

Energy & Sustainability Statement
Ref: Z55630.1

New Build House @ Rear of Fairport
171 Fortis Green
London
N10 3BG

On behalf of

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Executive Summary

This Energy & Sustainability Statement has been developed in support of the planning application for the proposed new build development at the rear of Fairport, 171 Fortis Green, London N10 3BG. The proposed development consists of the creation of 1No. 2 storey detached house. The development is classed as minor development under London Borough of Haringey (LBH) and GLA London Plan. The development will be assessed under Building Regulations Approved Document L1A 2021. This statement will evaluate the technical and economic feasibility of using both passive and low and zero carbon technologies and will assess the practical levels of CO₂ reduction possible for this development to comply with the following LBH planning requirements.

Development Plan policies contained in:

- Policy DM21 of the Haringey Plan
- GLA London Plan, comprising:
 - Policy SP4

Material considerations, including:

- National Planning Policy Framework (NPPF) (2021);
- Planning practice guidance (PPG);
- Building Regulations Part L 2021, SAP Energy Modelling

This strategy includes the following sections:

- Introduction
- Policy and Legislative Compliance
- Calculation Methodology
- Energy Consumption and CO₂ Emissions
- Minerals and Waste
- Sustainable Lifestyles
- Climate Change Adaptation
- Conclusions

LBH's Local Plan Policy DM21. Key extracts below:

POLICY DM21: SUSTAINABLE DESIGN, LAYOUT AND CONSTRUCTION

- A** All new development, including building and landscape works, will be expected to consider and implement sustainable design, layout and construction techniques. Proposals should:
- a** Apply the energy hierarchy to minimise energy use in order to meet, and if possible exceed, minimum carbon dioxide reduction requirements;
 - b** Apply the cooling hierarchy to reduce the potential for overheating and limit reliance on mechanical air conditioning systems;
 - c** Maximise opportunities to enhance biodiversity on-site, including through appropriate landscaping, Sustainable Drainage Systems, living roofs and green walls
 - d** Wherever possible, use building materials with high environmental performance ratings; and
 - e** Seek opportunities for locally sourced labour.
- B** The Council will support appropriate measures to sustainably retrofit existing homes and non-residential buildings.
- C** Proposals that fail to demonstrate adequate consideration for sustainable design, layout and construction techniques will be resisted.
- D** Consideration will be given to the use of carbon offset payments, to be secured by planning obligations, where it can be demonstrated that proposals are unable to meet carbon dioxide emission reduction targets on-site.

Energy efficiency

- 4.28** London Plan Policy 5.2 states that development proposals should make the fullest contribution to minimising carbon dioxide emissions in accordance with the energy hierarchy, as follows:
- 1 Be lean: use less energy
 - 2 Be clean: supply energy efficiently
 - 3 Be green: use renewable energy
- 4.29** The first step in the hierarchy should be met through adopting sustainable design principles. The second step should be met by prioritising decentralised energy, for which local requirements are set out below (see Policy DM22). The third step is to use renewable energy.
- 4.30** London Plan Policy 5.2 requires reductions in regulated CO2 emissions over the 2010 Building Regulations (Part L) with a graduated tightening of standards to achieve zero carbon by 2016 to residential buildings and 2019 for non-domestic buildings. The policy reflects the Government's previous intention to introduce a step-change in the national Building Regulations. However, the Summer Budget 2015 states that the Government will not progress with the proposed 2016 increase in on-site energy efficiency standards, but keep these under review.¹¹ The Council will continue to monitor changes in higher level policy and ensure proposals meet the appropriate minimum required reduction in carbon emissions on-site by prioritising use of the energy hierarchy.

It should be highlighted that this project falls within minor development and therefore some of the requirements set out in LBH and GLA do not apply. However, we have followed the condensed principles of their guidance at all stages to ensure that the scheme delivers a good quality, thermally and energy efficient solution. We have used the GLA's Energy Assessment Guide Section 6 to develop the Energy Hierarchy with the Notional Specification set out in Appendix 4 to set the baseline criteria.

The following low and zero carbon technologies have been evaluated:

- Biomass
- Wind
- Biogas
- Air Source Heat Pumps & Exhaust Air Heat Pumps
- Geothermal
- Combined Heat & Power (CHP)
- Solar Hot Water
- Solar Photovoltaic

Energy calculations have been undertaken to assess the Site's carbon dioxide (CO₂) emissions and to identify the most appropriate energy efficient solutions and appropriate low and zero carbon technologies.

The Standard Assessment Procedure (SAP 2021) was used to calculate the CO₂ emissions and energy consumption of dwellings. SAP is a government approved methodology for assessing residential dwellings and calculates the following metrics:

- Target Emissions Rate (TER) & Dwelling Emissions Rate (DER)
- Target Primary Energy Rate (TPER) & Dwelling Primary Energy Rate (DPER)
- Target Fabric Energy Efficiency Rate (TFEE) & Dwelling Fabric Energy Efficiency Rate (DFEE)

For each metric, the percentage difference between the Target and Dwelling rates is determined. Building Regulations require that the DER, DPER and DFEE for each dwelling must be equal to or better than the corresponding TER, TPER and TFEE.

Elmhurst software has been used for calculations within this assessment for Part L1A 2021 compliance. The GLA's Energy Assessment Guidance April 2020 Section 6 and Appendix 4 has been used to address the baseline notional targets.

Based on these calculations, the Energy Strategy has been written in compliance with the LBH Local Plan and Greening SPD. The Energy Hierarchy stages of 'Be Lean', 'Be Clean', 'Be Green' have been applied to maximise the reduction of Carbon Dioxide (CO₂) emissions from the proposed scheme. 'Be Lean', incorporates passive design measures and assesses energy efficient equipment for 'unregulated' emissions. 'Be Clean', incorporates the efficient supply of energy within a development, 'Be Green' incorporates the use of renewable technologies into a development.

The Energy Strategy demonstrates that the proposals are compliant with the regional and local energy policy requirements by exceeding the LBH carbon dioxide emissions (CO₂) reduction policy through the combination of the 'Be Lean', 'Be Clean' and 'Be Green' measures.

The 'Be Lean' measures include; U-values, glazing g-values and air permeability rates exceeding compliance with Part L1A 2021. Furthermore, low energy external lighting and potentially the incorporation of A+ rated white goods will reduce 'unregulated' emissions.

'Be Clean' technologies would include connection to a decentralised energy source or energy centre such as a district heating network. This is a small development under minor development regulations, and it isn't cost effective nor feasible to connect to a District Heating Network (DHN).

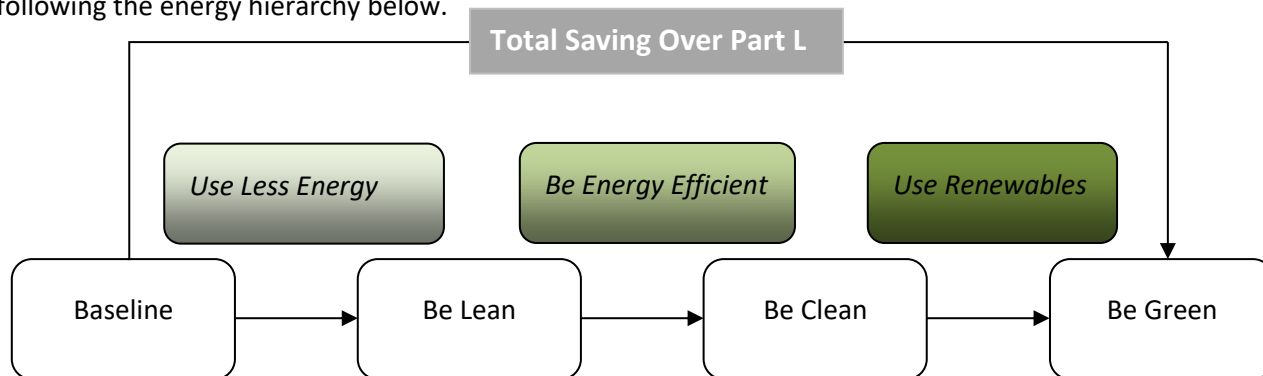
'Be Green' technologies include connection to an air source heat pump and a 4.5kWp PV array, locations as shown on the Architects dwgs. These combined measures achieve a 88.99% reduction in Carbon emissions from the target baseline. This meets LBH Planning policy requirements.

