RIDGE

Energy Strategy Report

Octagon House, Manchester

RICHARD EVERTON

12th August 2026

OCTAGON HOUSE, MANCHESTER
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VERSION CONTROL

VERSION	DATE	DESCRIPTION	CREATED BY	REVIEWED BY
1.0	29.05.2026	Draft	SW	CB
2.0	31.07.2026	Stage 2 Issue	SW	CB
3.0	12.08.2026	Update to Project Development Plans	SW	CB

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1. EXECUTIVE SUMMARY

1.1. Overview

Ridge have been appointed to provide an Energy Strategy Report to align with National Planning Policy Framework (NPPF), Manchester County Council (MCC) Core Strategy and Places for Everyone Joint Development Plan. As part of this energy Strategy Report the design strategy has been focused on energy efficiency and low and zero carbon technologies in addition to best practice measures in compliance with Building Regulations Part L.

1.2. Design Strategy

As part of the low carbon design strategy, the following design initiatives were adopted to reduce the operational energy demand of the building as much as possible. This design strategy has been developed in line with the Energy Hierarchy which has been outlined in section 4.

Be Lean

- Improved thermal fabric performance and air permeability by improving roof and windows to reduce heat losses.
- Passive solar control through orientation, layout, form, glazing percentages and G-Values to reduce heat gains and mitigate artificial cooling.
- Providing sufficient glazing to ensure natural daylighting targets are achieved and reduce the reliance on artificial lighting.

Be Clean

- Efficient LED lighting.
- Energy efficient plant and white good to reduce unregulated energy load.
- Integrating variable speed pumps and fans to reduce operational energy demand during off-peak hours.
- Highly efficient heat recovery on mechanical ventilation equipment to reduce fresh air heating and cooling loads.
- Occupancy controls to landlord areas on equipment to reduce off-peak energy loads.
- Smart controls of primary plant and plant within landlord areas to optimise performance and match energy usage with demand.
- Energy monitoring of landlord areas and primary plant to develop a real-life picture of energy use and carbon emissions.

Be Green

Low carbon technologies such as Air Source Heat Pumps for hot water demand and solar technologies such as Photovoltaics.

2. INTRODUCTION

As Low Carbon Design Consultants Ridge and Partners have been appointed by Richard Everton to provide a statement for the purposes of submitting a full planning application on the refurbishment and the new builds of the Octagon House site to include PBSA, residential accommodation aimed at key workers and the refurbishment of the existing Octagon House.

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

The document presented below outlines a preliminary low carbon design philosophy followed to develop an energy strategy for the proposed works. The "Energy Hierarchy" methodology provides a design framework which was used to develop the proposed low carbon energy strategy. The approach described by this methodology provides a staged process: LEAN, CLEAN and GREEN (Illustrated below) to assess design measures.

Each stage would focus on the following:

- Lean – Main aim is to reduce the buildings energy demand through "passive measures".
- Clean – Meet the reduced energy demand in the most efficient way possible using "active measures"
- Green – Assess the technical feasibility of incorporating a low or zero carbon technology to further reduce the CO2 emissions.

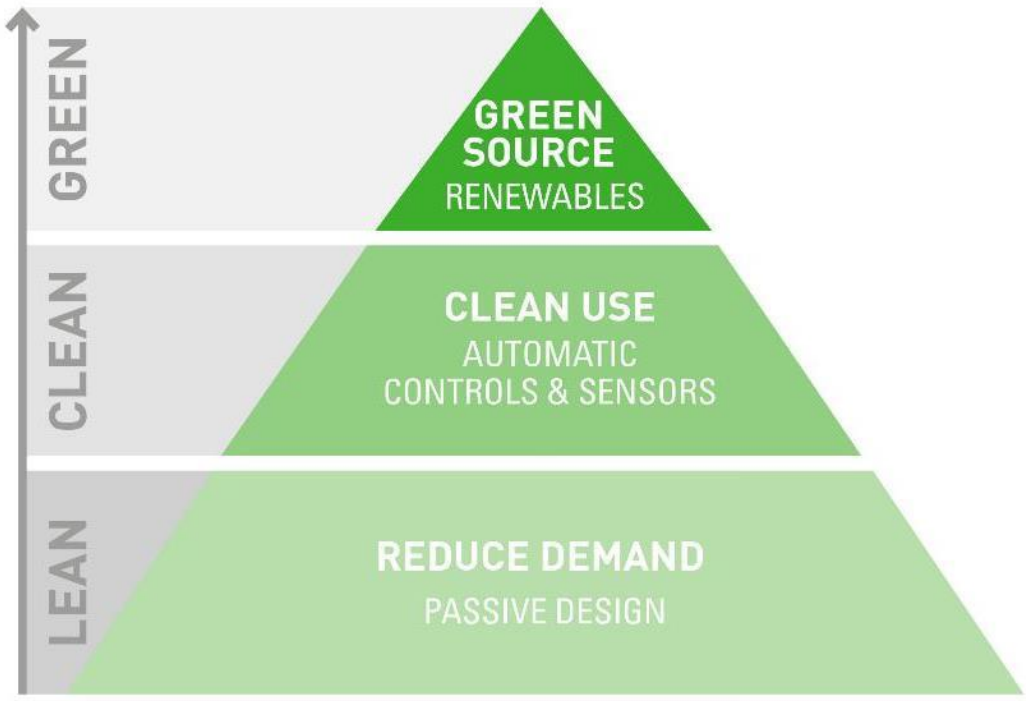


Figure 1 – Energy Hierarchy [Greater London Authority].

3. DEVELOPMENT PLANS

3.1. Description of Development Site

The Site is currently occupied by the Octagon building with its ground floor being occupied by Fresenius Medical Care. The building comprises of approximately 1,429 sqm GIA floorspace which is approximately 6 stories in height with associated car parking on both sides. The remainder of the site south of Bax road is occupied by the X building. One story in height the building comprises of under 650 sqm GIA floorspace. North of Bax road the site is more associated car parking.

The existing Octagon building will be retained and refurbished as part of the project.



Figure 2 - View of the existing site and surrounding area

The proposed development has all major services (gas, water, telecoms and electricity) within the surrounding roads which will need to be either isolated and either diverted or disconnected to develop the project.

3.2. Project Development Plans

Full planning application for the refurbishment and extension of Octagon House and the erection of buildings of up to 11 storeys in height to accommodate a mix of uses comprising Purpose Built Student Accommodation bedrooms (205 studios and 35 apartments accommodating 255 bedrooms) (Sui Generis Use Class); Key Worker accommodation (Sui Generis Use Class) (211 units); Residential units (16 no) (Use Class C3); 2,568 sq m of healthcare use (including the retention of an existing healthcare facility on site) (Use Class Ee); and 394 sq m of commercial or community uses (Use Classes Ea, Eb, Eciii, Ee, Ef, F1e, F2b, F2c) with associated site access, car and cycle parking and landscaping.

In terms of the key measures I have set out below this is updated as follows:

Key measurables:

- Number of student bedrooms – 455 (205 studios, 255 in cluster form contained within 35 apartments)
- Key worker units – 141 studios, 70 one and two bedroom units
- Residential units – 16
- Commercial or community unit at ground and first floor of Octagon House – 394 sq m
- Central Manchester Dialysis Unit (existing plus expansion to first floor of Octagon House) – 2,568 sq m
- Cycle parking spaces:
    - PBSA – 34
    - Key worker – 50
- Car parking
    - 19 spaces in south east part of the site currently used by staff and visitors of the Central Manchester Dialysis Unit to be retained for use by its visitors only
    - 32 new spaces to be provided for use by Central Manchester Dialysis Unit staff
    - 0 car parking across the rest of the site
    - All remaining existing car parking within the site will be removed

4. CORE STRATEGY POLICY EN4

In line with the draft definition of zero carbon, an energy hierarchy has been created (see Figure 2 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).

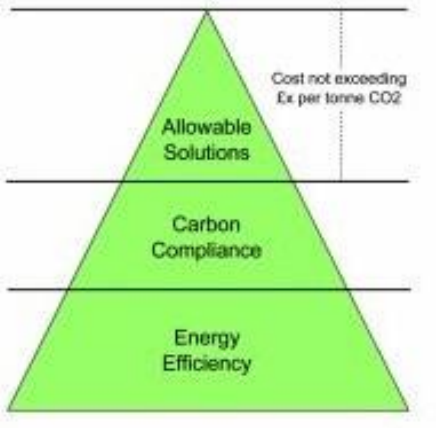


Figure 3 – Energy Hierarchy

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.

5. POLICY CONTEXT

5.1. National Policy Framework

A revised National Planning Policy Framework (NPPF) was updated and published in December 2024 which sets out the Government's planning policies for England and how they are expected to be applied. This framework replaces that published in December 2023. This framework states the purpose of Sustainable development that:

'The purpose of the planning system is to contribute to the achievement of sustainable development.'

This highlights sustainability as a critical issue that runs throughout all the planning policies. The National Planning Policy Framework (NPPF) defines sustainable development in agreement with the U.N. definition of "meeting the needs of the present without compromising the ability of future generations to meet their own needs." The NPPF outlines how three overarching objectives need to be pursued in mutually supportive ways to achieve sustainable development. These objectives are outlined below.

The environmental objective of this framework is to:

> *Contribute to protecting and enhancing our natural, built, and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste pollution, and mitigating and adapting to climate change, including moving to a low carbon economy.*

5.2. The Greater Manchester Combined Authority (GMCA)

The GMCA declared a climate emergency in 2019 and launched a plan in March 2020 following 12 months collaboration and consultation with representatives from areas across the city region. The plan omits the actions needed to achieve a 50% reduction in CO_2 emissions between 2020 and 2025 and actions to support the city to be carbon neutral by 2038.

5.3. Places For Everyone Joint Development Plan

The Places for Everyone Joint Development Plan of Bolton, Bury, Manchester, Oldham, Rochdale, Salford, Tameside, Trafford, and Wigan Councils sits at the foundations of proposals to improve employment opportunities for local communities, build the right homes in the right places, rejuvenate green spaces and reshape town centres. As a long-term plan for jobs, new homes, and sustainable growth, it will enable the region to tackle the inequalities experienced by many communities.

