

RIDGE

ENERGY STRATEGY REPORT
VIADUX PLOT 2A AND 2B
SALBOY CENTRAL LTD.

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SALBOY CENTRAL LTD

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1. EXECUTIVE SUMMARY

1.1. Overview

Ridge & Partners LLP 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 an Energy Modelling Calculation has been completed to assure 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 far exceeding the Part L minimum U-Values to reduce heat losses.
- Maximising natural ventilation through openable panels to reduce the reliance on mechanical ventilation.
- 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 Ambient Loop coupled with Water Source Heat Pumps for heating, cooling and hot water.

1.3. Results

As a result of the design strategy implemented, the proposed Viadux Plot 2a Development **complies with planning policy EN4.**

The SAP and BRUKL results relate to a RIBA Stage 2 design and will be subject to a design development at the next stages in order to meet the planning requirements of Manchester City Council. The SAP and BRUKL results are shown in Appendix 1.

1.3.1. Hotel (BRUKL Results)

Target CO2 emission rate (TER), $kgCO_2/m^2$. annum	10.59	
Building CO2 emission rate (BER), $kgCO_2/m^2$. annum	8.79	
Target primary energy rate (TPER), kWh/m^2.	114.97	
Building primary energy rate (BPER), $kWh/m^2/yr$	95.81	
Do the buildings emission and primary energy rates exceed the targets?	BER = < TER	BPER = < TPER

1.3.2. Residential Areas (SAP Results)

Target dwelling CO_2 emission rate (TER), $kgCO_2/m^2$.	12.91	
Dwelling CO_2 emission rate (DER), $kgCO_2/m^2$	2.92	
Dwelling primary energy rate (TPER), $kgCO_2/m^2$.	72.22	
Dwelling Target primary energy rate (DPER), $kgCO_2/m^2$	30.92	
Dwelling Fabric Energy Efficiency (DFEE) $kgCO_2/m^2$	22.30	
Target Fabric Energy Efficiency (TFEE) $kgCO_2/m^2$	25.10	
Do the buildings emission and primary energy rates exceed the targets?	PASS	PASS

2. INTRODUCTION

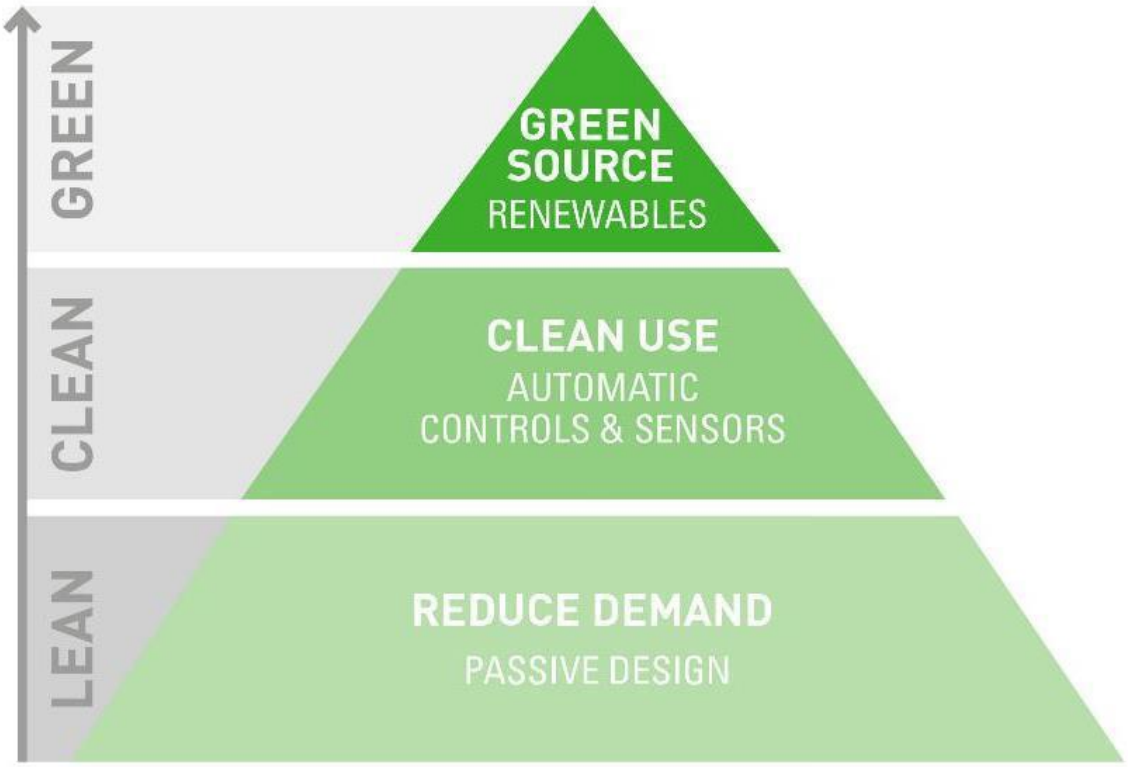
As Low Carbon Design Consultants, Ridge & Partners LLP have been appointed by Salboy Central Ltd to provide a statement for the purposes of submitting a full planning application for Viadux Plot's 2a and 2b.

The purpose of the statement is to summarise the relevant policies both National and Local and demonstrate the methods 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.

