



Hurstwood Environmental Consulting

ROCHDALE ROAD APARTMENTS Rochdale Road, Manchester

ENERGY STATEMENT

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1. INTRODUCTION

McGoff Construction have commissioned Hurstwood Environmental to undertake an Energy Strategy Study and report to support the planning application for a new development on Rochdale Road Manchester.

The purpose of the statement is to summarise the relevant policies both National and Local and demonstrate the ways Hurstwood have reviewed various options to promote policies set out in this report and subsequent design.

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2. DEVELOPMENT PROPOSALS

2.1. Description of Development Site

The site is located at 87 Rochdale Road, Ancoats, Manchester, Greater Manchester, M4 4HY.



The proposed development is to build 237 homes across two buildings on a plot behind the Marble Arch pub on Rochdale Road.

Featuring two blocks of 12 and 10 stories, comprising of 223 apartments, interconnected at ground floor level.

- B1 (finger block) = 10 Stories
- B2 (point block) = 12 stories

There are also 14 duplex's proposed and shall be separate to the two residential blocks.

The site falls within the 390-acre Victoria North masterplan, adjacent to MCR Property Group's 1,200-home Gasworks development.

The site has all major services (gas, water, telecoms and electricity) within the surrounding roads, with a small proportion requiring diverting or disconnecting within the proposed site boundary.

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2.2. Development Proposals

The Proposed Scheme is for a residential development set across two blocks and shall include the Demolition of existing buildings and structures; development of three new buildings comprising residential apartments and duplex homes (Use Class C3), commercial unit (Use Class E), basement car parking, new landscaping and public realm, and associated engineering and infrastructure works.

The Proposed Scheme will provide residential units (use class C3) in both blocks.

The development also includes a high-quality landscaping scheme and public realm pocket park, along with service space at ground level, amenity space, car parking & cycle parking

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3. GOVERNMENT POLICY

3.1. Energy Hierarchy

In line with the draft definition of zero carbon an energy hierarchy has been created (see figure 1 below). Under Policy EN4 developers will initially be expected to secure high levels of energy efficiency and low energy demand. This is followed by the incorporation of on-site measures where these exist, such as zero carbon energy technologies and directly connected heat (not necessarily on-site).

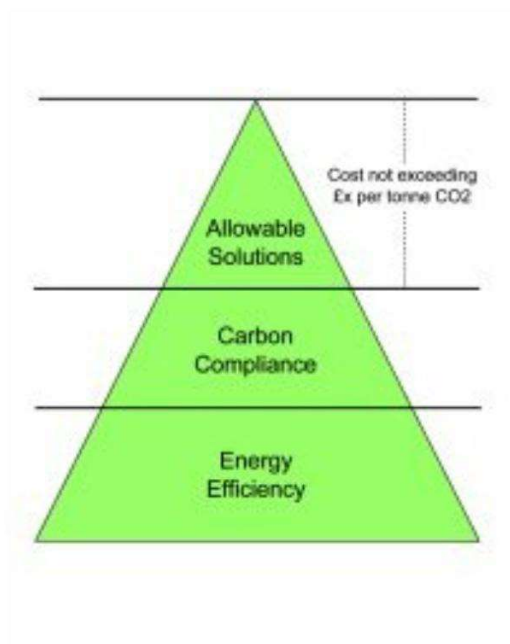


Figure 1. – Energy Hierarchy

However, in order to achieve the highest level of carbon reductions for the least cost it is intended that developers will be able to contribute to or co-ordinate investment in near or off-site infrastructure. This could include, for example, the connection of existing buildings to district heating networks and investment in low or zero carbon technologies on buildings owned by the City or by public and community institutions. Further guidance on these 'allowable solutions', possibly in the form of a Supplementary Planning Document (SPD), will be given following further national guidance on this matter expected from the Government.

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3.2. Decarbonisation of the Electricity Grid

The National Grid in the UK is decarbonising rapidly. This permits the electrification of heat and heralds the end to combustion of fossil fuels as the main source of heating. The attractive alternative to combustion is heat transfer using heat pumps linked to ground source energy.

The carbon factor of grid electricity was 495 grams of CO₂ for each kWh of electricity generated in 2014 according to Defra. This fell by 6.5% to 462 grams in 2015, and by a further 10.8% to 412 in 2016.

BEIS published its Energy and Emissions Projection (EEP) in October 2020 showing the projected Grid Carbon Factor falling dramatically from 156 grams in 2019 to just 67 grams in 2040.

