Sustainability & Energy Statement

Grosvenor Garage, Fitzgerald Avenue, East Sheen SW14

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Executive Summary

This Sustainability and Energy Statement has been prepared in support of a planning application for the demolition of the existing garage buildings at Grosvenor Garage, Fitzgerald Avenue, East Sheen and the construction of three, 3 and 4-bedroom 2½-storey houses, five, 1 and 2-bedroom apartments and a commercial unit.

The Statement sets out the commitments of the applicant to the site and the targets that will be applied to the development.

The methodology used has been based upon the 'Energy Assessment Guidance' published by the Mayor of London in June 2022 and uses the carbon factors for gas and electricity proposed for SAP 10.2.

In order to demonstrate the energy efficiency of the units a set of SAP calculations have been prepared for representative apartments and houses and a BRUKL calculation for the office unit for the 'Be Lean' scenario based on the notional systems specification set out in the Part L 2021 baseline. This is not the proposed strategy but purely demonstrates the reduction from the 'Be Lean' condition.

The TER & DER Worksheets for the modelled residential units for the Be Lean case are attached as Appendix 1 and the BRUKL Output Document for the office unit for the Be Lean case is attached as Appendix 2.

The fabric standards of the building will exceed the requirements of the Building Regulations.

It is proposed to install air source heat pumps into each of the houses and the office unit and heat pump hot water cylinders into each apartment. In addition, the Roof Plan attached as Appendix 5 demonstrates a total of 42 photovoltaic panels could be installed without detrimentally impacting on the aesthetics of the development (the output of the panels is assumed to be 400W).

A further set of SAP calculations have been prepared for the residential unit based on the proposed specification and the DER Worksheets for the Be Green scenario are attached as Appendix 3. A further BRUKL calculation has been prepared for the commercial unit for the Be Green scenario and the Output Document is attached as Appendix 4.

The completed GLA Carbon Emissions Reporting Spreadsheet accompanies the planning application but the site wide reductions in emissions can be summarised as follows:

	Total Emissions	% Reduction
	kg CO_2 per year	
Be Lean		
Baseline (Building Regulations TER)	8,534	
Be Lean - after energy efficiency (DER)	7,450	**12.70%**
Be Clean	7,450	12.70%
Be Green (Heat Pumps & Photovoltaic Panels)		
Be Green Emissions	2,696	**68.41%**

The residual emissions are **2.696 tonnes** and therefore the carbon offset payment would be **£7,683** (2.696 x £2,850).

The Be Lean reductions for each use class can be expressed as follows;

	TER Emissions	DER & BER Emissions	% Reduction
	kg CO_2 per year	kg CO_2 per year	
Residential Accommodation	8,006	7,053	**11.90%**
Non-Residential Accommodation	528	396	**25.00%**

The emissions reductions at the Be Lean stage meet the requirements of the planning policy and the GLA Energy Assessment Guidance.

The non-residential element is 107.0 m^2 in floor area and is proposed as of not sufficient scale to warrant a BREEAM assessment. The cost of the assessment for a development of this scale would outweigh any benefits.

The roof of the building is proposed to incorporate a 'green roof' and therefore in order to incorporate both the green roof and the photovoltaic panels it is proposed to use the Bauder BioSOLAR support system or similar.

The LBRuT Sustainable Construction Checklist is attached as Appendix 6.

1.0 Introduction

This report has been commissioned by Hesta Homes and provides a Sustainability and Energy Statement in support of a planning application for the demolition of the existing garage buildings at Grosvenor Garage, Fitzgerald Avenue, East Sheen and the construction of three, 3 and 4-bedroom 2½-storey houses, five, 1 and 2-bedroom apartments and a commercial unit.

The report describes the methodology used in assessing the development and the initiatives proposed.

The building has been designed and will be constructed to reduce energy demand and carbon dioxide emissions.

The objective is to reduce the energy demand to an economic minimum by making investments in the parts of the building that has the greatest impact on energy demand and are the most difficult and costly to change in the future, namely the building fabric.

Once a cost-effective structure has been designed, low-carbon and renewable technologies have been considered to provide heat and/or electricity.

The following hierarchy has been followed:

- Lean reduce demand and consumption
- Clean increase energy efficiency
- Green provide low carbon renewable energy sources

The report has been prepared by Ivan Ball of Bluesky Unlimited who are sustainability consultants.

