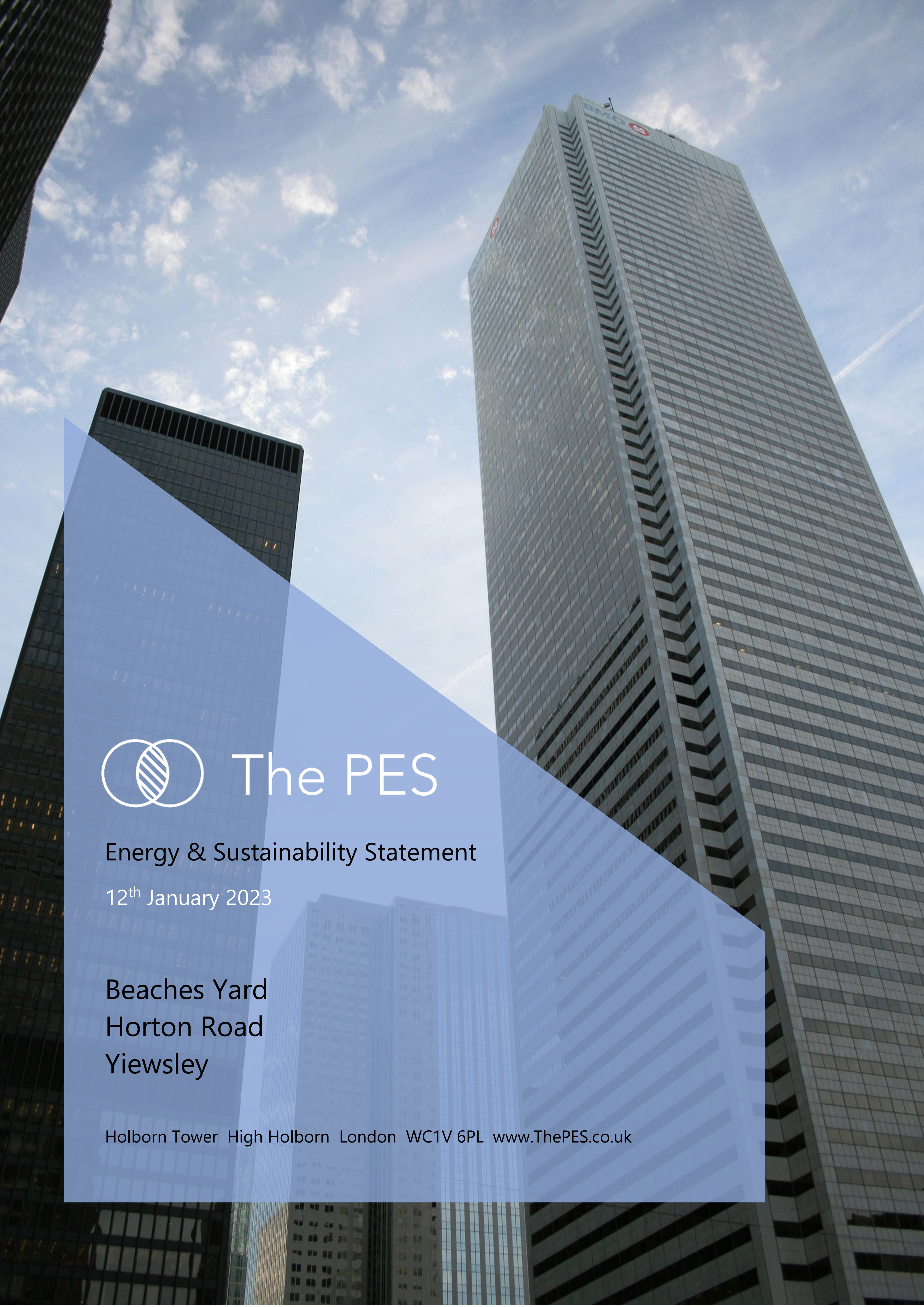

The PES

Energy & Sustainability Statement

12th January 2023

Beaches Yard
Horton Road
Yiewsley

Holborn Tower High Holborn London WC1V 6PL www.ThePES.co.uk

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Appendices

Version Control

V1	24-08-22	
V2	31-08-22	Wording corrections
V3	12-01-23	Increased PV

1.0 Executive Summary

The proposed warehouse facility at Beaches Yard 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 Hillingdon's Development Management policies.