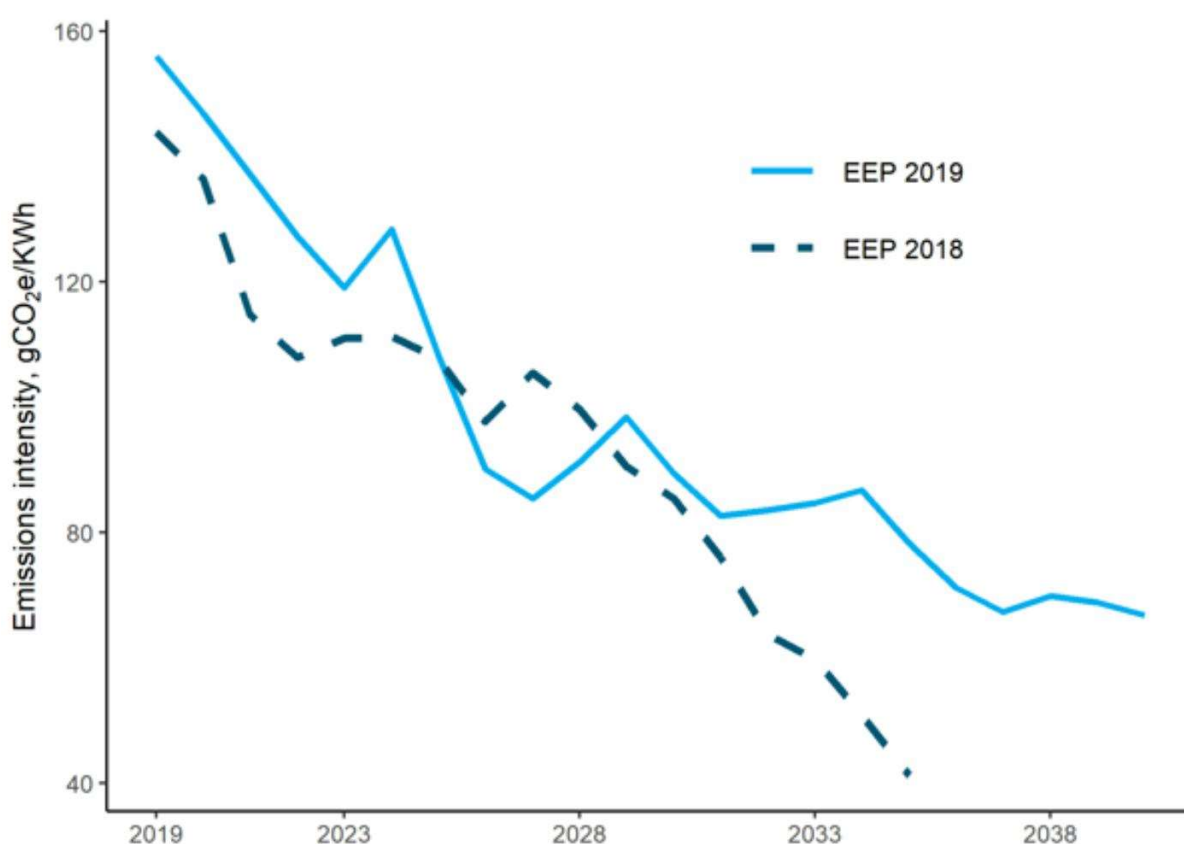


Figure 1 – Above indicates the predicted reduction in Carbon Emissions per kWh up to 2038.

Furthermore, the UK Government has passed laws that require the country to reduce all greenhouse gas emissions to net zero by 2050 and have committed to the phasing out of natural gas as a source of heating with gas heating to be banned from 2025.

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4. POLICY REVIEW

4.1. The Greater Manchester Combined Authority (GMCA)

The GMCA declared a Climate Emergency in July 2019 and launched a plan in March 2020 following 12 months of collaboration and consultation with representatives from areas across the city region. The plan commits to action needed to achieve a reduction in direct CO₂ emissions by at least 50% between 2020-2025 and by 2038, to have zero carbon emissions.

4.2. Manchester Climate Change Framework 2020-25

In June 2019, the UK Government committed the country to a legally binding target of net zero carbon emissions by 2050. Following this, a month later, Manchester City Council (MCC) adopted a motion to declare a climate emergency which commits the Council to action to combat climate change. The Council have set out their aim of making Manchester a zero-carbon city by 2038 or before.

The Manchester Climate Change Framework 2020-25 is MCC's high-level strategy for meeting their commitment on climate change that builds on the Draft Manchester Zero Carbon Framework 2020-38 and the declaration of a climate emergency in July 2019. This was endorsed by MCC at the Executive meeting in March 2020 and will develop over the next five years, in line with changes in policy, climate science, rate of progress and other factors. The framework has set out four objectives to facilitate this:

Objective 1 – Staying within our carbon budgets. This involves taking action in the following relevant areas:

- ▮ 'Direct CO₂ emissions: staying within our 15 million tonne carbon budget for 2018-2100, including reducing the CO₂ emitted from our homes, workplaces and ground transport by at least 50% during 2020-25.
- ▮ Indirect CO₂ emissions: understanding and taking action on the things that we consume, and which generate greenhouse gases through their production, transportation and disposal.'

Objective 2 – Climate adaptation and resilience. This will require the adaption of 'the city's buildings, infrastructure and natural environment to the changing climate and increasing the climate resilience of our residents and organisations.'

Objective 3 – Health and wellbeing. This aims to improve the 'health and wellbeing of everyone in Manchester through actions that also contribute to our objectives for CO₂ reduction and adaption and resilience'.

4.3. Manchester Core Strategy

Policy EN 4

Reducing CO₂ Emissions by Enabling Low and Zero Carbon Development

The council will seek to reduce fuel poverty and decouple growth in the economy, growth in CO₂ emissions, and rising fossil fuel prices, through the following actions:

- ▮ All development must follow the principal of the Energy Hierarchy, being designed:
 - To reduce the need for energy through design features that provide passive heating, natural light and cooling
 - To reduce the need for energy through energy efficient features such as improved insulation and glazing

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- 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 scheme and/or to incorporate provision to enable future connection to any existing/potential decentralised energy schemes
- ▮ The use of building material with low embodied carbon in new development and refurbishment schemes.

Policy EN5

Strategic Areas for low and zero carbon decentralised energy infrastructure

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.

Policy EN 6

Target Framework for CO₂ reduction from low or zero carbon energy supplies

Application for residential development of 10 or more units and all other development over 1,000 sq m will be expected as a minimum to meet the target shown in Tables 12.1 or 12.2, unless this can be shown not to be viable. This should be demonstrated through an energy statement, submitted as part of the Design and Access Statement. Such a statement will be expected to set out the projected regulated energy demand and associated CO₂ emissions for all phases of the development.

Developments smaller than the above threshold, but involving the erection of a building or substantial improvement to an existing building will also be expected to meet the minimum target, where viable, but will not be expected to submit an energy statement.

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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: location where predominant building type has an all-electric fit-out such as 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

Domestic CO₂ emissions reduction targets

Table 12.1

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

Where the CO₂ emissions reduction required under any future revision to Part L of the building regulations becomes greater than the '% Minimum requirement', the reduction required under building regulations would apply.

Where the Council identifies an 'allowable solution', for example within an energy proposals plan, that would produce higher carbon reductions at no extra cost than that of achieving the '% Minimum requirement' (or required under building regulations if greater) the higher percentage reduction will be required. The cost comparison is based on the cost of incorporating the 'allowable solution' at design stage.

The energy statement will be required to be submitted at the outset of any proposed development (outline application or before). Developers will be permitted to use green infrastructure elements such as green roofs, green walls, street trees and waterways to contribute to compliance with CO₂ mitigation, subject to the energy statement incorporating evidence such as modelling to demonstrate compliance.

Guidance on what the energy statement should contain and how to decide which target applies to a development proposal is given in Appendix A.

Policy EN8

Adaptation to Climate Change

All new developments will be expected to be adaptable to climate change in terms of the design, layout, sitting and function of both buildings and associated external spaces. In achieving developments which are adaptable to climate change developers should have regard to the following, although this is not an exhaustive list:

- Minimisation of flood risk by appropriate siting, drainage, and treatment of surface areas to ensure rainwater permeability.
- Reduction in urban heat island effect through the use of Green Infrastructure such as green roofs, green walls, increased tree cover and waterways

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- The need to control overheating of buildings through passive design/
- The opportunity to provide linked and diverse green space to enhance natural habitats which will assist species adaptation.