2.0 Planning Policy Context

National Policy

The UK Government published its sustainable development strategy in 1999 entitled "A better quality of life: A strategy for sustainable development in the UK". This sets out four main objectives for sustainable development in the UK:

- Social progress that recognises the needs of everyone.
- Effective protection of the environment.
- Prudent use of natural resources.
- Maintenance of high stable levels of economic growth and employment.

Sustainable Communities: Building for the Future, known colloquially as the Communities Plan was published in 2003. The Plan sets out a long-term programme of action for delivering sustainable communities in both urban and rural areas. It aims to tackle housing supply issues in parts of the country, low demand in other parts and the quality of our public spaces. The Communities Plan describes sustainable communities as: Active, inclusive and safe, well run, environmentally sensitive, well designed and built, well connected, thriving, well served and fair for everyone.

The most relevant national planning policy guidance on sustainability is set out in:

- National Planning Policy Framework - 2023

Paragraph 157 states;

"The planning system should support the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change. It should help to: shape places in ways that contribute to radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience; encourage the reuse of existing resources, including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure."

Regional and Local Policies

The Development Plan comprises the London Plan (2021) and the London Borough of Richmond Local Plan (2018).

London Plan, published March 2021 **–** the following policies are relevant to the application:

Policy SI 1 Improving air quality

A *Development Plans, through relevant strategic, site-specific and area-based policies, should seek opportunities to identify and deliver further improvements to air quality and should not reduce air quality benefits that result from the Mayor's or boroughs' activities to improve air quality.*

B *To tackle poor air quality, protect health and meet legal obligations the following criteria should be addressed:*

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

2) In order to meet the requirements in Part 1, as a minimum:

a) development proposals must be at least Air Quality Neutral

b) development proposals should use design solutions to prevent or minimise increased exposure to existing air pollution and make provision to address local problems of air quality in preference to post-design or retro-fitted mitigation measures

c) major development proposals must be submitted with an Air Quality Assessment. Air quality assessments should show how the development will meet the requirements of B1

d) development proposals in Air Quality Focus Areas or that are likely to be used by large numbers of people particularly vulnerable to poor air quality, such as children or older people should demonstrate that design measures have been used to minimise exposure.

C *Masterplans and development briefs for large-scale development proposals subject to an Environmental Impact Assessment should consider how local air quality can be improved across the area of the proposal as part of an air quality positive approach. To achieve this a statement should be submitted demonstrating:*

1) how proposals have considered ways to maximise benefits to local air quality, and

2) what measures or design features will be put in place to reduce exposure to pollution, and how they will achieve this.

D *In order to reduce the impact on air quality during the construction and demolition phase development proposals must demonstrate how they plan to comply with the Non-Road Mobile Machinery Low Emission Zone and reduce emissions from the demolition and construction of buildings following best practice guidance.*

E *Development proposals should ensure that where emissions need to be reduced to meet the requirements of Air Quality Neutral or to make the impact of development on local air quality acceptable, this is done on-site. Where it can be demonstrated that emissions cannot be further reduced by on-site measures, off-site measures to improve local air quality may be acceptable, provided that equivalent air quality benefits can be demonstrated within the area affected by the development.*

Policy SI 2 Minimising greenhouse gas emissions

A *Major development should be net zero-carbon. This means reducing greenhouse gas emissions in 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 operation*
   2) *be clean: exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly*
   3) *be green: maximise opportunities for renewable energy by producing, storing and using renewable energy on-site*
   4) *be seen: monitor, verify and report on energy performance.*

B *Major development proposals should include a detailed energy strategy to demonstrate how the zero-carbon target will be met within the framework of the energy hierarchy.*

C *A minimum on-site reduction of at least 35 per cent beyond Building Regulations is required for major development. Residential development should achieve 10 per cent, and non-residential development should 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, in agreement with the borough, either:*
   1) *through a cash in lieu contribution to the borough's carbon offset fund, or*
   2) *off-site provided that an alternative proposal is identified and delivery is certain.*

D *Boroughs must establish and administer a carbon offset fund. Offset fund payments must be ring-fenced to implement projects that deliver carbon reductions. The operation of offset funds should be monitored and reported on annually.*

