

Energy & Sustainability Statement

Ref: Z49618C

Proposed 50 New Build Apartments

at

Chorlton Baths, Manchester

for

Mosscares St Vincent's Housing Group



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Executive Summary

This Energy Statement has been developed in support of the planning application for the proposed development of 50No. apartments for the over 55's at the former Chorlton Baths site on Manchester Road in Manchester. The 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 planning requirements:

- National Planning Policy Framework (2021)
- Manchester City Council's Core Strategy 2012 - 2027 (2012) policies EN4 - EN7
- Principles of The Guide to Development in Manchester SPD

The following low and zero carbon technologies have been evaluated:

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

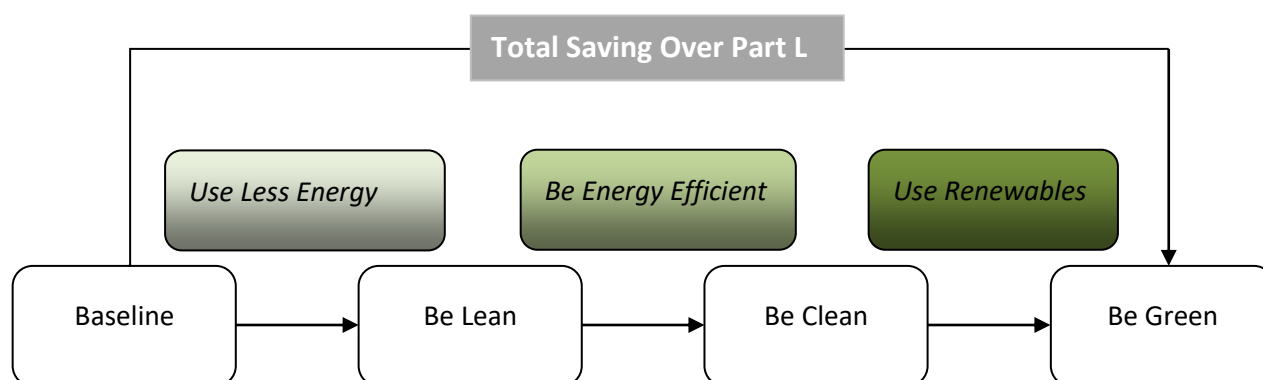
The approach for the Chorlton Baths residential development is to embed sustainability into the heart of the development through a range of design measures based on the 'Be Lean, Be Clean, Be Green' design hierarchy. Measures will include:

1. Enhanced building fabric to meet the new Building Regulations ADL1 2021 (15/06/2022)
2. Enhanced air tightness and thermal bridging.
3. Efficient mechanical ventilation system with heat recovery
4. Heating will be provided by highly efficient electric panel heaters.
5. Hot water will be provided by highly efficient air source heat pumps
6. Efficient lighting strategy primarily using CFL or LED type fittings.

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 heat pumps for hot water in the dwellings achieves the necessary levels of carbon reduction.



The principles of a Be Lean, Be Clean, Be Green philosophy have been applied, resulting in a 64% carbon emissions improvement and a 33% 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 CO₂ emissions and Primary Energy against Building Regulations Part L1 2021

	Total CO₂ Emissions (kgCO₂/yr)	Total Primary Energy (kWh/yr)
Target Dwelling Performance	35,599	200,573
Proposed Dwelling Performance	12,901	134,739
Total Reduction	22,698	65,835
Percentage Improvement (above ADL1 2021)	63.76%	32.82%

1. Introduction

The proposed development consists of 50no. apartments for the over 55's located at the former Chorlton Baths site on Manchester Road in Manchester. The development is required to achieve compliance under Building Regulations Approved Document Part L1 (2021).

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

- Manchester City Council's Core Strategy 2012 - 2027 (2012) policies EN4 - EN7
- Principles of The Guide to Development in Manchester SPD
- National Planning Policy Framework (2021)

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 Manchester City Council's planning policy.

