energycounsel
engineering sustainable buildings

Environmental Standards Statement
Ref: Z65118

Proposed 1No.
New Build Dwelling

at

The land to the rear of
8 Fairfax Ave,
Manchester

for

Twana Tariq





Energy Counsel
Viridor House
No.3 Bolholt Terrace
Bury /Gtr Manchester
BL8 1PP
Tel: +44 (0)161-762 1055
Fax: +44 (0)161-761 1094
Matthew.Gibson@energycounsel.co.uk
www.energycounsel.co.uk

DESIGNER CERTIFIED PASSIVE HOUSE DESIGNER
BREEAM ACCREDITED PROFESSIONAL
LOW CARBON ENERGY ASSESSORS
CIBSE Certification Ltd.
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Produced by:		Daniel Smith OCDEA	24th July 2024
Checked by:		Matthew Adams BEng (Hons) LCEA level 5	29th July 2024
Approved by:		Matthew Gibson BEng (Hons) CEng CEnv MIET MEI SocEnv	2nd August 2024

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Executive Summary

This Environmental Standards Statement has been developed in support of demonstrating compliance with planning condition No.13 for the proposed development of 1No. residential dwelling at the land to the rear of 8 Fairfax Ave, Manchester. 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 CO_2 reduction possible for this development to comply with the following planning requirements:

- National Planning Policy Framework (2023)
- Places for Everyone Joint Development Plan 2022 to 2039 (PFE) (March 2024)
- Planning condition No.13 states:
  "Prior to above ground development commencing, an Environmental Standards Statement shall be submitted to, and approved in writing by, the City Council, as Local Planning Authority. The statement shall demonstrate measures to be incorporated into the development to achieve energy efficiency and approved measures shall be implemented in the construction of the approved development"

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

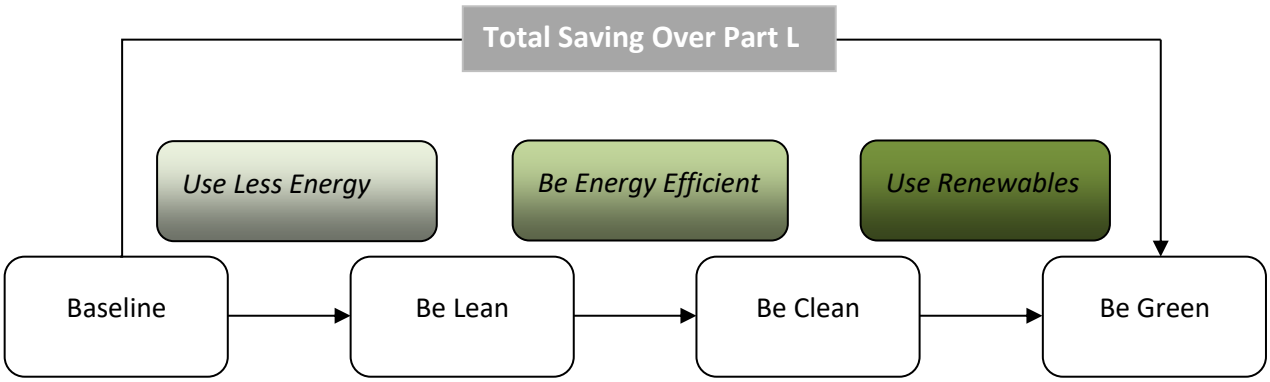
The approach for the residential development is to embed sustainability into the heart of the development through a range of design measures based on the 'Be Lean, Be Clean, Be Green' design hierarchy. Measures will include:

1) Enhanced building fabric to meet the new Building Regulation ADL1 2021 (15/06/2021).
2) Enhanced air tightness and thermal bridging.
3) Efficient continuous mechanical extract only ventilation will be provided to the wet rooms
4) Heating and hot water to be provided by highly efficient air source heat pumps.
5) Efficient lighting strategy primarily using LED type fittings.
6) Photovoltaic panels will be considered for the dwelling.

For the purpose of the assessment, we have evaluated a selection of dwelling types in SAP 10 (Standard Assessment Procedure) to provide an accurate estimate of predicted energy/ CO2 emissions. We have completed SAP calculations based on a representative dwelling type to provide an estimation of the worst-case total energy/emissions on site.

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. The use of air source heat pumps for heating and hot water on the dwelling, achieves the necessary levels of carbon reduction.



The principles of a Be Lean, Be Clean, Be Green philosophy have been applied, resulting in a **66.18%** carbon emissions improvement and a **33.25%** primary energy improvement over Building Regulations Part L1 2021, as indicated in Table 1. A full design specification that confirms inputs used within the SAP calculations is provided within the appendices of this report.

Table 1 - Proposed development CO_2 emissions against Building Regulations Part L1 2021

	Total CO_2 Emissions ($kgCO_2/yr$)	Total Primary Energy (kWh/yr)
Target Dwelling Performance	**1,904**	**10,032**
Proposed Dwelling Performance	**644**	**6,697**
Total Reduction	**1,260**	**3,335**
Percentage Improvement (above ADL1 2021)	**66.18%**	**33.25%**

1. Introduction

The proposed development consists of 1No. residential dwelling located at the land to the rear of 8 Fairfax Ave, Manchester. The development is required to comply with planning condition No.13, achieve compliance under Building Regulations Approved Document Part L1 (2021) and meet Places for Everyone Joint Development Plan's planning 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:

- National Planning Policy Framework (2023)
- Places for Everyone Joint Development Plan 2022 to 2039 (March 2024)
- Planning condition No.13 states:
  "Prior to above ground development commencing, an Environmental Standards Statement shall be submitted to, and approved in writing by, the City Council, as Local Planning Authority. The statement shall demonstrate measures to be incorporated into the development to achieve energy efficiency and approved measures shall be implemented in the construction of the approved development"

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 CO_2 emissions will be made based on the calculation methodology dictated by the Standard Assessment Procedure (SAP) and in line with the requirements of PFE's planning policy.

1.1. Location

The proposed development at the land to the rear of 8 Fairfax Ave in Manchester is highlighted by the red line boundary shown in Figure 1.



Figure 1 - Location of proposed residential development.

The site will be accessed off Essex Avenue, Manchester. Existing residential development surrounds the development. The site is a typical suburban site.

