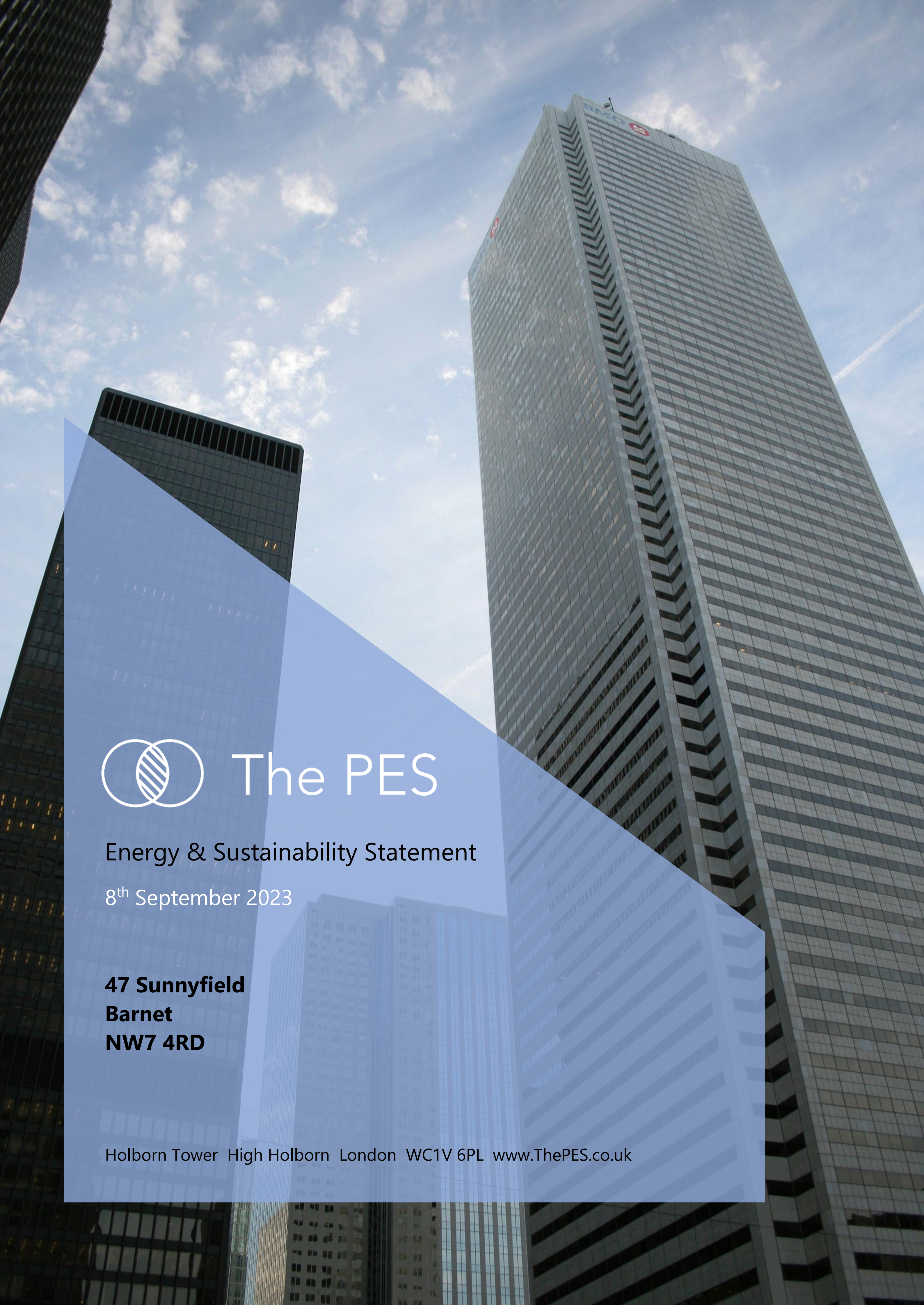

The PES

Energy & Sustainability Statement

8th September 2023

47 Sunnyfield
Barnet
NW7 4RD

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

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1.0 Executive Summary

The proposed development project at 47 Sunnyfield involves the development of the site to provide a new build 3 storey (plus roof), dwelling.

It has been designed to achieve the highest of environmental performance standards following the Energy Hierarchy as set down by the London Plan and the London Borough of Barnet's local plan policies.