1.1. Location

The area for the proposed development on the site of the old Chorlton Baths, Chorlton, Manchester is highlighted by the red line boundary shown in Figure 1.



Figure 1 - Location and surrounding area of proposed Chorlton Baths residential development.

The site is to be accessed off Manchester Road, Chorlton and on the opposite side is the Transport for Greater Manchester Metrolink tramway. The site is surrounded by commercial and residential development.



Figure 2 – Architectural site plan for the proposed Chorlton Baths residential development

The proposed development consists of 50No. apartments arranged over 5 floors in 2 Blocks (East and West) as indicated in Figure 2 above. Plot types and numbers are defined across the site as shown below:

Dwelling Type	Description	Number of Units
1B GF Apartment	1 Bed Ground floor Apartment	4
1B FF Apartment	1 Bed Mid Floor Apartment	21
1B TF Apartment	1 Bed Top floor Apartment	7
2B GF Apartment	2 Bed Ground floor Apartment	2
2B FF Apartment	2 Bed Mid Floor Apartment	12
2B TF Apartment	2 Bed Top Floor Apartment	4
		50

Floor Plans



Figure 3 – Ground and Typical Upper Floor plans for the proposed Chorlton Baths development

2. Policy Drivers for Energy Efficiency and Renewable Energy

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

2.1. National Policy

The National Planning Policy Framework was published in July 2021 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 Manchester City Council's Core Strategy 2012 – 2027 (2012), 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 Manchester Core Strategy 2012-2027 (2012) and the Supplementary Planning Document and Planning Guidance (2007) provide a set of guidelines for new development within 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

Manchester Core Strategy 2012 – 2027 (2012)		
Section	Policy Requirements	Design Response
EN 4 - Reducing CO₂ Emissions by Enabling Low and Zero Carbon Development	All development must follow the principle of the Energy Hierarchy, being designed: • to reduce the need for energy through design features that provide passive heating, natural lighting and cooling. • to reduce the need for energy through energy efficient features such as improved insulation and glazing • to meet residual energy requirements through the use of low or zero carbon energy generating technologies Wherever possible new development and retrofit projects, including energy generation plant, must be located and designed in a manner that allows advantage to be taken of opportunities for low and zero carbon energy supplies. Where possible new development and retrofit projects will be used as a mechanism to help improve energy efficiency and provide low and zero carbon energy supplies to existing buildings. Where appropriate new development and retrofit projects will be required to connect to and/or make contributions to low or zero carbon energy schemes and/or to incorporate provision to enable future connection to any existing / potential decentralised energy schemes. The use of building materials with low embodied carbon in new development and refurbishment schemes.	The proposed Chorlton Baths 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 Clean, Be Green' approach. A review of district heating opportunities is provided in Section 6 of this report, in line with current local development.

Policy EN 5 – Strategic Areas for low and zero carbon	Within Manchester it is considered that the following strategic areas, indicated on the key diagram, will have a major role to play in achieving an increase in the level of decentralised, low and zero carbon energy supplies available: • The Regional Centre, which also includes the Oxford Road Corridor and Eastlands • District Centres and associated major development sites • Airport Strategic Site • Strategic housing location • Strategic employment locations Within these areas new development, regeneration and retrofit projects, will be expected to take place in the context of more detailed proposals for decentralised low and zero carbon energy infrastructure in the form of energy proposals plans. The Council will work with all relevant stakeholders, which may include developers, landowners, residents, community groups, private sector partners, utilities companies, neighbouring authorities and other public sector bodies, as appropriate, to bring forward such plans. Where investment or development is being undertaken into or adjacent to a public building/asset or district heating network, full consideration shall be given to the potential role that these can have in providing an anchor load within a decentralised energy network or in creating opportunities for CO2 reduction funded by contributions.	The proposed development at the former Chorlton Baths site does not fall within a Strategic Area for decentralised development, as defined within the Manchester City Council Core Strategy 2012 – 2027. The proximity of the site to current decentralised energy networks is defined within Section 6 of this report.
Policy EN 6 - Target Framework for CO2 reductions from low or zero carbon energy supplies	Developments smaller than 10 units but involving the erection of a building or substantial improvement to an existing building will be expected to meet the minimum targets for the defined areas below, where viable, but will not be expected to submit an energy statement. The target framework relates to three broad development locations and their potential for low and zero carbon, decentralised energy. The areas are defined as follows: • Target 1 Network development areas: Locations where the proximity of new and existing buildings, the mix of uses and density of development provide the right conditions to support district heating (and cooling). • Target 2 Electricity intense areas: Locations where the predominant building type has an all-electric fit-out such as	The proposed development consists of 50No. units and is therefore within the threshold of a major development. The site does not sit within an area defined for development of low and zero carbon, decentralised energy. An overview of the site in relation to current decentralised