The approach for the proposed development is to embed sustainability into the heart of the development through a range of design measures based on the 'Be Lean, Be Clean, Be Green' Energy hierarchy. Measures will include:

1. Enhanced building fabric to exceed Building Regulation ADL1A 2021
2. Enhanced air tightness and thermal bridging
3. Efficient system 4 MVHR ventilation system (balanced whole dwelling supply and extract)
4. Efficient lighting strategy using LED type fittings.
5. Heating and hot water will be provided by a highly efficient air source heat pumps
6. Passive cooling provision
7. 4.5kW of PV panels mounted on the South East roof

Summary

The development has been provided with energy savings through the use of passive improvement measures such as improved energy efficiency. This passive approach to compliance will complement the integrated approach to the sustainable energy objectives of the national and local policies following the energy hierarchy below.



The principles of a Be Lean, Be Clean, Be Green design philosophy have been applied, which results in a 88.99% improvement over Building Regulations Part L1A 2021.

Table 1 - Proposed development CO₂ emissions SAP 2021

	Total CO₂ Emissions (KgCO₂/Yr)	Total Primary Energy (kWh/yr)
Target Dwelling Performance	1,724	9,072
Proposed Dwelling Performance	190	3,592
Total Reduction	1,534	5,480
Percentage Improvement (above ADL1 2021)	88.99%	60.40%

The dwelling will be fitted with a water meter and the dwelling will incorporate water saving and efficiency measures that comply with Regulation 36(2)(b) of Part G2 of the Building Regulations to meet the LBH's Local Plan and based on minor development.

Sustainability Headlines

The UK Government's policy targets relating to sustainability and the built environment is focused on moving to a low carbon economy through a stepped programme of reduced carbon budgets on route to the long-term goal of an 80% reduction in emissions by 2050.

New and existing buildings have become priority concerns for policy-makers with a range of policy (and related fiscal) measures targeting the energy and carbon performance of buildings. Below is a summary of the main performance criteria:



1. Introduction

The proposed development is for the creation of 1No. dwelling within the existing footprint of a garage at the rear of Fairport, 171 Fortis Green, London. The property is a 2-storey dwelling. The development is required to achieve compliance under Building Regulations Approved Document Part L1A (2021) and where possible to exceed these standards as set out within the GLA London Plan and LBH's policies.

Supporting information is provided within this report for the proposed energy strategy to be considered on site in accordance with the following planning policies:

- LBH's Local Plan incl. policy DM21
- GLA London Plan
- National Planning Policy Framework (2025)

Throughout this report, passive design techniques, energy efficient equipment and appropriate low carbon technologies will be appraised in line with the 'Be Lean, Be Clean, Be Green' philosophy of relevant planning documents and the Energy Hierarchy.

An assessment of CO₂ emissions will be made based on the calculation methodology dictated by the Standard Assessment Procedure (SAP) and in line with the requirements of LBH planning policy.

1.1. Location

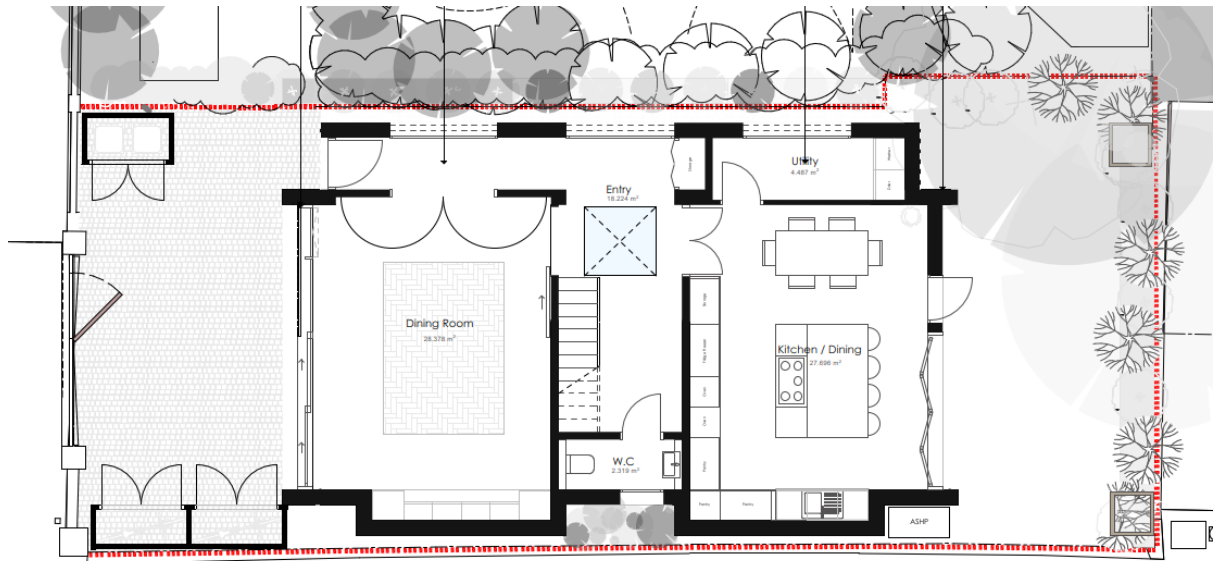
The proposed development at the rear of Fairport, 171 Fortis Green, London N10 3BG is highlighted by the red line boundary shown in Figure 1. The site sits in an urban area.



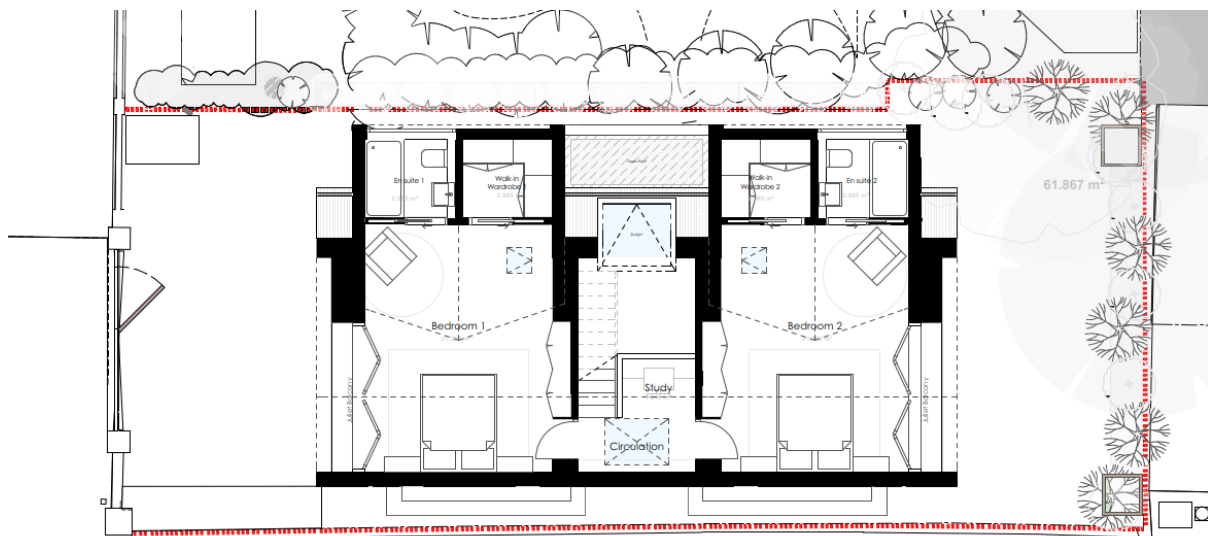
Figure 1 – Site plan for the proposed Fairport, Fortis Green London