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

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

A 'Lean, Clean, Green' has been adopted and the development is expected to achieve an overall improvement (DER/TER) in regulated emissions at over **70%** above Part L 2021 standard, through the adoption of passive design standards, high standards of insulation with heating and hot water to be provided via heat pump technology and a roof mounted PV installation.

2.0 The Site & Proposal

The proposal site is located to the north west of Sunnyfield in Barnet.

This report relates to an application to develop 1 x new build 3 storey dwelling with associated landscaping, bin ands cycle storage.

2.1 Local Planning Context

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

Barnet's Local Plan (Core Strategy) Development Plan Document was adopted in September 2012; Policy CS13 states:-

We will seek to minimise Barnet's contribution to climate change and ensure that through the efficient use of natural resources the borough develops in a way which respects environmental limits and improves quality of life.

- We will promote the highest environmental standards for development and through our SPDs on Sustainable Design and Construction and Green Infrastructure we will continue working to deliver exemplary levels of sustainability throughout Barnet in order to mitigate and adapt to the effects of a changing climate.
- We will expect all development to be energy efficient and seek to minimise any wasted heat or power.
- In line with London Plan Policy 5.2 – Minimising Carbon Dioxide Emissions we will expect major development in accordance with the Mayor's energy hierarchy to reduce carbon dioxide emissions beyond the 2010 Building Regulations.
- We will maximise opportunities for implementing new district-wide networks supplied by decentralised energy (including renewable generation) in partnership with key stakeholders in areas of major mixed use growth including town centres. Where feasible we will expect all development to contribute to new and existing frameworks.
- We will support solutions that minimise or avoid harm to a heritage asset's significance while delivering improved energy performance or generation.
- We will make Barnet a water efficient borough and minimise the potential for fluvial and surface flooding by ensuring development does not cause harm to the water environment, water quality and drainage systems.
- Development should utilise Sustainable Urban Drainage Systems (SUDS) in order to reduce surface water run-off and ensure such run-off is managed as close to its source as possible subject to local geology and ground water levels.
- We will improve air and noise quality by requiring Air Quality Assessments and Noise Impact Assessments from development in line with Barnet's SPD on Sustainable Design and Construction.

Barnet’s Development Management Policies – also adopted in 2012 – Policy DM04 states:

a. All major development will be required to demonstrate through an Energy Statement compliance with the Mayor’s targets for reductions in carbon dioxide emissions within the framework of the Mayor’s energy hierarchy.

b. Where Decentralised Energy (DE) is feasible or planned, major development will either provide:

i. suitable connection

ii. the ability to connect in future

iii. a feasibility study

iv. a financial contribution to a proposed feasibility study.

c. i. Where there is a localised source of air pollution, buildings should be designed and sited to reduce exposure to air pollutants.

ii. Development proposals will ensure that development is not contributing to poor air quality and provide air quality assessments where appropriate.

g. Development should demonstrate compliance with the London Plan water hierarchy for run off especially in areas identified as prone to flooding from surface water run off. All new development in areas at risk from fluvial flooding must demonstrate application of the sequential approach set out in the NPPF (paras 100 to 104) and provide information on the known flood risk potential of the application site.

h. Development proposals will wherever possible be expected to naturalise a water course, ensure an adequate buffer zone is created and enable public accessibility. Where appropriate, contributions towards river restoration

Following an initial dialogue with Barnet; a pre-application document and response is in place, and confirms:-

Sustainability

Barnet's Sustainable Design and Construction SPD (2016) states:-

If the proposal is a ‘major’ development* then the London Plan Policy 5.2 requires that major developments meet the required targets for carbon dioxide emissions reduction in buildings.

These targets are expressed as minimum improvements over the Target Emission Rate (TER) outlined in the national Building Regulations leading to zero carbon residential buildings from 2016 and zero carbon non-domestic buildings from 2019. Greater policy details are set out in London Plan Policy 5.2 for the applicant to review.

Major development proposals should include a detailed energy assessment to demonstrate how the targets for carbon dioxide emissions reduction outlined above are to be met within the framework of the energy hierarchy.

The carbon dioxide reduction targets should be met on-site. Where it is clearly demonstrated that the specific targets cannot be fully achieved on-site, any shortfall may be provided off-site or through a cash in lieu contribution to the relevant borough to be ring fenced to secure delivery of carbon dioxide savings elsewhere.

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.