	retail units and leisure complexes Target 3 Micro-generation areas: Locations where lower densities and a fragmented mix of uses tend to mean that only building scale solutions are practical. <table><tr><th>Target</th><th>% Minimum Requirement</th></tr><tr><td>Target 1: Network development area</td><td>CHP/district heating anchor or connection or where not feasible a 15% increase on Part L 2010.</td></tr><tr><td>Target 2: Electricity intense buildings</td><td>+15% increase on Part L 2010</td></tr><tr><td>Target 3: Micro generation area</td><td>+15% increase on Part L 2010</td></tr></table>	Target	% Minimum Requirement	Target 1: Network development area	CHP/district heating anchor or connection or where not feasible a 15% increase on Part L 2010.	Target 2: Electricity intense buildings	+15% increase on Part L 2010	Target 3: Micro generation area	+15% increase on Part L 2010	networks in the region is provided in Section 6. A fabric first approach is proposed for this development. Renewable technologies have not been specified for this development due to financial viability and ongoing maintenance issues. The development is an electricity intense building and there a +15% increase on Part L 2010 is required, this has been achieved within the design as detailed within section 8 of his report.
Target	% Minimum Requirement									
Target 1: Network development area	CHP/district heating anchor or connection or where not feasible a 15% increase on Part L 2010.									
Target 2: Electricity intense buildings	+15% increase on Part L 2010									
Target 3: Micro generation area	+15% increase on Part L 2010									
Policy EN 7 – Energy Infrastructure opportunities	There will be a general presumption in favour of low and zero carbon decentralised energy schemes, subject to the following considerations: That any new generating plant capable of producing heat and cooling as well as electricity should be located in a way that facilitates future connection to a local distributed energy system. - That any energy centre, including generating plant, standby/boiler plant and substations, shall be located and designed to a high quality so as to integrate with and contribute to the townscape. - Biofuels should be obtained from sustainable sources and processes and in a way that minimises transport impacts, following a sequential approach in order to minimise CO2 emissions – firstly prioritising local and regional sources, followed by national, European and international. - Consideration should be given to biofuel delivery by rail and	An overview of the site in relation to current decentralised networks in the region is provided in Section 6. Due to the relatively small scale of the development, the development of an energy centre would not be a feasible design solution. A fabric first approach to the development is a much preferred								