E *Major development proposals should calculate and minimise carbon emissions from any other part of the development, including plant or equipment, that are not covered by Building Regulations, i.e. unregulated emissions.*

F *Development proposals referable to the Mayor should 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.*

Policy SI 4 Managing heat risk

A *Development proposals should minimise adverse impacts on the urban heat island through design, layout, orientation, materials and the incorporation of green infrastructure.*

B *Major development proposals should demonstrate through an energy strategy how they will reduce the potential for internal overheating and reliance on air conditioning systems in accordance with the following cooling hierarchy:*

1) *reduce the amount of heat entering a building through orientation, shading, high albedo materials, fenestration, insulation and the provision of green infrastructure*
2) *minimise internal heat generation through energy efficient design*
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 SI 5 Water infrastructure

A *In order to minimise the use of mains water, water supplies and resources should be protected and conserved in a sustainable manner.*

B *Development Plans should promote improvements to water supply infrastructure to contribute to security of supply. This should be done in a timely, efficient and sustainable manner taking energy consumption into account.*

C *Development proposals should:*

1) *through the use of Planning Conditions 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 for the 'Wat 01' water category or equivalent (commercial development)*
3) *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.*

D *In terms of water quality, Development Plans should:*

1) *promote the protection and improvement of the water environment in line with the Thames River Basin Management Plan, and should take account of Catchment Plans*
2) *support wastewater treatment infrastructure investment to accommodate London's growth and climate change impacts. Such infrastructure should be constructed in a timely and sustainable manner taking account of new, smart technologies, intensification opportunities on existing sites, and energy implications. Boroughs should work with Thames Water in relation to local wastewater infrastructure requirements.*

E *Development proposals should:*

1) *seek to improve the water environment and ensure that adequate wastewater infrastructure capacity is provided*

2) *take action to minimise the potential for misconnections between foul and surface water networks. F Development Plans and proposals for strategically or locally defined growth locations with particular flood risk constraints or where there is insufficient water infrastructure capacity should be informed by Integrated Water Management Strategies at an early stage.*

London Borough of Richmond

The London Borough of Richmond adopted its Local Plan on the 3rd July 2018.

The following policy is of particular relevance to the topic area of this Statement and has been edited for clarity and relevance to the application in question.

Local Plan (2018)

Policy LP 22 - Sustainable Design and Construction

A. Developments will be required to achieve the highest standards of sustainable design and construction to mitigate the likely effects of climate change. Applicants will be required to complete the following:

1. *Development of 1 dwelling unit or more, or 100sqm or more of non-residential floor space (including extensions) will be required to complete the Sustainable Construction Checklist SPD. A completed Checklist has to be submitted as part of the planning application.*
2. *Development that results in a new residential dwelling, including conversions, change of use, and extensions that result in a new dwelling unit, will be required to incorporate water conservation measures to achieve maximum water consumption of 110 litres per person per day for homes (including an allowance of 5 litres or less per person per day for external water consumption).*
3. *New non-residential buildings over 100sqm will be required to meet BREEAM 'Excellent' standard.*

Reducing Carbon Dioxide Emissions

B. Developers are required to incorporate measures to improve energy conservation and efficiency as well as contributions to renewable and low carbon energy generation. Proposed developments are required to meet the following minimum reductions in carbon dioxide emissions:

1. *All new major residential developments (10 units or more) should achieve zero carbon standards in line with London Plan policy.*
2. *All other new residential buildings should achieve a 35% reduction.*
3. *All non-residential buildings over 100sqm should achieve a 35% reduction. From 2019 all major non-residential buildings should achieve zero carbon standards in line with London Plan policy.*

*Targets are expressed as a percentage improvement over the target emission rate (TER) based on Part L of the 2013 Building Regulations.**

C. This should be achieved by following the Energy Hierarchy:

1. *Be lean: use less energy*
2. *Be clean: supply energy efficiently*
3. *Be green: use renewable energy*

Decentralised Energy Networks

D. The Council requires developments to contribute towards the Mayor of London target of 25% of heat and power to be generated through localised decentralised energy (DE) systems by 2025. The following will be required:

1. *All new development will be required to connect to existing DE networks where feasible. This also applies where a DE network is planned and expected to be operational within 5 years of the development being completed.*

Applicants are required to consider the installation of low, or preferably ultra-low, NOx boilers to reduce the amount of NOx emitted in the borough.