1.2. Floor Plans

Ground Floor:



First Floor:



Roof Plan:

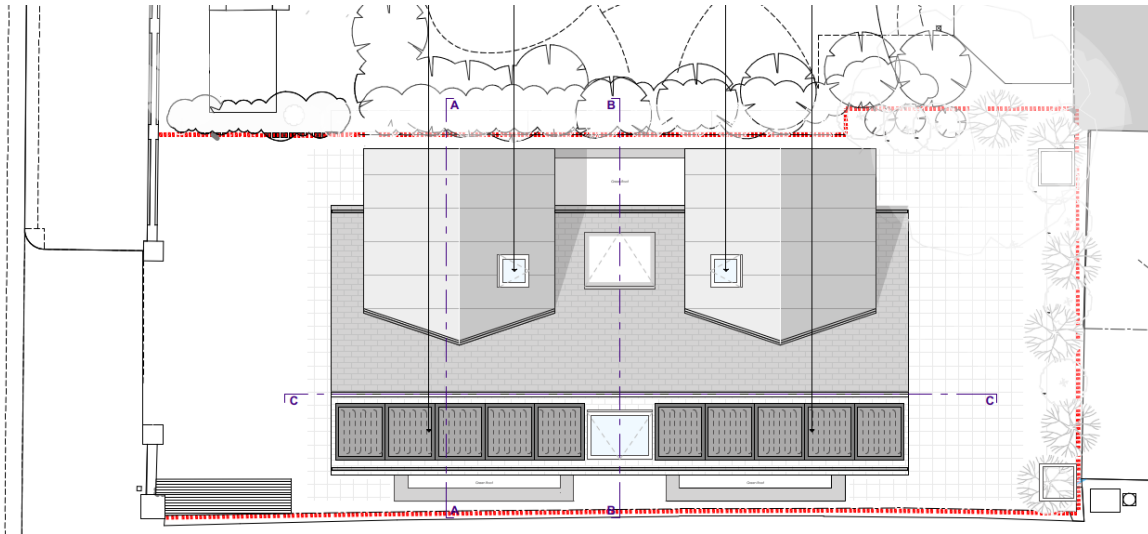


Figure 2 – Proposed floor and roof plans for the development at rear of Fairport, 171 Fortis Green London

2. Policy Drivers for Energy Efficiency and Renewable Energy

This section presents a range of planning policy that is applicable to the development of the proposed land at Fairport, Fortis Green London at both a national and a local level.

2.1. National Policy

The National Planning Policy Framework was published in 2025 and sets out the government's planning policies for England and they should be applied. Table 2 sets out the relevant energy standards for new developments and provides an indication of the design response to be provided.

Table 2 – Key National Planning Policy Requirements and Design Responses

Section	Policy Requirements	Design Response
14. Meeting the challenge of climate change, flooding and coastal change	The planning system should support the transition to net zero by 2050 and take full account of all climate impacts including overheating, water scarcity, storm and flood risks and coastal change. It should help to: Shape places in ways that contribute to radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience; encourage the reuse of existing resources, including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure.	This development will follow the principles set out in LBH's Local Plan using a 'Be Lean, Be Clean, Be Green' approach in reducing operational carbon emissions. An overview of current decentralised energy schemes around the Fortis Green London area and an assessment on the potential for future schemes in relation to this development is provided in Section 6 of this report. This Energy & Sustainability Statement appraises site specific information to determine the most appropriate approach to minimise energy consumption.

2.2. Local Policy

The adopted LBH Local Plan and the Greening Supplementary Planning Document provides a set of guidelines for new development. All relevant energy and sustainability policy within these documents is provided within this section.

Table 3 – Key Local Planning Policy Requirements and Design Responses

LBH Core Strategy
POLICY DM21: SUSTAINABLE DESIGN, LAYOUT AND CONSTRUCTION A All new development, including building and landscape works, will be expected to consider and implement sustainable design, layout and construction techniques. Proposals should: - a Apply the energy hierarchy to minimise energy use in order to meet, and if possible exceed, minimum carbon dioxide reduction requirements; - b Apply the cooling hierarchy to reduce the potential for overheating and limit reliance on mechanical air conditioning systems; - c Maximise opportunities to enhance biodiversity on-site, including through appropriate landscaping, Sustainable Drainage Systems, living roofs and green walls - d Wherever possible, use building materials with high environmental performance ratings; and - e Seek opportunities for locally sourced labour. B The Council will support appropriate measures to sustainably retrofit existing homes and non-residential buildings. C Proposals that fail to demonstrate adequate consideration for sustainable design, layout and construction techniques will be resisted. D Consideration will be given to the use of carbon offset payments, to be secured by planning obligations, where it can be demonstrated that proposals are unable to meet carbon dioxide emission reduction targets on-site.

3. Methodology

The first step of the full energy strategy assessment has been to undertake a baseline energy assessment. The baseline energy assessment consists of calculating the total CO₂ emissions of the development to meet Building Regulations and then compares the proposed improvement measures against this baseline.

Building Regulations Part L1A 2021(SAP) applies to all new build dwellings and confirms the carbon emissions from all regulated energy. The proposed redevelopment has been developed using the energy hierarchy below:

1. Be Lean <i>A reduction in energy use as a result of passive design and energy efficiency</i>
Thermal performance of envelope (U-values) Glazing design Airtight construction Efficient mechanical ventilation with heat recovery Variable speed fans and pumps Efficient lighting
2. Be Clean <i>A focus on supplying energy to the development through efficient means</i>
Connect to low carbon heat networks Develop site wide heat network from single energy centre Provide energy efficient individual heating
3. Be Green <i>The installation of renewable technologies to meet energy demand where possible</i>
Consider the feasibility of renewable energy technologies (PV etc) Assess the integration of renewable technologies based on the above measures Adopt use of cleaner efficient heat sources such as heat pumps to promote air quality and decarbonisation

The development must be provided with energy savings through the use of thermal improvements to fabric (a 'fabric first' approach), followed by other clean energy solutions (such as energy efficiency improvements, district heating) and finally the use of renewable energy technologies, where practical.

This hierarchy complements the integrated approach to the sustainable energy objectives of the LBH's Local Plan and its SPD.

The planning policies require a full review of the technical and economic feasibility of the following renewable technologies:

- Biomass heating
- Biomass combined heat and power
- Solar hot water
- Solar photovoltaic
- Ground source heat pumps
- Air source heat pumps / exhaust air heat pumps
- Wind power

To achieve the targets set the development must achieve a balance between fabric, heating and control, ventilation and air leakage improvements, the amount of zero or low carbon technology installed and the capital, life cycle and running costs, maintenance and operation, etc.

Feasible renewable energy technologies have been considered during the assessment to ensure the most suitable renewable energy is chosen for the demands of this scheme. The pros and cons of each technology with respect to this site are considered as part of this statement.

4. Baseline Energy Assessment

Energy Counsel have based the analysis on current Building Regulations ADL1A 2021 (SAP 2021), taking into account solutions that must not only be energy efficient but also practical, reliable and user friendly. Energy Counsel have carried out preliminary SAP 2021 calculation for the dwelling. To meet compliance with Building Regulations Part L1A 2021, the dwelling must comply with the following metrics set by the notional building:

- Dwelling Emissions Rate (DER) must be lower than or equal to the Target Emissions Rate (TER)
- Dwelling Primary Energy Rate (DPER) must be lower than or equal to The Target Primary Energy Rate (TPER)

SAP 2021 is the Governments Standard Assessment Procedure (SAP) for calculating the carbon aspects of a dwelling. SAP is a measure of fuel costs for heating, hot water and lighting for a dwelling. SAP 2021 can also be used to ascertain the energy requirements of a development.

4.1. Predicted Baseline Energy Requirements

The predicted baseline CO₂ emission demands for the development are provided in Table 4.