	waterways where possible. Where large-scale fuel or feedstock delivery is required by road the energy centre must be located in or adjacent to light industrial, industrial or leisure uses with any impact on local residential amenity minimised. • The cumulative impact of energy schemes will be taken into account when considering applications, to include modelled impacts on air quality and landscape character, with reference to Policy EN16. • Flood risk, through the Manchester-Salford-Trafford Strategic Flood Risk Assessment. In determining proposals for development, consideration will be given to the need to safeguard strategic energy sites and network routes, both proposed or existing, where these have been identified as having strategic significance for the delivery of low or zero carbon energy infrastructure or, would be required in order to achieve the successful regeneration of an area in line with targets for reducing carbon emissions.	method with the use of highly efficient heat pumps to provide hot water to the apartments.
Supplementary Planning Document and Planning Guidance (2007)		
Section	Policy Requirements	Design Response
4.5 – Energy Efficiency	Part 1 Policy E1.5 encourages high standards of energy efficiency in new development. In the Environmental Standards Statement, developers should show how they have considered the steps necessary to reduce energy demand at the earliest stages of design. Developers should aim to reduce CO2 emissions by at least 25% more than the requirements of the current Building Regulations, which at present are Building Regulations: Approved Document L (2006) – ‘Conservation of Fuel and Power.’ The following design principles will assist developers in achieving energy efficiency targets: • Minimise reliance on energy-using equipment for heating, cooling, lighting and natural ventilation • Position trees and soft landscaping on and around the development and within buildings to provide natural shading, insulation and air conditioning • Integrate energy efficient micro-generation and community heating schemes, such as combined heat and power (CHP)	In line with the principles of the Be Lean, Be Clean, Be Green design philosophy, the Chorlton Baths development seeks to provide a sufficient design solution that provides compliance with Building Regulations Part L1A. An early-stage overview of these calculations is provided in Section 8.

	Site layout and building design principles should maximise the capture and use of daylight and passive solar energy, whilst avoiding excessive solar gain in summer Specify energy and water efficient appliances and systems	
4.6 – Renewable Energy	To reduce energy demand and the harmful impact of using energy from non-renewables, in line with UDP Part 1 Policy E1.5, developers should aim for at least 20% of final site energy demand to be met by on-site renewable energy technologies. Renewable energy targets can be achieved more readily by undertaking the measures suggested above reducing the total energy demand of the building. It is possible to produce developments that use 50% and even 100% energy from renewable sources. To achieve this, developers should: - Assess opportunities for integrating small and large scale renewable energy generation systems to improve the energy security of occupants and the neighbourhood, including siting of energy generation businesses on-site and export of surplus energy - Use a mix of technologies to help generation patterns match demand - Investigate energy generation opportunities before designing building envelopes or fixing their location, to optimise utilisation of wind, solar and geothermal resources - Consider final energy demand rather than building energy consumption in the selection and sizing of generation equipment - Explore opportunities to tackle waste and energy issues collectively through use of anaerobic digesters linked to CHPs (Combined Heat and Power devices) Consider private wire networks as an alternative to grid connection and availability charges on larger developments.	A full appraisal of low and zero carbon technologies is provided in Section 7 of this report. Achieving compliance with Building Regulations Part L1A will be demonstrated through a passive fabric-first approach. This ensures that the highest standards of fabric efficiency and energy efficiency are achieved, rather than applying renewable technologies to the development.

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 compare the proposed improvement measures against this baseline. Building Regulations Part L1 2021 (SAP) applies to each of the 50No. apartments and provides carbon emissions from regulated energy.

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

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 On site district heating network 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 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 Manchester City Council's 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
- 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), considering 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 dwellings. Under Building Regulations Part L1 2021, dwellings 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 to set a target upon which the actual development can be compared.

4.1. Predicted Baseline Energy Requirements

The predicted baseline CO₂ emission and primary energy demands for the development:

Table 4 - Baseline dwelling carbon emissions and primary energy

Our Ref	Dwelling Type	No. of Type	Floor Area m ²	TER (Kg CO ₂ / yr/m ²)	TPER (kWh/yr/m ²)	Total Target Carbon Emissions (Kg CO ₂ /yr)	Total Target Primary Energy (kWh/yr)
Z49618	1B GF Apt	4	54	14.82	79.31	3,201	17,131
Z49619	2B GF Apt	2	62	14.91	79.59	1,849	9,869
Z49620	1B FF Apt	21	54	12.20	65.17	13,835	73,903
Z49621	2B FF Apt	12	62	11.95	63.63	9,077	47,341
Z49622	1B TF Apt	7	54	15.43	82.58	4,612	31,215
Z49623	2B TF Apt	4	62	15.94	85.14	3,026	21,115
Total		50				35,599	200,573

The baseline carbon emissions rate for the development is **35,599 KgCO₂/yr** and the baseline primary energy rate is **200,573 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 of Manchester City Council. 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, 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.