Developers will be permitted to use green infrastructure elements such as green roofs, green walls, street trees and waterways to contribute to compliance with CO₂ mitigation under Policy EN6, subject to evidence to quantify their contribution to compliance.

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4.4. Regulatory Framework

4.3.1 Building Regulations

Building Regulation, Part L – Conservation of fuel and Power sets the compliance standards for energy demand and carbon dioxide emissions from buildings.

Part L1A of the Government's 2013 Building Regulations applies to all domestic buildings in England and Wales.

Specifically, with regards to energy and carbon compliance, all domestic buildings must meet the building regulations Part L 'Target Emission Rate' (TER) requirements for the Part L revision which is current at the time of initial construction works for each particular developmental phase. This includes the requirement for the dwellings to meet the new Target Fabric Energy Efficiency standards (TFEEs) as laid out in AD L1A.

Part L2A of the Government's 2013 Building Regulations applies to all new non-domestic buildings in England and Wales. These regulations refer to new commercial buildings including offices, restaurants, bars, storage spaces, industrial units, schools, and conference facilities.

The aim of Part L2A is to conserve fuel and power in all buildings, apart from dwellings where L1A / L1B applies instead. Typically, commercial buildings use more energy through lighting and auxiliary power than domestic properties, which is why greater emphasis is placed on reducing carbon emissions during the non-domestic building process.

Part L2A compliance involves bringing CO₂ emissions below a specific target based on the size and scope of your building. In the UK, being compliant in this area is a key factor in the design and building stages of any commercial building or outlet.

Part L2B of the Government's 2013 Building Regulations applies to all existing non-domestic buildings in England. These regulations refer to existing commercial buildings including offices, restaurants, bars, storage spaces, industrial units, schools, and conference facilities.

Building Regulations Part L2A and L2B apply to all new and existing commercial buildings in England and Wales. These regulations outline the current target CO₂ emission rate (TER) for businesses.

CO₂ emissions are calculated using a number of factors, including:

- Building size
- Fabric energy efficiency
- Use of energy such as heating, cooling, ventilation, and lighting.

To be compliant with Part L2A, your target CO₂ emissions (based on 2010 regulations) should result in an aggregate 9% reduction in England, and a 20% reduction in Wales. A Target Primary Energy Consumption has also been introduced in Wales, setting a maximum kWh demand per m².

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5. APPRAISAL OF SOLUTIONS

5.1. Summary

The strategic approach outlined, follows a specific appraisal of technologies at each stage of design and to achieve the overall goal of CO₂ reduction.

As on the whole it becomes more expensive to implement carbon reduction measures the further along the design process as the opportunities to reduce demand diminish.

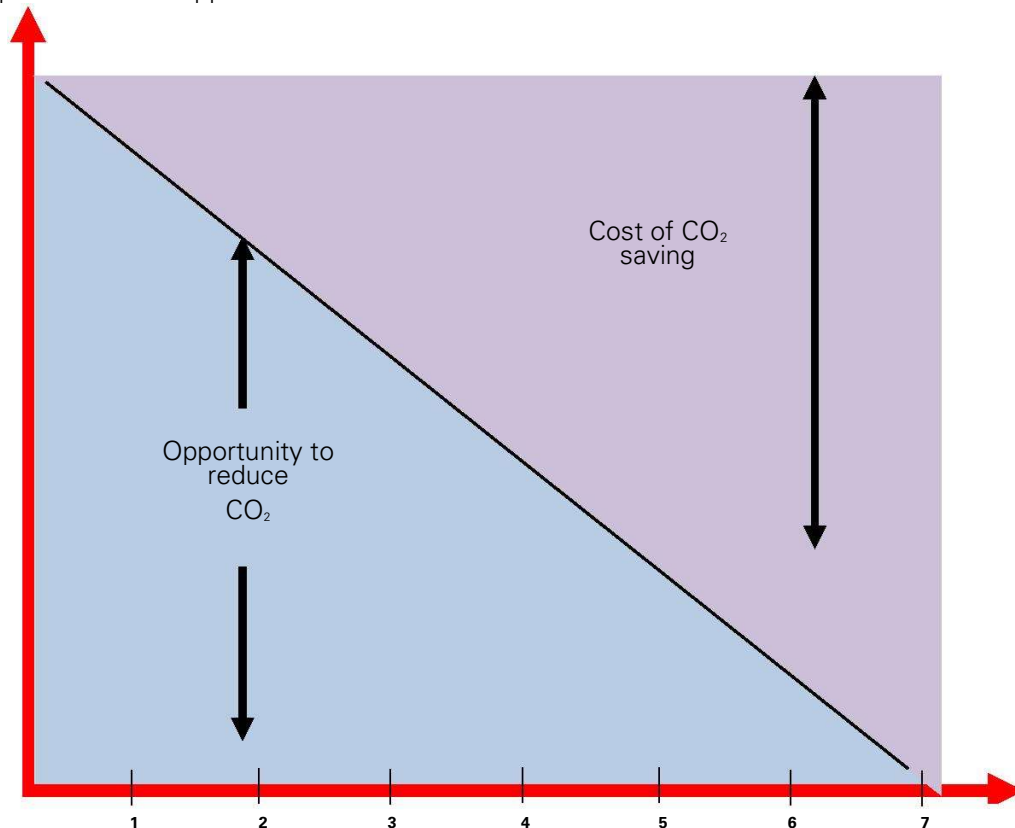


Figure 3

In this first instance it is therefore essential that the buildings 'passive measures' are optimised and the design team work in close collaboration with the user team to consider the future fit out demands.

The next stage is to adopt 'efficient technologies' such as heat recovery and variable speed drives etc to meet the demand efficiency with the final approach of applying 'renewable and low carbon' technologies accordingly.