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 2021. Guidance now seeks a minimum on-site improvement over Part L 2021 at 35%, with a benchmark improvement over Part L 2021 at 50%.

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

A 'Lean, Clean, Green, Be Seen' has been adopted and the development achieves an overall improvement (BER/TER) in regulated emissions at over **102.20%** above Part L 2021 standard, through the adoption of very high standards of insulation, efficient heat pump driven heating and domestic hot water systems, super-efficient variable refrigerant flow heating and cooling to service the office areas and a 120kWp roof mounted PV array.

The adoption of the above strategy will meet with London Plan "Zero Carbon" requirements.

The new commercial development will achieve BREEAM "Very Good" under the New Construction 2018 assessment regime.

2.0 The Site & Proposal

The development is located to the north of Horton Road on a site currently used for car storage and low rise industrial uses.

The proposal involves the clearance of the site and the construction of a new industrial building with top floor office space, changing facilities and basement car parking.

Overall, the project is to deliver circa 6,500m^2 of new warehouse and office space, with delivery areas, car parking and ancillary spaces.

It will be considered a major scheme when considering the requirements against London Plan and Local Plan policies:-

2.1 Local Planning Context

The site sits within the London Borough of Hillingdon (Hillingdon)

Hillingdon's Local Plan: Part 1 - Strategic Policies (Adopted November 2012)

Policy EM1: Climate Change Adaptation and Mitigation

The Council will ensure that climate change mitigation is addressed at every stage of the development process by:

1. Prioritising higher density development in urban and town centres that are well served by sustainable forms of transport.

2. Promoting a modal shift away from private car use and requiring new development to include innovative initiatives to reduce car dependency.

3. Ensuring development meets the highest possible design standards whilst still retaining competitiveness within the market.

4. Working with developers of major schemes to identify the opportunities to help provide efficiency initiatives that can benefit the existing building stock.

5. Promoting the use of decentralised energy within large scale development whilst improving local air quality levels.

6. Targeting areas with high carbon emissions for additional reductions through low carbon strategies. These strategies will also have an objective to minimise other pollutants that impact on local air quality. Targeting areas of poor air quality for additional emissions reductions.

7. Encouraging sustainable techniques to land remediation to reduce the need to transport waste to landfill. In particular developers should consider bioremediation as part of their proposals.

8. Encouraging the installation of renewable energy for all new development in meeting the carbon reduction targets savings set out in the London Plan. Identify opportunities for new sources of electricity generation including anaerobic digestion, hydroelectricty and a greater use of waste as a resource.

9. Promoting new development to contribute to the upgrading of existing housing stock where appropriate.

The Borough will ensure that climate change adaptation is addressed at every stage of the development process by:

10. Locating and designing development to minimise the probability and impacts of flooding.

11. Requiring major development proposals to consider the whole water cycle impact which includes flood risk management, foul and surface water drainage and water consumption.

12. Giving preference to development of previously developed land to avoid the loss of further green areas.

13. Promoting the use of living walls and roofs, alongside sustainable forms of drainage to manage surface water run-off and increase the amount of carbon sinks.

14. Promoting the inclusion of passive design(41) measures to reduce the impacts of urban heat effects.

Hillingdon's Local Plan Part 2 (Development Management Policies) was adopted in January 2020.

Policy DMEI 2: Reducing Carbon Emissions

A) All developments are required to make the fullest contribution to minimising carbon dioxide emissions in accordance with London Plan targets.

B) All major development proposals must be accompanied by an energy assessment showing how these reductions will be achieved.

C) Proposals that fail to take reasonable steps to achieve the required savings will be resisted. However, where it is clearly demonstrated that the targets for carbon emissions cannot be met onsite, the Council may approve the application and seek an off-site contribution to make up for the shortfall.

Policy DMEI 3: Decentralised Energy

A) All major developments are required to be designed to be able to connect to a Decentralised Energy Network (DEN).

B) Major developments located within 500 metres of an existing DEN, and minor new-build developments located within 100 metres, will be required to connect to that network, including provision of the means to connect to that network and a reasonable financial contribution to the connection charge, unless a feasibility assessment demonstrates that connection is not reasonably possible.