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 air source heat pumps within each apartment to provide hot water with efficient electric panel heaters for heating.

Dwellings will also be provided with a metering scheme based on their electricity usage.

A low energy high efficiency system 4 mechanical ventilation with heat recovery system will serve the kitchen and wet rooms, in line with the requirements of Building Regulations Part F (2021). This ventilation system provides whole house supply and extract ventilation to the dwellings.

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 the 's 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

There are currently no existing district heating networks within proximity to the site. The nearest district heating network is located at Withington Hospital which is over 2 miles of the site.

6.2. New Heating Networks – Options

Consideration has been given to adopting a centralised or decentralised energy strategy. A decentralised 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 50No. apartments is not sufficient to justify a DHN or CHN. The existing site is spatially constrained and there is insufficient space to locate the equipment and associated plant.

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 Manchester City Council policy aspirations.

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

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. 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

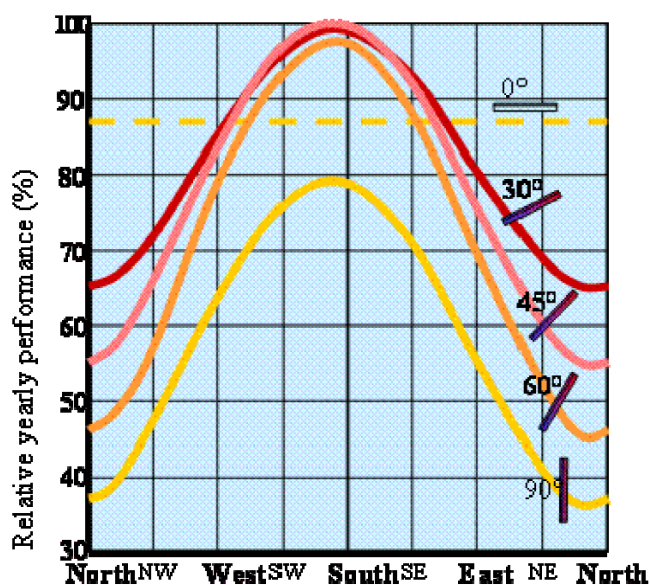


Figure 4 - Performance of photovoltaic panel orientation

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 to the right:

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

Photovoltaic panels have not been installed on the dwellings in this instance, however the use of heat pumps for hot water only ensure that carbon emission reductions are provided in line with Manchester City Council's Core Strategy.



Figure 5 - 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.

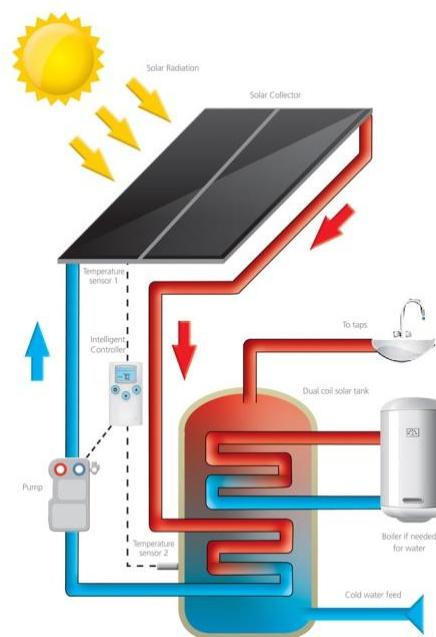


Figure 6 - The principles of a solar thermal system

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.