Table 4 - Baseline dwelling carbon emissions

Ref	Dwelling Type	No. of Type	SAP Area (m ²)	TER (Kg CO ₂ /yr/m ²)	TPER (kWh/yr/m ²)	Total Carbon Emissions (Kg CO ₂ /yr)	Total Target Primary Energy (kWh/yr)
Z55630.1	Rear of Fairport	1	136.62	12.62	66.40	1,724	9,072
Total		1				1,724	9,072

The baseline regulated carbon emissions rate for the development is **1,724 KgCO₂/yr** and the baseline primary energy rate is **9,072 kWh/yr**.

5. Passive Design, Energy Efficiency & Overheating

The approach of the development is to embed sustainability into the heart of the design from the outset of the project design process. The design will be developed with sustainable solutions, taking into account the relevant policies and strategies of the LBH's Core Strategy.

The development will seek to consider all aspects and principles of sustainable development, taking into account environmental, social and economic impacts.

5.1. Passive Design Measures

The philosophy for the site is to achieve as much of the necessary reduction in carbon emissions through the use of passive design techniques and energy efficient measures as possible, before resorting to the use of LZCs. This ensures that the highest standards of building fabric and energy efficiency are achieved. This will be undertaken through a fabric first, energy efficient design approach with high levels of thermal efficiency and a reduction in energy demand through efficient lighting design.

5.2. Energy Efficient Systems

Options have been reviewed for improving the energy efficiency of the development by installing an efficient heating system. The scheme will benefit from high efficiency SCOP 300%+ heat pumps providing heating and hot water to the dwelling.

The dwelling will also be provided with a metering scheme based on their gas and electricity usage.

A low energy, high efficiency whole house mechanical ventilation system with heat recovery will serve each dwelling, with an overall specific fan power (SPF) of <0.75W/l/s and 89+% heat recovery, improving on the requirements of Building Regulations Part F (2021). This system operates constantly providing supply and extract air to the habitable rooms and also offers a boost when the wet room is in use and can be used in a purge summer bypass mode to assist with thermal comfort. Ventilation can also be provided throughout the dwelling by openable windows.

5.3. Overheating

To ensure the risk of overheating is mitigated and the requirement for mechanical cooling is reduced, the scheme will be developed with consideration of the Good Homes Alliance (GHA) Early-Stage Overheating Risk Tool. Windows can be fully opened and will be specified with low solar transmittance g values on the South facing facades and higher g values on the North facades. MVHR ventilation with

summer bypass purge mode will provide higher ventilation rates within the dwelling to assist with passive thermal comfort, so we do not predict any significant issues with overheating.

It is not considered that the development will have undue issues with overheating although this could be reviewed through a full Part O overheating assessment to comply with building regulations.

The following measures will be considered and applied as required as a means to ensure TM59 compliance of the dwellings within the scheme as the detailed design is progressed:

- U-values to be balanced so that the Target Fabric Efficiency Rating (TFEE) is not exceeded,
- All DHW distribution pipework and cylinder will be fully insulated throughout to minimise unwanted heat gains,
- Low energy and LED lighting throughout,
- G-values are specified on windows (dependant on elevation) to limit solar gain across each façade,
- External windows to be recessed to allow for natural shading and overhangs,
- External windows to be openable,
- Internal blinds to minimise solar gain,
- Mechanical ventilation with heat recovery and summer bypass

6. District & Communal Heating Networks

This section outlines how consideration of energy supplied efficiently from a district heating network can be provided to the dwellings in line with the Energy Hierarchy.

6.1. Decentralised Heating Networks

The energy policy reaffirms the view that energy generated by centralised power stations and transmitted through the national grid is highly inefficient and wasteful.

One of priorities for reducing CO₂ emissions is to reduce reliance on centralised power stations. This means increasing the use of local, low-carbon energy supplies through decentralised energy systems.

Decentralised plant generally means any heating and hot water and/or electricity generation provided on a district wide (DHN) or site wide (CHN) basis. DHN and CHN can typically include combined heat and power equipment (CHP). CHP is an engine which, when running, generates electricity and heats water which can then be distributed around a development.

Benefits of district heating networks can include:

- Provision of low carbon / lower cost heat to domestic and commercial customers
- Diversification of the energy mix
- Reductions in region-wide carbon emissions
- Targeting and reduction of fuel poverty
- Potential long-term revenue streams for local authorities
- Alignment with regeneration programmes
- Driving the growth of the low carbon services sector

There are currently no existing district heating networks within proximity to the site, and the development of a decentralised system would not be feasible or beneficial for a project of this scale.

7. Renewable Energy Technologies

Energy Counsel have reviewed options for the use of on-site renewable energy/Low or Zero Carbon Technology (LZT) in line with the policy aspirations of LBH's Core Strategy.

This renewable Energy & Sustainability Statement/strategy reviews the technical and economic feasibility of the following technologies:

- Solar Photovoltaic
- Solar Hot Water
- Ground Source Heat Pumps
- Air Source Heat Pumps / Exhaust Air Heat Pumps
- Micro Wind Power
- Biomass

7.1. Photovoltaics (PV)

Photovoltaic panels convert sunlight into electricity to run lights and appliances. Photovoltaic panels use cells to convert light into electricity. A PV cell normally consists of 1 or 2 layers of a semi conducting material such as silicon. When light shines on a cell it generates energy causing electricity to flow, the higher the light intensity is, the more electricity flows.

The amount of energy PV cells generate is referred to as Kilowatt Peak (kWp). PV arrays now come in a variety of shapes and colours, ranging from grey 'solar tiles' that look like roof tiles to panels and transparent cells that you can use on conservatories and glass to provide shading as well as generating electricity. Solar panels are not light and the roof must be strong enough to take their weight, especially if the panel is placed on top of existing tiles. For flat roofs the panels can be mounted on A-frames to give the optimum angle.

The optimum panel inclination for solar collection is 35°, oriented due south; however panels that are inclined between 30° and 45° and oriented South, West or East are generally suitable. If solar

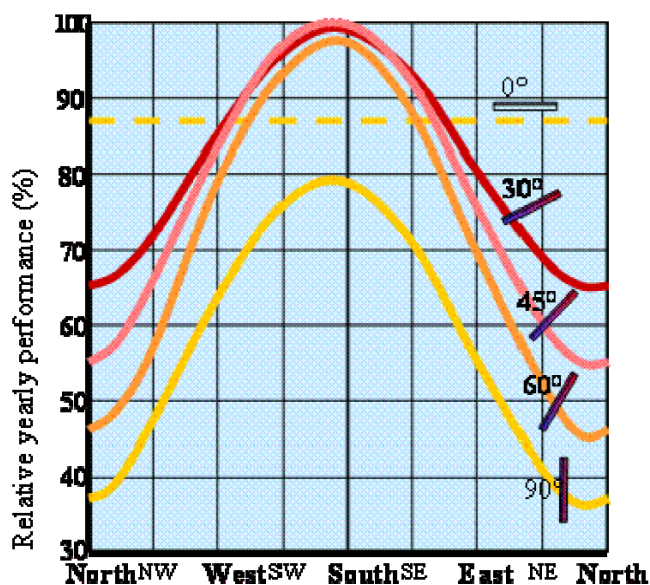


Figure 3 - Performance of photovoltaic panel orientation

collectors are oriented away from due South then a larger surface area will be required to generate a set amount of energy. The effect of non-optimal orientation is illustrated by the graph above.

The cost to install PV is typically £1,000 - £1,500 per kWp for 'on-roof' panel systems.

Photovoltaic (PV) panels are installed on the south-east facing roof, with the drawings indicating a total of 10 panels. These make a significant contribution to reducing the dwelling's carbon emissions, helping to ensure compliance with required targets and local planning policy.



Figure 4 - Photovoltaic array on a pitched roof

7.2. Solar Thermal HW Panels

Solar panel heating uses the radiant energy from the sun to heat hot water, most commonly for domestic hot water needs. There are two types of collectors used for solar water heating – flat plate collectors and evacuated tubes collectors. The systems function successfully in all parts of the UK, as they can work in diffuse light conditions. The collector should be mounted on a 10-60 degrees pitch facing south, although other variations can be used, south is the most efficient.