C) Major developments located within 500 metres of a planned future DEN, which is considered by the Council likely to be operational within 3 years of a grant of planning permission, will be required to provide a means to connect to that network and developers shall provide a reasonable financial contribution for the future cost of connection and a commitment to connect via a legal agreement or contract, unless a feasibility assessment demonstrates that connection is not reasonably possible.

D) The Council will support the development of DENs and energy centres in principle, subject to meeting the wider policy requirements of this plan and in particular on design and air quality.

2.2 The London Plan

Chapter 9 deals with Sustainable Infrastructure:-

Policy SI2 Minimising greenhouse gas emissions

Major development should be net zero-carbon.151 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 should include a detailed energy strategy to demonstrate how the zero-carbon target will be met within the framework of the energy hierarchy and will be expected to monitor and report on energy performance.

C In meeting the zero-carbon target a minimum on-site reduction of at least 35 per cent beyond Building Regulations is expected. Residential development should aim to achieve 10 per cent, and non-residential development should aim to achieve 15 per cent through energy efficiency measures. Where it is clearly demonstrated that the zero-carbon target cannot be fully achieved on-site, any shortfall should be provided:

1) through a cash in lieu contribution to the relevant borough's carbon offset fund, and/or
2) off-site provided that an alternative proposal is identified and delivery is certain.

Policy SI3 - Energy infrastructure

A Boroughs and developers should engage at an early stage with relevant energy companies and bodies to establish the future energy and infrastructure requirements arising from large-scale development proposals such as Opportunity Areas, Town Centres, other growth areas or clusters of significant new development.
B Energy masterplans should be developed for large-scale development locations (such as those outlined in Part A and other opportunities) which establish the most effective energy supply options. Energy masterplans should identify:

1) major heat loads (including anchor heat loads, with particular reference to sites such as universities, hospitals and social housing)
2) heat loads from existing buildings that can be connected to future phases of a heat network
3) major heat supply plant including opportunities to utilise heat from energy from waste plants
4) secondary heat sources, including both environmental and waste heat
5) opportunities for low and ambient temperature heat networks
6) possible land for energy centres and/or energy storage
7) possible heating and cooling network routes
8) opportunities for futureproofing utility infrastructure networks to minimise the impact from road works
9) infrastructure and land requirements for electricity and gas supplies
10) implementation options for delivering feasible projects, considering issues of procurement, funding and risk, and the role of the public sector
11) opportunities to maximise renewable electricity generation and incorporate demand-side response measures.

D Major development proposals within Heat Network Priority Areas should have a communal low-temperature 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 zero-emission or local secondary heat sources (in conjunction with heat pump, if required)
c) use low-emission combined heat and power (CHP) (only where there is a case for CHP to enable the delivery of an area-wide heat network, meet the development's electricity demand and provide demand response to the local electricity network)
d) 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 they meet the requirements in Part B of Policy SI 1 Improving air quality
3) where a heat network is planned but not yet in existence the development should be designed to allow for the cost-effective connection at a later date.

Policy SI4

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 SI5 Water infrastructure

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.

Policy SI12 Flood risk management

C Development proposals should ensure that flood risk is minimised and mitigated, and that residual risk is addressed. This should include, where possible, making space for water and aiming for development to be set back from the banks of watercourses.

E Development proposals for utility services should be designed to remain operational under flood conditions and buildings should be designed for quick recovery following a flood.

F Development proposals adjacent to flood defences will be required to protect the integrity of flood defences and allow access for future maintenance and upgrading. Unless exceptional circumstances are demonstrated for not doing so, development proposals should be set back from flood defences to allow for any foreseeable future maintenance and upgrades in a sustainable and cost-effective way.

G Natural flood management methods should be employed in development proposals due to their multiple benefits including increasing flood storage and creating recreational areas and habitat.

Policy SI13 - Sustainable drainage

A Lead Local Flood Authorities should identify – through their Local Flood Risk Management Strategies and Surface Water Management Plans – areas where there are particular surface water management issues and aim to reduce these risks. Increases in surface water run-off outside these areas also need to be identified and addressed.

B Development proposals should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible. There should also be a preference for green over grey features, in line with the following drainage hierarchy:

1) rainwater use as a resource (for example rainwater harvesting, blue roofs for irrigation)

2) rainwater infiltration to ground at or close to source

3) rainwater attenuation in green infrastructure features for gradual release (for example green roofs, rain gardens)It is noted that the proposed non-domestic development is greater than 1,000m^2 and would be considered major development.