Local opportunities to contribute towards decentralised energy supply from renewable and low-carbon technologies will be encouraged where appropriate.

* As a result of revisions to the Building Regulations the LBRuT have published an update to the policy. This sets out a requirement for smaller residential schemes (below 10 units) to achieve a 35% reduction in emissions against a Building Regulations Part L (2021) baseline.

  The update also sets out a requirement to follow the GLA Energy Assessment Guidance (2022) and to complete the 2022 Carbon Emissions Reporting Spreadsheet.

3.0 Assessment Methodology

The methodology used has followed that set out in the Energy Assessment Guidance published by the GLA in June 2022.

SAP and BRUKL calculations have been prepared using Part L 2021 to 'test' the Be Lean emissions. This uses the specification for building systems set out in the notional dwelling specification for new dwellings and non-residential accommodation (Part L 2021).

Further SAP and BRUKL calculations have been prepared for the Be Green scenario, which uses the fabric specification established at the Be Lean stage but includes the actual building systems proposed.

Emission Factors

The CO_2 emission factors, where applicable, used throughout this report have been taken from Part L - 2021 as required by the GLA Energy Assessment Guidance.

	kg CO_2/kWh
Mains gas	0.210
Grid supplied and displaced electricity	0.136

4.0 Proposal

The accommodation schedule in detail is;

Unit Type	Number	Area	Total Area
		m^2	m^2
Residential Accommodation			
1-Bedroom apartments	3	51.0	153.0
2-Bedroom apartment	1	76.0	76.0
2-Bedroom apartment	1	99.0	99.0
3-Bedroom 2½-storey End-terrace house	1	150.0	150.0
3-Bedroom 2½-storey Mid-terrace house	2	177.0	354.0
Sub-Total	8		832.0
Non-Residential Accommodation			
Office Unit	1	107.0	107.0
Sub-Total	1		107.0
Total			**939.0**

5.0 Energy Efficiency

5.1 Demand Reduction (Be Lean)

Design

The energy performance of a building is affected by its design, construction and use and whilst occupant behaviour is beyond the remit of this statement, better design and construction methods can significantly reduce the life cycle emissions of a building and assist the occupant to reduce consumption.

Sustainable design is not just about incorporating renewable technologies; buildings should be designed at the outset to provide suitable environmental conditions for the occupants whilst also consuming as little energy as practical.

Passive Design Measures

The passive design measures proposed include;

Passive Solar Gain

Passive measures include allowing for natural ventilation and exposed thermal mass coupled with high levels of insulation, air tightness and the control of solar gain.

The location and design of the building is in context with surrounding development and the shape of the site. The apartments are designed with dual aspects with the 1-bedroom units being orientated towards the southeast, east and northeast and the 2-bedroom units orientated towards the northwest and southeast. The three houses all benefit from orientations towards the southwest and northeast.

All units benefit from access to direct sunlight at some point throughout the day and from cross ventilation to limit summer overheating.

Natural Daylighting

The orientation and the size of the windows have been optimised to maximise the amount of natural daylight whilst avoiding summer overheating and therefore reduce the demand for artificial lighting.

Efficient Building Fabric

Building Envelope

U-values of the building envelope must meet Building Regulations Part L standards and further improvements to U-values will reduce the building's heating requirements.

The ground-floor will be insulated with 200mm 'Kingspan' PIR insulation or similar.

The external walls will be built in traditional cavity wall construction with an overall width of 300mm. This will be comprised of 100mm facing brick, 100mm fully-filled cavity and 100mm medium density block internally.

The flat roofs will be insulated with 200mm PIR insulation and sloping mansard walls to the second floor and dormers will be insulated with at least 150mm of PIR insulation.

Windows are proposed as double glazed with Low 'e' soft coat and argon filled.

It is proposed to set maximum limits for the elemental U-values as follows:

Element	Part L Limiting U-values	Proposed U-values	Proposed Improvement
	W/m²K	W/m²K	
Ground-Floors	**0.18**	**0.11**	**39%**
External Walls	**0.26**	**0.15**	**31%**
Flat Roof	**0.16**	**0.12**	**19%**
Sloping Walls to 2nd Floor & Dormers	**0.16**	**0.15**	**6%**
Windows, Glazed Doors	**1.60**	**1.20**	**25%**
Entrance Doors	**1.60**	**1.20**	**38%**

'g' Value for Windows and Glazed Doors	**0.54**

Air Leakage

Large amounts of heat are lost in winter through air leakage from a building (also referred to as infiltration or air permeability) often through poor sealing of joints and openings in the building.