The cost of installing the system is dependent on the distance between the solar collector and the hot water storage and therefore costs vary. The closer the collectors are to the hot water storage; the less pipe work is required. Annual maintenance checks are recommended. The solar collectors are connected to a condensing boiler via a HW cylinder with twin coil.

A typical installation in the UK has a panel size of 3-5m² which is used in conjunction with a HW storage tank of 180-300litres, of which a minimum of 90-150 litres must be dedicated to solar hot water storage.

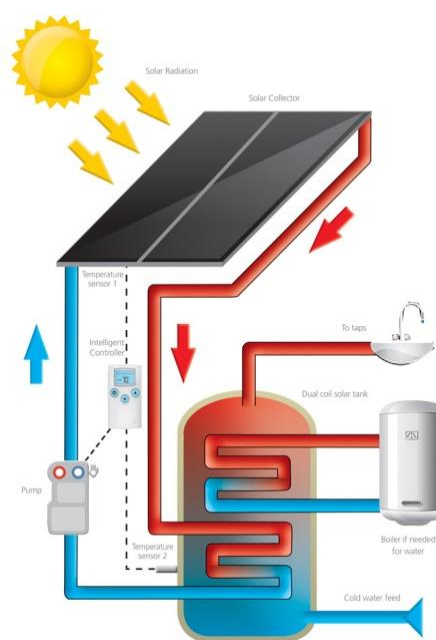


Figure 5 - The principles of a solar thermal system

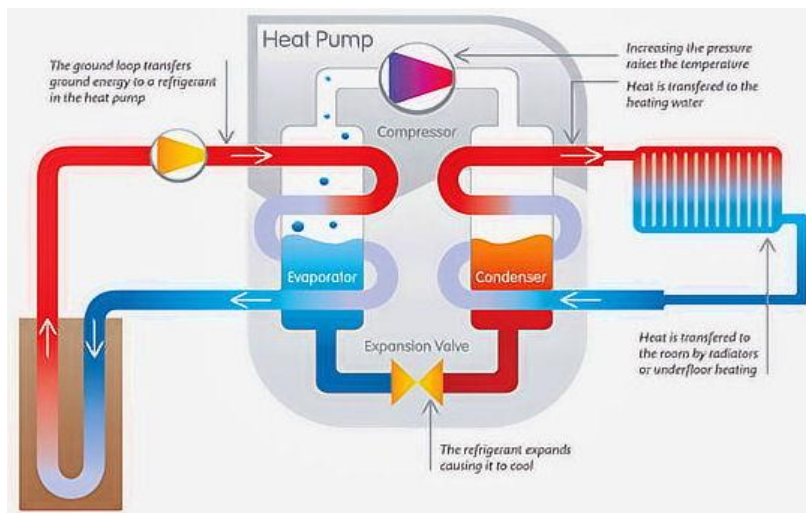
They are a 'simple' and guaranteed technology which will act as a pre-heat for the Hot Water and Heating usage. Payback between capital cost and energy saving can normally be achieved within 12 – 20 years, subject to usage and dwelling type.

The use of solar thermal panels work best in conjunction with individual heating systems for each dwelling. The orientation of the development is fine for the utilisation of solar water heating to provide domestic hot water however it will not achieve significant carbon savings. Carbon savings of approximately 5% are achievable with this technology. The roof space is predominantly taken up with Solar PV panels and there is minimal room to accommodate solar thermal panels. For the reasons aforementioned this is not considered for this scheme.

7.3. Ground Source Heat Pump (GSHP)

GSHPs have been developed specifically for the housing market and are now considered to be an established reliable technology. The GSHP would be sized to cater for the heating and domestic hot water requirements. Typically, they are more suited to dwelling as a centralised system would be installed with multiple bore holes to a depth of up to 125 metres depending on the ground conditions. GSHPs use a heat exchanger to extract heat from the earth.

The efficiency of ground source heat pumps is measured by Co-efficient of Performance (CoP), this is



the ratio of units of heat output for each unit of electricity used to drive the compressor and pump for the ground loop. Average CoP is around 2-4 although some systems may produce a greater rate of efficiency. This means that for every unit of electricity used to pump the heat, 2-4 units of heat are produced, making it

Figure 6 - Principles of a GSHP system

an efficient way of heating a building.

If grid electricity is used for the compressor and pump, then there is the opportunity to consider a range of energy suppliers to benefit from the lowest running costs, for example by choosing an economy 10 or economy 7 tariff.

Due to the relatively small scale of this development, the limited space at the rear to provide boreholes and potential issues with drilling noise, GSHPs are not considered an appropriate design solution.

7.4. Air Source Heat Pump/Exhaust Air Heat Pump

Air source heat pumps (ASHP) and exhaust air heat pumps (EAHP) work in a similar way to GSHP. Air source heat pumps can be fitted on the external façade or in the roof space. An air source heat pump uses small amounts of electricity to take in large quantities of air and extract heat. The efficiency of ASHP is measured by Coefficient of Performance (CoP); this is the ratio of units of heat output for each unit of electricity used to drive the system. Average CoP is around 2-4 although some systems may produce a greater rate of efficiency.

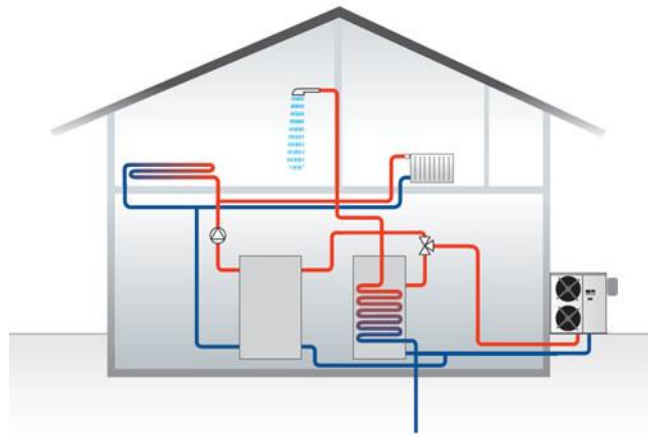


Figure 7 - Principles of an ASHP system

Exhaust air heat pumps such as the NIBE F370 work in a similar manner to ASHP units but have only indoor units (no outdoor compressors) and in addition they also recover heat from their integral exhaust air ventilation system. These units work well on apartment blocks and dwellings where mains gas is unavailable or unsuitable for a development. They are expensive in terms of capital cost of the equipment, installation and the enhanced structural requirements.

ASHPs are considered viable for this scheme and have been included as the chosen solution. They offer high efficiency heating and hot water at 300~% efficiency from a clean energy source. As the electrical grid continues to decarbonise in the future this development will also improve.

7.5. Micro Wind Power

Wind power is one of the cleanest and safest methods of generating electricity. However, wind power is unfeasible due to the fact the development is in an urban area and local wind conditions would not be sufficient to provide enough power. Most small wind turbines generate Direct Current (DC) electricity. Systems that are not connected to the national grid require battery storage and an inverter to convert DC electricity into Alternating Current (AC) which is mains electricity.

There are two types of wind turbine available:

- Roof mounted – These are mounted on the roof of dwellings
- Mast mounted – Which are free standing



Figure 8 - Mounted wind turbine

Important issues to consider when using wind turbines are:

- Wind speed increases with height so it's best to have the turbine high on a mast or tower.
- Generally speaking the ideal site is a smooth top hill with a flat, clear exposure, free from excessive turbulence and obstructions such as large trees, dwellings or other buildings.
- Small scale wind power is particularly suitable for remote off grid locations where conventional methods of supply are expensive or impractical.
- Where the local annual average wind speed is 6 m/s or more.
- Where there are no significant nearby obstacles such as buildings, trees or hills that are likely to reduce the wind speed or increase turbulence

As this development is in an urban and conservation area there will be obstacles which reduce wind speed, noise issues, structural issues with the mounting of turbines, and aesthetic considerations. Micro wind is not a viable technology for this development.