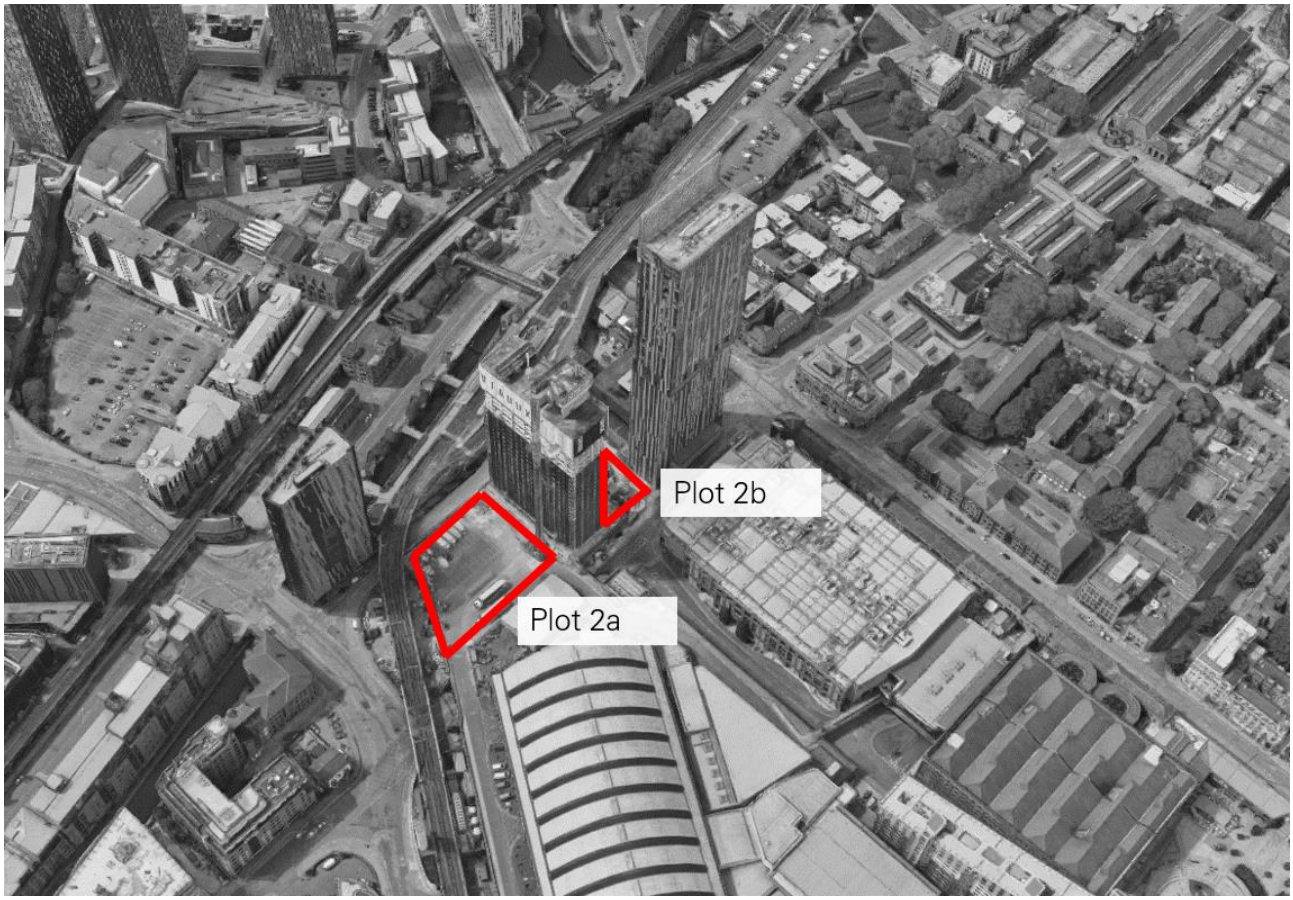
Each stage would focus on the following:

- 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.



3. DEVELOPMENT PROPOSALS

3.1. Description of Development Site



The Site is located in Manchester city centre. It is bounded by the Manchester Central Conference Complex and Great Northern Warehouse to the north, Albion Street to the east, the Deansgate Castlefield Metrolink station and Deansgate Locks to the south, and the Beetham Tower to the west. It extends to 1.49 ha.

3.2. Development proposals

The Site is located in Manchester city centre. It is bounded by the Manchester Central Conference Complex and Great Northern Warehouse to the north, Albion Street to the east, the Deansgate Castlefield Metrolink station and Deansgate Locks to the south, and the Beetham Tower to the west. It extends to 1.49 ha.

The Proposed Development will be delivered across two plots comprising the following principal uses:

- *Plot A: a hotel with residential apartments above.*
- *Plot B: affordable homes.*

Together with these principal uses, the Proposed Development comprises residential amenities; secure cycle parking; public realm improvements and new green landscaping; and associated works to the public highway.

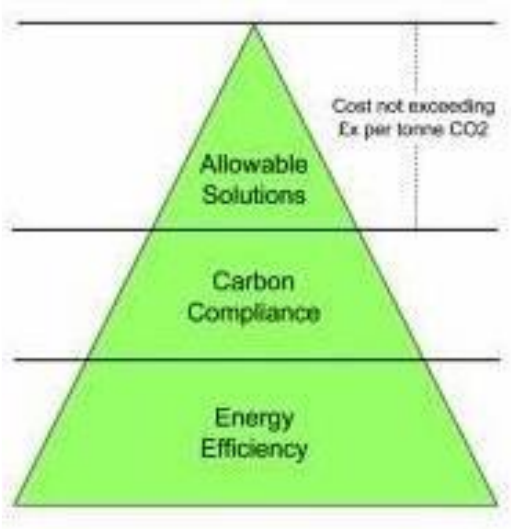
Plot 2a is located immediately east of the recently completed Phase 1 building, on land partially comprising the grade II listed Castlefield Viaduct. This plot will deliver a 76-storey mixed use tower comprising a hotel (Use Class C1) with associated bar and restaurant and residential units above comprising 1, 2 and 3 bed, and penthouse apartments (Use Class C3) with associated residential amenity spaces. Secure cycle spaces, serving this and the Phase 1 building, are provided at the ground floor level. At viaduct level, a redesigned

service yard for the conference centre is enclosed by a new podium structure with residents' external amenity space above. A section of the Great Bridgewater Street bridge (deck) is removed to bring light into the street below.