4) rainwater discharge direct to a watercourse (unless not appropriate)

5) controlled rainwater discharge to a surface water sewer or drain

6) controlled rainwater discharge to a combined sewer.

C Development proposals for impermeable surfacing should normally be resisted unless they can be shown to be unavoidable, including on small surfaces such as front gardens and driveways.

D Drainage should be designed and implemented in ways that promote multiple benefits including increased water use efficiency, improved water quality, and enhanced biodiversity, urban greening, amenity and recreation.

Accordingly, as a major development scheme, the project at Beaches Yard will comply with the requirements of the London Plan utilising SAP10.2 methodology in line with the GLA guidance on the preparation of Energy Statements.

The GLA Reporting Spreadsheet is attached at **Appendix D**.

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 Commercial Space

The energy requirements for space heating, water heating and ventilation within the proposed new build commercial units have been calculated using the National Calculation Method (NCM) in line with AD L2 of the Building Regulations 2021 and the Non-Domestic Heating Compliance Guide.

The Government approved assessment methodology is the Simplified Building Energy Model (SBEM), The PES Ltd use an advanced modelling software - IES Virtual Environment - which enables accurate SBEM models to be created, as well as heat loss and cooling load calculations and full M&E design to be undertaken.

To consider the subject building performance against The Building Regulations (Approved Document L2 2021) SBEM first creates the notional reference building, the characteristics of which are defined in within NCM and the minimum fabric values and fixed services efficiencies set down by AD L2 and the Non-domestic Compliance Guide.

This creates the target Emission Rate (TER) and should be considered as stage 'zero' of the energy hierarchy as described earlier and sets the benchmark for the worst performing, but legally permissible, development against which, SBEM assesses the "actual" design, fabric values, heating lighting and ventilation systems and creates the Building Emissions Rate (BER).

As noted above, SAP10.2 emissions data has been used for gas and electrical consumption; mains gas at 0.210kg/kWh and electricity at 0.136kg/kWh.

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

3.3 Unregulated Energy Use

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

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/sqm
Beaches Yard	3.35

The un-regulated emission rates are added to the baseline regulated emission rates (as calculated under 3.2 above) in order to set the total baseline emission rates before then applying the energy hierarchy in line with The London Plan and Hillingdon 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 SBEM outputs (which summarise the key data) are attached at **Appendix A**, with the GLA 2021 Carbon Emissions Reporting Spreadsheet attached at **Appendix D.**

Table 2 – Baseline energy consumption and CO2 emissions

Unit	Regulated Energy Use Kg/annum	Unregulated Energy Use Kg/annum	Total baseline emissions Kg/annum
Beaches Yard	9,100	21,700	30,800
Development Total			**30,800**

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

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 Beaches Yard 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, it has a significant impact on preventing heat travelling through the build fabric during the summer.

The use of LED lighting further reduces internal gains and the potential overheating risk.

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 based in a low rise industrial/employment area with wooded area to the north and east. This will offer some considerable level of evaporative cooling.

However, the proposed industrial building will have limited benefit from topographical shading.

The actual office accommodation is located at the upper floor with a north/south glazing arrangement.

The design incorporates a significant overhang to protect the glazing from the peak summer sun.

Glazing specification has been considered as part of the overheating risk and the specified glazing will achieve a low g-value in order to assist in reducing excessive solar gain

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

The main structure it expected to be a clad steel fame with cast in-situ concrete 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 office glazing is designed to have opening areas to introduce high levels of natural “purge” ventilation to further assist in the reduction of overheating risks.

Cross ventilation is also designed into the office space to maximise the potential for natural ventilation and the associated cooling impact.

5. **mechanical ventilation**

Due to the high occupancy levels in the office spaces and the activity levels/internal gains within, mechanical ventilation is proposed to ensure a high quality indoor climate.

The system will utilise heat recovery to enhance the developments energy efficiency, as well as make use of ‘free cooling’ via a summer bypass where the outside air temperature is below that in the building during summer months.

It is proposed that all other areas 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 heat pump systems providing heating and hot water to the office and shower areas.