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 dwellings are unlikely to require sufficient hot water storage to deem solar thermal a feasible technology for this site. For the reasons aforementioned this is not an appropriate option 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 apartments as a centralised system would be

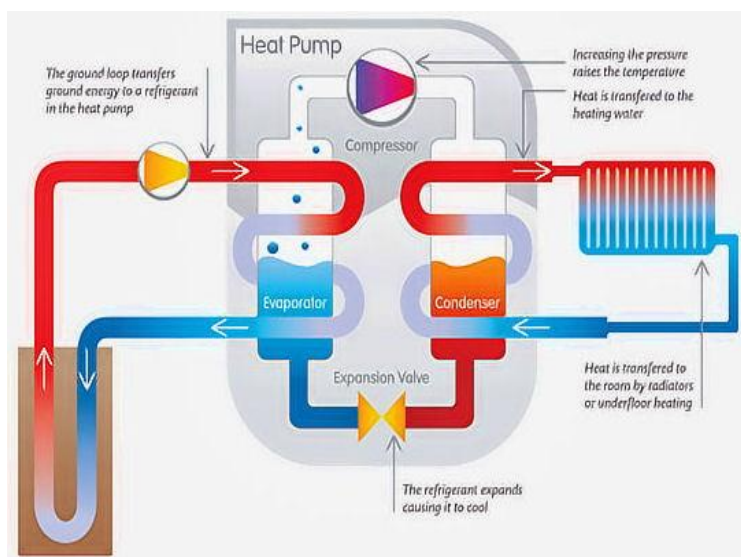


Figure 7 - Principles of a GSHP system

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.

Due to the scale of these dwelling units, 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.

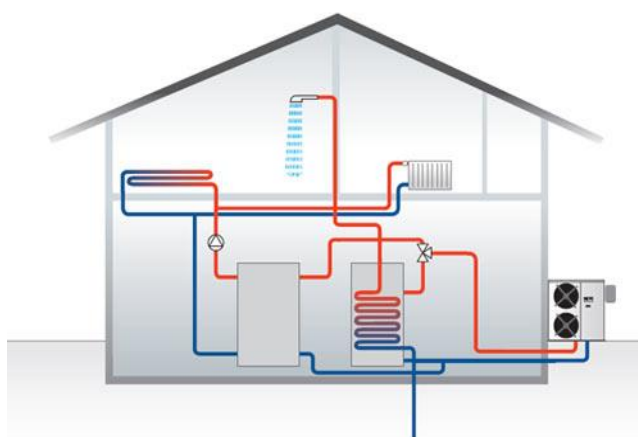


Figure 8 - Principles of an ASHP system

Exhaust air heat pumps 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 more expensive in terms of capital cost of the equipment, installation and the enhanced structural requirements.

ASHPs are considered the most appropriate technology on this scheme and can be utilised for generating hot water throughout the apartments. The introduction of this technology ensures that carbon emissions reductions can be provided in line with Manchester City Council's Core Strategy.

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

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, 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.



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 4.5 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.

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.

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.



Figure 10 - Biomass boiler and hopper

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 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 Chorlton Baths 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 for hot water supported by efficient ventilation system.

Table 5 - Proposed carbon emissions from the Chorlton Baths residential development

Ref	Dwelling Type	No. of Type	TER	DER	TPER	DPER	Total Carbon Emissions (Kg CO ₂ /yr)	Total Primary Energy (kWh/yr)
Z49618	1B GF Apt	4	14.82	5.27	79.31	54.90	1,138	11,858
			64.44%		30.78%			
Z49619	2B GF Apt	2	14.91	6.34	79.59	65.63	786	8,138
			57.48%		17.54%			
Z49620	1B FF Apt	21	12.20	3.72	65.17	39.14	4,218	44,385
			69.51%		39.94%			
Z49621	2B FF Apt	12	11.95	4.44	63.63	46.29	3,303	34,440
			62.85%		27.25%			
Z49622	1B TF Apt	7	15.43	5.11	82.58	53.30	1,932	20,147
			66.88%		35.46%			
Z49623	2B TF Apt	4	15.94	6.14	85.14	63.59	1,523	15,770
			61.48%		25.31%			
Total		50	64%		33%		12901	134739

The carbon emissions are **12,901 kgCO₂/yr**. This is a total carbon reduction of **22,698 kgCO₂/yr** from the baseline emissions of **35,599 kgCO₂/yr**. This equates to a 63.76% carbon reduction.