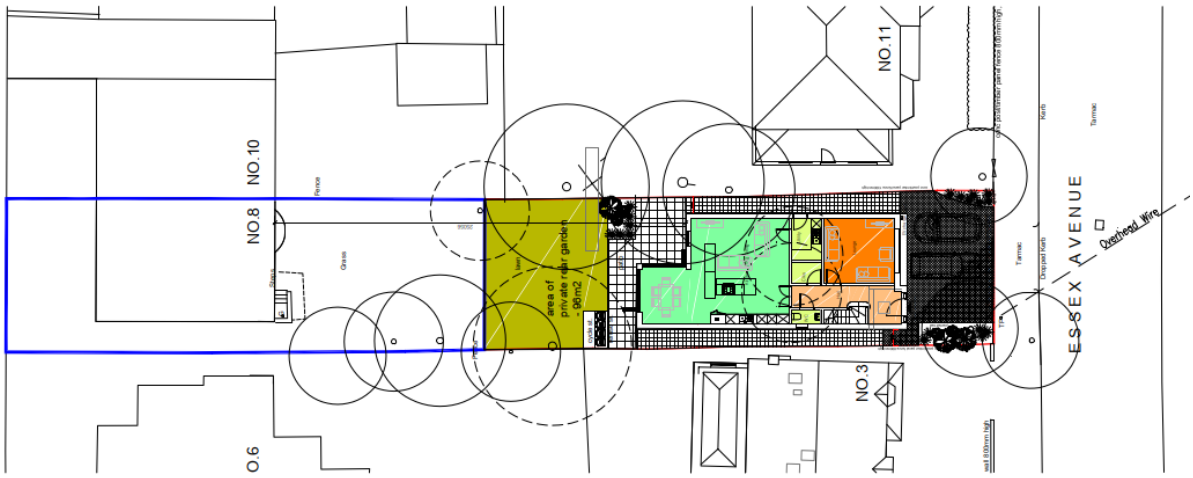


Figure 2 – Site plan for the proposed residential development.

The proposed development consists of 1No. dwelling to the rear of the existing property at 8 Fairfax Avenue, as indicated in Figure 2 above.

2. Policy Drivers for Energy Efficiency and Renewable Energy

This section presents a range of planning policy that is applicable to the residential development, at both a national and a local level.

2.1. National Policy

The National Planning Policy Framework was published in July 2021 (amended in December 2023) 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 a low carbon future in a changing climate, taking full account of flood risk and coastal change. It should help to: Shape places in ways that contribute to radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience; encourage the reuse of existing resources, including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure.	This development will follow the principles set out in the Places for Everyone Joint Development Plan 2022 to 2039 (March 2024), using a 'Be Lean, Be Clean, Be Green' approach in reducing operational carbon emissions. An overview of current decentralised energy schemes in Manchester and an assessment on the potential for future schemes in relation to this development is provided in Section 6 of this report. This sustainability and renewable energy statement appraises site specific information to determine the most appropriate approach to minimise energy consumption.

2.2. Local Policy

The adopted Places for Everyone Joint Development Plan 2022 to 2039 (March 2024) provides a set of guidelines for new development within Greater Manchester. All relevant energy policy within these documents is provided within this section together with a design response.

Table 3 – Key Local Planning Policy Requirements and Design Responses

Places for Everyone Joint Development Plan 2022 to 2039 (March 2024)		
Section	**Policy Requirements**	**Design Response**
Policy JP-S1: Sustainable Development	To help tackle climate change, development should aim to maximise its economic, social and environmental benefits simultaneously, minimise its adverse impacts, utilise sustainable construction techniques and actively seek opportunities to secure net gains across each of the different objectives. Carbon and Energy Within this, new development will have a critical role to play and all new homes and commercial/industrial buildings will need to achieve net zero carbon by 2028.The definition of net zero carbon development has been established by the UK Green Building Council. It is expected that development in the Plan area will apply a net zero carbon approach to operational emissions up until 2028, thereafter emissions in construction should be considered. Minimum carbon reduction targets will be set in line with the Future Homes Standard of 80% or until such a time this is superseded. To provide further confidence in decision making, supporting research23 was commissioned to outline how the pathway to 2028 can be achieved for 'net zero in operation'24 by setting out critical milestones and measures that would be expected when following the energy 'hierarchy' and adopting a fabric first approach. 5.17 Based on the evidence which has informed the 5 Year Environment Plan and achieving net zero carbon in new development, this has shown that there will need to be a significant increase in photovoltaic technology. Therefore, where planning applications for residential development are accompanied by an energy statement, the following best practice thresholds should be seen as the starting point in relation to reducing energy demand and onsite renewable energy generation. The thresholds set out in Table 5.1, for post 2025, are consistent with the GM Five Year Environment Plan.	The proposed development will follow the principles of the Energy Hierarchy by adopting a passive fabric-first approach to design rather than adopting the use of renewable technologies. A full energy strategy is provided in Section 8 of this report, following an appraisal of a range of site-specific measures in line with the 'Be Lean, Be

<table>
<tr>
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Table 5.1 Best Practice Thresholds for Reducing Energy Demand and Onsite Renewable Energy Generation within residential developments
<table>
<tr><th>-</th><th>Space Heat Demand[25]</th><th>Hot Water Energy Demand[26]</th><th>Renewable Energy Generation Targets</th></tr>
<tr><td>2021 - 2025</td><td>Houses (30kWh/m2)

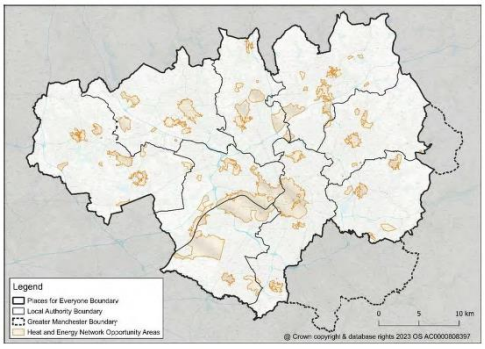
Flats (25kWh/m2)</td><td>20% energy demand reduction in the total heat required for water heating</td><td>*Photovoltaic installation: 20% ground floorspace</td></tr>
<tr><td>2025 - onwards</td><td>Houses (20kWh/m2)

Flats (15kWh/m2)</td><td>^20% energy demand reduction in the total heat required for water heating</td><td>*Photovoltaic installation: 40% ground floorspace</td></tr>
<tr><td>*Ground floorspace used as a proxy for available roof area.</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>^Will need to be reviewed with Future Homes Standard 2025 to determine if savings already embedded.</td><td>-</td><td>-</td><td>-</td></tr>
</table>
5.19 By following the energy hierarchy, new development will need to achieve net zero carbon through the maximisation of on-site measures first. However, in circumstances where a development has demonstrated that the hierarchy has been followed and there are no reasonable alternatives to meet the minimum carbon reductions, then payment to offset remaining emissions will also be required. Such payments should be expected to fund other carbon saving programmes within Greater Manchester to help meet the 5 Year Environment Plan targets (such as energy efficiency retrofit and renewable energy installations).
</td>
<td>Clean, Be Green' approach.