This section of the report summarises the policies within the Plan relevant to the energy strategy report.

- **Policy JP-S2: Carbon and Energy**

The aim of Policy JP-S2 is to deliver a carbon neutral Greater Manchester no later than 2038, with a dramatic reduction in greenhouse gas emissions. This will be supported through a range of measures, including:

- Promoting retrofitting of existing buildings with measures to improve energy efficiency and generating renewable and low carbon energy, heating and cooling.
- Promoting the use of life cycle cost and carbon assessment tools to ensure the long-term impacts from development can be captured.

- Taking a positive approach to renewable and low carbon energy schemes, particularly schemes that are led by, or meet, the needs of local communities.
- Increasing the range of nature-based solutions including carbon sequestration through the restoration of peat-based habitats, woodland management, tree-planting and natural flood management techniques.
- An expectation that new development will, unless it can be demonstrated that it is not practicable or financially viable:
    - Be net zero carbon which applies:
        - From adoption: to regulated operational carbon emissions
        - From 2028: to all emissions 'in construction'.

Starting from 2025, it will also be expected that carbon emissions from unregulated energy sources will be quantified and minimised. Reported through an energy statement, development proposals will be required to set out how this has been achieved in accordance with the energy hierarchy, which, in order of importance, seeks to:
i. Minimise energy demand
ii. Maximise energy efficiency
iii. Use renewable energy
iv. Use low carbon energy
v. Utilise other energy sources

Furthermore, from 2025, any residual carbon emissions that cannot be fully mitigated on-site should be offset, in agreement with the relevant local planning authority through a financial contribution to a carbon offset fund. As an interim measure, development should be consistent with the 2022 Part L Building Regulations, unless superseded by changes to building regulations and/or national or local planning policies.

- Incorporate adequate electric vehicle charging points in line with Part S of the Building Regulations, unless superseded by relevant Local Plan policies, to future proof for the likely long-term demand, taking account of the potential maximum energy demand for the site.

- Where practicable, prioritise connection to a renewable energy/heating/cooling network or a low carbon energy/heating/cooling network that is adaptable to non-fossil fuels at a later date.

- For non-residential developments, achieve at least BREEAM Excellent standard (or equivalent) for issue Energy 01 "Reduction of energy use and carbon emissions", rising to 'BREEAM Outstanding equivalent from 2028 (for issue Energy 01).

- Include a detailed energy statement to demonstrate via site relevant evidence how the development has sought to maximize reductions in carbon emissions in line with relevant policy targets, including the minimisation of overheating risks and appropriate measures for post occupancy evaluation. Whole life cycle emissions should be considered where possible. Districts may set out specific carbon emission reduction and energy demand targets within Local Plans.

Please note that the June 2022 release revision of "Approved Building Regulations Part L 2021" will be referred to as "Part L 2022" throughout this report, in accordance with the naming convention used in Policy JP-S-2.

- **Policy JP-S3: Heat and Energy Networks**

The provision of decentralised energy infrastructure is critical to the delivery of the objectives for low carbon growth, carbon reductions, and an increase in local energy generation. The following measures will assist in achieving this:

- Delivery of renewable and low carbon energy schemes will be supported, with particular emphasis on the use of decentralised energy networks in areas identified as "Heat and Energy Network Opportunity Areas". These have been identified where:
- Existing heat/energy networks are operational or have been commissioned;
- Proposals for new heat networks/energy networks are being progressed, or future opportunities have been identified in city-region master planning;
- Sufficient density of existing heat demand occurs; and
- Significant future development is proposed at the strategic development locations.
- Within the identified "Heat and Energy Network Opportunity Areas", unless it can be demonstrated that there are more effective alternatives for minimising carbon emissions or such connection is not practicable or financially viable, it is expected that:
- New residential developments that are '10 dwellings or more' or other developments over 1,000m2 floorspace shall:
    - Connect to an existing or planned heat/energy network or be designed to enable future connection (where within 500m of such a network); and/or
    - Install a site-wide or communal heat/energy network solution.
- An expectation that new industrial development will demonstrate that opportunities for using waste heat locally have been fully examined, and included in proposals;
- An expectation that where publicly owned buildings and assets adjoin new major development sites, opportunities for these buildings and assets to connect to site-wide proposals will be considered; and
- An expectation that any site-wide networks will be designed so as to enable future expansion to adjoining buildings or assets as appropriate.

- **Policy JP-S4: Flood Risk and the Water Environment**

An integrated catchment-based approach will be taken to protect the quantity and quality of water bodies with reference to the North West River Basin Management Plan and managing flood risk, by:

- Returning rivers to a more natural state, where practicable;
- Working with natural processes and adopting a natural flood management approach to slow the speed of water drainage and intercept water pollutants;
- Locating and designing development so as to minimise the impacts of current and future flood risk, including retrofitting or relocating existing developments, infrastructure and places to increase resilience to flooding;
- Expecting developments to manage surface water run-off through sustainable drainage systems and as close to source as possible. Development should achieve greenfield run-off rates unless it is demonstrated to be impracticable. District local plans should consider setting more detailed surface water drainage policies to reflect local circumstances, including alternative surface water discharge rates, such as in areas with critical drainage issues;
- Ensuring that sustainable drainage systems:
    - Are designed to provide multifunctional benefits wherever possible, including for water quality, nature conservation and recreation;

  - Avoid adverse impacts on water quality and any possibility of discharging hazardous substances to ground;
  - Are delivered in a holistic and integrated manner, including on larger sites split into different phases; and
  - Are managed and maintained appropriately to ensure their proper functioning over the lifetime of the development.
- Securing the remediation of contaminated land and the careful design of developments to minimise the potential for urban diffuse pollution to affect the water environment; and
- As a minimum, residential development should meet the mandatory water efficiency standard of 125 litres/person/day as set out in Building Regulations. District local plans may and should consider setting a tighter water efficiency standard of 110 litres/person/day where there is a clear local need with reference to national guidance on housing optional technical standards.

Policy JP-P1 Sustainable Places

Greater Manchester aims to become one of the most liveable city regions in the world, consisting of a series of beautiful, healthy and varied places, each having the following key attributes that all development, wherever appropriate, should be consistent with:

1. Distinctive, with a clear identity that:
a. Conserves and enhances the natural environment, landscape features, historic environment and local history and culture;
b. Enables a clear understanding of how the place has developed; and
c. Respects and acknowledges the character and identity of the locality in terms of design, siting, size, scale and materials used
2. Visually stimulating, creating interesting and imaginative environments which raise the human spirit through the use of green space, public art and quality design
3. Socially inclusive:
a. Responding to the needs of all parts of society;
b. Enabling everyone to participate equally and independently;
c. Providing opportunities for social contact and support; and
d. Promoting a sense of community
4. Resilient, capable of dealing with major environmental events
5. Adaptable, able to respond easily to varied and changing needs and technologies
6. Durable, being built to last and using robust materials that reflect local character, weather well and are easily maintained
7. Resource-efficient with:
a. A low carbon footprint;
b. Efficient use of land;
c. Minimised use of new materials;
d. High levels of recycling
8. Safe, including by designing out crime and terrorism, reducing opportunities for anti-social behaviour and by ensuring that developments make appropriate provision for response and evacuation in the case of an emergency or disaster.
9. Supported by critical infrastructure, such as energy, water and drainage and green spaces
10. Functional and convenient, enabling people and uses to act efficiently with minimal effort, and responding to needs relating to servicing, recycling facilities, refuse collection and storage
11. Incorporating inclusive design within all spaces with support for tackling inequality and poverty to form part of creating sustainable places

12. Legible, being easy to understand and navigate, with the protection and enhancement of key views and new development well-integrated into the place
13. Easy to move around for those of all mobility levels, particularly by walking and cycling, with enjoyable routes free from obstacles and disorienting stimuli, and with places to rest
14. Well-connected to other places, particularly by public transport and digital infrastructure enabling everyone to take advantage of the employment, cultural and leisure opportunities across Greater Manchester and beyond
15. Comfortable and inviting, with indoor and outdoor environments:

a. Offering a high level of amenity that minimises exposure to pollution; and
b. Addressing microclimate issues such as sunlight, indoor air quality, overheating, shade, wind and shelter

16. Incorporating high quality and well managed green infrastructure and quality public realm, with:

a. Opportunities for recreation and outdoor play for children, and interaction between the generations;
b. Public and private spaces clearly distinguished;
c. Development clearly defining, and promoting activity within, public spaces;
d. High quality landscaping with schemes

17. Well-served by local shops, services and amenities, including education and health facilities.

5.4. Manchester Core Strategy

This is the principal document of Manchester City Council as the local planning authority's Development Plan of which the following policies are of most relevance:

- **Policy EN4**

Reducing CO2 Emissions by Enabling Low and Zero Carbon Development

It must be demonstrated that the energy hierarchy has been applied to:

- Reduce the need for energy through design features that provide passive heating, natural lighting and cooling.
- Reduce the need for energy through energy efficient features such as improved insulation and glazing.
- Meet residual energy requirements through the use of low or zero carbon energy generating technologies.

(Note: That the above section of Policy EN 4 is now replaced by Places for Everyone (PfE) Policy JP-S2)

Furthermore, the following is also required:

- 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 must be considered.

- **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 developments, 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 CO_2 reduction funded by contributions.

Policy EN 6: Target Framework for CO2 Reductions from Low or Zero Carbon Energy Supplies
Residential developments of 10 or more units will be expected to achieve a minimum performance target as shown in the table below, 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 CO_2 emissions for all phases of the development'.

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

(Note: Most of Policy EN 6 is now replaced by PfE Policy JP-S2)

- **Policy EN8**

Adaptation to Climate Change

All new development 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.
- 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 CO_2 mitigation under Policy EN6 (replaced by PfE Policy JP-S2), subject to evidence to quantify their contribution to compliance.

(Note: The first and fourth bullet points of Policy EN 8 are now replaced by PfE Policies JP-S2, JP-S4 and JP-G8)

6. REGULATORY FRAMEWORK

6.1. 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 L Volume 2 of the Government's 2021 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.