The Building Regulations set a minimum standard for air permeability of 8 m^3 of air per hour per m^2 of envelope area, at 50Pa. It is proposed to achieve a 63% improvement over Building Regulations and the apartments will target a permeability of 3.0 $m^3/hr/m^2$.

Thermal Bridging

The significance of Thermal Bridging, as a potentially major source of fabric heat losses, is increasingly understood. Improving the U-values for the main building fabric without accurately addressing the Thermal Bridging is no longer an option and will not achieve the fabric energy efficiency and energy and CO_2 reduction targets set out in this strategy.

The thermal details for the building will be modelled at the detailed working drawing stage but for the purposes of this assessment the thermal details formulated by the Recognised Construction Details have been used. Any details not available on the RCD website will be modelled. These will enable the building to achieve the higher energy efficiency requirements of the Building Regulations.

The following table provides the values currently used within the modelled SAP calculations.

Reference	Location	PSI Values
		W/mK
E2	Other Lintels (including other steel lintels)	0.028
E3	Sill	0.024
E4	Jamb	0.019
E5	Ground Floor	0.046
E7	Party Floor	0.036
E10	Eaves (Ceiling)	0.051
E14	Flat Roof	0.041
E16	Corner (normal)	0.037
E17	Corner (inverted)	-0.079
E18	Party Wall	0.041

Ventilation

As a result of increasing thermal efficiency and air tightness, Building Regulations Approved Document F was also revised in 2021 to address the possibility of overheating and poor air quality. The ventilation to the En-Suites and Bathrooms will be comprised of continuous extract ventilation as per System 3 criteria. This reduces the number of external penetrations required to the building envelope.

Active Design Measures will include;

Efficient Lighting and Controls

Throughout the scheme natural lighting will be optimised.

Part L of the Building Regulations requires all light fitting to have lamps with a minimum luminous efficacy of 95 light source lumens per circuit-watt.

Space Heating and Hot Water

The baseline SAP modelling has been based upon the use of a combination boiler installed to each unit (as required by the GLA Guidance in order to test the efficiency of the building structure) but the proposed specification is based on the installation of heat pump hot water cylinders to the apartments and air source heat pumps installed to the houses and office unit.

5.2 Establishing Carbon Dioxide Emissions (Be Lean)

Residential

The GLA Energy Assessment Guidance requires the energy efficiency of a building (Be Lean) to be tested using the building systems set out in Table 1.1 of Part L 2021.

SAP calculations have been prepared for the 1-bedroom ground-floor, mid-floor and top-floor apartments, for the 2-bedroom mid-floor and top-floor apartments, for one of the mid-terrace houses and for the end-terrace house.

The baseline calculations are based on the fabric specification set out above but using the notional systems as required by the GLA Energy Assessment Guidance. These are not the proposed final option but are used to test the 'Be Lean' reductions only.

The TER & DER Worksheets for the modelled residential units for the 'Be Lean' scenario are attached as Appendix 1 but the emissions can be summarised as follows;

Unit Type	TER	DER
	kg CO_2/yr	kg CO_2/yr
1-Bed Ground-floor apartment	14.79	14.56
1-Bed Mid-floor apartment	12.51	12.79
1-Bed Top-floor apartment	14.22	14.50
2-Bed Mid-floor apartment	8.21	9.19
2-Bed Top-floor apartment	11.94	12.09
3-Bed End-terrace house	9.79	11.31
4-Bed Mid-terrace house	7.61	9.30

Non-Residential

A BRUKL calculation has been prepared for the office unit. The BRUKL Output Document for the 'Be Lean' scenario is attached as Appendix 2 but the emissions can be summarised as follows;

Unit Type	TER	BER
	kg CO_2/yr	kg CO_2/yr
Office Unit	4.93	3.70

Summary

The SAP and BRUKL calculations have allowed the GLA Carbon Reporting Spreadsheet to be populated.

This accompanies the planning application but from the spreadsheet the total TER emissions for the site are calculated as **8,534 kg CO_2 per year** with DER emissions of **7,450 kg CO_2 per year**.