The primary energy rate is **134,739 kWh/yr**. This is a primary energy reduction of **65,835 kWh/yr** from the baseline primary energy rate of **200,573 kWh/yr**. This equates to a 32.82% primary energy reduction.

The development proposal achieves carbon efficiency reductions through a highly efficient thermal fabric, energy efficient lighting and ventilation, improved thermal bridging, low air leakage and highly efficient heat pumps for domestic hot water and electric panel heaters for heating to reduce emissions in line with Manchester City Council's Core Strategy.

9. Conclusion

Following the 'Be Lean, Be Clean, Be Green' hierarchy the proposed solutions are predicted to:

- 1) Reduce the total carbon emissions by 64% compared to new building regulations ADL 2021. New building regs are a 31% improvement on 2013 regs, which in turn were a 6% improvement on 2010 regs upon which the energy policies are based. Therefore, the overall improvement of this project, based on 2010 standards is 101% betterment, which is greater than the requested 15% in the energy policy EN6.
- 2) The heat pumps are the 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 kWh/yr by 33% compared to new building regulations ADL 2021. This is a new metric under Part L.

The approach for the Chorlton Baths 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 extract ventilation system with heat recovery
- 4) Hot water to apartments will be provided by highly efficient air source heat pumps
- 5) Heating will be provided by highly efficient electric panel heaters
- 6) Efficient lighting strategy primarily using CFL or LED type fittings

9.1. Low/ Zero Carbon Technologies (LZT) Discounted

- Solar Thermal Hot Water is not a viable option as heat pumps are proposed and hot water demand will be heated and stored efficiently through this system.
- PV has not been included within the preliminary SAP calculations as heat pumps provide the necessary carbon emission reductions required by the Manchester City Council Core Strategy.
- 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 not viable for site because of spatial and financial costs. There is no room to accommodate a GSHP vertical bore and associated communal plant room, ground conditions are unknown, and systems are very costly.
- ASHP/ EAHP are considered the most viable option for the dwellings and can provide a carbon emission reduction in line with the requirements of Manchester City Council's Core Strategy.

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

9.2. Summary Headlines

- A fabric-first approach to meeting Manchester City Core Strategy energy policy has been undertaken for the Chorlton Baths residential development, defined within the 'Be Lean, Be Clean, Be Green' energy hierarchy. The proposed design provides compliance with Building Regulations ADL1 2021, and the application of heat pumps for hot water and electric panel heaters for heating ensures reductions in line with Manchester City Council's Core Strategy.
- The use of high-efficiency heat pumps reduces carbon emissions by 64% and provides a primary energy reduction of 33% when compared to new building regulations Part L 2021.
- Site constraints and viability for District Heating Network (DHN) and Communal Heating Network (CHN) have been reviewed. Existing DHN is not sufficiently close to connect into. In addition to this, the scheme's heating and hot water (HW) demand is too small to justify connection to DHN or CHN.
- Photovoltaic panels could easily be retrofitted or added at later date to meet Future Homes Standard (FHS) or a 'Zero Carbon' development.

An overall 64% improvement in CO₂ emissions and a 33% improvement in primary energy above the Building Regulations baseline is proposed to support our application and to meet policy.

	Total CO ₂ Emissions (kgCO ₂ /yr)	Total Primary Energy (kWh/yr)
Target Dwelling Performance	35,599	200,573
Proposed Dwelling Performance	12,901	134,739
Total Reduction	22,698	65,835
Percentage Improvement (above ADL1 2021)	63.76%	32.82%