Part L2B features consequential improvements which apply *"to an existing building with a total useful floor area over 1000m^2 where the proposed building work consists of or includes:*

a. *An extension*

b. *The initial provision of any fixed building services*

c. *An increase to the installed capacity of any fixed building services"*

Part L2B also provides a threshold U-value for which if elements are either at or are worse than the threshold U-value, they should be upgraded to the improved U-value.

Table 5 **Upgrading retained thermal elements**

Element[1]	U-value W/(m^2.K)	
	(a) Threshold	(b) Improved
Wall – cavity insulation	0.70	0.55[3]
Wall – external or internal insulation	0.70	0.30[3]
Floors[4,5]	0.70	0.25
Pitched roof – insulation at ceiling level	0.35	0.16
Pitched roof – insulation at rafter level[6]	0.35	0.18
Flat roof or roof with integral insulation[7]	0.35	0.18

Figure 4 - Upgrading retained thermal elements, U-value table

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.

CO_2 emissions are calculated using a number of factors, including:

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

6.2. BREEAM

The Building Establishment's Environmental Assessment Method (BREEAM) is the world's leading and most widely used voluntary environmental assessment method for commercial buildings that aims to quantify and reduce the environmental impact of buildings in a robust and cost effective manner.

This is achieved by the use of the scheme by clients and their project team at key stages during the design and construction process.

The performance based assessment awards credits within the following categories:

- Energy
- Water
- Transport
- Materials
- Land use and ecology
- Pollution
- Health and wellbeing
- Management
- Waste

The assessment process provides in a report that covers the areas assessed, along with a formal certification on a scale of UNCLASSIFIED, PASS, GOOD, VERY GOOD, EXCELLENT and OUTSTANDING.

The diagram below shows how the BREEAM assessment scores and rates a building:

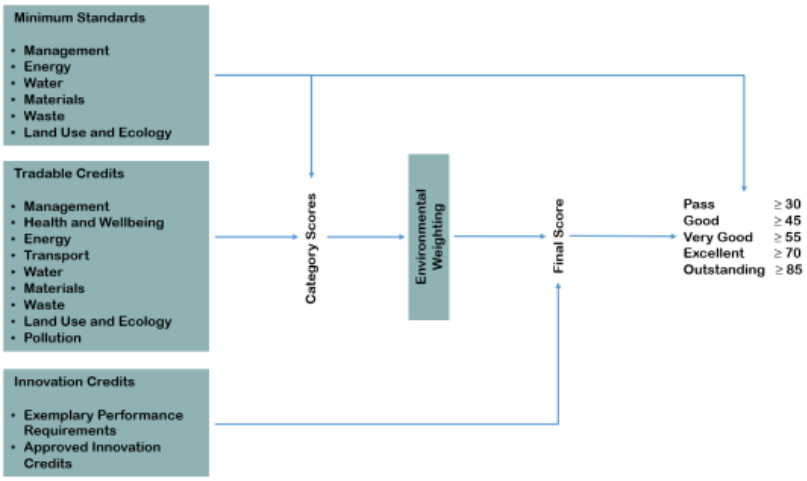


Figure 5 - Process for Awarding BREEAM Ratings

The BREEAM categories include a number of environmental elements that reflect the different options available when designing, procuring and constructing a building. Each environmental element has credits available that are awarded when compliance has been demonstrated.

For the building to meet a specific BREEAM rating, there are a series of minimum standards that must be achieved for that rating to be awarded.

In addition to the credits, there are also innovation credits available that provide additional recognition of sustainable performance that goes beyond what is currently recognised and rewarded by the standard BREEAM credits.

The innovation credits are awarded for either meeting the BREEAM exemplary level requirements or by an application to BRE to have a specific feature, system or process recognised as 'innovative'.

An environmental weighting is applied to the scores achieved under each category as shown in the table below, in order to calculate the final BREEAM score. The weighting factors vary depending on the

assessment type and whether the project is fully fitted, shell and core or shell only. The weightings for each category are summarised in the table below.

The weightings are:

BREEAM SECTION	WEIGHTING (%)
Management	11.0
Health and Wellbeing	15.0
Energy	16.5
Transport	8.5
Water	7.5

BREEAM SECTION	WEIGHTING (%)
Materials	16.0
Waste	7.0
Land Use and Ecology	10.5
Pollution	8.0

Once the weightings have been applied, the score is then assigned a BREEAM rating as follows:

BREEAM RATING	SCORE (%)
UNCLASSIFIED	<30
PASS	≥30
GOOD	≥45
VERY GOOD	≥55
EXCELLENT	≥70
OUTSTANDING	≥85

At this stage it is difficult to predict the exact number of BREEAM credits achievable by each Low and Zero Carbon Technology. These technologies will have an influence over the following:

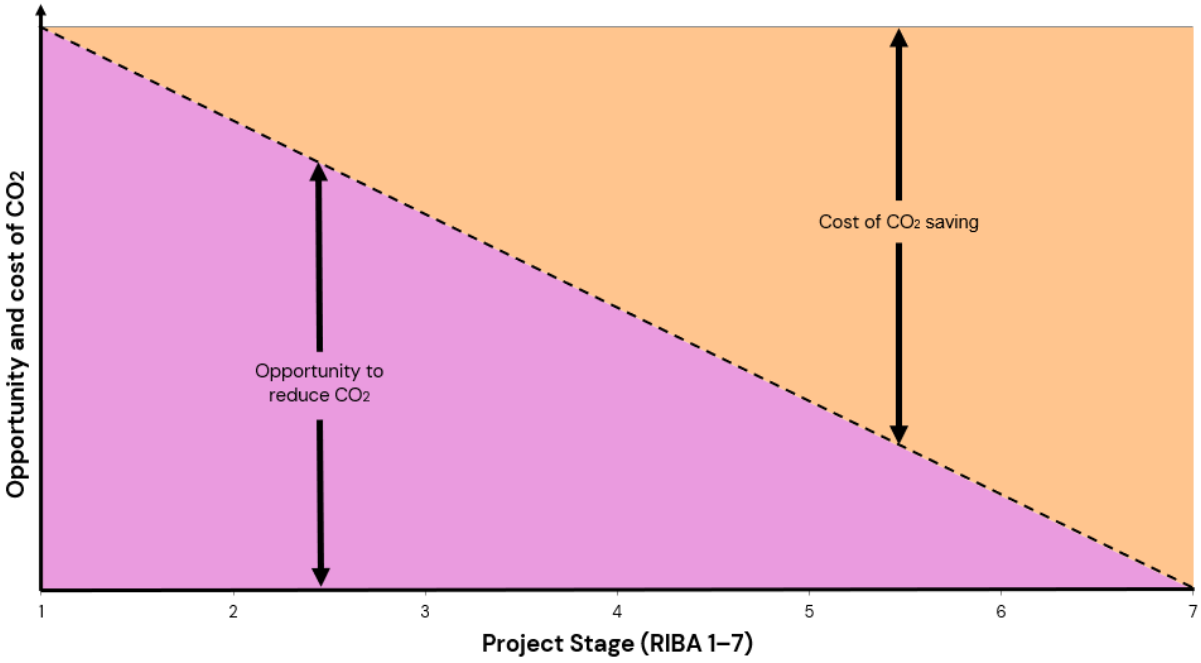
- Ene 01 – Reduction of CO2 Emissions – Up to 15 (+5 innovation) credits are available
- Ene 04 – Low and Zero Carbon Technologies – Up to 3 (+1 innovation) credits are available
- Po12 – NOx Emissions – Up to 3 credits are available.

7. APPRAISAL OF SOLUTIONS

7.1. Summary

The strategic approach outlined, follows a specific appraisal of technologies at each stage of design and to achieve the overall goal of CO_2 reduction.

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

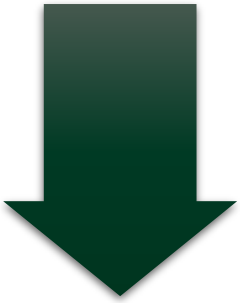


In this first instance it is therefore essential that the buildings 'passive measures' are optimised and the design
team work in close collaboration with the user team to consider the future fit out demands.

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.

Our approach has followed the following route:

Reduce Demand

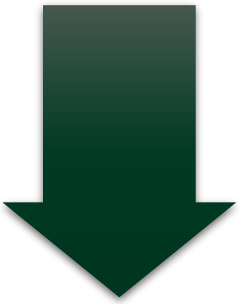


Passive design:

- Thermal insulation
- Air tightness
- Natural daylight
- Solar shading
- Thermal mass
- Low energy fit out
- Glass Specification
- Sub-metering
- Adaptation to climate change

LEAN — Reduce Energy Demand

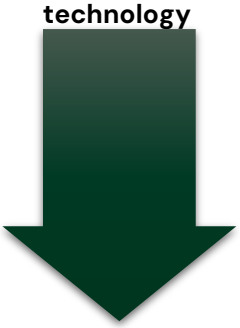
Meet demand efficiently



- Mechanical Ventilation with heat recovery
- Low energy lighting (LED)
- Power management
- Variable speed drives
- Demand Operated Systems
- Low Specific Fan Power

MEAN — Supply Energy Cleanly and

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
- District heating network

GREEN — Incorporate Renewable Energy

8. DESIGN MEASURES

This section presents the design measures evaluated to reduce the building's energy demand to develop an energy efficient design solution. The implications in relation to Part L 2013 (Approved document L2A and L2B) of the Building Regulations are explored, with reference to the technical and functional feasibility of various energy efficiency measures.

9. PASSIVE DESIGN MEASURES

9.1. Reducing Demand (Passive Design)

Options have been reviewed for the use of passive technologies to reduce the carbon emissions from the building.

The site location is in central Manchester, with weather typical of the North-west. Mild conditions are present throughout the year, with relatively high rainfall and cloud cover expected throughout the year. The microclimate in the centre of Manchester tends towards higher temperatures than typical in the North-west generally, due to the urban heat island effect.

In terms of expected building occupancy, these are expected to be typical of buildings of this type with variable usage with generally but high occupancy in the weekday evenings and weekends.