The reduction in emissions is therefore **1,084 kg CO_2 per year**, which equates to a reduction of **12.70%** for the 'Be Lean' case.

The Be Lean reductions for each use class can be expressed as follows;

	TER Emissions	DER & BER Emissions	% Reduction
	kg CO_2 per year	kg CO_2 per year	
Residential Accommodation	8,006	7,053	**11.90%**
Non-Residential Accommodation	528	396	**25.00%**

The emissions reductions at the Be Lean stage meet the requirements of the planning policy and the GLA Energy Assessment Guidance.

5.3 Low-Carbon and Renewable Technologies (Be Clean and Be Green)

The carbon dioxide emissions established above have been used to test the viability of various renewable and low carbon technologies as follows.

The Government's Renewable Obligation defines renewable energy in the UK. The identified technologies are;

- Small hydro-electric
- Landfill and sewage gas
- Onshore and offshore wind
- Biomass
- Tidal and wave power
- Geothermal power
- Solar

The use of landfill or sewage gas, offshore wind or any form of hydroelectric power is not suitable for the site due to its location. The remaining technologies are considered below;

Wind

Wind turbines are available in various sizes from large rotors able to supply whole communities to small roof or wall-mounted units for individual dwellings.

The Government wind speed database predicts local wind speeds at Fitzgerald Avenue to be 4.8 m/s at 10m above ground level and 5.5 m/s at 25m above ground level. This is below the level generally required for commercial investment in large wind turbines. In addition the land take, potential for noise and signal interference make a large wind turbine unsuitable for this development.

Roof mounted turbines could be used at the development to generate small but valuable amounts of renewable electricity but the small output and contribution to total emissions means any investment would be small and purely tokenism. In addition the use of wind turbines will have a detrimental aesthetic impact on the appearance of the development.

Combined Heat and Power and Community Heating

Combined heat and power (CHP) also called co-generation is a de-centralised method of producing electricity from a fuel and 'capturing' the heat generated for use in buildings. The plant is essentially a small-scale electrical power station. The production and transportation of electricity via the National Grid is very inefficient with over 65% of the energy produced at the power station being lost to the atmosphere and through transportation.

CHP units are generally gas fuelled and generate electricity with heat being a by-product. The heat is usually used to meet the hot water load, which is fairly consistent throughout the year.

Historically CO_2 savings have been achieved because gas has been used to generate electricity and gas has had a lower emissions factor than electricity, However, with the de-carbonisation of the electricity grid the benefit of CHP is negated and consequently the use of a CHP would increase emissions rather than reduce them.

CHP is not proposed.

Ground Source Heat Pumps

Sub soil temperatures are reasonably constant and predictable in the UK, providing a store of the sun's energy throughout the year. Below London the groundwater in the lower London aquifer is at a fairly constant temperature of 12º C. Ground source heat pumps (GSHP) extract this low-grade heat and convert it to usable heat for space heating.

GSHP operates on a similar principle to refrigerators, transferring heat from a cool place to a warmer place. They operate most efficiently when providing space heating at a low temperature, typically via under floor heating or with low temperature radiators.

The installation of ground source heat pumps to this scheme is not appropriate.

Solar

(i) Solar Water Heating

Solar hot water panels use the suns energy to directly heat water circulating through panels or pipes. The technology is simple and easily understood by purchasers.

Solar hot water heating panels are based generally around two types, which are available being 'flat plate collectors' and 'evacuated tubes'. Flat plate collectors can achieve an output of up to 1,124 kWh/annum (Schuco) and evacuated tubes can achieve outputs up to 1,365 kWh/annum (Riomay).

Panels are traditionally roof mounted and for highest efficiencies should be mounted plus or minus 30 degrees of due south. Evacuated tubes can be laid horizontally on flat roofs but flat plate collectors are recommended for installation at an incline of 30 degrees

The installation of heat pumps reduces the emissions from the hot water demand significantly and the installation of solar hot water heating panels only reduces further emissions marginally and does not represent good value when compared with only technologies.

In addition, solar hot water panels are only applicable to the top-floor apartments.

They are therefore are not proposed.

(ii) Photovoltaics

Photovoltaic panels (PV) provide clean silent electricity. They generate electricity during most daylight conditions although they are most efficient when exposed to direct sunlight or are orientated to face plus or minus 30 degrees of due south.