Plot 2b, located at the western-most section of the Site between the viaduct and Beetham Tower, consists of a 23-storey residential building accommodating affordable 1-, 2- and 3-bed apartments (Use Class C3), secure cycle parking spaces, flexible commercial units (Use Class E) opening onto the viaduct, and public realm enhancements on Great Bridgewater Street.

4. ENERGY HIERARCHY

In line with the draft definition of zero carbon an energy hierarchy has been created. 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 low or zero carbon energy technologies and directly connected heat (not necessarily on-site).



Energy Hierarchy

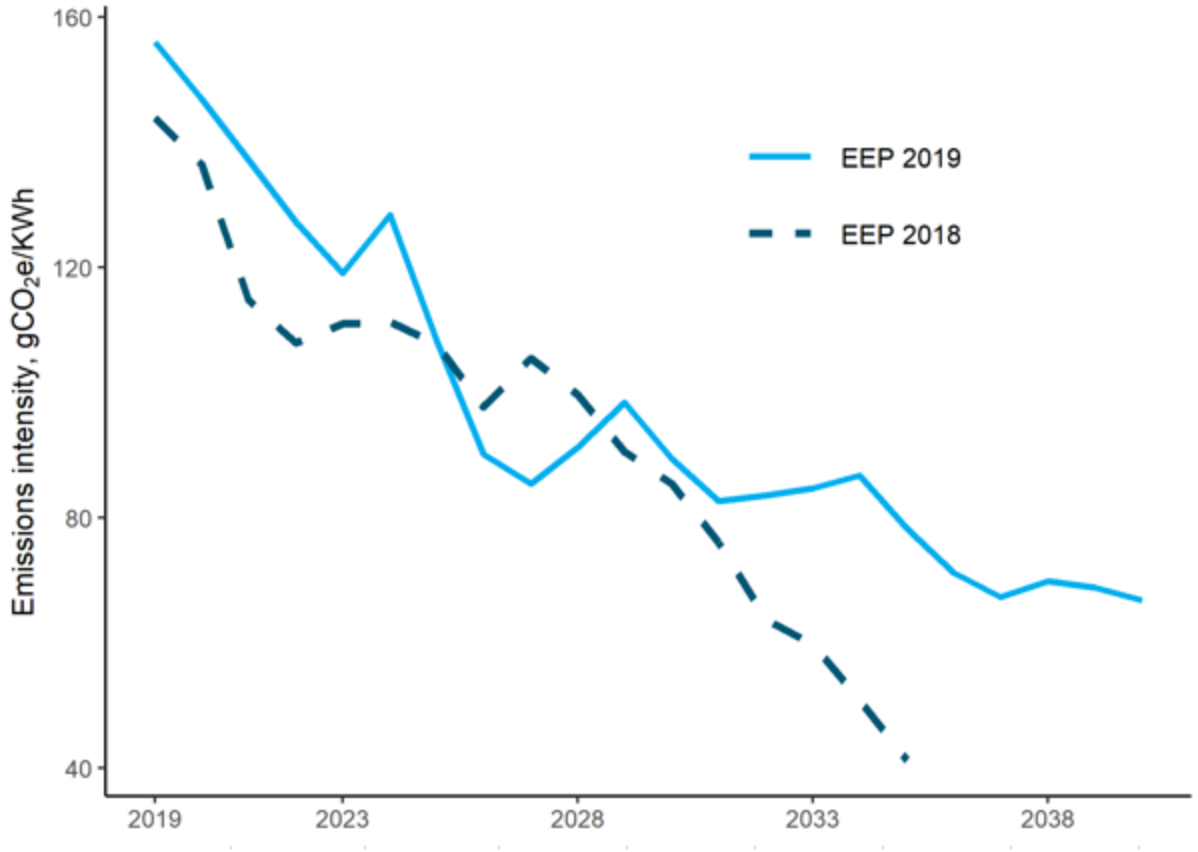
However, in order to achieve the highest level of carbon reductions it is intended that developers will be able to contribute to or co-ordinate investment in near or off-site infrastructure. This could include, for example, the connection of buildings to district heating networks and investment in low 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 Local Planning Authority.

4.1. 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 or air 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.

The Department for Business, Energy and Industrial Strategy (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.



Predicted Reduction in Grid Carbon Factor

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

5. GOVERNMENT REVIEW POLICY

5.1. National Planning Policy Framework

A revised National Planning Policy Framework (NPPF) was updated and published in December 2023 which sets out the Government's planning policies for England and how they are expected to be applied. This framework replaces that published in July 2021. 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:

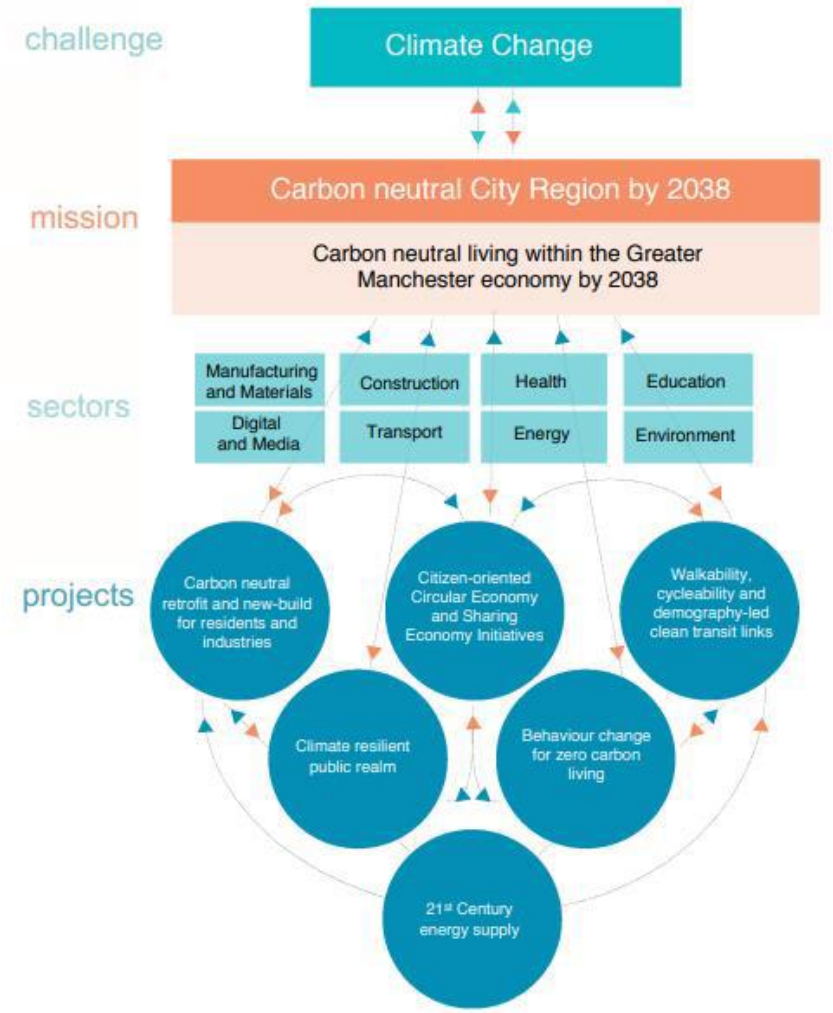
> *Contribute to protecting and enhancing our natural, built, and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste pollution, and mitigating and adapting to climate change, including moving to a low carbon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

At the heart of the Framework is a 'presumption in favour of sustainable development.' Section 14 of the National Planning Policy Framework (NPPF) specifically addresses the challenge of climate change. It states that: 'New development should be planned for in ways that:

> *(a) Avoid increased vulnerability to the range of impacts arising from climate change. When new developments are brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure; and (b) can help to reduce greenhouse gas emissions, such as through its location, orientation, and design. Any local requirements for the sustainability of buildings should reflect the government's policy for national technical standard Local Plan and supplementary guidance.'*

5.2. 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 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.



Potential components of a Greater Manchester clean growth mission

5.3. 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:

5.3.1. 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

  - 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

5.3.2. 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.

5.3.3. 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 plots 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.

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

Table 12.2 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 (Applies to commercial uses with high proportion of emissions from electricity use (>45 kg CO2/m2)	10% increase on Part L 2010
Target 3: Micro generation area	+ 15% increase on Part L 2010

Non-domestic CO2 emissions reduction targets

Where the CO2 emissions reduction required under any future revision to Part L of the building regulations becomes greater that 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 CO_2 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 of 'Manchester's Local Development Framework, Core Strategy Development Plan Document, Adopted 11th July 2012'.

5.3.4. 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, subject to evidence to quantify their contribution to compliance.

5.4. Places for Everyone Joint Development Plan

The Places for Everyone sets out how the nine Greater Manchester boroughs should develop until 2039.

The plan states that *"Collectively our plans are focused on delivering the ambitions in the Greater Manchester Strategy: a good start in life for everyone; good opportunities for our young people to equip them for life; good work and the best jobs in a valuable, productive, zero carbon economy; safe, secure housing in inclusive and diverse communities; a good cultural and leisure offer for everyone; a green city-region; good health and support for people to live fulfilling lives, with quality care for those who need it; to be a good place to grow older and to be a place where everyone is connected – socially, digitally and by a clean, integrated and accessible transport system."*

Relevant policies from this document include:

5.4.1. Policy JP-S1: Sustainable Development

To help tackle climate change, development should aim to maximise its economic, social and environmental benefits simultaneously, minimise its adverse impacts, utilise sustainable construction techniques and actively seek opportunities to secure net gains across each of the different objectives.

In preparing plans, authorities should make as much use as possible of suitable previously developed (brownfield) land and vacant buildings to meet development needs.

In bringing forward previously developed sites for development, particular attention will be paid to tackling land contamination and stability issues, ensuring that appropriate mitigation and remediation is implemented to enable sites to be brought back into use effectively.

5.4.2. Policy JP-S2: Carbon and Energy

The aim of delivering a carbon neutral Greater Manchester no later than 2038, with a dramatic reduction in greenhouse gas emissions, will be supported through a range of measures including:

1. *Promoting the retrofitting of existing buildings with measures to improve energy efficiency and generate renewable and low carbon energy, heating and cooling;*
2. *Promoting the use of life cycle cost and carbon assessment tools to ensure the long-term impacts from development can be captured;*
3. *Taking a positive approach to renewable and low carbon energy schemes, particularly schemes that are led by, or meet the needs of local communities;*
4. *Increasing the range of nature-based solutions including carbon sequestration through the restoration of peat-based habitats, woodland management, tree planting and natural flood management techniques;*
5. *An expectation that new development will, unless it can be demonstrated that it is not practicable or financially viable;*
    a. *Be net zero carbon(29) which applies:*
        i. *from adoption – to regulated operational carbon emissions;*
        ii. *from 2028 – to all emissions 'in construction'.*

        From 2025 development should also calculate and minimise carbon emissions from unregulated emissions alongside regulated emissions.