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Our approach has followed the following route:-

Reduce Demand



Passive design

- ▢ Thermal insulation
- ▢ Natural ventilation
- ▢ Natural daylight
- ▢ Thermal mass
- ▢ Air tightness
- ▢ Solar shading/Glass Specification
- ▢ Low energy fit out

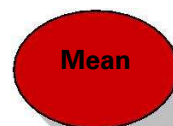


Reduce Energy Demand

Meet demand efficiently

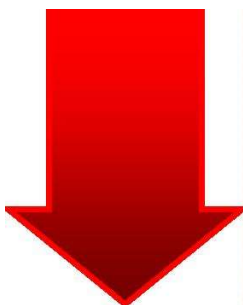


- ▢ Heat recovery
- ▢ Mixed mode ventilation
- ▢ Low energy lighting (LED)
- ▢ Power management
- ▢ Variable speed drives
- ▢ Demand Operated Systems
- ▢ Low Specific Fan Power

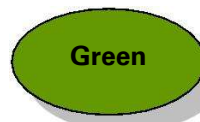


Supply Energy Cleanly and Efficiently

Supply energy from low and zero carbon technology



- ▢ Combined heat power/tri-generation
- ▢ Biomass/biofuels
- ▢ Solar thermal hot water
- ▢ Ground source heat pumps (GSHP)
 - ▢ Open loop
 - ▢ Closed loop
- ▢ Photovoltaics
- ▢ Fuel cells
- ▢ Air source heat pumps (ASHP)
- ▢ Wind
- ▢ Hydro



Incorporate Renewable Energy

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5.2. Low to Zero Carbon Technologies – Considered

Options have been reviewed for the use of on-site Low or Zero Carbon Technology (LZT) in line with the Manchester City Council's policy aspirations.

This LZC energy statement/strategy reviews the technical and economic feasibility of the following technologies –

- ▮ Biomass
- ▮ Wind
- ▮ Biogas/ Anaerobic Digestion
- ▮ Geothermal
- ▮ Ground Source Heat Pump
- ▮ Air Source Heat Pumps
- ▮ Combined Heat & Power (CHP) [Natural gas and Biomass]
- ▮ Solar Hot Water
- ▮ Solar Photo-voltaic

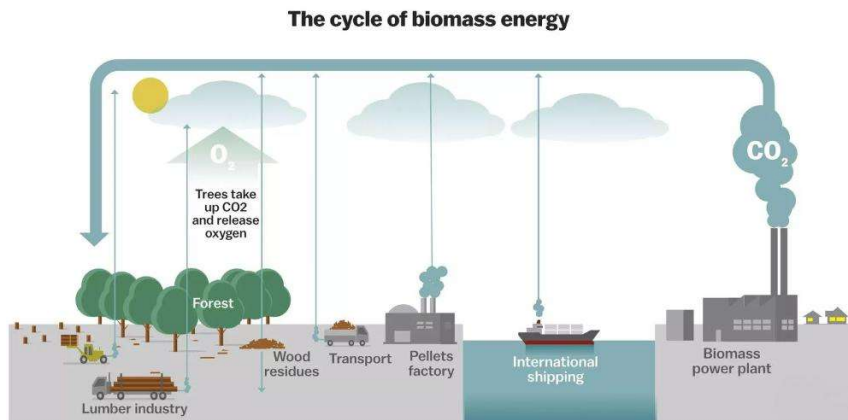
Biomass

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 are also an important factor when looking to install biomass, especially in the Manchester area.

The cost of the fuel depends on the type, delivery distances and whether it is obtained as simple waste product or from another organisation.

There is noise, transportation and delivery of fuel and air quality issues associated with biomass technology which could be problematic for a city centre development and for this reason biomass is discounted.

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Wind Power

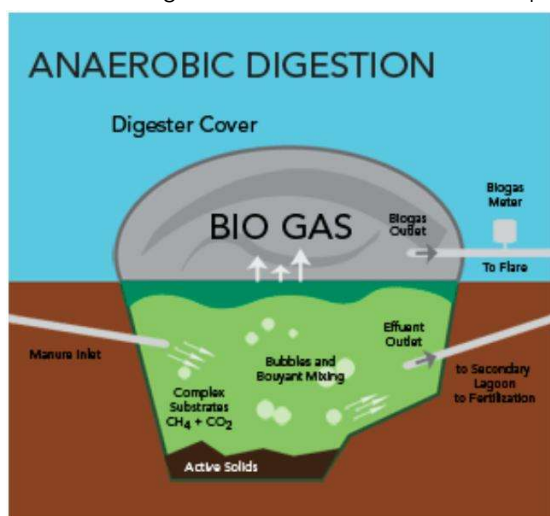
Wind power is one of the cleanest and safest methods of generating electricity. However, wind power is unfeasible due to the fact the development is in an urban area and local wind conditions would not be sufficient to provide enough power.

Furthermore, as this development is in an urban area with numerous tall buildings in close proximity there will be obstacles which reduce wind speed. The average wind speed in this area is 2.4 m/s which is much less than the 6 m/s required. Therefore, wind is not a viable technology for this development.



Biogas/ Anaerobic Digestion (AD)

Anaerobic Digestion (AD) is a collection of processes by which microorganisms break down biodegradable material in the absence of oxygen. The process is used for industrial or domestic purposes to manage waste and/or to produce fuels. Anaerobic digestion is widely used as a source of renewable energy. The process produces a biogas, consisting of methane, carbon dioxide and traces of other 'contaminant' gases. This biogas can be used directly as fuel, in combined heat and power gas engines or upgraded to natural gas-quality bio-methane. The nutrient-rich digestate also produced can be used as fertilizer.



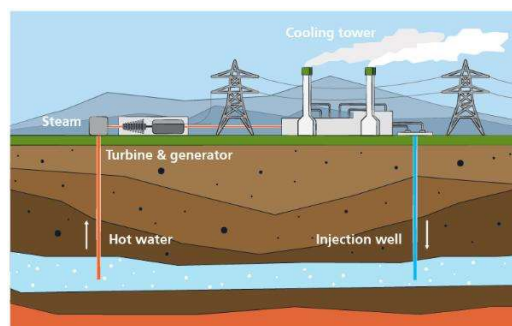
material, sewage, green waste or food waste. It is a renewable energy source and in many cases exerts a very small carbon footprint.

Biogas can be produced by anaerobic digestion with anaerobic bacteria, which digest material inside a closed system, or fermentation of biodegradable materials.

As the site is extremely efficient in terms of available space the AD solution is not deemed practical and discounted.

Geothermal

Geothermal energy is thermal energy generated and stored in the Earth. The geothermal energy of the Earth's crust originates from the original formation of the planet and from radioactive decay of materials. The geothermal gradient, which is the difference in temperature between the core of the planet and its surface, drives a continuous conduction of thermal energy in the form of heat from the core to the surface. Geothermal power is cost effective, reliable, sustainable, and environmentally friendly, but has historically been limited to areas near tectonic plate boundaries. Recent technological advances have dramatically expanded the range and size of viable resources, especially for applications such as home heating. As a result, geothermal power



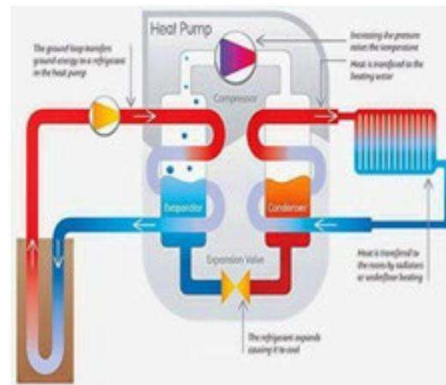
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has the potential to help mitigate global warming if widely deployed in place of fossil fuels. The geothermal energy can be used to heat homes directly or can be used to drive steam turbines to generate electricity.