A fabric first approach to the development is a much preferred method with the use of highly efficient air source heat pump to the dwelling.</td>
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<tr>
<td>Policy JP-S2: Carbon and Energy</td>
<td>The aim of delivering a carbon neutral Greater Manchester no later than 2038, with a dramatic reduction in greenhouse gas emissions, will be supported through a range of measures including:
1. Promoting the retrofitting of existing buildings with measures to improve energy efficiency and generate renewable and low carbon energy, heating and cooling;
2. Promoting the use of life cycle cost and carbon assessment tools to ensure the long-term impacts from development can be captured;
3. Taking a positive approach to renewable and low carbon energy schemes, particularly schemes that are led by, or meet the needs of local communities;</td>
<td>Renewable technologies have not been specified for this development due to financial viability and ongoing</td>
</tr>
</table>

	4. Increasing the range of nature-based solutions including carbon sequestration through the restoration of peat-based habitats, woodland management, tree-planting and natural flood management techniques; 5. An expectation that new development will, unless it can be demonstrated that it is not practicable or financially viable; a. Be net zero carbon which applies: • from adoption– to regulated operational carbon emissions; • from 2028 -to all emissions 'in construction'. From 2025 development should also calculate and minimise carbon emissions from unregulated emissions alongside regulated emissions. Development proposals should set out how this has been achieved in an energy statement in accordance with the energy hierarchy, which in order of importance seeks to: i. Minimise energy demand; ii. Maximise energy efficiency; iii. Use renewable energy; iv.Use low carbon energy; and v.Utilise other energy sources. From 2025 any residual carbon emissions that cannot be fully mitigated on-site should be offset, in agreement with the relevant local planning authority through a financial contribution to a carbon offset fund. As an interim measure, development should be consistent with the 2022 Part L Building Regulations unless superseded by changes to building regulations and/or national or local planning policies. b. Incorporate adequate electric vehicle charging points, in line with Part S of the Building Regulations, unless superseded by relevant Local Plan policies, to future proof for the likely long-term demand, taking account of the potential maximum energy demand for the site; c. Where practicable, prioritise connection to a renewable energy/heating/cooling network in the first instance or a low carbon energy/heating/cooling network that is adaptable to non-fossil fuels at a later date; d. In residential developments, achieve energy demand reductions in terms of space heat demand; hot water energy demand and the delivery of on-site renewable energy generation, in accordance with Table 5.1. For renewable energy generation priority should be given to PV installation where technically feasible, alternative technologies will be appropriate where the equivalent generation is evidenced.	maintenance issues.

	Include a detailed energy statement to demonstrate via site relevant evidence how the development has sought to maximize reductions in carbon emissions in line with relevant policy targets, including the minimisation of overheating risks and appropriate measures for post occupancy evaluation.	
Policy JP-S3: Heat and Energy Networks	The provision of decentralised energy infrastructure is critical to the delivery of our objectives for low carbon growth, carbon reductions and an increase in local energy generation. The following measures will help to achieve this: 1. Delivery of renewable and low carbon energy schemes will be supported with particular emphasis on the use of decentralised energy networks in areas identified as "Heat and Energy Network Opportunity Areas". These have been identified where: • Existing heat/energy networks are operational or have been commissioned; • Proposals for new heat networks/energy networks are being progressed, or future opportunities have been identified in city-region master planning; • Sufficient density of existing heat demand occurs; and • Significant future development is proposed at the strategic development locations. 2. Within the identified "Heat and Energy Network Opportunity Areas", unless it can be demonstrated that there are more effective alternatives for minimising carbon emissions or such connection is not practicable or financially viable, it is expected that: • New residential developments that are '10 dwelling or more' or other developments over 1,000 m2 floorspace shall: a. Connect to an existing or planned heat/energy network or be designed to enable future connection (where within 500m of such a network); and/or b. Install a site-wide or communal heat/energy network solution. • An expectation that new industrial development will demonstrate that opportunities for using waste heat locally have been fully examined, and included in proposals; • An expectation that where publicly-owned buildings and assets adjoin new major development sites, opportunities for these buildings and assets to connect to site-wide proposals will be considered; and • An expectation that any site-wide networks will be designed so as to enable future expansion to adjoining buildings or assets as appropriate.	An overview of the site in relation to current decentralised networks in the region is provided in Section 6.1. A review of district heating opportunities is provided in Section 6 of this report, in line with current local development. The proximity of the site to current decentralised energy networks is illustrated within Section 6.1 of this report. Due to the relatively

	Figure 5.1 Heat and Energy Network Opportunity Areas  Flood Risk and the Water Environment 5.39 Climate change and population and economic growth can put increasing pressure on the available potable water supply for homes and businesses. It is important that water is conserved and efficiently used as much as possible to help build resilience to periods of drought; avoid over abstraction; reduce carbon emissions from water treatment and disposal; and protect river and wetland habitats from degradation. All new homes have to meet mandatory national standard set out in Building Regulations (of 125 litres/person/day). Where there is a clear local need, the government's Housing Optional Technical Standards paragraph 013 and 014 set out that local authorities may also consider tighter water efficiency requirements for new homes (110 litres a day) to help manage water demand. This will be determined through the preparation of district local plans.	small scale of the development, the development of an energy centre would not be a feasible design solution.

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 CO_2 emissions of the development to meet Building Regulations and then compare the proposed improvement measures against this baseline. Building Regulations Part L1 2021 (SAP) applies to the dwelling and provides carbon emissions from regulated energy.

The building can then be benchmarked/ thermally modelled using the energy hierarchy:

1. Be Lean *A reduction in energy use as a result of passive design and energy efficiency*
Thermal performance of envelope (U values) Glazing design Airtight construction Efficient mechanical ventilation Variable speed fans and pumps Efficient lighting
2. Be Clean *A focus on supplying energy to the development through efficient means*
Connect to low carbon heat networks Develop site wide heat network from single energy centre On site district heating network Provide energy efficient individual heating
3. Be Green *The installation of renewable technologies to meet energy demand where possible*
Consider the feasibility of renewable energy technologies Assess the integration of renewable technologies based on the above measures

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 (energy efficiency improvements, district heating, etc.) and finally the use of renewable energy technologies, where practical. This hierarchy complements the integrated approach to the sustainable energy objectives of the energy hierarchy, as set out in the PFE (2024) planning policies.