The project at 47 Sunnyfield would be considered a non-major residential scheme and as such, many of the above policies would not apply and this report is informed accordingly.

The design team at utilising SAP10.2 emissions data and Part L 2021, in line with the latest GLA guidance.

The GLA Part L 2021 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 New Build Dwellings

The baseline emission levels – the Target Emission Rate (TER) - is obtained by applying the design to a reference 'notional' building the characteristics of which are set by regulations – SAP10.2; The new Part L Building Regulations 2021 came into force in June 2022 and introduced a completely new notional dwelling as detailed below:-

Table 1.1 Summary of notional dwelling specification for new dwelling[1]

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

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

SAP first creates the notional reference building, based upon the same shape and form as the proposed dwelling and applies the above the characteristics as defined in SAP10.2, prior to applying the actual construction and HVAC solution of the proposed dwellings to generate the Dwelling Emission Rate (DER).

Once all of the baseline emission rates have been calculated in line with the above Government approved methodologies, they are considered as stage 'zero' of the energy hierarchy as described earlier and Target Emission Rate sets the benchmark for the worst performing, but legally permissible, development.

3.3 Unregulated Energy Use

The baseline un-regulated energy use for cooking & appliances in the residential units have been calculated using the SAP Section 16 methodology; the same calculation used for Code for Sustainable Homes (CfSH) Ene 7.

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

Cooking = (119 + 24N)/TFA

N = no of occupant SAP table 1B

TFA – Total Floor Areas

The emissions associated with unregulated energy use per sqm is summarised in Table 1 below.

Table 1 – Unregulated Energy Use

Unit	CO_2 emissions - Unregulated Energy Use SAP10.2 Kg
New dwelling	665

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

3.4 Baseline Results

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

Table 2 – Baseline energy consumption and CO_2 emissions

Unit	Target Emission Rate (regulated energy use) Kg/annum	Unregulated Energy Use Kg/annum	Total baseline emissions Kg
47 Sunnyfield	1,831	665	2,496
Development Total	**1,831**	**665**	**2,496**

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 7 47 Sunnyfield has had been designed to ensure the building is not vulnerable to overheating; to instigate consideration of the risk of overheating with the proposed development, the design team have followed the guidance within the London Plan, which consider the control of overheating using the Cooling Hierarchy:-

1. **minimise internal heat generation through energy efficient design**

The project will be designed to best practice thermal insulation levels as noted, full details of which are noted under 4.3 below.

Not only does good insulation assist in reducing heat losses in the winter, but it also has a significant impact on preventing heat travelling through the build fabric during the summer.

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 located in a low rise suburban location, on a south east/north west facing plot.

The dwelling will benefit from some topographical shading from the dwelling to the south west.

The proposed living areas and master bedroom are orientated to the northwest, with significant glazed areas introducing natural daylight and attracting useful solar gain, whilst avoiding the peak southern sun.

Glazing specification has been a significant consideration as part of the overheating risk mitigation and the specified new glazing will achieve a low g-value in order to further assist in reducing overheating risk from excessive solar gain.

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

The dwelling is designed with floor to ceiling heights at circa 2.5m, with a vaulted roof arrangement to the master bedroom, able to facilitate the stack effect within the dwelling.

The new build structure is expected to be a highly insulated brick/block construction proving thermal mass able to offer further thermal control.

4. **passive ventilation**

All glazing is designed to have opening areas to introduce high levels of natural "purge" ventilation to further assist in the reduction of overheating risks in appropriate areas.

The property can cross ventilate to further assist air flow thought the dwelling.

5. **mechanical ventilation**

The project designers have opted for a natural ventilation solution within a highly insulated fabric to optimise energy efficiency.

4.3 Heating System

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

- High efficiency boiler – (92+%+ SEDBUK efficiency) & load compensation.
- High insulated primary and secondary pipework to prevent distribution heat losses.

To increase the efficiency in the use of the heating system, the following controls will be used to eliminate needless firing of the boilers.

- Boilers fitted with weather compensation and delayed start thermostats.

4.4 Fabric heat loss

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

- New wall constructions will be of a brick/block construction and will target a U-Value of 0.15W/m^2k or better.
- New pitched and flat roof constructions are to be of a warm-roof type, achieving a U-Value of 0.11W/m^2k
- The floor construction will achieve a U-Value of 0.14W/m^2k

All of the above standards are at Passivhaus minimum fabric standards or better and aligns with the LETI guidance;

LETI (Low Energy Transformation Initiative) is a network of over 1,000 built environment professionals who are working together to put London on the path to a zero carbon future

The guidance document published in 2019 set out performance standards for fabric, operational carbon and embedded carbon to enable new building to contribute the London's emission reduction targets.