The following measures are to be incorporated in the design:

- Thermal Insulation
- Air tightness
- Natural daylight
- Low energy fit out
- Good quality and controllable ventilation
- Acoustically sound environment
- Adaption to climate change

These measures promote the reduction of Energy use and carbon emission in the first instance.
The demand for cooling has also been reduced through the adoption of efficient building services and by matching or exceeding the u-values stated in the Building Regulations.

This combination of passive design measures act to stabilise the temperatures within the building and enable it to adapt to the likely extremes of both high and low temperature.

TECHNOLOGY	CHARACTERISTICS	COMMENTS	FEASIBILITY
Thermal insulation	Thermal insulation is the reduction of heat transfer (i.e., the transfer of thermal energy between objects of differing temperature) between objects in thermal contact or in range of radiative influence.	Insulation is central to low energy construction to reduce unnecessary heat loss. The Part L building regulations set out limiting efficiencies U-values on which we intend to improve on. This will help reduce the energy required to heat the spaces in the proposed refurbished building.	Feasible/Suitable
Air Tightness	Airtightness is the control of air leakage, i.e. the elimination of unwanted draughts through the external fabric of the building envelope. This may be achieved by the correct and proper installation of a vapour check or vapour barrier.	The Proposed Development will target an air tightness that exceeds the minimum requirements of Part L 2021 building regulations to reduce air infiltration and unwanted draughts through the external fabric of the building envelope and so heating and cooling energy demand will be lowered.	Feasible/Suitable

TECHNOLOGY	CHARACTERISTICS	COMMENTS	FEASIBILITY
Natural Daylight	Natural light is light that is generated naturally, the common source of which is the Sun. This is as opposed to artificial light, which is typically produced by electrical appliances such as lamps.	To reduce the energy used for artificial lighting the natural daylight entering occupied spaces will be maximised.	Feasible/Suitable
Solar Shading	Solar shading is a method by which solar radiation in the form of heat and light can be mitigated in a building through various methods. While natural heat and light are essential in most buildings there are occasions when the levels are too high. This leads to overheating and too much light.	Whilst maximising daylight care must be taken to ensure that direct sunlight does not cause glare in the spaces and does not cause excessive solar gains in summer which will cause spaces to overheat. Examples of solar shading are: canopies, solar control glazing, balconies, internal blinds and curtain. Solar shading has been proposed for the refurbished building but is not present for the new builds on the scheme. Low G-Value glass will help to prevent unwanted solar gain of the proposed Development.	Feasible
Thermal Mass	Thermal mass is a material's capacity to absorb, store and release heat. Materials like water and concrete have high thermal mass, while insulation foam has very little. A common analogy compares thermal mass to a thermal battery. It has long been part of building design but is now increasingly used to improve energy efficiency. However, it is not a 'one size fits all' solution.	Thermal mass such as concrete can absorb large amounts of heat energy which prevents spaces from overheating. The thermal mass can be cooled overnight when the space is not occupied to further reduce energy needed for cooling when the space is occupied. The Proposed Development will be of medium lightweight structure with a concrete flat roof.	Feasible
Low Energy Fit Out	A low energy fit out is an interior development of a building that is low carbon in its design, operation, and entire lifecycle.	All goods and appliances should be highly energy efficient to reduce overall energy demand.	Feasible/Suitable
Sub-metering	Building submetering is a meter within your building or facility for specific energy measurements.	Power, lighting, major plant and separate tenancy areas will be metered to allow energy consumption to be pinpointed and reviewed if it's excessive. Baselines and targets will also be set to help reduce energy use. The individual apartments will be metered individually, and the buildings as a whole will be bulk metered. PBSA will be metered per block.	Feasible/Suitable
Adaption to climate change	Average temperatures for central England have risen by approximately 1°C since the 1970s	An uplift in fabric improvements on a development can maximise the retention of heat in winter and reduce heat	Feasible/Suitable

TECHNOLOGY	CHARACTERISTICS	COMMENTS	FEASIBILITY
	and this has resulted in changing rain patterns and rising sea levels. In addition to unpredictable extreme weather events such as floods, droughts and freezing winters. Climate change increases the risk of higher external temperatures, which can elevate internal building temperatures, potentially damaging equipment and driving up cooling demand.	gains in summer. These improvements will help combat the extremes expected as a result of climate change. G-Values have been selected to maximise natural light and thus reduce reliance on artificial lighting without introducing unwanted thermal gain during the summer months.	

9.2. Building Fabric.

Reduced U-values and air permeability are proposed to exceed the minimum requirements of Part L2A and are summarised in the table below. This low carbon design measure aimed to reduce the heat demand through the external fabric of the building reducing fabric and uncontrolled ventilation heat losses. In addition to the above, the solar transmittance of all glazing units (G-value) needs to be carefully considered to limit the solar gains and reduce overheating risk.

10. ACTIVE DESIGN MEASURES

After reducing the demand of energy through passive design principles, the next step is to evaluate the active design principles. This section focusses on meeting the reduced demand through the most energy efficient mechanical and electrical services strategies technically suitable. The following active design measures have been considered for the new Octagon House build.

10.1. Meeting Demand Efficiently - (Be Clean)

This section looks at technologies that will be used to ensure that energy demand is further reduced and met efficiently:

- Ventilation
- Heat recovery
- Demand Operated Systems
- Variable Speed Drives on fans and pumps
- Power Management
- LED Lighting
- BMS Optimisation

TECHNOLOGY	CHARACTERISTICS	COMMENTS	FEASIBILITY
Mechanical Ventilation Heat Recovery (MVHR)	MVHR provides fresh filtered air into a building whilst recovering a high percentage of the energy that has already been used in heating the building. This makes heat recovery ventilation an effective and efficient solution for meeting the ventilation demands of energy-efficient buildings.	Where fresh air is supplied, and stale warm air extracted by mechanical ventilation, heat recovery will be used to recycle up to 85% of the heat from the extracted air to warm the incoming air. The re-use of waste heat in the mechanical ventilation systems could provide a significant step towards reducing CO_2 emissions. MVHR units also work to pre-cool warm fresh air during summer months in order to reduce the cooling energy required in air-conditioned spaces. Mechanical Ventilation with Heat Recovery (MVHR) units will be installed within all apartments, bedrooms/studios and communal/amenity spaces.	Feasible/Suitable
Demand Operated Systems	The control of the heating, cooling, ventilation, and lighting systems is fundamental to the energy efficiency of buildings. The use of the following measures can reduce energy consumption: Zoned thermostatic control; Time control; Variable flow control; BMS (Building Management System) automated control; Lighting PIR (Passive Infra-Red Sensor) control; Daylight linked lighting control; CO_2 detection; and Energy management control	Where ventilation, heating and cooling is provided to a space that may not always be in use, occupancy sensors will be used, this will be fundamental to the energy efficiency of each building. These will shut down the systems serving the spaces when they are not required and turn them back on instantly when necessary. The use of the following measures will be encouraged: Zoned thermostatic control; Time control; Variable flow control; BMS (Building Management System) automated control; Lighting PIR (Passive Infra-Red Sensor) control; Daylight linked lighting control; CO_2 detection; and Energy management control. The use of passive infra-red (PIR) for lighting,heating and ventilation will be adopted where feasible. Typically, this will be in the form of PIR sensors in small spaces and microwave sensors in larger areas.	Feasible/Suitable
Variable Speed Drives	Variable speed drives and controls allow an energy system to modulate during periods of low demand. Therefore, using variable speed drive pumps uses less energy than constant speed traditional pumps.	All pumps and fans would be provided with variable speed motors which will speed up and slow down as the demand increases or reduces to conserve energy. These can be used in conjunction with the demand operated systems to reduce the speed of pumps and fan motors to a minimum to conserve energy. Variable speed drives can be adopted on all fan and pump motors where possible to reduce energy consumption.	Feasible/Suitable
Power Management	Power management is a computing device feature that allows users to control the amount of electrical power consumed by an underlying device, with minimal impact on performance. It enables the	Power factor correction can be used on the electrical supplies of a building to improve energy efficiency. Provision including allocation of spare plant space will be made for future introduction of power factor correction into	Feasible

TECHNOLOGY	CHARACTERISTICS	COMMENTS	FEASIBILITY
	switching of devices in various power modes, each with different power usage characteristics related to device performance.	the Proposed Development, this will follow a survey undertaken after 6 months of operation.	
LED Lighting	An LED lamp or LED light bulb is an electric light that produces light using light-emitting diodes. LED lamps are significantly more energy-efficient than equivalent incandescent lamps and can be significantly more efficient than most fluorescent lamps	Extensively adopted LED fittings will be used throughout the scheme to limit the energy associated with internal and external lighting. LED lighting will be used throughout the Proposed Development.	Feasible/Suitable
BMS Optimisation	A building management system is a computer-based control system installed in buildings that controls and monitors the building's mechanical and electrical equipment such as ventilation, lighting, power systems, fire systems, and security systems.	The building may be provided with an intelligent building management system that will learn how the building operates and optimise the function of the ventilation, heating, and cooling systems within the amenity areas to minimise energy use.	Feasible

11. GREEN MEASURES

It is important to understand the building's energy annual consumption to assess the suitability of any Low & Zero Carbon (LZC) technologies. The following section presents a preliminary low and zero carbon technology (LZC) feasibility study for the proposed new and refurbishment elements of Octagon House, Manchester.