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 ADL1 2021 (SAP 10), 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 10 calculations for the dwelling. Under Building Regulations Part L1 2021, dwelling must comply with all three metrics set by the notional building shown below.

- 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)
- Dwelling Fabric Energy Efficiency Rate (DFEE) must be lower or equal to the Target Fabric Energy Efficiency Rate (TFEE)

SAP 10 is the Governments Standard Assessment Procedure (SAP) for calculating the energy aspects of a dwelling. SAP is a measure of fuel costs for heating, hot water and lighting for a dwelling. SAP 10 can also be used to ascertain the energy requirements of a development.

To assess the baseline carbon emissions, we must make an estimation of the energy demands through Building Regulations in order to set a target upon which the actual development can be compared.

a. Predicted Baseline Energy Requirements

The predicted baseline CO_2 emission and primary energy demands for the development.

Our Ref	Floor Area m^2	TER (Kg CO2/ yr/m2)	TPER (kWh/yr/m2)	Total Target Carbon Emissions (Kg CO2/yr)	Total Target Primary Energy (kWh/yr)
Z65118	183.97	10.35	54.53	1,904	10,032
Total				**1,904**	**10,032**

Table 4 - Baseline dwelling carbon emissions and primary energy

The baseline carbon emissions rate for the development is **1,904 KgCO_2/yr** and the baseline primary energy rate is **10,032 kWh/yr**.

5. Passive Design and Energy Efficiency

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 set out in the Places for Everyone Joint Development Plan (2024). The development will seek to consider all aspects and principles of sustainable development, taking into account environmental, social and economic impacts.

a. 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, rather than offsetting a poorer performance with LZC contributions.

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.

Passive solar design is an architectural approach that uses the building's design and materials to collect, store, and distribute solar energy for heating, cooling, and lighting. When applied to a dwelling, passive solar design can significantly reduce energy consumption and enhance living comfort. Here are the key points we have considered:

1. Orientation and Layout

- The building is orientated to maximize exposure to sunlight within the constraints of the existing site layout.

2. Window Placement and Design

- Large windows are positioned to maximise solar heat during the winter.
- The scheme is proposing High-Performance Windows with low-emissivity coatings
- The scheme is using glazing with appropriate solar transmittance g values to optimise solar gain.

3. Thermal Mass

- Materials with a medium / high thermal mass, like concrete, brick, or stone, absorb and store heat during the day and release it at night.

- The scheme Integrates thermal mass strategically in floors, walls, or other structural elements to moderate indoor temperatures.

4. Insulation and Air Sealing

- High levels of Insulation are proposed for walls, roofs, and floors to minimize heat loss.
- The building envelope is well-sealed to prevent drafts and heat leakage with low air tightness.

5. Natural Ventilation

- The scheme will be provided with natural openable windows to assist with purge ventilation and occupier comfort.
- Efficient MEV ventilation is proposed to assist with health and wellbeing**.**
- Party walls are fully filled to prevent thermal bypass from the stack effect.

6. Daylighting

- Window placement is optimized to maximize natural light, reducing the need for artificial lighting.

7. Landscaping and Surroundings

- Planting of deciduous trees on the South side could provide shade in summer and allow sunlight in winter.
- Use evergreen trees or other barriers can be used to block cold winter winds, reducing heating demands.

8. Building Shape and Size

- A compact building shape reduces surface area and, thus, heat loss.

9. Sustainable Materials and Design

- Use sustainable and low-embodied energy materials will be considered to minimize environmental impact.

By integrating these passive solar design principles, the dwelling can achieve greater energy efficiency, lower operational costs, and improved comfort for residents.

b. Energy Efficient Systems

Options have been reviewed for improving the energy efficiency of the development by installing an efficient hot water and heating system. The dwelling will benefit from high efficiency air source heat pump to deliver heating and hot water. The dwelling will also be provided with a metering scheme based on their electricity usage.

A low energy mechanical extract only ventilation system will be provided to the dwelling within each kitchen and bathroom.

6. District & Communal Heating Networks

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

a. 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 CO_2 emissions is to reduce the reliance on centralised power stations. This means increasing the use of local, low-carbon energy supplies through de-centralised 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.

A number of heat network opportunities across the region are at various stages of 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

The PFE policy requires consideration of DHN connection if within 500m of the site. There are currently no existing district heating networks within proximity to the site. The nearest district heating network is located at Christie Hospital over 0.5 mile north of the site.

b. New Heating Networks – Options

Consideration has been given to adopting a centralised or decentralised energy strategy. A de-centralised energy option would typically be an energy centre distributing heat, hot water and electricity to the development from a single source either as a DHN or CHN. This typically would

include boilers and a CHP type unit or district heat pumps, sized to provide the whole development. Sometimes multiple energy centres are used to split the loads, provide resilience and to serve different buildings.

The proposed heating and hot water demand from the development of 1No. dwelling is not sufficient to justify a DHN or CHN. The existing site is spatially constrained, there is insufficient space to locate the equipment and associated plant, and connection to a DHN would be cost prohibitive.