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 be of a clad steel frame and will target a U-Value of 0.20W/m^{2}k or better.
- The roof structures will also be of a clad constructions achieving a U-Value of 0.15W/m^{2}k.
- The newly laid ground floor will achieve a minimum u value of 0.15W/m^{2}k, subject to the final P/A ratio.

Glazing

- The new glazing for windows and doors will be double glazed with an area weighted average U-Value of 1.6W/m^2 K or better.

Air Tightness

- The Beaches Yard project will be tested for air tightness with a target value of 3m^3/hr/m^2 .

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 building is to utilise a low energy natural ventilation strategy, with the exception of the offices; due to the dense occupation levels and high levels of activity, internal air quality requirements dictate the need for mechanical ventilation.

4.5 Lighting and appliances

The development will incorporate high efficiency light fittings utilising LED lamps with PIR and photocell controls to minimise daytime/unnecessary use.

Office and warehouse areas will have photocell diming to further reduce energy consumption.

The use of LED lighting will also minimise the internal gains commonly associated with tungsten and fluorescent lighting systems and thereby reduce cooling loads.

It is anticipated that under best practice sustainability requirements, all of the electrical appliances will be provided with energy star ratings, while domestic scale appliances in the kitchen areas will have a high EU energy rating.

4.6 Energy efficiency results

The above data has been used to update the SBEM models, the Building 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	Regulated Energy Use Kg/annum	Unregulated Energy Use Kg/annum	Total be lean emissions Kg/annum
Beaches Yard	9,000	21,700	30,700
Development Total			**30,700**

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 **0.32%.**

Regulated emissions have been reduced by **1.1%** via the passive design measures highlighted above in line with the guidance from the GLA.

The energy demands of the proposed development are tabulated below.

Table 4 – Energy Demand, "Be-Lean"

Building	**Energy demand following energy efficiency measures (MWh/year)**						
	Space Heating	Hot Water	Lighting	Cooling	Auxiliary	Unregulated electricity	Unregulated gas
Commercial Units	14.10	22.94	38.34	N/A	2.79	160.05	N/A

Further reporting requirements for referable schemes are tabulated below.

The Energy Use Intensity and space heating demand of the development – Table 5 below

Table 5 – Energy and Heat Demands

Building Type	Energy Use Intensity (kWh/m^2/year)	Space Heating (kWh/m^2/year)
Commercial Units	12.6	2.17

5.0 Supplying Energy Efficiently

5.1 Community Heating/Combined Heat and Power (CHP)

The London Plan policy SI3 Energy infrastructure requires major development proposals within Heat Network Priority Areas to have a communal heating system and/or be designed to enable connection to a DEN when feasible.

Energy networks, often driven by 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.

The extract from the London Heat Map (reproduced below) identifies that the site is within the heat network priority area.

Fig 1. Extract from London Heat Map

Clearly there is limited potential for the project site to connect to a DEN at some time in the future.

However, it must be recognised that the warehouse areas will be unheated, so the actual heat demand for the office (at only circa 300m^2) and WC/kitchen spaces will be highly limited.

Indeed, given the GIA of these spaces, the project could be considered as non-major when considering the potential DEN connection.

As such the design team are not proposing that the project be DEN connection ready – which also aligns with the "be green" HVAC solution – see Section 6.0.

5.2 On-site 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 an industrial development with limited heat 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 non-domestic projects in March 2021.

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 and woodlands of similar height in all directions. To overcome these obstructions and to receive practical amounts of non-turbulent wind, the blades of a wind turbine would need to be placed significantly above the roof level of the surrounding buildings and the proposed project at Beaches Yard itself.

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

6.3 Solar Energy

The development at Beaches Yard has areas of flat roofed area 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 emissions rates of gas as a source of energy, it would require a very large system to compete with the off-setting of electricity use afforded by PV panels.

Accordingly, given the limited DHW demand in an industrial building 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 carbon savings

Accordingly, solar thermal would not be the optimum solution for the Beaches Yard development.

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 area of panelling required to achieve 1kWp is dependent upon the efficiency of the system, but in the case of Beaches Yard, with ample areas of flat roof space at top floor level, a high efficiency panel such as the Canadian Solar 330p series, which have a rating of 330w from 1.6m^2 of panel area would optimise the roof space available.

Despite the loss of the Feed in Tariff, the saving in electrical consumption can lead to installed arrays achieving annual returns in the region of 6-7%.