- Photovoltaics (PV)
- Soler Thermal
- Wind Turbines
- Biomass Boilers
- Combined Heat and Power CHP
- Fuel Cells
- Air to Air Heat Pumps (Electric or Gas)
- Ground to Air/Water Heat Pumps (Electric)
- Hydroelectric/Tidal/Wave Power

11.1. Low and Zero Carbon Technologies Feasibility.

TECHNOLOGY	CHARACTERISTICS	COMMENTS	FEASIBILITY
Solar Technologies			
Photovoltaics (PV)	Photovoltaic (Solar PV) systems use solar cells to convert sunlight into electricity.	• Requires careful orientation and tilt to obtain optimum generation performance. • Note that specialist maintenance is required. • Access considerations should be considered. • Low carbon savings compared to capital cost of installation.	Feasible/Suitable
Solar Thermal	Solar thermal is a system for generating hot water from the sun.	• Consideration of adequate DHW demand is required. • Note that specialist maintenance is required. • Medium carbon savings.	Feasible
Wind Technologies			
Wind Turbines	Wind turbines convert the wind's kinetic energy into electrical power.	• Ideally located in open non-urban areas. • Regular maintenance is required, special consideration for safe access is required. • Low to medium carbon savings depending on scale of system.	Not Feasible
Bio-fuel technologies			
Biomass Boilers	Biomass boilers generate heat through burning organic matter.	• Direct replacement to existing gas fired system. However, careful considerations should be given to fuel storage and availability. • Some technologies are self-cleaning. • Quality of fuel might increase the maintenance requirements for these systems. • High carbon savings.	Not Feasible
Low Carbon Technologies			
Combined Heat and Power CHP	Combined Heat & Power (CHP) converts a single fuel into both electricity and heat in a single process at the point of use.	• Requires predictable and relatively high constant DHW loads for efficient performance. • CHP plant requires regular planned maintenance. • Medium carbon savings. • Consider type of fuel for better CO_2 savings.	Not Feasible
Fuel Cells	A fuel cell is a device that generates electricity by a chemical reaction.	• Requires predictable and relatively high constant loads for an efficient operation. • Specialist maintenance is required. • Please note that technology is not common.	Not Feasible

TECHNOLOGY	CHARACTERISTICS	COMMENTS	FEASIBILITY
		• Carbon savings depend on fuel source.	
Air to air heat pumps (Electric)	Low-temperature heat, which occurs naturally in the air, is converted to high-grade heat by using an electrically driven or gas-powered pump.	• Can provide both heating and cooling to an internal environment. • Specialist maintenance is required. • Please note that refrigerants are often use and their impact on the environment requires consider. • System can provide both low carbon heating and cooling.	Feasible/Suitable
Ground to air/water heat pumps (Electric)	The principle of operation revolves around the refrigerant (with a very low boiling point) being heated by the ground through an evaporator heat exchanger and pumped by a compressor to the indoor heat exchanger whereby it cools and condenses back to a liquid whilst expelling heat into the space.	• System to provide low carbon heating and cooling. • Ground conditions will dictate the systems technical feasibility • Low maintenance requirements • Medium-High carbon savings. • Efficiency of the system is highly dependent on heating and cooling flow and return temperatures. • Please note it is often associated with high capital costs of installation.	Feasible
Water Energy			
Hydroelectric / tidal / wave power	Hydro power systems convert the potential energy of elevated water into kinetic energy in a turbine, which drives a generator to produce electricity.	• There is no flowing water near the site, so this option is not feasible. • Planned maintenance is required. • Medium to high carbon savings.	Not feasible



SOLAR TECHNOLOGIES

11.2. Detailed LZC Feasibility Study

SOLAR PHOTOVOLTAICS



System Description

Photovoltaic (Solar PV) systems use solar cells to convert sunlight into electricity. These cells consist in either one or two layers of a semi-conducting material, usually silicon. When light shines on the cells it creates an electric field across the layers, causing electricity to flow. The greater the light intensity the greater the flow of electricity. There are three basic kinds of solar cells:

- Mono-crystalline: Typical efficiency = 15%
- Polycrystalline: Typical efficiency = 13%
- Thin film: Typical efficiency = 17%

In the northern hemisphere, this technology is ideally located on inclined south-facing facades or roofs of a building. The units work at their highest efficiency when inclined between 20-40° from horizontal and facing within 20° of due south.

Key Consideration

ADVANTAGES	DISADVANTAGES
Electrical generating technology – good for a building with a large electrical load.	Significantly reduced output during winter months particularly during snowy conditions
A true renewable technology.	
Tried and tested technology with good payback periods.	
Large area of roof available to install PV – ideal.	

Land Use / Roof Use

Suitable roof area for this technology must refer to the sensitivity of the system's performance to orientation, tilt angle and local shading obstructions. The building's roof would allow for solar panels to be orientated and tilted in a favourable location.

Local Planning Criteria

Local authorities can sometimes impose restrictions where glare from reflected sunlight off the panels could cause nuisance or problems with the local area. Advice should be sought from the relevant body within the Manchester planning requirement.

Noise

The panels themselves are silent as they have no moving parts, however the only source of minor noise may be the inverter. This piece of equipment is not usually located anywhere near a frequently occupied space for safety reasons, therefore noise is not considered to be an issue for this technology.

Possibility of electricity export

Should the generation of electricity from the PV system exceed the requirement of the building at any point, it can be exported and sold to the grid. Utilities providers typically offer two different rates for the electricity based upon the predictability of electricity exported. Suitable measures and infrastructure to enable the system to export electricity are typically inexpensive and relatively simple for small systems, but co-ordination with the local district network operator is usually necessary.

Summary

Due to the height and area of the buildings in this scheme they will have ample sunlight and are a feasible energy generation source for this project. Although the BRUKL results demonstrate the building passes Part L without photovoltaics, provision should be made for PV on each block to provide flexibility for the client in future construction and beyond.

SOLAR THERMAL



System Description

Solar thermal is a system for generating hot water from the sun. Typical systems consist of a circulation loop filled with glycol that runs from a solar Collection box into a hot water storage tank. In the solar collection box, the sun heats the glycol coil with brings the heat into the hot water tank effectively acting as an electric emersion heater, heating the water in the tank. This type of system can act alone as a water heater or as a pre-heat, bringing the mains water up in temperature before it is heated to LTHW temperatures (for heating) or domestic hot water temperatures.

Key Consideration

ADVANTAGES	DISADVANTAGES
Low running costs.	Usually a long payback period.
Not carbon intensive.	Requires a hot water storage tank, sometimes an additional one.
Minimal upkeep.	Takes space away from more efficient PV panel on a roof array.
Small operating costs.	
Can add efficiency to an existing system.	
Eligible for renewable heat incentive.	

Land Use / Roof Use

Most commonly installed as a roof mounted system.

Local Planning Criteria

Local authorities can sometimes impose restrictions where glare from reflected sunlight off the panels could cause nuisance or problems with the local area. Advice should be sought from the relevant body within the Manchester planning requirement.

Noise

The panels themselves are mostly silent save for the occasional sound of running water. There is a pump in the plant room but depending on the system, this will shut off once the water begins moving.

This piece of equipment is not usually located anywhere near a frequently occupied space for safety reasons, therefore noise is not considered to be an issue for this technology.

Possibility of electricity export

None.

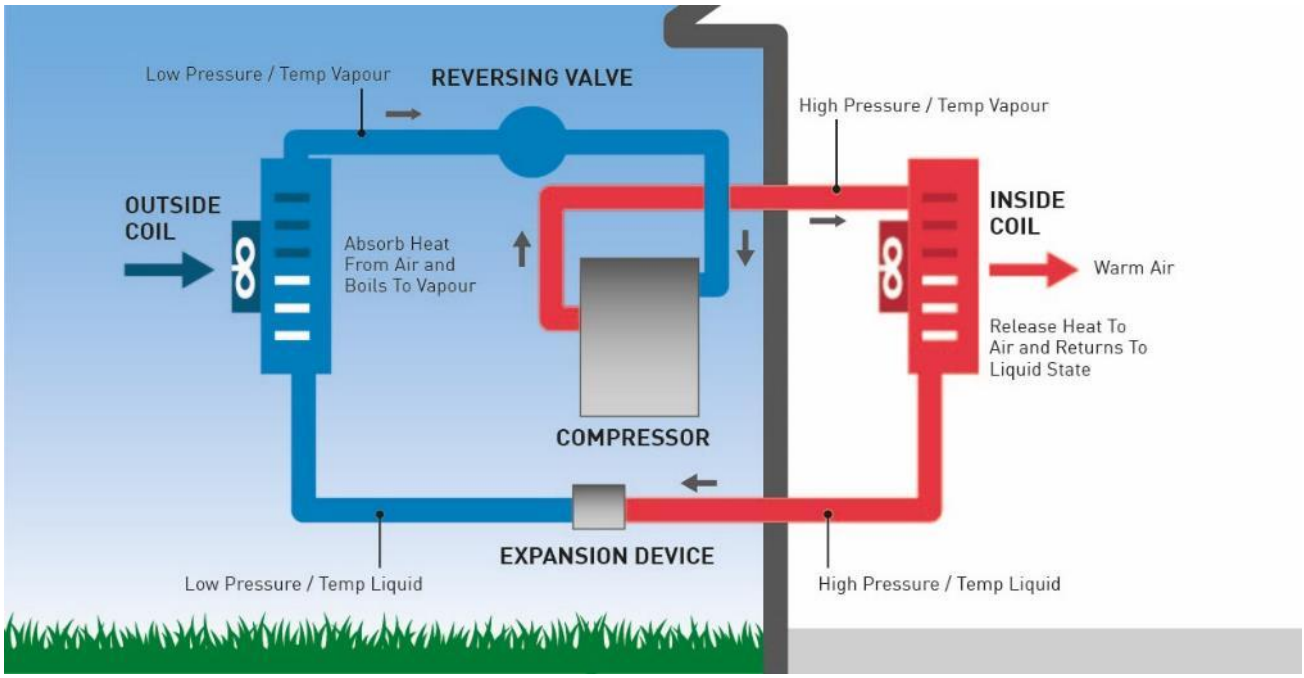
Summary

This option is feasible however not suitable for this project as the roof area available will be used for the more energy efficient photovoltaics panels foe electrical generation.



LOW CARBON TECHNOLOGIES

AIR TO AIR/WATER HEAT PUMPS



System Description

Air source heat pumps (ASHP) absorb heat from the outside air. This heat can then be used to heat radiators, underfloor heating systems, or warm air convectors and hot water in your home.

An ASHP extracts heat from the outside air in the same way that a fridge extracts heat from its inside. It can get heat from the air even when the temperature is as low as -15° C. Heat pumps have some impact on the environment as they need electricity to run, but the heat they extract from the ground, air, or water is constantly being renewed naturally.

Key Consideration

ADVANTAGES	DISADVANTAGES
Minimal maintenance.	Some occupants find terminals unsightly.
Provide heating and cooling.	Condensers can be noisy.
No fuel deliveries.	Cost.
Coefficient of Performance (COP) is between 2 and 3.	Not as low carbon an option if using mains electricity.
Pairs well with PV panels as there is no transmission loss making the ASHP more efficient.	
Works well with underfloor heating.	