Glazing

- The new glazing for windows and doors for the residential units will be triple glazed with an area weighted average U-Value of 1.0W/m^2K or better.

Air Tightness

- The project will be tested to 4m^3/hr/m^2 in line with best practice for naturally ventilated dwellings.

Construction Details

- Heat loss via non-repeating thermal bridging within the new build elements will be minimised by the use of Accredited Construction Details for these new build units. An overall Y-Value <0.07 is targeted.

4.5 Ventilation

As noted above, the new house is to be naturally ventilated via background/trickle ventilation, opening windows and wet room extracts.

4.6 Waste Water Heat Recovery

The project is to utilise waste water heat recovery systems recovery in excess of 35% of heat from bath/shower water that would normally be lost to the drains.

4.7 Lighting and appliances

The dwelling will incorporate high efficiency light fittings utilising LED lamps.

The use of LED lighting will also minimise the internal gains commonly associated with tungsten and fluorescent lighting systems and thereby further reduce the potential for the dwelling to overheat.

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

4.8 Energy efficiency results

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

Table 3 – Energy Efficient emission levels

Unit	Emission Rate (regulated energy use) Kg/annum	Unregulated Energy Use Kg/annum	Total "be lean" emissions Kg
47 Sunnyfield	1,682	665	2,347
Development Total	**1,682**	**665**	**2,347**

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 **5.97%.**

Regulated emissions have been reduced by **8.14%** via the passive design measures highlighted above.

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

Table 4 – Residential FEES

	Target Fabric Energy Efficiency (MWh/year)	Design Fabric Energy Efficiency (MWh/year)	Improvement (percent)
Development total	35.45	32.89	7%

5.0 Supplying Energy Efficiently

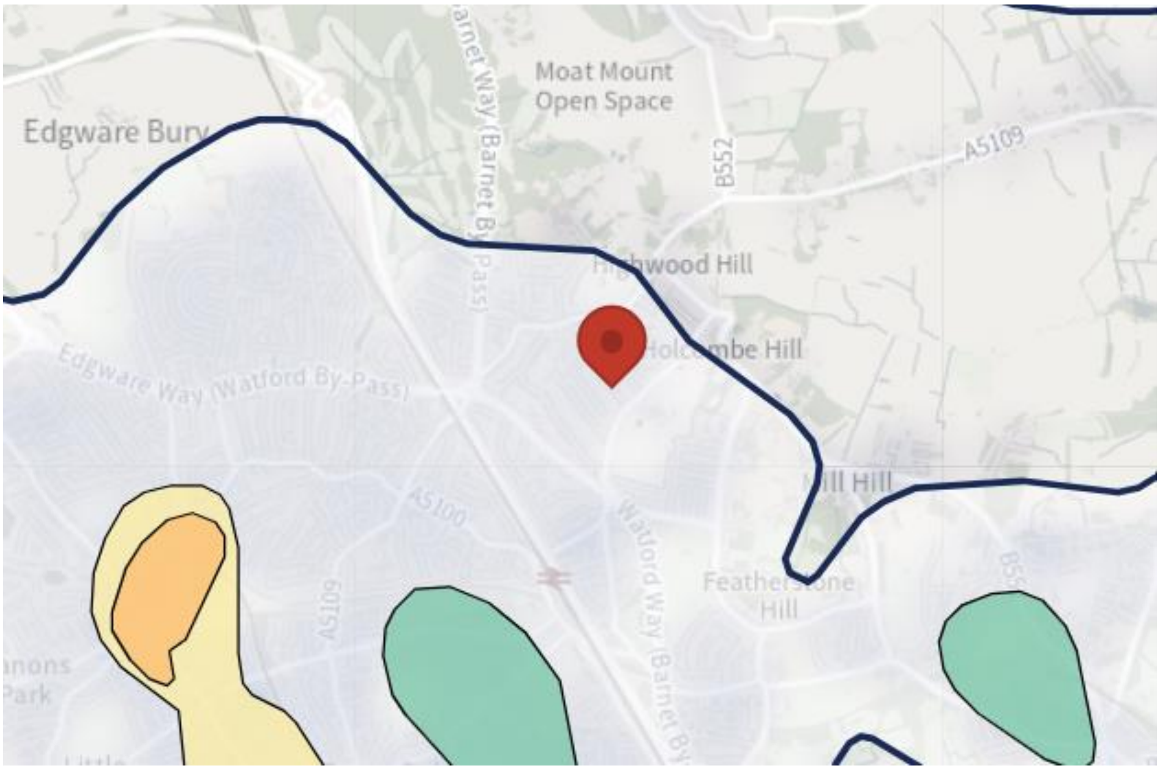
5.1 Community Heating/Combined Heat and Power (CHP)