The design team are proposing the use of a PV array at top floor roof level – a circa 120kWp array that would generate some 93,311.28kWh/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 within the London boroughs. 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, leaving deep bore GSHP as the only potential option.

Normally the boreholes would need to be 6 to 8 metres apart and a 100 metre deep borehole will only provide about 5kW of heat. The borehole should also be formed around 3m away from the perimeter of the building and most specialists don't recommend using the structural boreholes.

Clearly, in the case of the proposed Industrial development at Beach Yard, there is no scope for the locating of the ground collector devices and as such, ground source heating cannot be considered.

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 and the associated emissions, so that the actual reduction in emissions can be limited.

Assuming a seasonal system efficiency of 320% (Coefficient of Performance of 3.2) and that the air source heat pump will replace 100% of the space heating/hot water demand, then the system would reduce the overall CO_2 emissions by approximately 17%. The table below demonstrates, on the assumption of a demand of 1000Kwh/year for heating and hot water.

Table 6 – 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%

Accordingly, the design team are proposing the use of heat pump driven hot water systems to deliver the DHW requirements to the shower areas, with an efficiency at 320%

In addition, given the requirement to future proof the development against future overheating potential, the design team are proposing the use of variable refrigerant (VRF) flow air-to-air heating and cooling system which incorporates inter-zone heat recovery.

VRF systems can have numerous indoor units, served by a single outdoor unit, in both heating and cooling modes simultaneously. This mixed mode operation leads to energy savings as both ends of the thermodynamic cycle are delivering useful heat exchange. If a system has a cooling COP (Coefficient of Performance) of 3, and a heating COP of 4, then heat recovery operation could yield a COP as high as 7.

Fig.3 - Typical VRF heating and cooling system

It should be noted that this perfect balance of heating and cooling demand is unlikely to occur for many hours each year, but whenever mixed mode is used energy is saved. In mixed mode the energy consumption is dictated by the larger demand, heating or cooling, and the lesser demand, cooling or heating is delivered free; ideal for the north/south office layout at Beaches Yard

Given the very high occupation levels in the proposed office space, and the associated internal gains, the design team are proposing the use of a new three pipe heat recovery VRF system utilising roof mounted condensing units centralised branch selector boxes and void mounted fan evaporator units and/or ceiling cassettes.

Whole system seasonal efficiencies (to be confirmed at commissioning) are expected to be at circa 4.9 for heating and 6.3 for cooling.

Heating for the warehouse WC and shower areas will be provided by electric panel heaters.

Accordingly, this electrical only building will emit zero local emissions and de-carbonise in line with the UK grid.

6.8 Final Emissions Calculation

Given the outcome of the feasibility study above, the developer is proposing the use heat pumps to drive the shower hot water systems, the above noted VRF heat recovery system is to be utilised for heating and cooling in the office areas and the 120kWp roof mounted PV array.

The final table – Table 7 – summarises the final outputs from the SBEM models; attached at **Appendix C.** The GLA reporting tool is attached at **Appendix D**

Table 7 – "Be Green" emission levels

Unit	Regulated Energy Use Kg/annum	Unregulated Energy Use Kg/annum	Total be green emissions Kg/annum
Beaches Yard	-200	21,700	21,500
Development Total			**21,500**

The data at Table 7 confirms that overall emissions – including unregulated energy use - have been reduced by **30.19%** over and above the baseline model, with a **29.97%** 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 BER/TER equates to **102.20%.**

7.0 "Be Seen"