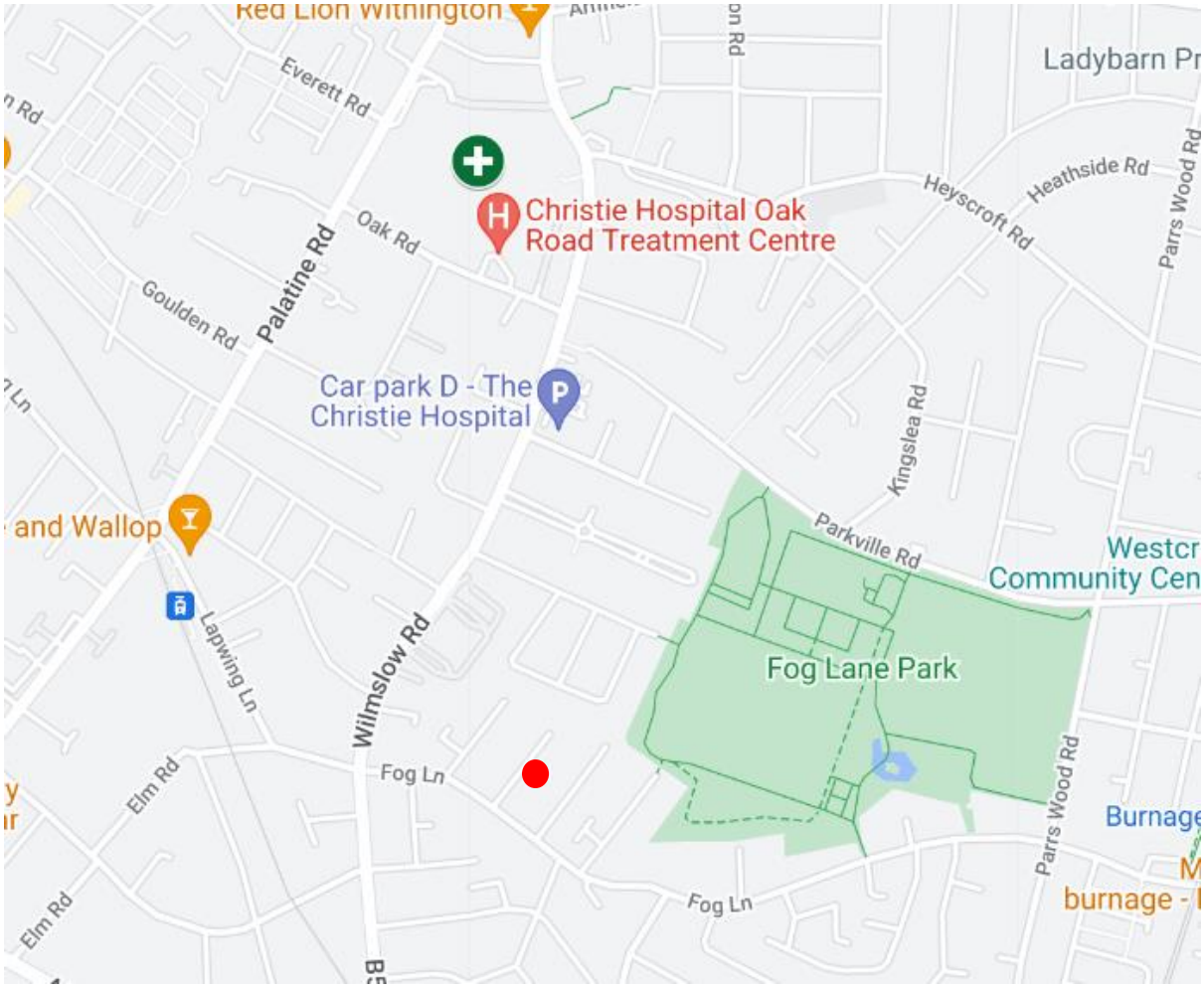


Figure 3 - District heating networks nearby site (indicated by red dot)

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 Places for Everyone Joint Development Plan (2024).

This renewable energy 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

a. 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.

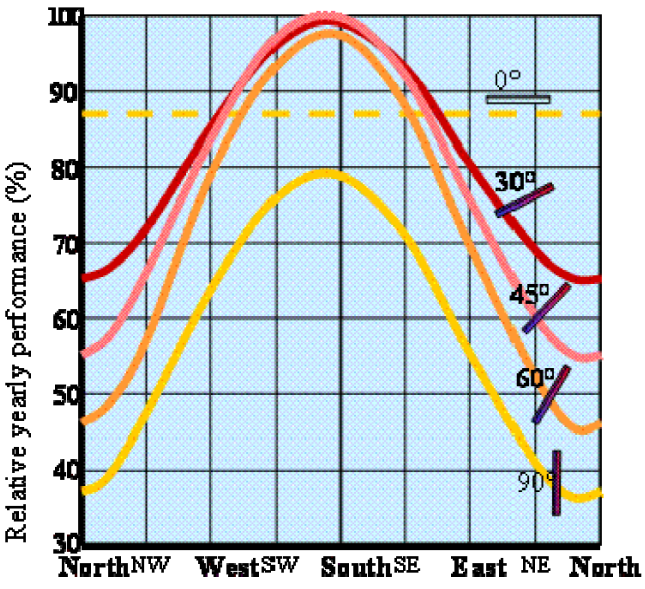


Figure 4 - Performance of photovoltaic panel orientation

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. The roof must be strong enough to take the weight of the panels, 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 35° and 45° and oriented south of west or east are generally suitable. If solar

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 to the right:

The cost to install PV is typically £1,500 – 2,000 per kWp for 'on-roof' panel systems.

Photovoltaic Panels to be considered where feasible in accordance with Policy JP-S1 in line with the Places for Everyone Joint Development Plan.



Figure 5 - Photovoltaic array on a pitched roof

b. 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.

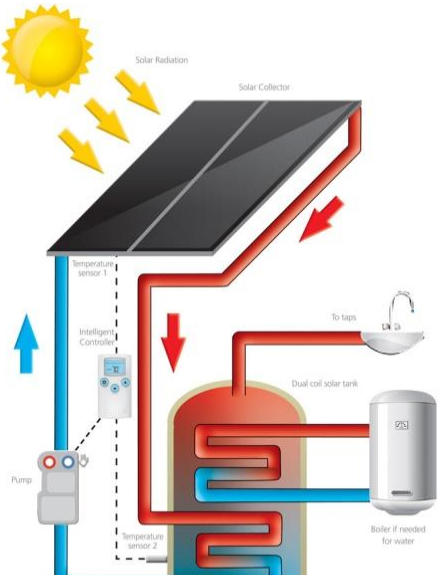


Figure 6 - The principles of a solar thermal system

A typical installation in the UK has a panel size of 3-5m^2 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.

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 are applied 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 4-5% are achievable with this technology. The dwelling are unlikely to require sufficient hot water storage to deem solar thermal a feasible technology for this site. For the reasons aforementioned we do not consider this a viable option for this scheme.

c. 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 apartments 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 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.