PV panels can be integrated into many different aspects of a development including roofs, walls, shading devices or architectural panels. The panels typically have an electrical warranty of 20-25 years and an expected system lifespan of 25-40 years.

The Roof Plan attached as Appendix 5 demonstrate a total of 42 panels could be installed. These will be very gently inclined at around 10 degrees to allow for self-cleaning on racks and orientated towards the southeast. Assuming the installation of 400W panels the total reduction in emissions from the array will be **991 kg CO_2 per year**. This reduction has been incorporated into the Be Green SAP calculations.

Air Source Heat Pumps (ASHP)

Air sourced heat pumps operate using the same reverse refrigeration cycle as ground source heat pumps; however, the initial heat energy is extracted from the external air rather than the ground.

The installation of heat pump hot water cylinders is appropriate to the apartments and air source heat pumps to the houses and office unit and the analysis set out in 5.4 below considers the use of these technologies.

5.4 Establishing Carbon Dioxide Emissions (Be Green)

Residential

Further SAP calculations have been prepared for the modelled units based on the fabric specification set out above but with the actual systems proposed for installation.

These include the installation of a heat pump hot water cylinder to each apartment and air source heat pumps to each house. In addition, the installation of 6 x 400W photovoltaic panels to the 3-Bedroom End-terrace house, 9 panels to each of the 4-Bedroom Mid-terrace houses and 5.7 kW of photovoltaic panels to the apartments (apportioned by floor area).

The DER Worksheets for the 'Be Green' scenario are attached as Appendix 3 but the emissions from the apartments can be summarised as follows;

Unit Type	DER
	kg CO_2/yr
1-Bed Ground-floor apartment	5.84
1-Bed Mid-floor apartment	4.73
1-Bed Top-floor apartment	5.81
2-Bed Mid-floor apartment	3.16
2-Bed Top-floor apartment	4.64
3-Bed End-terrace house	2.54
4-Bed Mid-terrace house	1.49

Non-Residential

A further BRUKL calculation has been prepared for the office unit based on the actual specification and includes the installation of an air source heat pump and 1.5 kW of photovoltaic panels. The BRUKL Output Document for the 'Be Green' scenario is attached as Appendix 4 but the emissions can be summarised as follows;

Unit Type	BER
	kg CO_2/yr
Office Unit	2.66

Summary

These emissions have been inputted into the GLA Carbon Emissions Reporting Spreadsheet and from these the total DER/BER emissions for the Be Green scenario are calculated as **2,696 kg CO_2 per year**.

The reduction in emissions is therefore **5,838 kg CO_2 per year**, which equates to a reduction of **68.41%** for the 'Be Green' case.

5.5 Summary of Calculations

Be Lean

SAP calculations have been prepared using Part L 2021 of the Building Regulations.

Based on the Be Lean scenario the total CO_2 emissions are calculated as **8,534 kg CO_2 per year** (TER) and **7,450 kg CO_2 per year** (DER/BER)**.**

This equates to a reduction of **1,084 kg CO_2 per year** or **12.70%** of the total TER emissions and is therefore compliant with the GLA energy guidance.

The TER & DER Worksheets for the modelled residential units for the Be Lean scenario are attached as Appendix 1 and the BRUKL Output Document for the office unit is attached as Appendix 2.

Be Green

A further set of calculations has been prepared for the proposed energy strategy.

These propose the installation of a heat pump hot water cylinder into each apartment and air source heat pumps to each of the houses and the office unit as well as a total of 42 x 400W photovoltaic panels installed on the flat roof of the building.

A Roof Plan showing the indicative layout of the panels is attached as Appendix 5.

Based on the Be Green scenario the total CO_2 emissions are calculated as **2,696 kg CO_2 per year** (DER)**.**

This equates to a reduction of **5,838 kg CO_2 per year** or **68.41%** of the total TER emissions.

The DER Worksheets for the modelled residential units for the Be Green scenario are attached as Appendix 3 and the BRUKL Output Document for the office unit for the Be Green scenario is attached as Appendix 4.

Summary

The GLA Carbon Emissions Reporting Spreadsheet has been completed and (separately) accompanies this Statement

The residual emissions are **2.696 tonnes**, which requires a carbon offset payment of **£7,683** (based on the carbon offset payment of £2,850 per tonne).