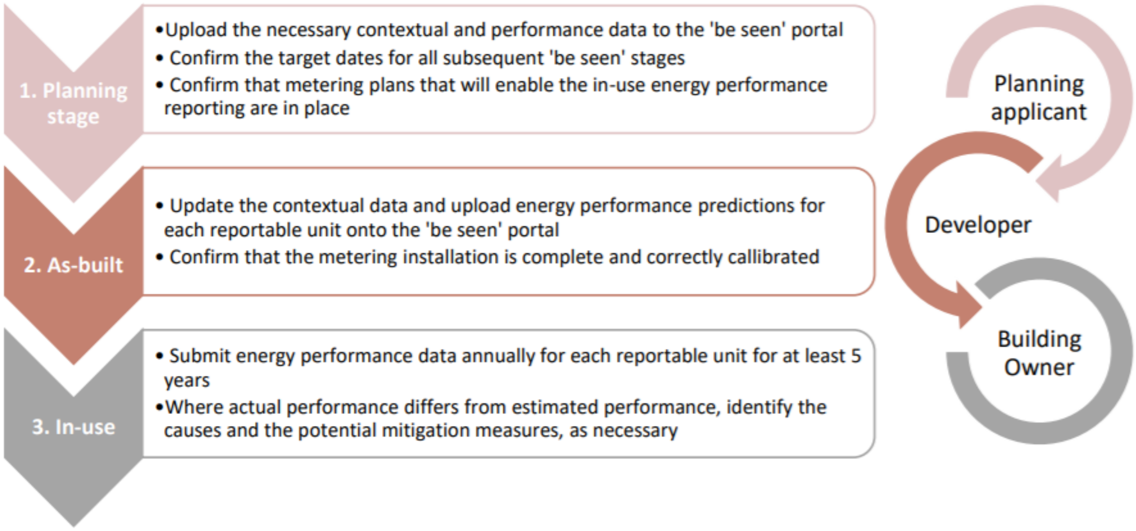
The "Be Seen" Energy Monitoring Guidance Consultation Draft was published in October 2020 and adopted in September 2021.

Although Part L calculations and Energy Performance Certificates (EPCs) give an indication of the theoretical performance of buildings, it is well established that there is a 'performance gap' between design theory and measured reality.

To address this gap the London Plan Policy SI 2 'Minimising greenhouse gas emissions' introduces a fourth stage to the energy hierarchy; the 'be seen' stage, which requires monitoring and reporting of the actual operational energy performance of major developments for at least five years via the Mayor's 'be seen' monitoring portal.

The 'be seen' policy establishes post-construction monitoring as good practice, enabling developers and building owners to better understand their buildings and identify methods for improving energy performance from the project inception stage and throughout the building's lifetime.

The extract below graphically 'be seen' process through the reporting stages of a development including the parties likely to be responsible for the provision of the necessary data at each reporting stage.



The applicants make the commitment that the development will be designed to enable post construction monitoring and that the information set out in the 'be seen' guidance is submitted to the GLA's portal at the appropriate reporting stages.

The initial submission will be made within 8 weeks of the grant of planning permission.

It is further acknowledged that this will be secured via legal agreement.

8.0 Sustainable Design & Construction

The sustainable assessment criteria as developed by BRE are utilised within this report to confirm that the development meets with the requirements of the London Borough of Hillingdon guidance.

7.1 BREEAM New Construction 2018

The BREEAM assessment is considered the most appropriate manner in which to demonstrate the Sustainable Design and Construction credentials of the newly constructed non-domestic development in order to fully comply with local plan policies.

The project would be considered within the Scope of BREEAM UK New Construction and would be assessed against the criteria set down under "Commercial – Industrial"

A pre-assessment estimator is attached at **Appendix E** which demonstrates how the project will meet the "Very Good" criteria. However, the notes below explain how the BREEAM assessment method will deal with specific issues:-

Energy and CO2

To further reinforce the need to meet London Plan delivering passive cooling techniques to ensure that the development will not suffer from overheating, the project will ensure that it complies with the following BREEAM issues:-

- Achieve 6 credits under Ene 01
- Achieve 2 credits under Hea 04 by undertaking thermal modelling in line with CIBSE Guidance AM11 – full dynamic thermal analysis to ensure that the development will comply in terms of compliance with CIBSE Guide A and TM52 via the heating, cooling and ventilation strategy set out within this report.

Water Consumption

Under the Wat01 section, the Beaches Yard development will be achieving a 12.5% improvement over the baseline performance. In order to perform beyond the BREEAM Excellent standard for internal water use, the development will achieve at least 2 credits under this section – a 25% improvement in water usage (l/person/day) over the baseline model.

Biodiversity

Clearly, the existing site has elements of existing planting and mature trees. Additional landscaping is to be included as part of the overall scheme. The development is to employ an ecologist to consider the use of green walls and an overall improvement in the levels of fauna and flora.