        Development proposals should set out how this has been achieved in an energy statement in accordance with the energy hierarchy, which in order of importance seeks to:

i. *Minimise energy demand;*
ii. *Maximise energy efficiency*
iii. *Use renewable energy;*
iv. *Use low carbon energy; and*
v. *Utilise other energy sources.*

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

b. *Incorporate adequate electric vehicle charging points, in line with Part S of the Building Regulations, unless superseded by relevant Local Plan policies, to future proof for the likely long-term demand, taking account of the potential maximum energy demand for the site;*
c. *Where practicable, prioritise connection to a renewable energy/heating/cooling network in the first instance or a low carbon energy/heating/cooling network that is adaptable to non-fossil fuels at a later date;*
d. *In residential developments, achieve energy demand reductions in terms of space heat demand; hot water energy demand and the delivery of on-site renewable energy generation, in accordance with Table 5.1*

For renewable energy generation priority should be given to PV installation where technically feasible, alternative technologies will be appropriate where the equivalent generation is evidenced

e. *For non-residential developments, achieve at least BREEAM excellent standard (or equivalent) for the 'Ene 01 – reduction of energy use and carbon emissions' category rising to 'BREEAM outstanding' equivalent for ENE 01 from 2028.*
f. *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*

5.4.3. Policy JP-S3: Heat and Energy Networks

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

1. *Delivery of renewable and low carbon energy schemes will be supported with particular emphasis on the use of decentralised energy networks in areas identified as "Heat and Energy Network Opportunity Areas". These have been identified where:*
    a. *Existing heat/energy networks are operational or have been commissioned;*
    b. *Proposals for new heat networks/energy networks are being progressed, or future opportunities have been identified in city-region master planning;*
    c. *Sufficient density of existing heat demand occurs; and*
    d. *Significant future development is proposed at the strategic development locations.*
2. *Within the identified "Heat and Energy Network Opportunity Areas", unless it can be demonstrated that there are more effective alternatives for minimising carbon emissions or such connection is not practicable or financially viable, it is expected that:*

a. *New residential developments that are '10 dwellings or more' or other developments over 1,000 m2 floorspace shall:*
    i. *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*
    ii. *Install a site-wide or communal heat/energy network solution.*
b. *An expectation that new industrial development will demonstrate that opportunities for using waste heat locally have been fully examined, and included in proposals; Places for Everyone Joint Development Plan 2022 to 2039 Adopted with effect from 21 March 2024 94*
c. *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*
d. *An expectation that any site-wide networks will be designed so as to enable future expansion to adjoining buildings or assets as appropriate*

To comply with policy JP-S3, heat and energy network assessments will be required as part of an energy statement to support planning applications for new developments within the identified "Heat and Energy Network Opportunity Areas" to demonstrate compliance with PfE energy policies. To ensure consistency of approach and to aid the decision-making process, decentralised heat/energy network assessments are required to demonstrate consideration and analysis of:

a) Identification of existing and proposed heat/energy loads;
b) Identification of heat/energy supply sources;
c) Identification of opportunities to utilise renewable and low carbon energy sources;
d) Identification of opportunities to utilise waste and secondary heat sources;
e) Impact of proposals and technology choices on local air quality;
f) Design according to national best practice in relation to efficient heat network design (e.g. CIBSE CP1 Heat Networks: Code of Practice for the UK35, or equivalent); and
g) Adopting appropriate consumer protection standards (e.g. Heat Trust36 or equivalent).

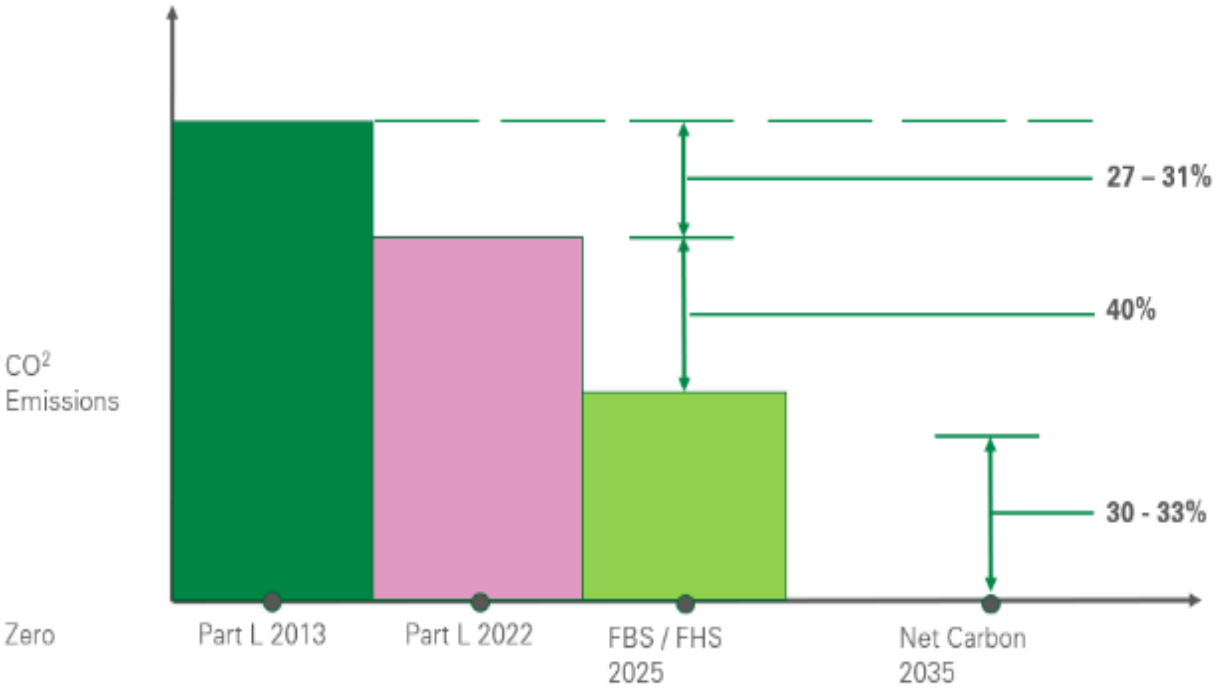
6. REGULATORY FRAMEWORK

6.1. Building Regulations

The Part L 2021 building regulations came into effect in June 2022 with a transitional period of 12 months and has acted as an uplift to help the construction industry adapt to changing regulations and low carbon heating.