Ground Source Heat Pump (GSHP)

GSHP's 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 a centralised system with multiple bore holes to a depth of up to 150-250 metres depending on the ground conditions. GSHP's 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 3-5 although some systems may produce a greater rate of efficiency. This means that for every unit of electricity used to pump the heat, 3-5 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.



Although they reduce CO₂ emissions they rely directly on electricity for power and therefore are not fuel or energy efficient. The cost and practicalities to install GSHP's on this type of scheme is also prohibitive. GSHP are typically £20-30k per borehole. There is insufficient space at ground level to accommodate the number of boreholes to service the development, which makes this option unviable. GSHP's are not considered appropriate for this scheme.

Air Source Heat Pump (ASHP)

Air source heat pumps 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.



The ASHP system does offer an attractive solution in terms of the de-carbonisation of the grid and the omission of natural gas to the site. The main limitation to the development is the available roof space in relation to the size of the development.

Combined Heat & Power (CHP)

Combined heat and power (CHP) is a highly efficient process that captures and utilises the heat that is a by-product of the electricity generation process from an engine. By generating heat and power simultaneously (co-generation) CHP can reduce carbon emissions by up to 30% compared to the separate means of conventional generation via a boiler and power station. Typically a CHP would use natural gas as the main fuel source, although other forms of fuel can also be considered.

The main components of a typical system are:

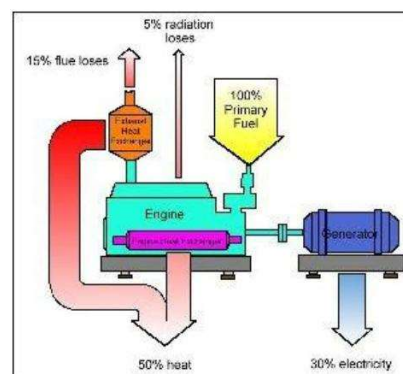
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- the engine which drives the generator.
- the generator which produces electricity.
- the heat recovery system that recovers the waste heat from both the engine water cooling jacket and exhaust gases.
- the exhaust system to take away the products of combustion.
- the control panel to monitor the operation.

The heat generated during this process is supplied to an appropriately matched heat demand that would otherwise be met by a conventional boiler. CHP systems are highly efficient, making use of the heat which would otherwise be wasted when generating electrical or mechanical power. This allows heat requirements to be met that would otherwise require additional fuel to be burnt.

For many developments CHP is the measure that offers the most significant single opportunity to reduce energy costs and to improve environmental performance with existing users of CHP typically saving around 20% of their energy costs. Advantages of CHP include:

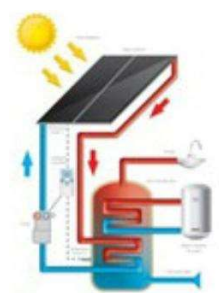
- CHP typically has an efficiency of 80-90%
- Operators typically saving around 20% on energy bills
- Significant carbon dioxide emission savings can be made
- Transmission and distribution losses are reduced
- Increases fuel supply security



However as the design intent and client brief is to have a strategy non reliant on fossil fuel and embrace the decarbonisation of the Electricity Grid then CHP is discounted.

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. The closer the collectors are to the hot water storage, the less pipe work is required. Annual maintenance checks are recommended. The solar collectors are connected to a condensing boiler via a HW cylinder with twin coil. A typical installation in the UK has a panel size of 3-5m² which is used in conjunction with a HW storage tank of 180-300litres, of which a minimum of 90-150 litres must be dedicated to solar hot water storage. For the reasons aforementioned this is not an appropriate option for this scheme.

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. They work best on individual singular dwellings with a small HW cylinder. As the available roofspace for solar panels is limited and the use of photovoltaic panels is considered more effective in reducing carbon emissions than solar thermal panels are discounted.

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Photovoltaic Panels (PV)

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. Panels can be mounted flat or 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 also 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 use of photovoltaic panels is considered attractive as this system offers an effective method of offsetting carbon emissions.

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Low/Zero Carbon Technologies (LZT) Discounted (Summary)

- ▮ 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 larger plant space for storing fuel, which is not currently included and is not conducive to city centre developments.
- ▮ Wind turbines are not seen to work particularly well 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 shading, noise and air traffic.
- ▮ Ground Source Heat Pump's (GSHP) are not viable for site because of spatial constraints and financial costs. There is insufficient space to install GSHP vertical bores in the public realm.
- ▮ Geothermal. Availability of suitable location poses serious problem in adopting a geothermal solution. Extensive research is required prior to investing to ensure the location is suitable and sites do not 'run out of power' over a period of time. It may release harmful gases from deep within the Earth. High installation and investigation costs make the technology unviable.
- ▮ Biogas/ Anaerobic Digestion (AD). Emissions are likely to cause local air pollution and compliance with the Clean Air Act is problematic. Finding a secure supply of fuel can be difficult. The environmental impact of fuel transportation can be expensive. AD used to generate gas for heat or electricity requires pollution prevention and a control permit or waste management license. Digester, storage areas and delivery areas can cause problems via escape of odour and liquids. High installation costs make the technology unviable.
- ▮ Biomass CHP. As with standard biomass, this technology's problems lie in air quality, delivery of fuel, storage and transportation for deliveries etc. It would require a larger plant space for storing fuel, which is not currently included, and it is not conducive to city centre developments.
- ▮ Gas Fired CHP – Although a viable technology in terms of cost and carbon reductions the system is discounted on the basis of the move towards the decarbonisation of the Electrical Grid and the phasing out of Fossil fuels.
- ▮ Solar Thermal – Although a viable solution the system is discounted in favour of the adoption of the use of ASHP which after a more reliable cost-effective method of carbon emissions reduction.