Green walls are proposed for elements of the facade

Materials, Waste and Construction Impacts

Under BREEAM requirements, the design time will undertake to ensure that the development will achieve at least:-

- Mat 2 credits for the use of materials able to demonstrate an environmental performance declaration (EPD)
- 1 credit on Responsible Sourcing (Mat 3) by sourcing material from companies able to demonstrate certificated Environmental Management Strategies (EMS), or timber suppliers from FRCS/PEFC approved suppliers
- 50% of credits on Construction Waste Management (Wst 1) by putting in place a compliant Site Waste Management Plan and achieving a non-hazardous construction waste efficiency at < 6.5tonnes/100m^2 of GIA, albeit the project will target 100% of the available credits.

Sustainable Urban Drainage

The existing site is currently made up of a hard standing and other impermeable surfaces. Accordingly, the introduction of new planted areas and green roof areas will help to reduce the levels of surface water run-off.

A formal report has been commissioned to consider this matter specifically and ensure that run off levels are reduced and managed in line with Hillingdon policy.

The flood risk assessment and SuDs report is attached under separate cover.

Management

The main contractor will register the site under the Considerate Constructors scheme and achieve a score of over 35 – achieving credits under the BREEAM Man 03 issue.

Additionally, a Construction Management Plan will be put in place to instigate best practice for the control and prevention of air (dust) and ground water & noise pollution.

Security

The developer is to seek the advice of an appropriately qualified security consultant and will instigate the advice offered and thereby achieving the BREEAM Hea 06 credits.

Recycling

Under BREEAM Wst 03 – All tenanted areas, and the commercial elements will have capacity for occupants to sort recyclable waste streams “at source”. Thereafter, adequate external waste storage is available to maintain the separation of the waste stream prior to collection by private contractor and/or the local authority.

Light Pollution.

All external lighting will comply with ILE guidance on the prevention for night time light pollution and utilise low energy lights and daylight controls – all as required under BREEAM issues Pol 04 and Ene 03.

Noise Pollution

The applicant acknowledges the importance of considering the needs of local residents to the west of the development

An acoustician is to be employed to advise upon the appropriate acoustic measures for the main building and associated plant to ensure there is no undue disturbance to neighbours and thereby achieve the credits under Pol 5.

The BREEAM pre-assessment document (**Appendix E**) offers further background on all of the above elements.

9.0 Conclusions

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

The baseline results have shown that if the 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 **30,800Kg/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 **30,700Kg/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 of air source heat pumps for DHW and the main heating/cooling systems, with heat recovery for the office areas, supplemented by a 36kWp PV array.

This has been used in the SBEM models (reproduced at **Appendix C**) for the development which have also been detailed above in Table 7, which show a final gross emission level of **21,500Kg/year**, representing a total reduction in emission over the baseline model, taking into account unregulated energy, of **30.19%.**

In addition, the final BRUKL 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 102.20%.

The GLA 2021 Carbon Emissions Reporting Spreadsheet is attached at **Appendix D.**

Tables 8 & 9 Demonstrate how the Beaches Yard 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 – Non-domestic Buildings

Key	Tonnes/annum
Baseline CO_2 emissions (Part L 2013 of the Building Regulations Compliant Development)	9.1
CO2 emissions after energy demand reduction (be lean)	9.0
CO2 emissions after energy demand reduction (be lean) AND heat network (be clean)	9.0
CO2 emissions after energy demand reduction (be lean) AND heat network (be clean) AND renewable energy (be green)	-0.2

Table 9 – Regulated Emissions Savings – Non-domestic Buildings

	Regulated Carbon Dioxide Savings	
	(Tonnes CO2 per annum)	%
Savings from energy demand reduction	0.1	2%
Savings from heat network	0.0	0%
Savings from renewable energy	9.2	101%
Total Cumulative Savings	9.3	102%
	(Tonnes CO_2)	
Carbon Shortfall	-0.2	
Cumulative savings for off-set payment	-6	
Cash-in-lieu Contribution	**N/A**	

Appendix A

Baseline/Un-regulated Energy Use:-

SBEM Outputs & Target Emission Rates

Appendix B

Energy Efficient Design:-

SBEM Outputs & Building Emission Rates

Appendix C

Generating energy on-site:-

Final SBEM & Building Emission Rates

Appendix D

GLA 2021 Carbon Emissions Reporting Spreadsheet

Appendix E

BREEAM New Construction 2018

Pre-assessment Estimator