The London Plan, Chapter 9, requires that major developments exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly.

Development in Heat Network Priority Areas should follow the heating hierarchy in Policy SI3 Energy infrastructure.

Therefore, this report must consider the availability of heat networks in the Barnet area.

The map below shows the location of the site, and it is on the periphery of the heat network priority area (HNPA) and not within any Potential Heat Network Project Areas.



Extract from London Heat Map

Clearly, it is highly unlikely that a viable DEN will service the 47 Sunnyfield area, the requirement to be DEN connection ready can be dismissed.

However, consideration must be given to onsite community systems/CHP

5.2 On-site CHP/District Heating

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

CHP is, as a rule of thumb, 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 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.

A small-scale residential development – in this case, a single dwelling – simply does not provide the constant heat demand required and as such, the potential use of on-site community networks/CHP is dismissed

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.

Payments are made against metered exports only.

6.1.1 Renewable Heat Incentive

The Renewable Heat Incentive (RHI) was formally withdrawn for all new projects in March 2022.

6.2 Wind turbines

Wind turbines come in two main types'- horizontal axis and vertical axis. The more traditional horizontal axis systems rotate around the central pivot to face into the wind, whilst vertical axis systems work with wind from all directions.

The potential application of wind energy technologies at a particular site is dependent upon a variety of factors. But mainly these are: -

- Wind speed
- Wind turbulence
- Visual impact
- Noise impact
- Impact upon ecology

The availability and consistency of wind in urban environments is largely dependent upon the proximity, scale and orientation of surrounding obstructions. The site is surrounded by low-rise buildings 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 47 Sunnyfield itself.

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

6.3 Solar Energy

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

In general, the roofs will have an unrestricted aspect, so there is scope therefore to site solar photovoltaic (PV) or water heating equipment at roof level.

6.3.1 Solar water heating

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

Both collector types can capture heat whether the sky is overcast or clear. Depending on location, approximately 900–1100 kWh of solar energy falls on each m^2 of unshaded UK roof surface annually. The usable energy output per m^2 of solar panel as a result of this amount of insolation ranges from between 380 – 550 kWh/yr.

Solar hot water systems are of course, displacing heat pumps for DHW provision (as noted below), and due to the efficiency as a source of energy, solar thermal systems tend to have a very poor pay back model unless there is a reliable and consultant demand for hot water; a medium size residential scheme simply does not provide this.

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

6.3.2 Photovoltaics (PV)

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

Despite the withdrawal of the Feed in Tariff, the returns on PV installations are still able to achieve 6-7% returns via the reduction in (ever more expensive) electricity consumption.

Accordingly, the design team are proposing to utilise flat dormer roof space to install a 6 panel PV array, utilising high power 440w panels, a total 2.64kWp array generating some 2,280kWh/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 and particulate matters, as well as other pollutants and would therefore have to be considered carefully against the high standard of air quality requirements within Barnet's Borough wide AQMA. Accordingly, the use of biomass is not considered appropriate for this project.

6.5 Ground source heat pump

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

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

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

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

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

Clearly, there is little land area to install low level collector loops and deep bore GSHP boreholes are not considered viable on a small scale; ground source heating cannot be considered.

6.6 Air source heat pump

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

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

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

Table 5 – Air Source Heat Pump Performance

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

A theoretical carbon saving of 77%

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

6.7 Final Emissions Calculation

Given the outcome of the feasibility study above, the developer is proposing the use the above noted ASHP systems to deliver the heating and hot water demands to the development, as well as a roof mounted 6 panel PV array, a total 2.64kWp array generating some 2,280 kWh/annum.