10. Appendices

10.1. LZT Feasibility Table

Technology	Technical Feasibility	Carbon Savings	Estimated Costs	Financial Viability
Solar photovoltaics	A photovoltaic array is not required for the dwellings as carbon emissions reductions in line with BRegs Part L1 2021 are already achieved.	A 1kWp system could save around 213 kg of CO ₂ / year per dwelling	Average cost for such a system is around £1.5K per dwelling.	Current potential income generation is around £120 minimum per annum per dwelling with a fuel cost saving of around £40 / year per dwelling.
Wind	Average wind speeds on the site according to the <u>NOABL</u> Wind Speed Database are 4.5m/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 capa 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
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. Hot water is to be provided from highly efficient heat pumps to ensure compliance.	Around 270 kg of CO ₂ / year per dwelling.	£3-5K per dwelling	Income generation from RHI in a 4-person household would be in the region of £340 / year (per dwelling) with a fuel saving of around £65 / 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: Provided to all dwellings for hot water supply.	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: £2,590 minimum annual RHI income generation per dwelling with fuel saving of £440 / year minimum per dwelling ASHP: £920 minimum annual RHI income generation per dwelling with 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

10.2. 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 AD L1).	Please note submission is in two stages. A) Design , B) As installed	
1. Dwelling Type			
1.1	Building Regulations Part L1 2021 apply.		
1.2	Post code of site is	M21 0UA	
1.3	Electricity is supplied by standard tariff rather than economy 7, 10 or 24.	<i>Assumed Standard tariff</i>	
1.4	It is assumed that the dwellings have a medium thermal mass parameter.	<i>Masonry Construction</i>	
2. Floor Construction Details			
2.1	Ground floor is insulated to achieve the U-value stated opposite.	U-Value = 0.12W/m ² K	
3. Wall Construction Details			
3.1	Main external walls to achieve the U-value stated opposite.	U-Value = 0.15 W/m ² K	
3.2	Party walls are fully filled and sealed to achieve the U-value stated opposite.	U-Value = 0.0 W/m ² K	
4. Roof Construction Details			
4.1	All roofs are insulated to achieve the U-value indicated opposite.	U-Value = 0.13 W/m ² K	
5. Openings			
5.1	External doors/Doors to cold corridors are installed to achieve the U-value stated opposite.	U-Value = 1.0 W/m ² K	
5.2	All double-glazed windows, rooflights and patio type doors/windows with Low-e glass hard coating to achieve the U-Value stated opposite.	U-value = 1.3 W/m ² K. G-value= N= 0.63 S=0.4 E=0.5 W=0.4	
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 Mechanical extract ventilation with heat recovery is installed in wet areas.	Vent Axia Sentinel Kinetic B or equal	
6.3	No open flues or fireplaces or flue-less gas fires are present anywhere.		
7. Space Heating			
7.1	There is only one main heating system installed to all dwelling types.	No secondary heating.	
7.2	Heating is provided to the apartments by individual wall mounted electric panel heaters		
7.3	The heating system for the apartments has a programmer and appliance stats		
8. Water Heating			
8.1	Hot water is provided by air source heat pumps with cylinder storage to the apartments as indicated opposite	Dimplex Edel 170l or 200UK-630 Cylinder volume 201l Heat loss 1.61 (kwh\day)	
8.2	Independent time control is provided to the hot water cylinder.		
8.3	Water usage per person per day is ≤105 Litres.	To exceed Part G. Requires good specification of flow rates on all	

		water consuming appliances – taps, showers, etc	
8.4	All showers to be flow restricted to no more than 8l/min and supplied from the HW cylinder @ 3bar		
9. Renewables			
9.1	There are no renewable technologies on the development.	PV could be added later to improve dwelling running costs.	
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 0.04W/mK (summation of all the junctions)	All info contained below 10.2-10.4 is to assist the Contractor in the development of their own detailing.	
10.2	In order to complete the early-stage energy analysis we have used a default standard for the initial thermal bridging details as Constructive Details and other standardized manufacturers literature. To enhance the thermal bridging the specialist values will be adopted. An indication of the required standards is listed in the table below.	Psi value of 0.01W/mK. split	
10.3	Thermabate cavity closures will be used to achieve improved thermal bridging for SAP ref: E3 and E4		
10.4	Low energy (LE) lights are installed throughout.	All lighting must be specified with efficacy of 80 lumens/circuit watt or more.	
10.5	Windows on upper floors can be half opened in summer to prevent overheating. Dwellings will require further analysis under part O	Part O overheating assessment required for all dwellings	

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