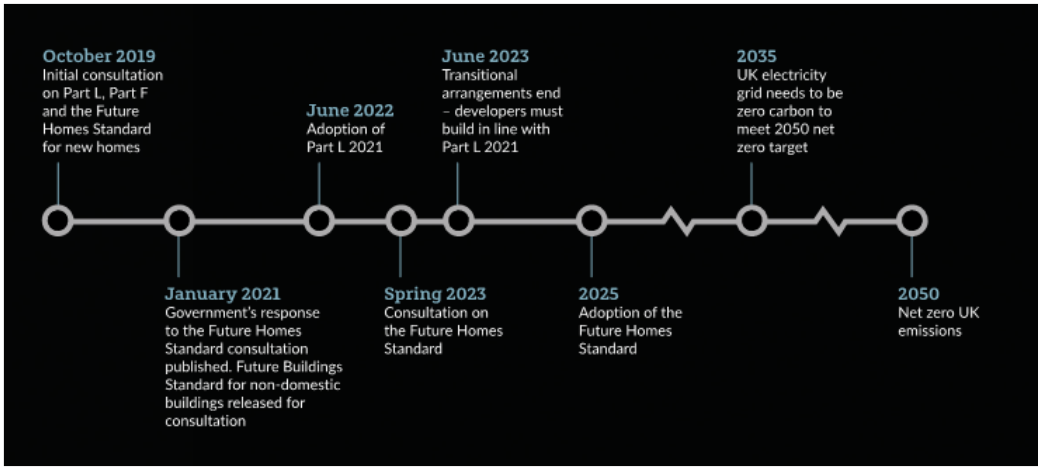
The graph below shows the projected target reductions in CO2 emissions compared against the previous and current versions of Part L and the proposed future iterations to the Regulations.

Approved Building Regulations Part L 2021 display a 27%-31% reduction in CO_2 emissions compared to the previous 2013 Part L iteration for domestic buildings and non-domestic buildings respectively.



Building Regulations Part L changes

The future building standards which will come into effect in 2025 will require CO2 emissions to be further decreased by 40% in comparison to current figures. The timeline for the future buildings standards is displayed in figure 8:



Future Homes Standard

Part L 2021 Volume 1 Key Changes (Domestic buildings)

- Part L 2021 Volume 1 has a CO2 reduction of 31% compared to 2013 regulations.
- No ban on use of gas boilers.
- Local planning authorities will retain powers to set higher energy efficiency targets than building regulations.
- All new builds to be air tightness tested and reducing unwanted air infiltration in existing dwellings.
- Improve accuracy of as built energy calculations

Part L 2021 Volume 2 Key Changes (Non-Domestic buildings)

- Part L 2021 Volume 2 has a CO2 reduction of 27% compared to 2013 regulations.
- Encourage use of low carbon systems and high levels of building fabric.
- Uplift in the efficiencies of building services.
- Update to SBEM and NCM modelling guide.
- Uplift to limiting U-values and air permeability.
- Air tightness in existing buildings – reducing unwanted air filtration.
- Maximum flow temperature of 55°C in wet space heating systems.

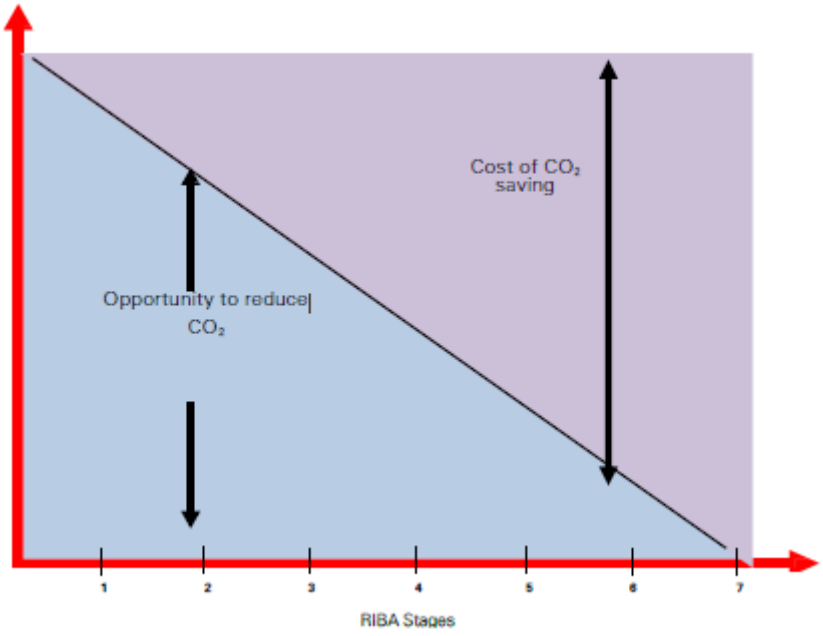
A new performance metric has also been ushered in; primary energy has become the principal measure replacing CO_2 emissions as the main metric. CO_2 emissions are now less effective as a measure of energy performance as the electricity grid becomes decarbonised. If this was not addressed, this could result in a dwelling with low CO_2 emissions complying with regulations, despite having excessively high energy consumption. Consequently, the Primary Energy metric has been introduced to ensure that energy efficiency is directly measured rather than assuming it is linked to CO_2 emissions.

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 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.