Land Use

Externally mounted condensers can take up a fairly large amount of space.

Local Planning Criteria

Since the end of 2011, if you live in England, all heat pumps (air, ground and water) are considered a permitted development, so no planning permission is required. Different outcomes apply however if you live in a listed property, conservation area or a world heritage site. Additionally, this provision is only applicable to ASHPs that are used for heating only. Further guidance can be found here: https://www.thegreenage.co.uk/tech/heat-pumps-and-planning-permission/.

Noise

Condensers are noisy and become more so when they are under a heavy load. Care should be taken where they are placed, and appropriate action taken to limit noise pollution

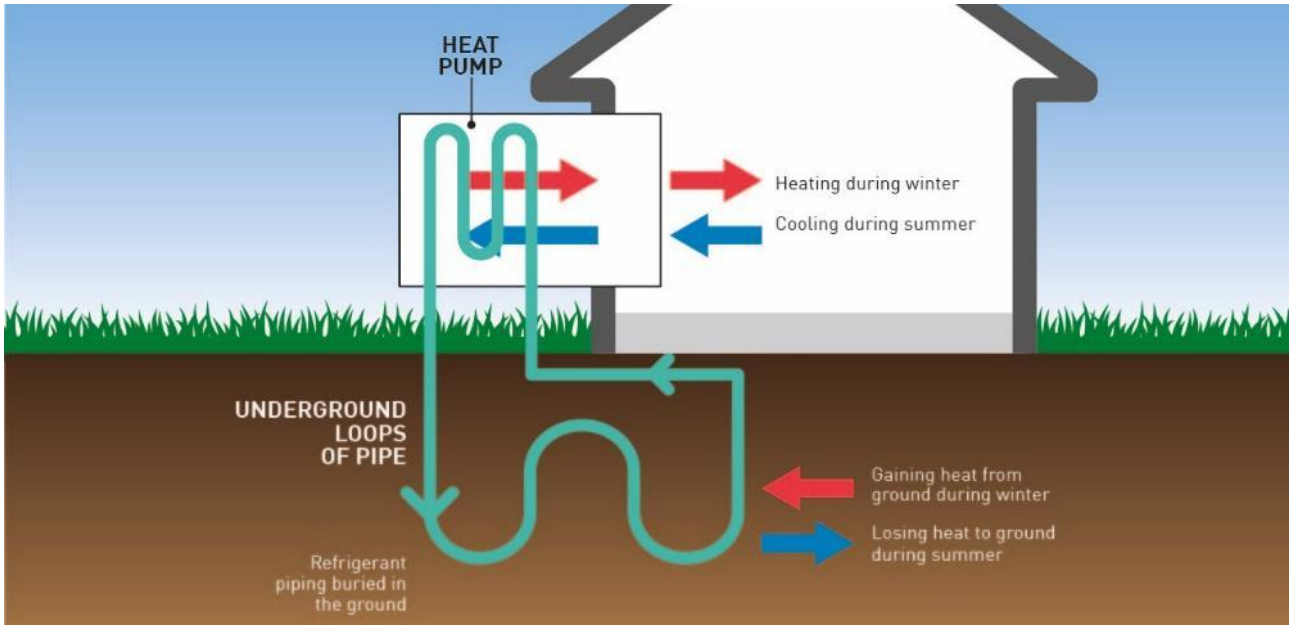
Possibility of electricity export

No.

Summary

ASHPs is a feasible and suitable solution to generate and deliver hot water to the site.

GROUND TO AIR/WATER HEAT PUMPS



System Description

For a ground source heat pump (GSHP), heat from the ground is absorbed at low temperatures into a fluid inside a loop of pipe (a ground loop) buried underground. The fluid then passes through a compressor that raises it to a higher temperature, which can then heat water for the heating and hot water circuits of the house.

Normally the loop is laid flat or coiled in trenches about two metres deep, but if there is not enough space, a vertical loop down into the ground to a depth of up to 100 metres can be run. Heat pumps have some impact on the environment as they need electricity to run, but the heat they extract from is constantly being renewed naturally. The loop can also be installed in the piles of the building which reduces the environmental impact and decreases the cost of earthworks.

Key Consideration

ADVANTAGES	DISADVANTAGES
Minimal maintenance.	Some occupants find terminals unsightly.
Provide heating and cooling.	Costs more, primarily due to installation than an ASHP – can be less costly if pile loops are used.
No fuel deliveries.	Not as low carbon an option if using mains electricity.
Higher COP than ASHPs of around 4 rather than between 2 and 3.	

ADVANTAGES	DISADVANTAGES
Pairs well with PV panels as there is no transmission loss making the GSHP more efficient.	
Works well with underfloor heating.	

Land Use

If pile loops are not used, extensive ground works need to be carried out to bury the thermal loops.

Local Planning Criteria

Since the end of 2011, if you live in England, all heat pumps (air, ground and water) are considered a permitted development, so no planning permission is required. Different outcomes apply however if you live in a listed property, conservation area or a world heritage site. Additional guidance can be found here: https://www.thegreenage.co.uk/tech/heat-pumps-and-planning-permission/.

Noise

With no condensers, GSHPs are relatively quiet although circulator pumps will generate some noise.

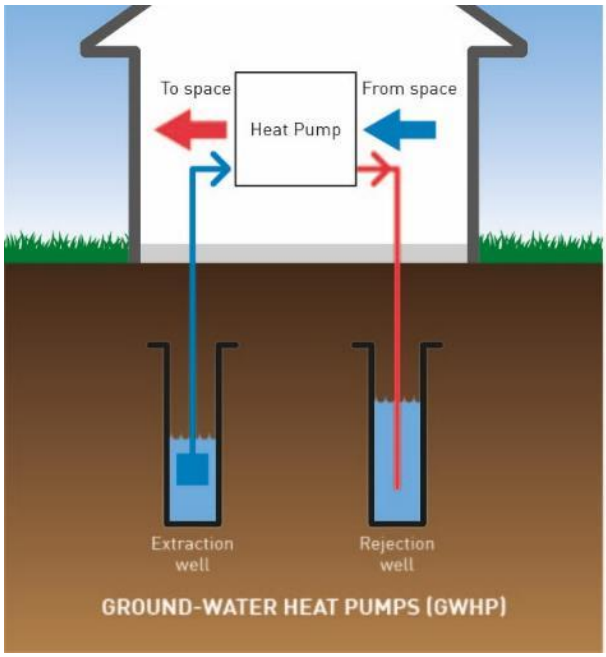
Possibility of electricity export

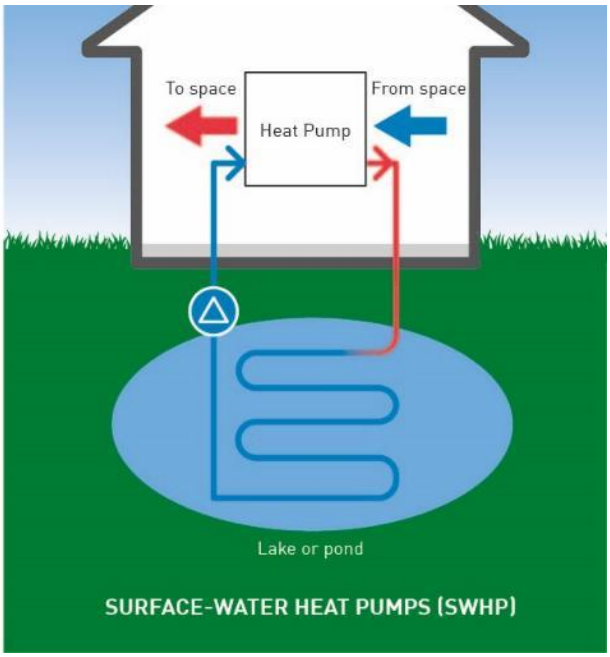
No.

Summary

This option is feasible but not suited to this project due to the cost inefficient extensive ground works that would be required.

WATER TO AIR/WATER HEAT PUMPS





System Description

An Open Water Heat Pump system works by recovering the solar energy stored naturally in river water or open water. The water then passes through heat pumps to yield its low-grade heat before being returned to the river with a temperature change of 3°C. The Energy Secretary has described water source heat pumps as "game changing" in relation to Britain's need for renewable energy.

Water source heat pumps (WSHP) work the same way as ASHPs and GSHPs where the thermal loops collect heat or cold and deliver it to the unit to be converted.

Key Consideration

ADVANTAGES	DISADVANTAGES
Minimal maintenance.	Some occupants find terminals unsightly.
Provide heating and cooling.	Stricter environmental regulations are faced if open loops are used.
No fuel deliveries.	Cannot store summer heat in the water to extract in the winter.
The high thermal capacity of water promotes an efficient transfer of energy.	Loops are more easily damaged by recreational activities or the environment as they are installed in waterbodies.
Has a much larger area of heat to draw from as it is a liquid based heat store.	Not as low carbon an option if using mains electricity.

ADVANTAGES	DISADVANTAGES
Pairs well with PV panels as there is no transmission loss.	
Works well with underfloor heating.	

Land Use

Require access to bodies of water.

Local Planning Criteria

Since the end of 2011, if you live in England, all heat pumps (air, ground and water) are considered a permitted development, so no planning permission is required. Different outcomes apply however if you live in a listed property, conservation area or a world heritage site. Additional guidance can be found here: https://www.thegreenage.co.uk/tech/heat-pumps-and-planning-permission/.

Noise

With no condensers, WSHPs are relatively quiet although circulator pumps will generate some noise.

Possibility of electricity export

No.

Summary

There is no access to bodies of water at the site, so this option is unfeasible and cost inefficient due to the extensive ground works that would be required.

