with BREEAM standards – 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 in order to align with the principles of the circular economy.

The procurement plan will follow the waste hierarchy Reduce; Reuse & Recycle.

The SWMP will 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.

The project will target a figure in excess of 97% of construction waste diverted from landfill.

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 Bexley's collection policies.

Pollution

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

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

The main contractor will be required to register the site with the Considerate Constructors Scheme and achieve a best practice score of 33 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 roof mounted PV.

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

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

Water

The development minimise water use as far as practicable by incorporating appropriate water efficiency and water recycling measures. The applicants will ensure that all dwellings meet the required level of 105 litres maximum daily allowable usage per person in accordance with Bexley Policy.

Sustainable Urban Drainage (SuDs)

The existing site is currently made up of existing buildings - accordingly, there will be no impacts on surface water run-off.

8.0 Conclusions

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

The baseline results have shown that if the development was built to a standard to meet only the minimum requirements of current building regulations, the total amount of CO_2 emissions would be **6,600Kg/year**.

Following the introduction of passive energy efficiency measures into the development, as detailed in section 4, the total amount of CO_2 emissions would be reduced to **6,163Kg/year.**

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

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

The results of the assessment of suitable technologies relative to the nature, locations and type of development suggest that the most suitable solution to meeting reduction in CO_2 emissions would be via the use heat pumps to drive the LTHW and DHW systems, and the installation of an 0.88kWp PV array at roof top level.

This has been used in the SAP models (reproduced at **Appendix C**) for the development which have also been detailed above in Table 6, which show a final gross emission level of **4,106Kg/year**, representing a total reduction in emission over the baseline model, taking into account unregulated energy, of **37.78%.**

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 74%.

The GLA Part L 2021 Reporting Spreadsheet is attached at **Appendix D.**

Tables 8 & 9 Demonstrate how the Gilbert Road project complies with the London Plan requirements and the GLA guidance relating to zero carbon development based up SAP10.2 emissions data.

Table 8 – Carbon Emission Reductions – Domestic Buildings

Key	Tonnes/annum
Baseline CO_2 emissions (Part L 2021 of the Building Regulations Compliant Development)	3.4
CO2 emissions after energy demand reduction (be lean)	2.9
CO2 emissions after energy demand reduction (be lean) AND heat network (be clean)	2.9
CO2 emissions after energy demand reduction (be lean) AND heat network (be clean) AND renewable energy (be green)	0.9

Table 9 – Regulated Emissions Savings – Domestic Buildings

	Regulated Carbon Dioxide Savings	
	(Tonnes CO2 per annum)	%
Savings from energy demand reduction	0.4	13%
Savings from heat network	0.0	0%
Savings from renewable energy	2.1	61%
Total Cumulative Savings	**2.5**	**74%**
	(Tonnes CO_2)	
Carbon Shortfall	0.9	
Cumulative savings for off-set payment	**26**	
Cash-in-lieu Contribution	**£2,456**	

Appendix A

Baseline/Un-regulated Energy Use:-

SAP Outputs & Dwelling Emission Rates

Appendix B

Energy Efficient Design:-

SAP Outputs & Dwelling Emission Rates

Appendix C

Generating energy on-site:-

SAP Outputs & Dwelling Emission Rates

Appendix D

Project Emission Calculations

GLA Part L 2021 Reporting Spreadsheet