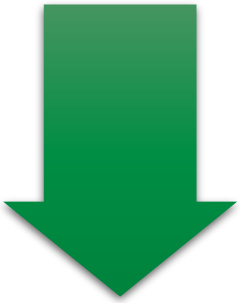
Costs of implementing design measures at each RIBA Stage

In this first instance it is therefore essential that the buildings 'passive measures' are optimised and the design teamwork 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



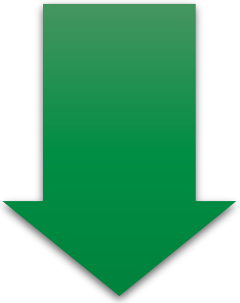
Passive design:

- Thermal insulation
- Natural ventilation
- Natural daylight
- Thermal mass
- Air tightness
- Solar shading/Glass Specification
- A Rated White Goods

LEAN

Reduce Energy Demand

Meet demand efficiently

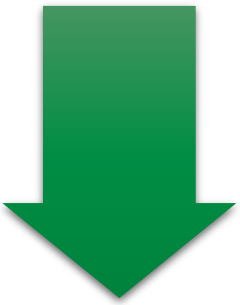


- Low energy fit out
- Heat recovery
- Mixed mode ventilation
- Low energy lighting (LED)
- Power management
- Variable speed drives
- Demand Operated Systems
- Low Specific Fan Power
- Wastewater Heat Recovery

MEAN

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

GREEN

Incorporate Renewable Energy

7.2. Passive Design Measures – (Be Lean)

This section looks at the proposed measures that will ensure the initial demand for energy within both the hotel and residential aspects of the Viadux Plot 2a development is low from the outset when utilising passive measures.

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**, the hotel is expected to be typical of other hotels, with high usage in the morning and evenings with minimal occupation during the day. The residential part of the development is expected to be typical of buildings of this type with variable usage.

The following measures are to be incorporated in the design:

- Passive Design
  - Thermal Insulation and Thermal Bridging
  - Natural Ventilation / Mixed mode
  - Natural Daylight
  - Thermal Mass
  - Air tightness
  - Solar Shading
  - Adaption to climate change

These measures promote the reduction of Energy use and carbon emission in the first instance.

Firstly, due to the passive design features, the energy demand has been reduced and therefore the building will be less affected by the decreased availability of energy.

Secondly, the building will have a lower carbon footprint helping to stop the effects of climate change from increasing any further.

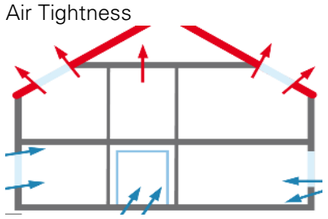
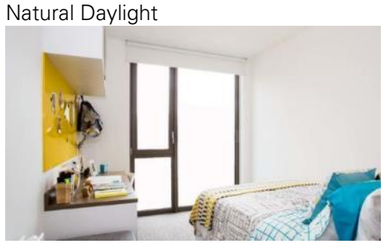
The expected increase in external temperatures could result in future overheating problems. Whilst the building cannot be relocated, by having low g-value glass, there is less solar heat gain entering the rooms.

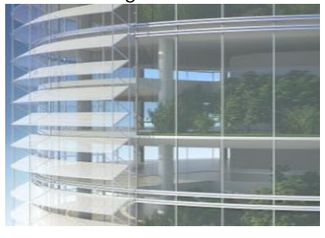
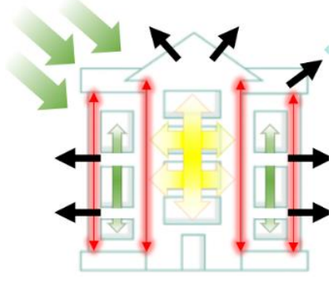
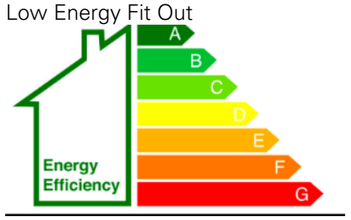
The demand for cooling has also been reduced through by exceeding minimum U-values required under Part L of the Building Regulations.

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

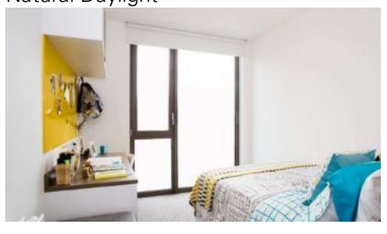
Key:
Y– Yes could be incorporated
P – Possible
N – Not appropriate

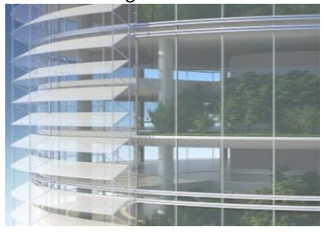
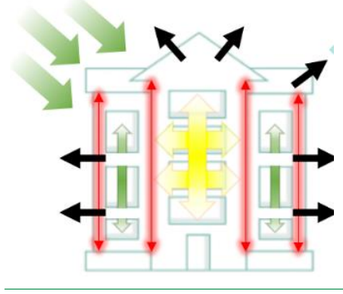
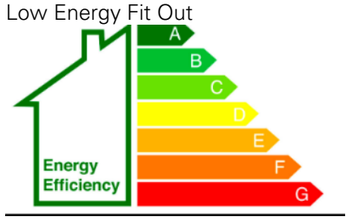
7.2.1. Passive Design Measures – Hotel

MEASURE	DESCRIPTION	SUITABLE FOR CONSIDERATION	COMMENTARY
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.	**Y**	Insulation is central to low energy construction as it reduces the required heating load by minimising unnecessary heat loss. Future building standards also must be considered, and these are due to come into effect in 2025 with a 40% reduction in Co2 emissions over Part L 2021. The proposed development will adopt the minimum U-values stated within Part L of the Building Regulations will be improved on, and these are detailed in Section 9, to reduce heat loss and therefore overall energy demand.
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.	**Y**	The Proposed Development will target an air tightness that exceed 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. The currently air tightness target for the Proposed Development is 3 m³/(h.m²) at 50 Pa, this is a 63% improvement over the Part L minimum of 8 m³/(h.m²) at 50 Pa.
Natural Ventilation 	Natural ventilation is a method of supplying fresh air to a building or room by means of passive forces, typically by wind speed or differences in pressure internally and externally. During design, natural ventilation is first considered before mechanical ventilation because this reduces carbon emissions.	**P**	Due to the nature of hotel rooms, natural ventilation alone is not typically suitable due to the heat gains within the space, as a result mechanical ventilation with heat recovery will be adopted. For natural ventilation to be effective, the internal planning, building geometry and external topography must be optimised to take full advantage of natural ventilation. Careful attention to the placement of openable windows and interior partitions can greatly increase the natural flow of air through a building by capturing the prevailing winds.
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.	**Y**	To reduce the energy used for artificial lighting, the natural daylight entering occupied spaces will be maximised by optimising window size and orientation. Dimmable lighting with photocells in amenity spaces will sense if the illuminance level of the space has been met and reduce lighting levels as required. North facing windows are particularly effective at providing useful daylight and will be incorporated on the building. The buildings orientation and fenestration strategy will take advantage of passive solar gains and natural daylight to reduce heating energy and the need for artificial lighting.