6.0 Climate change adaption and Water resources

Sustainable Drainage Systems (SUDS)

The site lies within Flood Zone 1 and is classified as being of low risk. A Flood Risk Assessment and Development Drainage Strategy has been prepared and accompanies the planning application.

Surface Water Management

Consideration has been given to the use of grey water recycling. However, customer's resistance to the appearance of the recycled water and the cost of the systems does not currently make them a viable option. They have therefore not been included in the proposals.

Green Roofs

The plans for the building propose the installation of a 'green' roof as part of the roof structure over the second floor.

As well as providing additional surface water storage capacity, the green roof will also increase biodiversity.

Green roofs decrease the total amount of rainwater runoff and slow the rate of runoff from the roof. It has been found that they can retain up to 75% of rainwater, gradually releasing it back into the atmosphere via condensation and transpiration, while retaining pollutants in their soil. Green roofs have also been found to dramatically improve a roof's insulation value.

In addition, green roofs can: reduce heating (by adding mass and thermal resistance value) and cooling (by evaporative cooling) loads on a building, reduce the urban heat island effect. reduce surface water run-off, filter pollutants and CO_2 out of the air and increase wildlife habitat in built-up areas.

The proposals for the building also include the installation of photovoltaic panels on the roof and it is proposed to use the Bauder BioSOLAR support system for the panels.

Water efficiency measures

In excess of 20% of the UK's water is used domestically with over 50% of this used for flushing WCs and washing (source: Environment Agency). The majority of this comes from drinking quality standard or potable water.

The water efficiency measures included will ensure that the water use target of 110 litres per person per day is achieved.

Water efficient devices will be fully evaluated, and installed, wherever possible. The specification of such devices will be considered at detailed design stage and each will be subject to an evaluation based on technical performance, cost and market appeal, together with compliance with the water use regulations.

The following devices will be incorporated within the apartments and houses:

- water efficient taps
- water efficient toilets
- low output showers
- flow restrictors to manage water pressures to achieve optimum levels and
- water meters

Water consumption calculations have been carried out using the Water Efficiency Calculator provided by the BRE. Although not perfect this calculator gives a good indication of the probable water use in a dwelling, although this is largely dependent on the way on which occupants use their homes.

Below is a typical specification, which would achieve the 110 Litres per person per day target (including five litres per person per day allowance for external water use).

Schedule of Appliance Water Consumption		
Appliance	Flow rate or capacity	Total Litres
WC	6/3 litres dual flush	17.64
Basin	2.0 litres/min.	4.74
Shower	9.0 litres/min	39.33
Bath	175 litres	19.25
Sink	5.0 litres/min	12.56
Washing Machine	6.75 litres/kg	14.18
Dishwasher	1.25 litres/places	4.50
		112.20
	Normalisation Factor	0.91
	Total Internal Water Consumption	102.10
	External Water Use	5.00
	Total Water Consumption	107.10

7.0 Materials and Waste

The BRE Green Guide to Specification is a simple guide for design professionals. The guide provides environmental impact, cost and replacement interval information for a wide range of commonly used building specifications over a notional 60-year building life. The construction specification will prioritise materials within ratings A+, A or B.

Preference will be given to the use of local materials & suppliers where viable to reduce the transport distances and to support the local economy. A full evaluation of these suppliers will be undertaken at the next stage of design.

In addition, timber would be sourced, where practical, certified by PEFC or an equivalent approved certification body and all site timber used within the construction process would be recycled.

All insulation materials to will have a zero ozone depleting potential

Construction waste

Targets will be set to promote resource efficiency in accordance with guidance from WRAP, Envirowise, BRE and DEFRA.

The overarching principle of waste management is that waste should be treated or disposed of within the region where it is produced.

Construction operations generate waste materials as a result of general handling losses and surpluses. These wastes can be reduced through appropriate selection of the construction method, good site management practices and spotting opportunities to avoid creating unnecessary waste.

The Construction Strategy will explore these issues, some of which are set out below:

- Proper handling and storage of all materials to avoid damage.
- Efficient purchasing arrangements to minimise over ordering.
- Segregation of construction waste to maximise potential for reuse/recycling.
- Suppliers who collect and reuse/recycle packaging materials.