7.6. Biomass

Biomass is a generic name for any fuel produced from organic sources and falls into mainly two categories:

- Woody biomass- forest products, untreated wood products, energy crops and wood pellets
- Non-wood biomass – liquid biofuels (such as biodiesel, bioethanol) or animal waste industrial municipal products and high energy crops such as rape seed, sugar cane and maize.



Figure 9 - Biomass boiler and hopper

For domestic properties the fuel used is normally wood pellets, wood chips or wood logs. For larger applications, biomass boilers replace conventional fossil fuel boilers and come with an automated feed by screw drives from hoppers.

Biomass systems require more cleaning than gas or oil boilers and they must be capable of being taken out of service for cooling and cleaning whilst maintaining the building heating supply particularly in communal heating systems. Centralised gas boilers are therefore still required to support the biomass

boiler, which would be the lead boiler. The size of the dedicated plant rooms is substantial. Fuel availability, delivery and storage are also important issues to consider.

Air quality issues are also an important factor when looking to install biomass. The cost of the fuel depends on the type, delivery distances and whether it is obtained as simple waste product or from another organisation. The cost of wood pellets is currently a little more expensive than mains gas, and woodchip is approx. 30% cheaper, however prices are fluctuating rapidly in the bio-fuel market at the present time creating uncertainty over their take up.

Biomass CHP is still relatively new to the UK market and is more suitable to large developments where energy demand does not require significant modulation. There are technical issues with small scale Biomass CHP and until these can be resolved and proven the take up of these systems in the UK and Europe has been slow.

Overall carbon savings of 40%+ are achievable with biomass technology. Biomass is more suited to larger communal heating networks; there is insufficient space to accommodate the equipment and fuel storage to facilitate a biomass boiler. Furthermore, there are noise and air quality issues associated with this type of technology. For this reason, biomass is discounted.

8. Energy Assessment of Proposed Scheme

The proposed development at Fairport, Fortis Green London has adopted the principles of the 'Be Lean, Be Clean, Be Green' approach. The most practical and economically feasible solution for the development is a good quality thermally insulated fabric, airtight envelope, passive improvements and the use of highly efficient air source heat pumps for heating and hot water supported by efficient mechanical ventilation system with heat recovery.

Table 5 - Proposed Be Lean and Clean carbon emissions

Ref	Dwelling Type	No.	SAP Rating	TER	DER	TPER	DPER	Total Carbon Emissions (Kg CO2/yr)	Total Primary Energy (kWh/yr)
Z55630.1	Fairport	1	89B	12.62	1.39	66.40	26.29	190	3,592
				88.99%		60.40%			
Total		1		88.99%		60.40%		190	3,592

The predicted carbon emissions for the proposed development is **190 kg/CO₂/yr**. This is a total carbon reduction of **1,534 kg/CO₂/yr** from the baseline emissions of **1,724 kg/CO₂/yr** this equates to a **88.99%** CO₂ emissions reduction.

The predicted energy rate for the proposed development is **3,592 kWh/yr**. This is a total primary energy reduction of **5,480 kWh/yr** from the baseline primary energy rate of **9,072 kWh/yr**. This equates to a **60.40%** primary energy reduction

9. Sustainable Design & Construction

The proposed development has been developed to a high standard. In order to achieve these levels, a number of sustainable design and construction techniques will need to be explored and where feasible incorporated into the design. Potential measures are provided in the list below.

- Minimising internal gains through good specification of lighting and low energy consuming equipment.
- Procuring materials sustainably using local suppliers;
- Using materials which are responsibly sourced and have a low embodied impact (Green Guide rating);
- Controlling unwanted ventilation and draughts by minimising air leakage;
- Ensuring building designs make the most of natural systems both within and around the building;
- Managing flood risk to residential buildings, through sustainable drainage systems (SUDS) and flood resilient design for infrastructure and residential properties;
- Ensuring buildings are comfortable and secure for occupants;
- Conserving and enhancing the natural environment, particularly in relation to biodiversity and enabling easy access to open spaces;
- Avoiding creation of adverse local climate conditions;
- Reducing the thermal transmittance of the building envelope by adding high performance insulation and use of medium/high thermal mass;
- Optimising window design through the type of glazing specified, along with the shape, location and functionality of the building.

9.1. Adaption to Climate Change

Much current practice in designing more sustainably relates to mitigating (preventing or slowing) our impact on climate change. However, climate change is still happening and it is expected that temperatures will increasingly rise over time and weather will continue to become more unsettled and more extreme. With this in mind, the development has been designed to adapt to these potential changes in climate. The strategies described below provide a sample of ideas that has been considered in order to future-proof the development from such climatic extremes:

- Designing buildings to survive extreme winds. This increases the longevity of the building and reduces the frequency of replacing materials. This therefore reduces the embodied impacts of these materials and in turn the entire buildings.

- Specifying building materials and designs that can withstand flooding to ensure that, should a significant flood event occur, any damage is minimised.
- In urban and suburban areas, maintaining solar access for buildings.
- Planting native, climatically appropriate trees and other vegetation.
- Plumbing buildings with water-conserving fixtures in mind.
- Designing cooling-load-avoidance measures into buildings.
- Designing for robustness, as increasing the longevity of a building decreases the embodied energy.

9.2. Post-Construction Sustainable Living

A number of design principles have been included above to target future building occupants' 'sustainable living' behaviours such as:

- Ensuring buildings are safe and secure for occupants to reduce the need for unnecessary noise and lighting when occupants are absent.
- Promoting sustainable waste behaviour, including support for local integrated recycling schemes.
- Influencing occupant behaviour to reduce, reuse and recycle resources throughout the building operation.

There are numerous design principles that often fail or become redundant when building occupants move into newly created dwellings and purposefully and/or unintentionally use the systems in ways that reduce the efficiencies originally designed in. Occupants of buildings have been found to be confused by new heating and cooling controls, for example, and there is increasing evidence of (often unintentional) 'sabotaging' behaviours, which can be targeted by initial and ongoing interventions.

9.3. Strategy for Building Occupants

A strategy will be put into place to ensure that a 'sustainable living' ethos is adopted by the occupants to ensure that the dwellings and their sustainable technologies has been operated to their maximum efficiency throughout their life cycle. The client is in a strong position to ensure this happens effectively. This strategy will include measure to enforce and promote 'sustainable living' among occupants.

Secure cycle storage will be provided to the properties as shown on the Architect's drawings.

An Electric Vehicle Charging points will be considered to the dwellings, which aligns with the requirements of the future Building Regs Document S (15th June 2022).

An additional 5-10% saving in CO2 emissions can be saved through behavioural change techniques over the life cycle of the building. This aspiration has been explored further, throughout the design stages, construction and post-construction. Much of this saving will reduce the unregulated emissions of the development.

9.4. Passive Design

Energy requirements have been lowered through passive design features such as:

- Improving the fabric of the main construction materials to reduce energy demand and minimise space heating peaks
- Keeping air-leakage levels as low as possible with quality air-tight construction using accredited thermal bridging details
- Reducing other energy demands - in the case of lighting, by the maximisation of day lighting levels and solar gain (in winter) and the fitment of low energy fittings, where practicable

9.5. Materials

Material selection plays a key role in the design, development and construction of the project. An organic, fluid and informed approach will be taken to the building design with information presented from findings produced using industry tools. Key performance indicators such as pre-demolition audits, site waste management plans and experience from other projects assists with this process and ensures that careful selection of materials will be considered. Material selection will be highlighted and continually reviewed, with the estimated waste being produced and recovered impacting upon the materials selected. Once selected careful consideration will be given to minimising waste produced through deliveries, handling and storage of materials.