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5.3. Summary of Technologies & Measures Considered & Adopted

5.3.1. Residential

Key:

Y – **Yes could be incorporated**

P – **Possible**

N – **Not appropriate**

REDUCE DEMAND	SUITABLE FOR CONSIDERATION	COMMENTARY
Natural ventilation	Y	Site mostly suitable to adopt natural ventilation for purge ventilation, but with MVHR back up.
Good Natural daylight	Y	Essential to reduce the reliance on artificial lighting.
	P	Heavy weight concrete structure and roof.
Air tightness	Y	Essential to minimise air leakage with the condition of the exposed site and reduce heat losses and exceed the minimum requirements of Part L 2013.
Solar shading/Low G Value Glass	Y	Specific solar shading adopted and low 'G' value glass adopted to reduce unwanted solar gain on specific elevations
Thermal Insulation That Exceeds Minimum Standards	Y	Essential to minimise heat losses. Minimum standards Building Regulation U Values exceeded
Low 'G Value' glass specification	Y	Important to limit summertime overheating. TM59 compliance and current targets G Value 0.4 - 0.5 on appropriate elevations
'A' Rated White Goods & Appliances	Y	Will be an integral part of the fit-out requirements to reduce electricity demand.
ENERGY EFFICIENCY		
Ventilation Heat recovery	Y	MVHR adopted on ventilation systems local, both residential and communal spaces
Low energy lighting	Y	Extensively adopted LED fittings throughout the scheme
Variable speed drive	Y	Variable speed drives can be adopted on all fan and pump motors where possible to reduce energy consumption (Central Plant)
Demand Operated Systems	Y	The use of passive infra-red (PIR) for lighting, heating, ventilation where feasible (typically corridors)
Electric heating and hot water generation	Y	Lot 20 compliant, fast response system heating
RENEWABLE AND LOW CARBON TECHNOLOGY		
Solar		
Solar hot water	P	Feasible but not as robust or effective as Photovoltaics
Photovoltaics (PV's)	P	Feasible - but minimal roof space available

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RENEWABLE AND TECHNOLOGIES	LZT	SUITABLE FOR CONSIDERATION	COMMENTARY
Water			
Small scale hydro power		N	Not feasible as no significant water source available
Tidal power		N	Not Applicable
Wave power		N	Not Applicable
Wind			
Wind turbines		N	Not suitable for city centre environment
Biomass			
Biomass single room heaters/stoves		N	Not appropriate for Application
Biomass boilers		P	Could be adopted to offset heating and hot water but high NO _x levels a concern in city centre environment but discounted.
Biomass community heating schemes		N	Could be adopted to offset heating and hot water but high NO _x levels a concern in urban environment/city centre.
Combined Heat and Power (CHP) for use with the following fuels:			
Biofuel		N	Gasification process too large for scale of site. Biodiesel considered immature feedstock and unreliable.
Gas Fired CHP		P	Feasible but not in line with government strategy for decarbonisation of electricity grid
Sewerage gas and other biogases		N	Scale of site too small.
Heat Pumps			
Ground source heat pumps		P	Extensive underground pipework difficult to install due to availability of land.
Water source heat pumps		N	No significant water sources to reject / absorb heat.
Geothermal heating systems		N	Not considered appropriate.
Air source heat pumps		Y	This technology is feasible to generate hot water for the development by introducing independent Dimplex EDEL ASHP Cylinders to the apartments
For heat pumps to comply, the heat source (ground or water) must be from a renewable source, for example soil, outside air, ground water, or a river.			
Other			
Fuel cells using hydrogen generated from any of the above 'renewable' sources.		N	Technologies not yet mature enough for application.
Rainwater recycling		P	Rainwater collection system could be adopted to recycle rainwater for toilet flushing purposes but minimal space to provide below ground tanks.
Green roofs		P	Could be adopted

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5.3.2. Amenity Spaces

Key:

Y	–	Yes could be incorporated
P	–	Possible
N	–	Not appropriate

REDUCE DEMAND	SUITABLE FOR CONSIDERATION	COMMENTARY
Natural ventilation	N	Site not considered wholly suitable due to proximity of main road.
Good Natural daylight	Y	Essential to reduce the reliance on artificial lighting.
Thermal mass	N	High rise lightweight structure, but concrete roof
Air tightness	Y	Essential to minimise air leakage with the condition of the exposed site and reduce heat losses and exceed the minimum requirements of Part L 2013.
Solar shading/Low G Value Glass	P	Specific solar shading not adopted but low 'G' value glass adopted to reduce unwanted solar gain on specific elevations
Thermal Insulation That Exceeds Minimum Standards	Y	Essential to minimise heat losses. Minimum standards Building Regulation U Values exceeded
Low 'G Value' glass specification	Y	Essential to reduce solar gain.
ENERGY EFFICIENCY		
Ventilation Heat recovery	Y	Adopted on ventilation systems.
Low energy lighting	Y	Extensively adopted LED fittings throughout the scheme
Variable speed drives	Y	Variable speed drives can be adopted on all fan and pump motors where possible to reduce energy consumption.
Demand Operated Systems	Y	The use of passive infra-red (PIR) for lighting, heating, ventilation where feasible
Daylight Dimming	Y	Use of photocells to dim office lights when there is sufficient daylight from outside
RENEWABLE AND LOW CARBON TECHNOLOGY		
Solar		
Solar hot water	N	Not sufficient hot water demand within building
Photovoltaics (PV's)	P	Feasible - but minimal roof space available.

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RENEWABLE AND TECHNOLOGIES	LZT	SUITABLE FOR CONSIDERATION	COMMENTARY
Water			
Small scale hydro power		N	Not feasible as no significant water source available
Tidal power		N	Not Applicable
Wave power		N	Not Applicable
Wind			
Wind turbines		N	Not suitable for city centre environment
Biomass			
Biomass single room heaters/stoves		N	Not appropriate for Application
Biomass boilers		N	Amenity area too small to justify.
Biomass community heating schemes		N	Could be adopted to offset heating and hot water but high NO _x levels a concern in urban environment/city centre.
Combined Heat and Power (CHP) for use with the following fuels:			
Biofuel		N	Gasification process too large for scale of site. Biodiesel considered immature feedstock and unreliable.
Gas Fired CHP		N	Not sufficient hot water demand within building
Sewerage gas and other biogases		N	Scale of site too small.
Heat Pumps			
Ground source heat pumps		P	Extensive underground pipework difficult to install due to availability of land.
Water source heat pumps		N	No significant water sources to reject / absorb heat.
Geothermal heating systems		N	Not considered appropriate.
Air source heat pumps		Y	This technology is feasible for heating to the main area.
For heat pumps to comply, the heat source (ground or water) must be from a renewable source, for example soil, outside air, ground water, or a river.			
Other			
Fuel cells using hydrogen generated from any of the above 'renewable' sources.		N	Technologies not yet mature enough for application.
Rainwater recycling		N	Rainwater collection system could be adopted to recycle rainwater for toilet flushing purposes but minimal space to provide below ground tanks.
Green roofs		N	N/A as 2 nd floor only.