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

Table 6 – "Be Green" emission levels

Unit	Emission Rate (regulated energy use) Kg/annum	Unregulated Energy Use Kg/annum	Total baseline emissions Kg
47 Sunnyfield	515	665	1,179
Development Total	**515**	**665**	**1,179**

The data at Table 6 confirms that overall emissions – including unregulated energy use - have been reduced by **52.75%** over and above the baseline model, with a **49.75%** 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 **71.89%.**

The Energy Use Intensity and space heating demand of the development are also reported – Table 7 below.

Table 7 – Energy and Heat Demands

Building Type	Energy Use Intensity ($kWh/m^2/year$)	Space Heating ($kWh/m^2/year$)
Residential	38.03	35.87

7.0 Sustainable Design & Construction

The Sustainability credentials of the proposed residential development at 47 Sunnyfield are set out below; based on the environmental assessment criteria developed by the Building Research Establishment.

Materials

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

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

The design team will seek out construction techniques with a lower embodied carbon contents, timbers and lightweight blockwork.

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

- Concretes with a minimum of 20% cement replacement
- Plasterboard with a significant recycled content – subject to market availability

In addition to the above low carbon strategy, the development will source all materials form supplier that can demonstrate that materials are sourced responsibly in line with recognised Environmental Management Systems (FCS, BES6001 etc.)

The principal contractor with be required to produce a site waste management plan and sustainable procure plan, in line with BREEAM standards – this will include a pre-demolition audit to identify demolition/strip-out materials to reuse on-site or salvage appropriate materials to enable their reuse or recycling off-site in order to align with the principles of the circular economy.

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

The SWMP will inform the adoption of good practice waste minimisation in design. This will set targets to minimise the generation of non-hazardous construction waste using the sustainable procurement plan to avoid over-ordering and to use just-in-time delivery policies.

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

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

Pollution

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

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

To avoid the issue of noise pollution, the development will comply with Building Regulations Part E, providing a good level of sound insulation between the proposed development and surrounding buildings.

Energy

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

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

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

Water

The development minimise water use as far as practicable by incorporating appropriate water efficiency and water recycling measures. The applicants will ensure that all dwellings meet the required level of 105 litres maximum daily allowable usage per person in accordance with the former Level 4 of the Code for Sustainable Homes.

8.0 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 dwelling was built to a standard to meet only the minimum requirements of current building regulations, following the guidance from the GLA (June 2022), the total amount of CO_2 emissions would be **2,496Kg/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 **2,347Kg/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 heat pump driven, heating and hot water systems and the generation of electricity on site via an 2.64kwp PV array.

This has been used in the SAP models (reproduced at **Appendix C**) for the development which have also been detailed above in Table 6, which show a final gross emission level of **1,179Kg/year**, representing a total reduction in emission over the baseline model, taking into account unregulated energy, of **52.75%.**

In addition, the final SAP outputs at Appendix C demonstrate that the building achieves an overall improvement in regulated emissions over the Building Regulations Part L standards for regulated emissions of minimum of 71.89%.

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

Tables 8 & 9 Demonstrate how the 47 Sunnyfield project complies with the London Plan requirements and the GLA guidance relating to zero carbon development based up SAP10.2 emissions data.

Table 8 – Carbon Emission Reductions – Domestic Buildings

Key	Tonnes/annum
Baseline CO_2 emissions (Part L 2021 of the Building Regulations Compliant Development)	1.8
CO2 emissions after energy demand reduction (be lean)	1.7
CO2 emissions after energy demand reduction (be lean) AND heat network (be clean)	1.7
CO2 emissions after energy demand reduction (be lean) AND heat network (be clean) AND renewable energy (be green)	0.5

Table 9 – Regulated Emissions Savings – Domestic Buildings

	Regulated Carbon Dioxide Savings	
	(Tonnes CO2 per annum)	%
Savings from energy demand reduction	0.1	8%
Savings from heat network	0.0	0%
Savings from renewable energy	1.2	64%
Total Cumulative Savings	**1.3**	**72%**
	(Tonnes CO_2)	
Carbon Shortfall	0.5	
Cumulative savings for off-set payment	15	
Cash-in-lieu Contribution	**NA**	

Appendix A

Baseline/Un-regulated Energy Use:-

SAP Outputs & Target Emission Rates

Appendix B

Energy Efficient Design:-

SAP Outputs & Dwelling Emission Rates

Appendix C

Generating energy on-site:-

SAP Outputs & Dwelling Emission Rates

Appendix D

GLA Part L 2021 Reporting Spreadsheet