The Building Research Establishment's (BRE's) "Green Guide" will play a critical role in the selection of materials. The Green Guide www.greenguide.org.uk investigates the materials and components (bricks, block, timber, hard-core etc) used to construct building elements – external walls, roof, windows etc. with each element then awarded a Green Guide rating (A+ to E). A+ being the most environmentally friendly material and E being the worst. By reviewing the Green Guide rating for each building element we can assess and manage the actual materials used on site and the key components that the Green Guide considers as follows:

- | | |
|-------------------------------|---------------------------------|
| • Water extraction | • Stratospheric ozone depletion |
| • Climate change | • Acidification |
| • Mineral resource extraction | • Nuclear waste |

- Waste disposal
- Fossil fuel depletion
- Eutrophication
- Photochemical ozone creation
- Human toxicity and Eco-toxicity to Freshwater and land

Wherever possible the building design will utilise building elements that receive an A+ / A rating from the Building Research Establishment.

9.6. Lighting

During the construction phase best practice measures, as recommended by the institution of Lighting Engineers (ILE), CIRIA and the Health and Safety Executive will be implemented as part of the CEMP in order to mitigate potential lighting impacts.

9.7. Water Resources

Good construction practice measures will be followed which will assist in avoiding, reducing or minimising the potential for contaminants migrating to surface and ground waters, reducing localised flood risk and thus protect water quality and the ecosystems they support. Measures will be specified within the CEMP to accord with the pollution prevention guidelines published by the Environment Agency, particularly PPG Works In, near or Liable to Affect Watercourses and PPG 6: Working at Construction and Demolition Sites.

10. Waste Management

As suggested in LBH Supplementary Planning Guidance, the proposed design and construction strategies are based on the following objectives:

- The 3R's of Waste Management – Reduce, Re-use, Recycle
 - Reduce the amount of waste produced in Fortis Green London
 - Make the best use of waste that is produced by re-cycling
 - Choose waste management options which minimise the risk of immediate and future environmental pollution and harm to human health

10.1. Construction Waste Management

The UK construction industry makes significant contributions to the amount waste produced each year and a significant proportion of this waste would end up in landfill sites were it not for the WMS. The design team has reviewed the early options to realise greater reductions in waste going to landfill, thus saving valuable resources, reducing transportation and the risk linked to waste from by-products being produced that are hazardous to human health.

This project team will ensure compliance is provided in regards to:

- environmental policies regarding air, dust and water pollution
- polices for waste management to segregate, recycle and reuse waste generated on site
- energy and water saving measures in place during the construction process
- procuring of materials from local sources and certified responsible sources

At all times the developer should follow the waste hierarchy of “reduce, reuse and recycle”. By implementing this holistic waste strategy the developer will establish key techniques to safeguard against excessive amount of waste being produced. Any waste produced, will then be reused (or refurbished and reused. Once this initial step has been exhausted, waste materials should then enter the recycling process. Where possible the materials will then be recycled into secondary raw material, thus maximising potential applications. The potential energy content of waste will also be examined. Consideration will be given to recovering energy from the waste which could then be used to offset non-renewable energy. After following this hierarchy and once all other possibilities have been exhausted, waste would be disposed of in a safe and controlled manner.

10.2. Waste Management During Occupation

The dwellings will be provided with space to house the external bin store for separating and storing household waste and recyclable waste, in line with the local authority collection scheme. The bin store is located on the ground floor with level access. The following will be provided or adapted to suit LBH local waste collection scheme:

- General waste
- Paper waste
- Mixed waste
- Food waste

Adequate internal storage space will be provided in each dwelling to allow for waste storage and segregation.

From the outset, a high-quality detailed design ensures virtually no material wastage during construction and low maintenance products means energy and materials are efficient across maintenance and repair. Insulating materials are specified to have a low Global Warming Potential. Carefully balancing the cut and fill across the site will ensure no ground material is exported off-site.

WRAP guidelines will be followed during construction, and the contractor must develop and implement a detailed Site Waste Management Plan, in accordance with latest guidelines/regulations for Waste Management and Pollution Control.

11. Water Efficiency

Wherever possible, the proposed development is designed to reduce consumption of water.

Future climate change predictions suggest that the Fortis Green London area will experience wetter and warmer winters and drier and hotter summers. In the locality, storms and heavy rainfall events have increased considerably over the last 10 -15 years. Induced pluvial flooding from summer storms are predicted to be more prevalent than river flooding and this is likely to lead to damage to property and infrastructure. This trend is expected to continue. Concurrently with these predictions, the demand for water is increasing and potable natural supplies are diminishing. The processing of water to potable standards will be resource and energy intensive so developments need to consider and minimise potable water consumption as much as possible.

Operational water consumption can be reduced by specifying appliances which use less water. Built-up areas will be drained to remove surface water and this process has traditionally been done using underground pipes to prevent flooding locally by conveying the water away as quickly as possible but other Sustainable Urban Drainage systems can be introduced to manage rainwater runoff rates and protect water quality. By managing the natural flow patterns we can mitigate flooding problems elsewhere in the catchments' area and the surface water run-off can be reduced to prevent contamination with silt, heavy metals, chemicals, and oil, which can be damaging to watercourses.

During the construction process this construction site will be managed in an environmentally and socially considerate manner; adhering to best practice policies in respect of both ground and surface water pollution. During construction water usage is monitored, metered and benchmarks set to minimise water consumption.

The proposed development does not propose to introduce Sustainable Urban Drainage Systems on the site due to the fact that the site is an infill development which is significantly constrained by the waterways, footpaths and highways.

11.1. Water Consumption

The proposed development is to be designed to minimise consumption of water in building, landscape and by occupants. Maximum water consumption per person per day is targeted to be ≤ 105 l/p/day.

The following water-consuming components shall be specified to improve on baseline efficiency for standard models:

- WCs – double flush toilets will be specified wherever possible

- Taps – where improvements on baseline efficiency cannot be met by a particular model, flow restrictors will be specified to bring water flow rates to the required level
- Showers
- Baths – shall be avoided due to high water use
- Dishwashers (domestic and commercial sized)
- Washing machines (domestic and commercial or industrial sized)

Water consumption could meet less than 105l/person/day. This compares favourably with the average of 161l/person/day. Suggested water appliance details are as follows and this could be reviewed at detailed design stages:

Table 6 - Suggested water consumption Levels

Sanitary fittings	Flow rate or capacity		Consumption (L/person/day)
WC (Full Flush)	4	L/flush	13.53
WC (Half Flush)	2.6	L/flush	
Hand Basin Tap	3	L/min	6.32
Shower	10	L/min	43.7
Bath	140	L/capacity	15.40
Kitchen Tap	4	L/min	12.12
Washing Machine	8.17	L/kg dry load	17.16
Dishwasher	1.25	L/place setting	4.50
Total	Incl. normalization factor 0.91		104.18

The dwelling will be fitted with a water meter and units will incorporate water saving and efficiency measures that comply with Regulation 36(2)(b) of Part G2 of the Building Regulations.

11.2. Water Management and Weather Resilience

The development indicates that the site is not located within a river or sea flood risk area. The flood risk map suggests that there is a risk to flooding from reservoirs in the area, albeit extremely unlikely. Furthermore, there is a high risk of flooding identified from surface water, when heavy rain cannot drain away.

There is significant urban development surrounding the site, however the development will ensure the use of soft landscaping and permeable surfaces will be maximised (as opposed to hard surfacing) wherever possible. A suitable planting/ landscaping scheme will ensure that some permeable surface area is introduced as a result of development. The Flood risk map area is as confirmed by the government website: <https://check-long-term-flood-risk.service.gov.uk/risk>

12. Conclusion

Following the 'Be Lean, Be Clean, Be Green' hierarchy, the proposed design solutions are predicted to reduce the total carbon emissions by 1,534 Kg/CO₂/yr from the baseline emissions of 1,724 kg/CO₂/yr. This equates to a 88.99% carbon reduction from the calculated baseline regulated energy emissions. The proposed design solutions are predicted to reduce the total primary energy rate by 5,480 kWh/yr from the baseline primary energy rate of 9,072 kWh/yr. This equates to a 60.40% reduction.