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5.4. District Heating Network

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.

De-Centralised/ District Heating Networks (DHN)

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 city'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 site or district wide basis. District heating is generally provided from 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.

Manchester City Council are working in partnership with Vital Energi to create the Manchester Civic Quarter Heat Network.

The network will provide heat and power solution for a number of buildings, making significant carbon reductions.

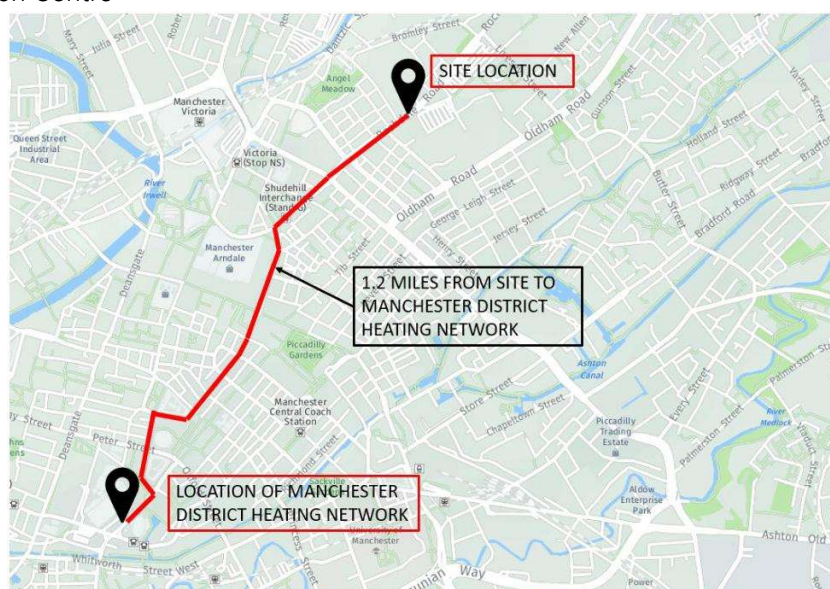
The first buildings to be connected are:

- Town Hall
- Town Hall Extension and Central Library
- Manchester Central Convention Centre
- The Bridgewater Hall
- Heron House

The network will contain power cables to distribute the electricity generated and underground pipes that deliver heat and hot water to connected buildings – one of the most cost-effective ways of reducing carbon emissions from heating. The network has been designed to enable future expansion, with efficiency and carbon savings increasing as more buildings join.

Heat will be generated from an energy centre, which is being built near to Manchester Central Convention Centre, at the junction of Great Bridgewater Street and Lower Mosley Street.

The distance of the proposed district heating mains to this development site is considered to be too far to be economically viable and are therefore discounted.



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6. CARBON EMISSION CALCULATIONS

6.1. Residential

Carbon emission calculations have been carried out in accordance with SAP Ratings 2012 with the following output:

Calculation Summary

Total Floor Area	14867.02
Average TER	22.57
Average DER	17.56
Average DFEE	28.46
Average TFEE	32.77
Compliance	Pass
% Improvement DER TER	22.2
% Improvement DFEE TFEE	13.15

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7. PROPOSALS

7.1. Residential

This report has set out the methodology in which the design team have approached the design of the proposed residential building and how the strategies of Manchester City Council and the Government guidelines have been adopted.

7.1.1. Passive Measures - Lean

In the first instance, the team have maximised passive measures to reduce the initial energy load of the building in terms of heating and anticipated lighting loads with the following measures: -

- U values that exceed minimum Building Regulation Standards as below

Element	Target U-Value (w/m2K)	Limiting U-Value (w/m2K)
Walls	0.18	0.30
Exposed Floors	0.19	0.25
Roof	0.13	0.20
Windows	1.4	2.0

The proportion of glass to wall ratio is balanced to allow good natural daylight into the spaces with tall windows that promote natural daylight and reduce the reliance on artificial lighting, but do not allow excessive heat losses in winter.

- Air leakage rates that exceed minimum Building Regulations

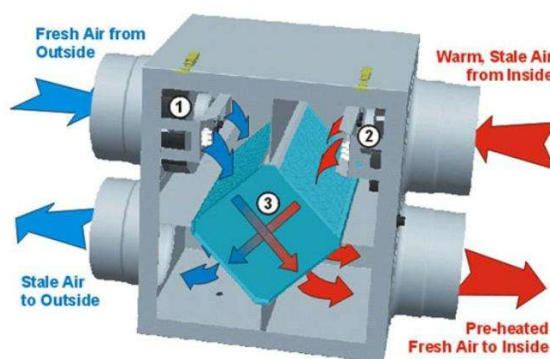
Air Permeability	Worst acceptable standard	This building
M ³ /(h.m ²) at 50 Pa	10	3.5

- Improved glazing specification (G Value of 0.4 - 0.5) that limits the amount of unwanted solar gain to avoid overheating
- The G Value of the glass will vary dependant on the orientation to promote solar gain in the NW/NE elevations to reduce heat losses in the colder months but reduce the escalation of solar gain on the SW/SE elevations to mitigate summertime overheating.

7.1.2. Energy Efficiency Measures - Mean

The next stage of the design development was to establish energy efficiency measures to meet the demand of the building, these being: -

- Heat recovery on the apartment and amenity mechanical ventilation systems, as shown in the image to the right.
- Low specific fan power ratings to ventilation fans
- High efficiency LED lighting throughout
- Demand operated lighting in corridors
- Variable speed drives on central pumps
- Lot 20 compliant direct electric heating with local control and occupancy sensing and set point temperature



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7.1.3. Renewable & Low Carbon Technologies - Green

The final aspect of the design has been to establish what renewable and low carbon technologies can be adopted. Following the appraisal of the building and site rooftop, photovoltaic panels will be provided to generate zero carbon electricity for the development as the most effective solution.



7.2. Amenity Spaces

The Amenity spaces will benefit from the passive measures as set out in 7.1.1 of this report and result in an initial reduction in the energy use of the space for heating, cooling and lighting. The spaces will be ventilated by local MVHR systems with heat recovery heat exchanger and have high efficiency LED lighting with intelligent control systems.

Heating and cooling to the spaces will be provided by reverse cycler air source heat pumps (ASHP) that will provide an efficient method of generating both heating and cooling to the Amenity space.