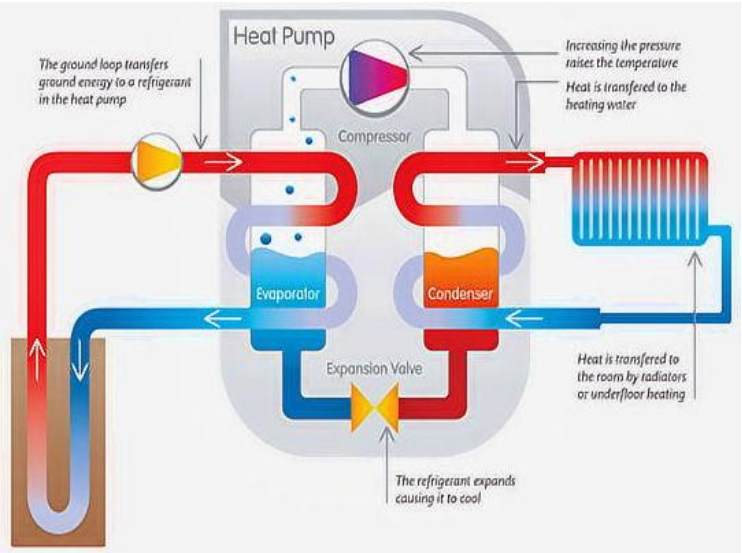


Figure 7 - Principles of a GSHP system

Due to the scale of these dwelling units, GSHPs are not considered an appropriate design solution.

d. Air Source Heat Pump/Exhaust Air Heat Pump/ Hot Water Heat Pumps

Air source heat pumps (ASHP), exhaust air heat pumps (EAHP) and Hot Water Heat Pumps (HWHP) 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.

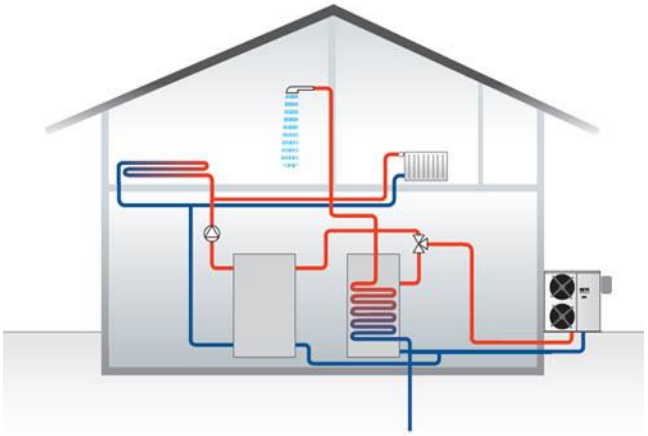


Figure 8 - Principles of an ASHP system

Exhaust air heat pumps (EAHP) 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 dwelling 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.

Hot Water Heat Pumps (HWHP) are considered the most appropriate technology for this scheme and can be utilised to deliver efficient hot water throughout the dwelling. The introduction of this technology ensures that carbon emissions reductions can be provided in line with Places for Everyone Joint Development Plan's Core Strategy and planning condition No.13.

e. 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 dwelling
- Mast mounted – Which are free standing

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.
- The ideal site is a smooth top hill with a flat, clear exposure, free from excessive turbulence and obstructions such as large trees, dwelling 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



Figure 9 - Mounted wind turbine

As this development is in an urban area there will be obstacles which reduce wind speed. The average wind speed in this area is 4.6 m/s at a height of 10 metres, which is less than the 6 m/s required. Therefore, micro wind is not a viable technology for this development. Please refer to section 9.1 for more details.

f. 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.

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 re 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.



Figure 10 - Biomass boiler and hopper

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 a communal heating system; 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 residential development 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, air-tight envelope, passive improvements and the use of highly efficient heat pumps supported by efficient ventilation system.

Be Lean

The development proposal achieves carbon efficiency reductions through a highly efficient thermal fabric, improved thermal bridging and low air leakage following the Be Lean methodology defined in the Energy Hierarchy. In order to demonstrate that the fabric has been designed adequately, we have compared our current fabric specification with the minimum standards set out in Part L Building Regulations ADL1 2021.

Table 5 - Proposed specification compared against the minimum part L standards.

Parameter		Maximum Allowable U-Value ADL 2021	Proposed Spec U Values	Betterment on ADL 2021
Roof	Flat Roof	0.16	0.14	12.5%
	Warm Roof		0.12	25%
External Wall		0.26	0.18	31%
Ground Floor		0.18	0.11	39%
Window		1.60	1.2	25%
Door		1.60	1.2	25%
Air permeability		8.0m3/(hm2)@50PA	5.0m3/(hm2)@50PA	37.5%
Thermal Bridging		0.2	0.05	80%

Be Clean

In line with be clean methodology, we have reviewed the feasibility of connecting into a heat network which is further discussed in section 6. To summarise, the PFE policy requires consideration of DHN connection if within 500m of the site, there are currently no existing district heating networks within a 500m radius to the site. The nearest district heating network is located at Christie Hospital just over 0.5 mile north of the site.

Consideration has been given to adopting a centralised or decentralised energy strategy. A de-centralised energy option would typically be an energy centre distributing heat, hot water and

electricity to the development from a single source either as a DHN or CHN. This typically would include boilers and a CHP type unit or district heat pumps, sized to provide the whole development. Sometimes multiple energy centres are used to split the loads, provide resilience and to serve different buildings.

The proposed heating and hot water demand from the development of 1No. dwelling is not sufficient to justify a DHN or CHN. The existing site is spatially constrained, there is insufficient space to locate the equipment and associated plant, and connection to a DHN would be cost prohibitive.

Be Green

The development proposal achieves 'be green' carbon/energy efficiency reductions through highly efficient heat pumps for heating and/or domestic hot water to reduce emissions in line with PFE's Core Strategy. Consideration has also been given to Photovoltaic panels, where deemed feasible.

Table 6 - Proposed Carbon Emissions from the residential development

Ref	TER	DER	TPER	DPER	Total Carbon Emissions (Kg CO2/yr)	Total Primary Energy (kWh/yr)
Z65118	10.35	3.50	54.53	36.40	644	6,697
	66.18%		33.25%			
Total						

The predicted carbon emissions for the proposed development is **644** $kgCO_2/yr$. This is a total CO_2 emission reduction of **1,260** $kgCO_2/yr$ from the baseline emissions of **1,904** $kgCO_2/yr$. This equates to a **66.18%** CO2 emission reduction.

The predicted primary energy rate for the proposed development is **6,697** kWh/yr. This is a primary energy reduction of **3,335** kWh/yr from the baseline primary energy rate of **10,032** kWh/yr. This equates to an **33.25%** primary energy reduction.

9. Policy JP-S1

In accordance with Policy JP-S1, the dwelling should be below the maximum allowable space heating and hot water energy demands set out in table 5.1 below.