In addition, Section 9 identifies Sustainability standards which set out good practice standards and are in accordance with Policy. The proposals contained herein meet the emission and water standards as set out in LBH's Local Plan.

The approach for the proposed development at the rear of Fairport, 171 Fortis Green, London is to embed sustainability into the heart of the development through a range of design measures based on the 'Be Lean, Be Clean, Be Green' design hierarchy. Measures will include:

1. Enhanced building fabric to exceed Building Regulation ADL1A 2021
2. Enhanced air tightness and thermal bridging
3. Efficient system 4 MVHR ventilation system (balanced whole dwelling supply and extract)
4. Efficient lighting strategy using LED type fittings.
5. Heating and hot water will be provided by a highly efficient air source heat pump
6. 4.5kWp PV located on the roof of the dwelling

12.1. Low/ Zero Carbon Technologies (LZT) Review

- ASHP units have been considered and will be used to move away from fossil fuel heating. The solution will future proof the development adopting the decarbonisation strategy aligned with government and local authority policy. The heat pumps will provide heating and hot water whilst optimising the efficiencies associated with heat pumps (SCOP=300%+). They are a viable solution which will be adopted.
- Photovoltaic panels are a viable option, and 4.5kWp has been included within the project.
- Solar Thermal Hot Water is a viable option but is not considered at this time due to limited roof space available for mounting.
- Biomass has been discounted as it poses problems in terms of air quality, delivery of fuel, storage and transportation for deliveries, etc. It would require a centralised larger plant space for storing fuel, which on this constrained site is not viable.
- Micro-wind turbines do not work on this type of development due to problems with wind turbulence and mounting of the units. The wind speeds in the area are not conducive to wind

power electricity generation and there would be issues with turbulence, wind shading, noise and air traffic.

- GSHPs are viable for site but an air source heat pump offers a more cost effective alternative.

A more detailed overview of LZC technologies is provided in the appendices of this report.

12.2. Summary Headlines

- A passive fabric-first approach has been taken to reduce the energy demand of the proposed development at Fairport, Fortis Green London. By focusing on the energy hierarchy, the project offers an efficient and sustainable solution for the life of the building.
- In line with the requirements of the LBH Local Plan, high efficiency air source heat pumps have been chosen for the “Be Green” strategy delivering heating and hot water for the development.
- 4.5kWp photovoltaic panels have been added to assist with reducing the dwelling’s primary energy usage and reduction of CO₂ emissions.
- An overall 88.99% improvement in CO₂ emissions above the Building Regulations baseline and a 60.40% improvement in Primary energy rate. LBH Local Planning Policy has been met.

Table 7 - Summary of Carbon Emissions

	Total CO₂ Emissions (KgCO₂/Yr)	Total Primary Energy (kWh/yr)
Target Dwelling Performance	1,724	9,072
Proposed Dwelling Performance	190	3,592
Total Reduction	1,534	5,480
Percentage Improvement (above ADL1 2021)	88.99%	60.40%

13. Appendices

13.1. LZCT Feasibility Table

Technology	Technical Feasibility	Carbon Savings	Estimated Costs	Financial Viability
Solar photovoltaics	South East facing aspects of the roof support a rooftop array of 4.5kWp to ensure energy consumption is reduced sufficiently.	A 1.0kWp system could save around 490 kg of CO ₂ / year per dwelling.	Average cost for such a system is around £1.5-2K per dwelling.	Current potential income generation is around £230 minimum per annum per dwelling with a fuel cost saving of around £60 / year per dwelling.
Wind	Average wind speeds on the site according to the <u>NOABL</u> Wind Speed Database are 4.9m/s. To be technically feasible a minimum of 6m/s is required, therefore this site is not considered feasible.	N/A	N/A	N/A
Micro Hydro	There is no capacity for micro hydro on this site since there are no local water courses available.	N/A	N/A	N/A
District Heating	There are currently no existing or planned district heating networks to facilitate connection at this stage.	N/A	N/A	N/A
Solar Hot Water	This technology has been discounted as the level of hot water usage in each dwelling does not merit a storage system, which poses space issues.	Around 120 kg of CO ₂ per year per dwelling.	£3-5K per dwelling	Income generation from RHI in a 2 person household would be in the region of £210 / year (per dwelling) with a fuel saving of around £35 / year per dwelling
Heat Pumps	GSHP: Ground conditions on site are unknown, and installation of coils are likely not economically viable for this project. ASHP: An air source heat pump to provide heating and hot water has been proposed	GSHP: 2,100 to 3,300 kg CO ₂ / year per dwelling ASHP: 1,700 to 2,700 kg CO ₂ / year per dwelling.	GSHP @ £13-20K per dwelling ASHP: £7-11K / dwelling	GSHP: fuel saving of £440 / year minimum per dwelling ASHP: fuel saving of £335 / year minimum per dwelling
Biomass	The small scale of this development would not facilitate the installation of biomass boilers due to the space required for pellet storage.	N/A	N/A	N/A

13.2. Specification for the Proposed Development (ADL1A 2021 - SAP)

Item	Brief description	Notes	Confirm
	The following information is required for the design submission (as per requirements of ADL1B).	Please note submission is now in two stages. A) Design , B) As installed	
1. Dwelling Type			
1.1	Building Regulations Part L1A 2021 apply.		
1.2	Postcode of site is Fairport, Fortis Green London		
1.3	Electricity is supplied by standard tariff rather than economy 7, 10 or 24.		
1.4	It is assumed that the dwelling will have a medium thermal mass parameter.		
2. Floor Construction Details			
2.1	Ground Floor construction to achieve U-value	U-Value = 0.12 W/m ² K	
3. Wall Construction Details			
3.1	New external walls to achieve U-value	U-Value = 0.15 W/m ² K	
4. Roof Construction Details			
4.1	Flat, Green or Sloping Roof – to achieve the U-value indicated opposite.	U-Value = 0.11 W/m ² K	
5. Openings			
5.1	New front or rear doors are installed to achieve the U-value stated opposite.	U-Value = 1.2 W/m ² K	
5.2	All new double-glazed windows, rooflights and patio type doors/windows with Low-e glass hard coating to achieve the U-Value stated opposite.	U-value = 1.0 W/m ² K. Non-specialist triple glazed window. g value=0.40	
6. Ventilation			
6.1	Design stage SAP calculation presumes an air permeability of 4m ³ /m ² /hr at 50pa will be achieved.	4m ³ /m ² /hr at 50pa	
6.2	System 4 MVHR installed for all dwelling. SFP<0.75W/l/s and Heat Recovery of 89+%	Nuair MRXBOX-ECO3 K+4 SFP =0.71 & HR= 89%	
6.3	No open flues or fireplaces or flue-less gas fires are present		
7. Space Heating			
7.1	There is only one main heating system installed.	No secondary heating.	
7.2	Heating is provided to by air source heat pump (ASHP)	Vaillant aroTHERM 8kW database ref: 102619	
7.3	The heating system has time and temp zone control		
7.4	Weather compensation is not installed.		
8. Water Heating			
8.1	Hot water is supplied from the ASHP		
8.2	Water usage per person per day considered to be ≤105 Litres.	To meet Part G and London Policy	
8.3	Shower installed will be flow regulated to 9l/min and fed from the HW cylinder		
9. Renewables			
9.1	PV is installed with export capable meter. No battery store or PV divert is included.	4.5kWp PV installed horizontally	
10. Other			
10.1	The Contractor will be responsible for undertaking thermal bridging calculations for each detail to provide a comprehensive set of calculations to meet building regs	Y=0.05 or better as a total of all thermal bridges	

	compliance ADL1 2021. They will be responsible for meeting an overall Y value of 0.05W/mK (summation of all the junctions).		
10.2	Low energy (LE) lights are installed throughout.	Minimum efficiency of 100lumens/circuit watt	
10.3	Windows can be half opened in summer to prevent overheating.	Overheating Part O assessment required for Building Regs	

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