11.3. District Heating Network

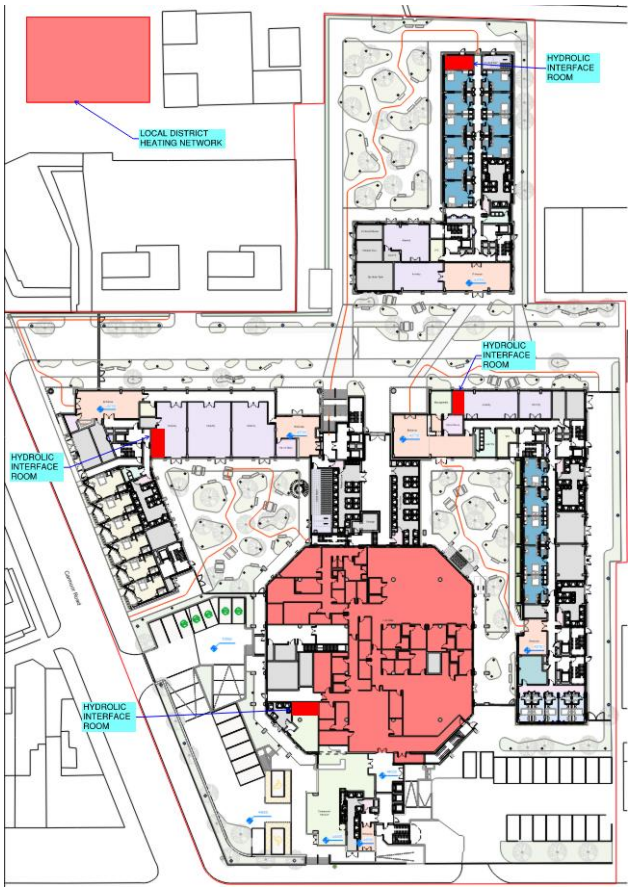
This section outlines how consideration of energy supplied efficiently from a district heating network can be provided to the proposed redevelopment in line with the Energy Hierarchy.

There are two options for district heating,

- Localised district heating network
- Manchester district heating network

Localised District Heating Network

Another option is a proposed District Heating Network that is being considered local to the site being the "Octagon Project Energy Network" (OPEN) located on Carmoor road as indicated on the map below:



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 CO_2 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

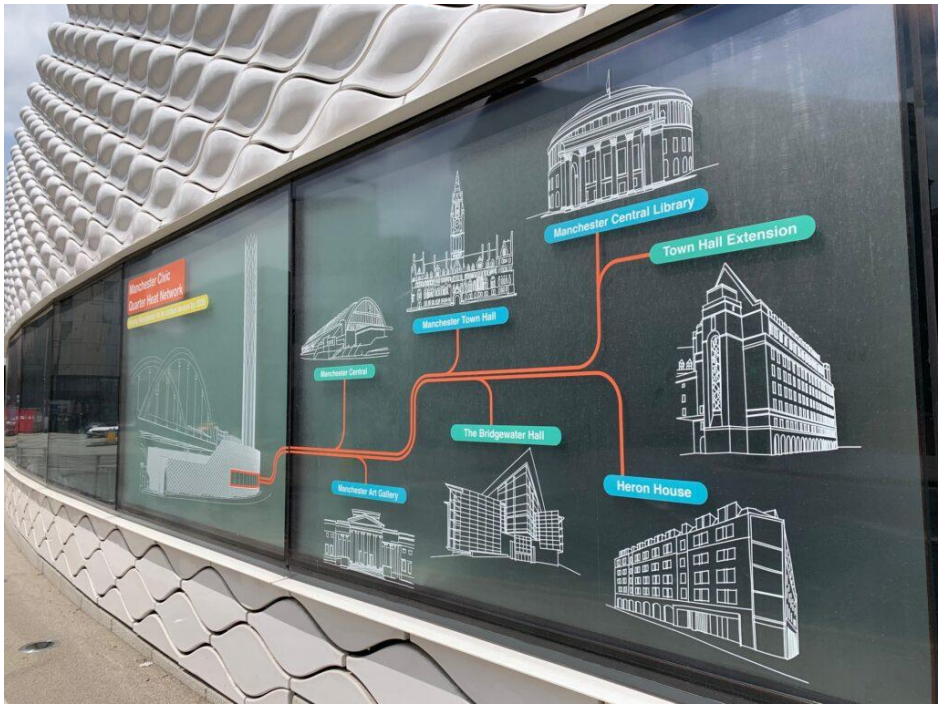
equipment (CHP). CHP is an engine which, when running, generates electricity and heats water which can then be distributed around a development.

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.

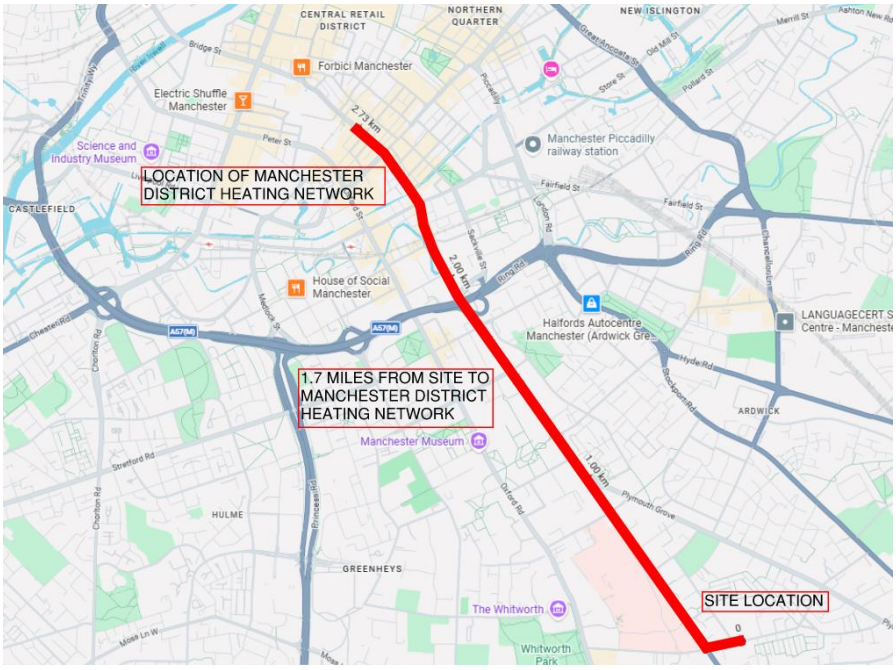
The first buildings to be connected are:

- 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.

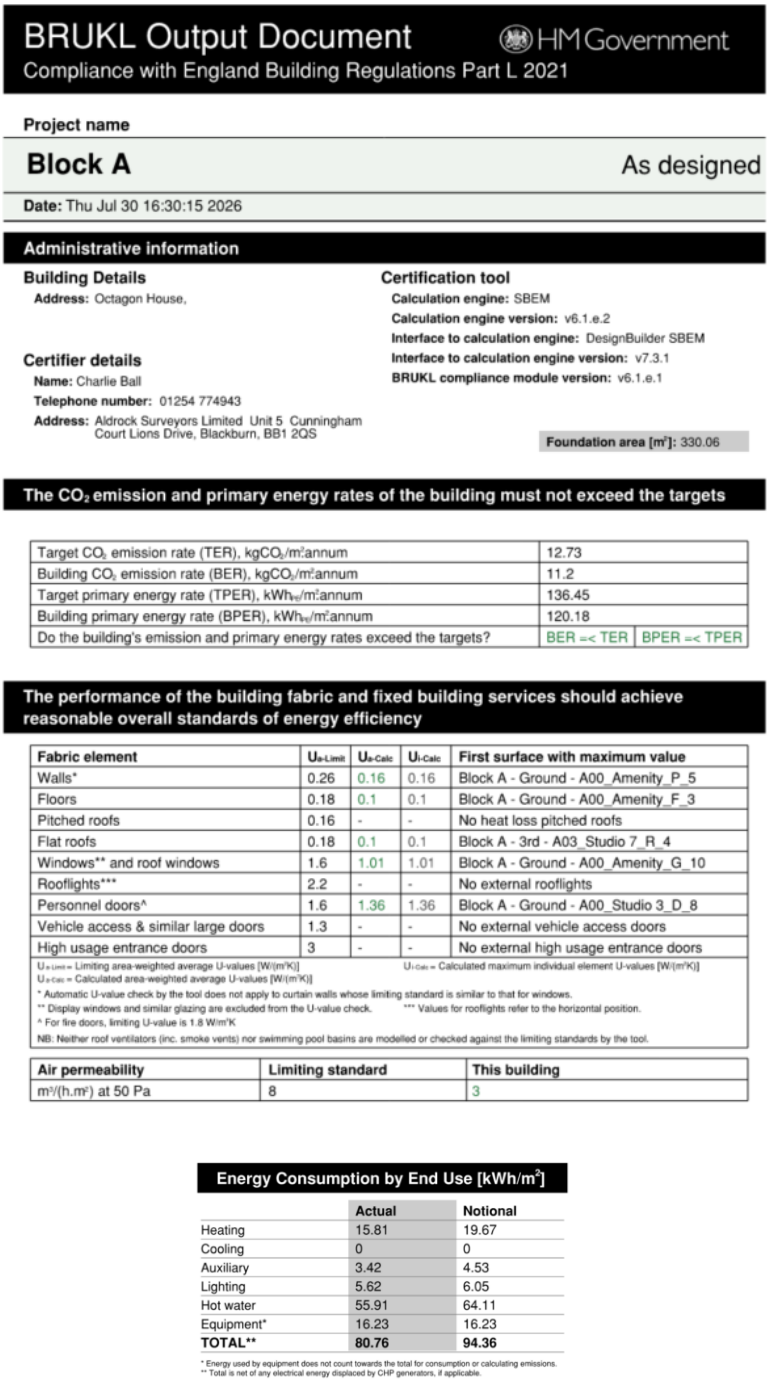


The diagram above shows the Octagon House site location and the distance to the closest connection to the current Manchester District Heating network.

Octagon House is approximately 1.7 miles to the nearest point on the Manchester District Heating network. However, considering the distance needed to be covered from the DSN to the site the feasibility of this technology is discounted.