7.3. Overall Summary

Our Energy Strategy report is set out to explain the policies that affect the proposed development, reviewed the existing site and its surroundings, establishing the opportunities for energy reduction and Low and Zero Carbon technology on the site, and presented results from the SAP calculations.

The approach of our design for the development is to embed the low carbon design through a range of design measures based on the recognised Energy Strategy Hierarchy of 'Be Lean, Be Clean, Be Green'.

This approach is known as the fabric first approach and has driven a design intent to provide building U-values, air leakage rates that exceed the minimum requirements of Part L and therefore provide a significant reduction in the heat demand to the development.

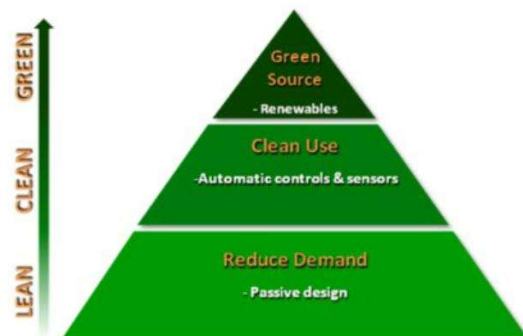


Figure 2 Energy Hierarchy

Furthermore, the passive design, optimised use of natural ventilation where appropriate and reduced unwanted solar gain has mitigated the extent of comfort cooling to the development.

The combination of these measures has significantly reduced the initial energy demand to the development and subsequent carbon emissions.

The next stage of the design process has been to incorporate energy efficiency measures such as:

- Ventilation heat recovery
- Low energy LED lighting
- Demand operated controls
- Variable speed drives

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These systems deliver the required services such as heating, ventilation and lighting in an energy efficient manner and therefore further reduce the energy use and subsequent carbon emissions.

The final aspect of the design has been to incorporate the renewable and low carbon technologies such as the:

- Air Source Heat Pump Technology
- Solar PV to Block 3 & 4

A further key element of Energy Strategy has been the consideration of the decarbonisation of the national grid.

Decarbonisation of “the Grid” is being achieved by increasing the share of low-carbon energy sources, particularly renewables, and a corresponding reduction in the use of fossil fuels. Capping greenhouse gas emissions from fossil fuel power stations by installing carbon capture and storage (CCS) technology is also expected to play an increasing role.

The grid carbon factor (GCF) of electricity has seen significant reductions in previous years and is predicted to fall further as shown in the graph below.

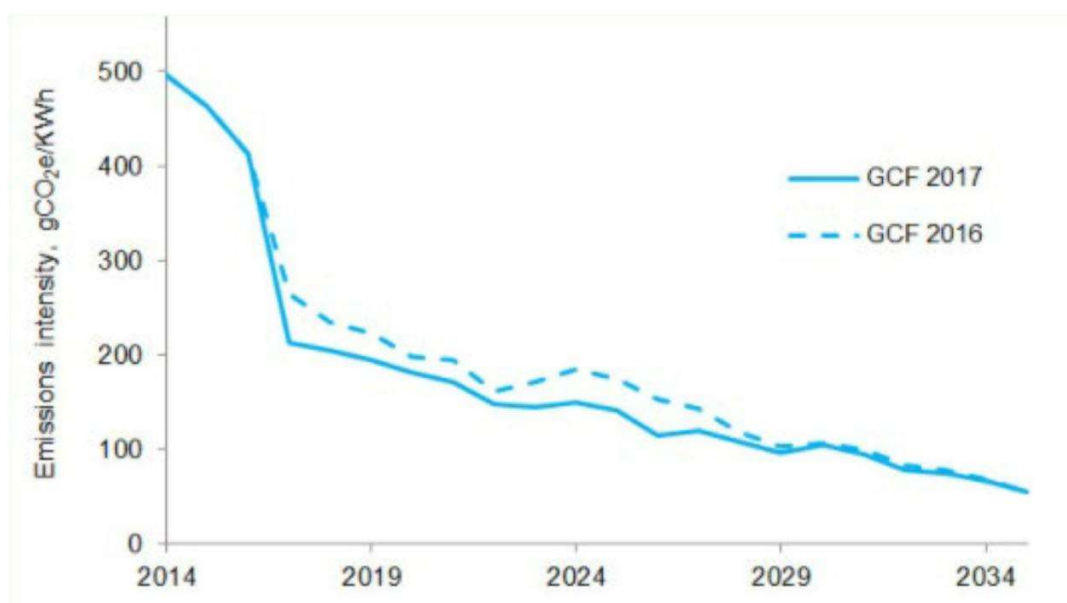


Figure 3 Predicted Reduction in Grid Carbon Factor

Decarbonising the grid would mean the carbon emissions from any systems using electricity would fall further in the future and make grid electricity supplied technology potentially more attractive and futureproof compared to fossil fuel burning technologies such as gas boilers.

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The table below sets out the anticipated reduction in carbon emissions of the National Grid.

YEAR	CARBON FACTOR (KGCO ₂ /KWHR)
Baseline	0.519
Current Design 2021	0.519
2025	0.108
2030	0.085
2038	0.040

The predicted reduced carbon factors have come from the Department of Business, Energy & Industrial Strategy (BEIS) 'Updated Energy and Emissions Projections 2018'.

The current design will meet the requirements of Part L with a betterment of 0.6% of the sample calculations based on the current Carbon Factor of 0.519 Kg CO₂ per kWh as referred to in SAP20. The impending changes to the SAP20 and to the new Regulations SAP10 is set to reduce the carbon factor of Electricity as referred to below:

Change in CO ₂ emissions factors			
	Emissions kg CO ₂ e per kWh		
	SAP 2012	Draft SAP 2016	Draft SAP 10
Mains gas	0.216	0.2077	0.210
Electricity	0.519	0.398	0.233

The SAP 10 emission factors for electricity are a three-year projection for 2018-2020. They are now closer to figures for grid electricity published by other official bodies, such as the Government GHG Conversion Factors figure of 0.283 for CRC reporting, and the BRE projected figure for 2019/21 of 0.302.

These changes will improve as the predicted carbon emissions comparatively against the current Regulations:

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In terms of fabric, the performance in the DFEE / TFEE figure is a betterment of 13.15% as referred to in Section 6.1 (Table 2). This demonstrates that the proposed fabric performance meets the targets set out in Part L1A.

Finally, the Air Source Heat Pump Hot Water Cylinders provided to the available apartments will provide a further offset to give a DER/TER betterment of 22% and a minimum EPC rating of 'B' for all Apartments. Apartments in Block 3 and 4 to also be supplemented with Solar PV to achieve an EPC rating of B.