Table 5.1 Best Practice Thresholds for Reducing Energy Demand and Onsite Renewable Energy Generation within residential developments

-	Space Heat Demand[25]	Hot Water Energy Demand[26]	Renewable Energy Generation Targets
2021 - 2025	Houses (30kWh/m2) Flats (25kWh/m2)	20% energy demand reduction in the total heat required for water heating	*Photovoltaic installation: 20% ground floorspace
2025 - onwards	Houses (20kWh/m2) Flats (15kWh/m2)	^20% energy demand reduction in the total heat required for water heating	*Photovoltaic installation: 40% ground floorspace
*Ground floorspace used as a proxy for available roof area.	-	-	-
^Will need to be reviewed with Future Homes Standard 2025 to determine if savings already embedded.	-	-	-

Table 7 – Proposed Space Heating and Hot Water Energy Demand

Our Ref	Dwelling Space Heating Demand (kWh/m²)	Dwelling Hot Water Energy Demand (kWh/m²)	Target Hot Water Energy Demand (kWh/m²)
Z65137	39.81	8.43	17.31
Total			

With a very good passive solution, the shape and form of the proposed dwelling makes compliance with the space heating demand target very challenging. The hot water target has been met and exceeded by using an air source heat pump.

We have also reviewed the feasibility of connecting into an existing DHN however there are none within a 500m radius of the site as PFE policy requires for consideration of connection. There are currently no existing district heating networks within proximity to the site. The nearest district heating network is located at Christie Hospital over 0.5 miles north of the site.

The proposed heating and hot water demand from the development of 1No. dwelling is not sufficient to justify a DHN or CHN. The existing site is spatially constrained, there is insufficient space to locate the equipment and associated plant, and connection to a DHN would be cost prohibitive and therefore has been discounted.

10. Sustainable Design and Construction

The design currently includes a number of components that gives the scheme a solid grounding in relation to sustainability. The list below is not exhaustive but spans a range of areas as follows:

a. Management

- The contractor will manage and monitor environmental issues during construction process in accordance with their company policy and site management plan. It may include the monthly monitoring and management of energy and water consumption of site activities, separation, streaming and recycling of waste, the reduction of air, dust and ground pollution.

b. Health and Wellbeing

- External and internal lighting to the proposed development will be highly efficient and will comply with all current guidelines and regulations.

c. Energy

- The development will be designed and constructed to achieve low energy and carbon dioxide emissions, improving upon current Building Regulations Part L 2021 using the Be Lean, Be Clean, Be Green energy hierarchy.
- Dedicated energy efficient lighting will be installed internally and externally. The efficacy and colour rendering index ratings will be considered.
- Unregulated energy demand will be assessed and minimised where possible through the selection of energy-efficient appliances and systems.

d. Water

- The proposed development 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 to ensure that a maximum of 125 litres of water is consumed per person per day. Suggested water appliance usage details are shown in Table .
- Internal water consumption will be reduced using low flush/ flow appliances. This will include appliances such as aerated and flow regulated taps, low-flow showers and dual flush toilets, where practicable.

Table 8 - Recommend water consumption for residential appliances

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	6	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**

e. Materials

- All building and construction materials used on the schemes will aim to be sought from environmentally managed accreditation schemes, (such as EMAS/ ISO 14001 accreditation). All timber will be sourced from a certified chain of custody. All other building materials on this project will be responsibly sourced, where practicable.
- Insulation will have low environmental impact in use and during manufacture.

f. Waste

- Wherever practicable, site waste as a result of the development will be diverted from landfill.

11. Conclusion

Following the 'Be Lean, Be Clean, Be Green' hierarchy, the proposed design solutions on the residential development are predicted to:

1) Reduce the total carbon emissions by 66.18% compared to new Building Regulations ADL 2021.
2) Air source heat pumps are the proposed renewables/ low carbon technology. Their contribution to the overall energy reduction under the 'be green' energy hierarchy is approx. 50%.
3) Reduce the total primary energy by 33.25% compared to new building regulations ADL 2021. This is a new metric under Part L 2021.
4) Dwelling is complaint with the PFE space heating demand figures set out in table 5.1.
5) There are no DHN within a 500m radius of the site as PFE policy requires for consideration of connection. The nearest district heating network is located at Christie Hospital over 0.5 mile north of the site.
6) The dwelling adheres to planning condition No.13.

The approach for the residential 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' design hierarchy. Measures will include:

1) Enhanced building fabric to meet the new Building Regulation ADL1 2021 (15/06/2021).
2) Enhanced air tightness and thermal bridging.
3) Efficient continuous mechanical extract only ventilation will be provided to the wet rooms.
4) Heating and hot water will be provided by highly efficient air source heat pump.
5) Efficient lighting strategy primarily using LED type fittings.
6) Photovoltaic panels will be considered for the dwelling.

a. Low/ Zero Carbon Technologies (LZT) Chosen

- Air Source Heat Pumps (ASHP) are viable and are considered most suitable on this development for the following reasons:

a) The ASHP achieves a 50%+ reduction in CO2 emissions based on the SAP 10 ADL1 2021 standards.
b) Every dwelling benefits directly from the heat pump performance.
c) ASHP efficiency SCOP of circa 350% contributes towards reducing CO2 and energy usage.
d) Heat pumps require annual standard maintenance and have a long service life.

b. Low/ Zero Carbon Technologies (LZT) Considered

- Solar Thermal Hot Water is viable however it is discounted for the following reasons:

a) The dwelling will have a HW cylinder but solar thermal is not proposed as the hot water is being supplied from an efficient air source heat pump.

b) CO_2 savings from this technology are not significant enough to justify the cost of these systems.

c) Increased maintenance and operating costs. These include annual service, heat transfer fluid changes and filter changes.

d) Access to the roof will require RAMS and is high risk item.

- Hot Water Heat Pumps (HWHP) are viable is viable however it is discounted for the following reasons:

a) HWHP are useful for smaller apartment schemes. However, for larger dwellings the space heating load is higher than the hot water load and therefore a full air source heat pump is preferred over a hot water heat pump.

- PV is viable and has been considered suitable on this development for the following reasons:

a) CO_2 savings are beneficial and could be considered as a future retrofit solution to meet zero carbon.

b) Over time, photovoltaic panels offer a cost-effective solution for energy generation, with decreasing installation costs and long-term savings on electricity bills, making them financially viable for development projects.

- Biomass has been discounted for the following reasons:

a) It poses problems in terms of delivery of fuel.

b) It poses problems in terms of noise and air quality issues.

c) Storage and transportation for deliveries would be required.

d) It would require a centralised larger plant space for storing fuel, which on this constrained site is not viable.

- Micro-wind has been discounted for the following reasons:

a) Turbines do not work on this type of development due to problems with wind turbulence and mounting of the units.

b) 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.