12. BRUKL RESULTS

Block A



BRUKL Output Document — HM Government

Compliance with England Building Regulations Part L 2021

Project name

Block A — As designed

Date: Thu Jul 30 16:30:15 2026

Administrative information

Building Details

Address: Octagon House,

Certifier details

Name: Charlie Ball

Telephone number: 01254 774943

Address: Aldrock Surveyors Limited Unit 5 Cunningham Court Lions Drive, Blackburn, BB1 2QS

Certification tool

Calculation engine: SBEM

Calculation engine version: v6.1.e.2

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v7.3.1

BRUKL compliance module version: v6.1.e.1

Foundation area [m²]: 330.06

The CO_2 emission and primary energy rates of the building must not exceed the targets

Target CO_2 emission rate (TER), $kgCO_2/m^2annum$	12.73	
Building CO_2 emission rate (BER), $kgCO_2/m^2annum$	11.2	
Target primary energy rate (TPER), kWh_{PE}/m^2annum	136.45	
Building primary energy rate (BPER), kWh_{PE}/m^2annum	120.18	
Do the building's emission and primary energy rates exceed the targets?	BER =< TER	BPER =< TPER

The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Fabric element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	First surface with maximum value
Walls*	0.26	0.16	0.16	Block A - Ground - A00_Amenity_P_5
Floors	0.18	0.1	0.1	Block A - Ground - A00_Amenity_F_3
Pitched roofs	0.16	-	-	No heat loss pitched roofs
Flat roofs	0.18	0.1	0.1	Block A - 3rd - A03_Studio 7_R_4
Windows** and roof windows	1.6	1.01	1.01	Block A - Ground - A00_Amenity_G_10
Rooflights***	2.2	-	-	No external rooflights
Personnel doors^	1.6	1.36	1.36	Block A - Ground - A00_Studio 3_D_8
Vehicle access & similar large doors	1.3	-	-	No external vehicle access doors
High usage entrance doors	3	-	-	No external high usage entrance doors

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m²K)] — $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m²K)]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m²K)]

* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

** Display windows and similar glazing are excluded from the U-value check. *** Values for rooflights refer to the horizontal position.

^ For fire doors, limiting U-value is 1.8 W/m²K

NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air permeability	Limiting standard	This building
$m^3/(h.m^2)$ at 50 Pa	8	3

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	15.81	19.67
Cooling	0	0
Auxiliary	3.42	4.53
Lighting	5.62	6.05
Hot water	55.91	64.11
Equipment*	16.23	16.23
TOTAL**	**80.76**	**94.36**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

There is a 14.41% improvement on the Actual building's energy consumption compared to the Notional building as a result of the passive measures, the adoption of low and zero carbon technologies in addition to the mixed mode ventilation system.

Block B

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

Block B — As designed

Date: Thu Jul 30 16:24:23 2026

Administrative information

Building Details

Address: Octagon House,

Certifier details

Name: Charlie Ball

Telephone number: 01254 774943

Address: Aldrock Surveyors Limited Unit 5 Cunningham Court Lions Drive, Blackburn, BB1 2QS

Certification tool

Calculation engine: SBEM

Calculation engine version: v6.1.e.2

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v7.3.1

BRUKL compliance module version: v6.1.e.1

Foundation area [m²]: 358.24

The CO_2 emission and primary energy rates of the building must not exceed the targets

Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	13.7	
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	12.02	
Target primary energy rate (TPER), $kWh_{PE}/m^2.annum$	146.87	
Building primary energy rate (BPER), $kWh_{PE}/m^2.annum$	128.97	
Do the building's emission and primary energy rates exceed the targets?	BER =< TER	BPER =< TPER

The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Fabric element	$U_{e\text{-}Limit}$	$U_{e\text{-}Calc}$	$U_{i\text{-}Calc}$	First surface with maximum value
Walls*	0.26	0.16	0.16	Block B - Ground - B00_Amenity_W_6
Floors	0.18	0.1	0.1	Block B - Ground - B00_Amenity_F_3
Pitched roofs	0.16	-	-	No heat loss pitched roofs
Flat roofs	0.18	0.13	0.16	Block B - 4th - B04_Key Worker 10_R_4
Windows** and roof windows	1.6	1.01	1.01	Block B - Ground - B00_Amenity_G_8
Rooflights***	2.2	-	-	No external rooflights
Personnel doors^	1.6	-	-	No external personnel doors
Vehicle access & similar large doors	1.3	-	-	No external vehicle access doors
High usage entrance doors	3	-	-	No external high usage entrance doors

$U_{e\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$]
$U_{e\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$]
$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
** Display windows and similar glazing are excluded from the U-value check. *** Values for rooflights refer to the horizontal position.
^ For fire doors, limiting U-value is 1.8 W/m^2K

NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air permeability	Limiting standard	This building
$m^3/(h.m^2)$ at 50 Pa	8	3

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	17.12	21.42
Cooling	0	0
Auxiliary	3.47	4.96
Lighting	6.05	5.93
Hot water	60.03	69.07
Equipment*	9.72	9.72
TOTAL**	**86.67**	**101.37**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

There is a 14.50% improvement on the Actual building's energy consumption compared to the Notional building as a result of the passive measures, the adoption of low and zero carbon technologies in addition to the mixed mode ventilation system.

Block C

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

Block C — As designed

Date: Thu Jul 30 16:17:34 2026

Administrative information

Building Details

Address: Octagon House,

Certifier details

Name: Charlie Ball

Telephone number: 01254 774943

Address: Aldrock Surveyors Limited Unit 5 Cunningham Court Lions Drive, Blackburn, BB1 2QS

Certification tool

Calculation engine: SBEM

Calculation engine version: v6.1.e.2

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v7.3.1

BRUKL compliance module version: v6.1.e.1

Foundation area [m²]: 621.26

The CO_2 emission and primary energy rates of the building must not exceed the targets

Target CO_2 emission rate (TER), $kgCO_2/m^2annum$	12.06	
Building CO_2 emission rate (BER), $kgCO_2/m^2annum$	10.63	
Target primary energy rate (TPER), kWh_{PE}/m^2annum	129.3	
Building primary energy rate (BPER), kWh_{PE}/m^2annum	113.87	
Do the building's emission and primary energy rates exceed the targets?	BER =< TER	BPER =< TPER

The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Fabric element	$U_{b\text{-}Limit}$	$U_{b\text{-}Calc}$	$U_{i\text{-}Calc}$	First surface with maximum value
Walls*	0.26	0.16	0.16	Block C - Ground - C00_Amenity_W_6
Floors	0.18	0.1	0.1	Block C - Ground - C00_Amenity_F_3
Pitched roofs	0.16	-	-	No heat loss pitched roofs
Flat roofs	0.18	0.12	0.16	Block C - 5th - C05_LKD 1_R_4
Windows** and roof windows	1.6	1.01	1.01	Block C - Ground - C00_Amenity_G_7
Rooflights***	2.2	-	-	No external rooflights
Personnel doors^	1.6	-	-	No external personnel doors
Vehicle access & similar large doors	1.3	-	-	No external vehicle access doors
High usage entrance doors	3	-	-	No external high usage entrance doors

$U_{b\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m²K)] — $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m²K)]

$U_{b\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m²K)]

* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

** Display windows and similar glazing are excluded from the U-value check. *** Values for rooflights refer to the horizontal position.

^ For fire doors, limiting U-value is 1.8 W/m²K

NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air permeability	Limiting standard	This building
$m^3/(h.m^2)$ at 50 Pa	8	3

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	15.11	18.18
Cooling	0	0
Auxiliary	2.89	3.92
Lighting	5.6	6.22
Hot water	52.88	61.12
Equipment*	17.36	17.36
TOTAL**	**76.48**	**89.44**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

There is a 14.49% improvement on the Actual building's energy consumption compared to the Notional building as a result of the passive measures, the adoption of low and zero carbon technologies in addition to the mixed mode ventilation system.

Block D

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

Block D — As designed

Date: Thu Jul 30 16:36:08 2026

Administrative information

Building Details

Address: Octagon House,

Certifier details

Name: Charlie Ball

Telephone number: 01254 774943

Address: Aldrock Surveyors Limited Unit 5 Cunningham Court Lions Drive, Blackburn, BB1 2QS

Certification tool

Calculation engine: SBEM

Calculation engine version: v6.1.e.2

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v7.3.1

BRUKL compliance module version: v6.1.e.1

Foundation area [m²]: 943.29

The CO_2 emission and primary energy rates of the building must not exceed the targets

Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	11.57	
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	10.23	
Target primary energy rate (TPER), $kWh_{PE}/m^2.annum$	123.35	
Building primary energy rate (BPER), $kWh_{PE}/m^2.annum$	109.54	
Do the building's emission and primary energy rates exceed the targets?	BER =< TER	BPER =< TPER

The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Fabric element	$U_{i\text{-}Limit}$	$U_{i\text{-}Calc}$	$U_{i\text{-}Calc}$	First surface with maximum value
Walls*	0.26	0.16	0.16	Block D - GF (Fresenius) - Zone 1_W_5
Floors	0.18	0.1	0.1	Block D - GF (Fresenius) - Zone 1_S_3
Pitched roofs	0.16	-	-	No heat loss pitched roofs
Flat roofs	0.18	0.12	0.16	Block D - FF (Fresenius) - Zone 1_R_4
Windows** and roof windows	1.6	1.01	1.01	Block D - GF (Fresenius) - Zone 1_G_6
Rooflights***	2.2	-	-	No external rooflights
Personnel doors^	1.6	1.36	1.36	Block D - 2F - En-Suite Bed_D_9
Vehicle access & similar large doors	1.3	-	-	No external vehicle access doors
High usage entrance doors	3	-	-	No external high usage entrance doors

$U_{i\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$]
$U_{i\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$]
$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
** Display windows and similar glazing are excluded from the U-value check.
*** Values for rooflights refer to the horizontal position.
^ For fire doors, limiting U-value is 1.8 W/m^2K

NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air permeability	Limiting standard	This building
$m^3/(h.m^2)$ at 50 Pa	8	3

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	17.4	23.96
Cooling	0	0
Auxiliary	3.19	4.17
Lighting	6.42	5.72
Hot water	46.54	53.21
Equipment*	20.14	20.14
TOTAL**	**73.55**	**87.06**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

There is a 15.52% improvement on the Actual building's energy consumption compared to the Notional building as a result of the passive measures, the adoption of low and zero carbon technologies in addition to the mixed mode ventilation system.