- Ground Source Heat Pumps (GSHP) are potentially viable for site but have not been chosen for the following reasons:

a) The size of the development is very small for a GSHP system. Costs increase for smaller developments.
b) Ground conditions are unknown which is a large risk item.
c) Site spatial requirements are limited and unfeasible for vertical bore holes or horizontal slinky type units.
d) Financial costs of installing ground source bore holes are a significant and unaffordable. Furthermore, the proposed solution provides significant CO2 savings comparable with a ground source ambient heat loop.

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

c. Summary Headlines

- A fabric-first approach to meeting PFE's Core Strategy energy policy has been undertaken for the residential development, defined within the 'Be Lean, Be Clean, Be Green' energy hierarchy. The proposed design provides compliance with Building Regulations ADL1 2021, and with the application of an air source heat pump providing heating and hot water at 350%+ efficiency it ensures CO2 and primary energy reductions.
- The use of high-efficiency heat pumps reduces carbon emissions by 66.18% and provides a primary energy reduction of 33.25% when compared to new Building Regulations Part L 2021.
- There is no District Heat Network (DHN) within a 500m radius of the site as PFE policy requires for consideration of connection.
- Development is complaint with planning condition No.13.

An overall 66.18% improvement in CO_2 emissions and a 33.25% improvement in primary energy above the Building Regulations baseline is proposed to support our application.

	Total CO_2 Emissions ($kgCO_2/yr$)	**Total Primary Energy (kWh/yr)**
Target Dwelling Performance	**1,904**	**10,032**
Proposed Dwelling Performance	**644**	**6,697**
Total Reduction	**1,260**	**3,335**
Percentage Improvement (above ADL1 2021)	**66.18%**	**33.25%**

12. Appendices

a. LZT Feasibility Table

Technology	Technical Feasibility	Carbon Savings	Estimated Costs	Financial Viability
Wind	Average wind speeds on the site according to the NOABL Wind Speed Database are 4.6m/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 no existing or planned district heating networks to facilitate connection at this stage.	N/A	N/A	N/A
Heat Pumps	GSHP: Ground conditions on site are unknown, and installation of coils are likely not economically viable for this project. ASHP: Provided for heating and hot water.	GSHP: 2,100 to 3,300 kg CO2 / year per dwelling ASHP: 1,700 to 2,700 kg CO2 / year per dwelling. HWHP: 1,700 to 2,700 kg CO2 / year per dwelling.	GSHP @ £13-20K per dwelling ASHP: £7-11K / dwelling ASHP: £3K / dwelling	GSHP: £2,590 minimum annual RHI income generation per dwelling with fuel saving of £440 / year minimum per dwelling ASHP: RHI removed. Fixed £5000 grant fund per property. HWHP: N/A
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

b. Specification for Energy Assessments (ADL1 2021 – SAP 10)

Item	Brief Description	Notes	Confirm
	The following information is required for the design submission (as per requirements of approved doc L1A)	Please note submission is now in two stages. A) **Design**, B) As installed	
1. Dwelling Type			
1.1	New Building Regulations 2021 applies.	The Contractor is responsible for meeting Building Regs 2021 compliance including part L (energy), F (ventilation), O (overheating), G (water consumption), E (sound) and S (Elec Vehicle Charging).	
1.2	Full address and Post code of site to be provided from Royal Mail.		
1.3	Electricity is supplied by standard tariff rather than economy 7, 10 or 24.	Assumed Standard tariff.	
1.4	It is assumed that the dwelling have a Medium thermal mass parameter.		
2. Floor Construction Details			
2.1	Ground floor is insulated to achieve the U-value stated opposite. 150mm PIR insulation or equivalent.	U-Value = 0.11 W/m²K P/A ratio dependent.	
3. Wall Construction Details			
3.1	Main external walls to achieve the U-value stated opposite.	U-Value = 0.18W/m²K.	
3.2	Dormer walls to achieve the U-value stated opposite.	U-Value = 0.24W/m²K.	
4. Roof Construction Details			
4.1	Flat roofs are insulated to achieve the U-value indicated opposite.	U-Value = 0.14 W/m²K.	
4.2	Warm sloping roofs are insulated to achieve the U-value stated opposite.	U-Value = 0.12 W/m²K.	
5. Openings			
5.1	External doors are installed to achieve the U-value stated opposite.	U-Value =1.2 W/m²K.	
5.2	All double-glazed windows and patio type doors/windows with Low-e glass hard coating to achieve the U-Value stated opposite.	U-value=1.2 W/m²K frame and glazing BFRC certified G-Value=0.4	
5.3	Roof lights double-glazed with Low-e glass hard coating to achieve the U-Value stated opposite.	U-value = 1.4 W/m²K frame and glazing G-Value=0.4	
6. Ventilation			
6.1	Design stage SAP calculation presumes an air permeability of 5m³/m²/hr at 50pa will be achieved.	Dwelling tested and certificated.	
6.2	Mechanical extract ventilation system is installed in wet areas.	Greenwood Unity CV3 or equal and approved.	
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	The pump and cylinder are inside the dwelling.	Within the heated space.	
7.3	Space heating and hot water is provided by air source heat pumps. HP kW Size to be determined by Contractor	Vaillant aroTHERM 12kW with AI used for calculation or equal and approved	
7.4	Heating is controlled by time and temperature zone control.		
8. Water Heating			
8.2	Hot Water connected to air source heat pump : A hot water cylinder is installed.	To be sized by a specialist	
8.3	Independent time control is provided to the hot water cylinder.		
8.4	Water usage per person per day is ≤105 Litres.	To meet or exceed Part G. Requires good specification of flow rates on all water consuming appliances – taps, showers, etc.	
8.5	Showers – All showers will be supplied from the Hot Water cylinder via a pump.	All showers to be flow regulated to <8litres/minute@3bar. Water consumption will be considered to reduce to 105l/p/day.	
9. Renewables			
9.1	Photovoltaic Panels to be considered where feasible in accordance with Policy JP-S1 in line with the Places for Everyone Joint Development Plan		
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 compliance ADL1 2021. They will be responsible for meeting a overall Y value of 0.05W/mK (summation of all the junctions).	Y Value target 0.05W/mK. Consider Recognised Construction Details or similar.	
10.2	Split lintels or insulated thermally broken lintels will be used throughout	Applicable only for masonry construction. For steel frame specialist calcs will likely be required	
10.3	Low energy (LE) lights are installed throughout.	All lighting to meet a min efficacy of 90 lumens/circuit watt. The Contractor will provide a drawing schedule of all proposed light fittings with efficacies detailed.	

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