Solar Shading 	Solar shading is a method by which solar radiation in the form of heat and light can be mitigated in a building. While natural heat and light are essential in most buildings and modern architecture uses it more and more there are occasions when the levels are too high. This leads to overheating and too much light. Solar shading is a general term for a range of methods used to reduce the amount of solar gain.	**N**	Whilst maximising daylight, care must be taken to ensure that direct sunlight does not cause glare in the spaces or cause excessive solar gains in summer which will cause spaces to overheat. This is managed by solar shading on affected windows. Some examples of solar shading are canopies, solar control glazing, balconies, internal blinds and curtains which could be adopted on the Proposed Development Solar shading is not proposed on the scheme, however low G-Value glass will help to prevent unwanted solar gain entering the spaces of the Proposed Development
Thermal Mass 	Thermal mass describes a materials capacity to absorb, store and release heat. For example, water and concrete have a high capacity to store heat and are referred to as 'high thermal mass' materials. Insulation foam, by contrast, has very little heat storage capacity and is referred to as having 'low thermal mass'. A common analogy is thermal mass as a kind of thermal battery. Though thermal mass has always been an aspect of buildings, only in recent years has it evolved as a tool to be deployed in the conservation of energy. However thermal mass does not offer a 'one size fits all' concept.	**N**	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.
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.	**Y**	All goods and appliances should be highly energy efficient to reduce energy demand.
Sub-metering 	Building submetering is a meter within your building or facility for specific energy measurements.	**Y**	Power, lighting, major plant and separate areas will be individually metered to allow energy consumption to be pinpointed and reviewed if it is excessive. Baselines and targets will also be set to help reduce energy use.
Adaption to climate change 	Average temperatures for central England have risen by approximately 1°C since the 1970s and this has resulted in higher temperatures, changing rain patterns, rising sea levels, in addition to unpredictable extreme weather events such as floods, droughts and freezing winters. Risks of climate change include the increased likelihood of increased external temperatures which could lead to staff illness and therefore lower productivity, damage to equipment due to the high internal building temperatures in addition to increased cooling demand.	**Y**	An uplift in fabric improvements on a development can maximise the retention of heat in winter and reduce heat gains in summer. These improvements will help combat the extremes expected as a result of climate change. G-Values will be carefully selected to maximise natural light and thus reduce reliance on artificial lighting without introducing unwanted thermal gain during the summer months.

7.2.2. Passive Design Measures – Residential

MEASURE	DESCRIPTION	SUITABLE FOR CONSIDERATION	COMMENTARY
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.	**Y**	Insulation is central to low energy construction as it reduces the required heating load by minimising unnecessary heat loss. Future building standards also must be considered, and these are due to come into effect in 2025 with a 40% reduction in Co2 emissions over Part L 2021. The proposed development will adopt the minimum U-values stated within Part L of the Building Regulations will be improved on, and these are detailed in Section 9, to reduce heat loss and therefore overall energy demand.
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.	**Y**	The Proposed Development will target an air tightness that exceed 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. The currently air tightness target for the Proposed Development is 3 m³/(h.m²) at 50 Pa, this is a 63% improvement over the Part L minimum of 8 m³/(h.m²) at 50 Pa.
Natural Ventilation 	Natural ventilation is a method of supplying fresh air to a building or room by means of passive forces, typically by wind speed or differences in pressure internally and externally. During design, natural ventilation is first considered before mechanical ventilation because this reduces carbon emissions.	**P**	Natural ventilation to be used in a mixed mode approach with mechanically powered ventilation using MVHR units to counter space overheating. This will help to reduce on site carbon emissions by the avoidance of operating electrically driven ventilation fans and cooling plant. The internal planning, building geometry and external topography will be optimised to take full advantage of natural ventilation. Careful attention to the placement of openable windows and interior partitions can greatly increase the natural flow of air through a building by capturing the prevailing winds. Perforated opening panels will provide a level of natural ventilation to the rooms.
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.	**Y**	To reduce the energy used for artificial lighting, the natural daylight entering occupied spaces will be maximised by optimising window size and orientation. Dimmable lighting with photocells in amenity spaces will sense if the illuminance level of the space has been met and reduce lighting levels as required. North facing windows are particularly effective at providing useful daylight and will be incorporated on the building. The buildings orientation and fenestration strategy will take advantage of passive solar gains and natural daylight to reduce heating energy and the need for artificial lighting.

Solar Shading 	Solar shading is a method by which solar radiation in the form of heat and light can be mitigated in a building. While natural heat and light are essential in most buildings and modern architecture uses it more and more there are occasions when the levels are too high. This leads to overheating and too much light. Solar shading is a general term for a range of methods used to reduce the amount of solar gain.	**N**	Whilst maximising daylight, care must be taken to ensure that direct sunlight does not cause glare in the spaces or cause excessive solar gains in summer which will cause spaces to overheat. This is managed by solar shading on affected windows. Some examples of solar shading are canopies, solar control glazing, balconies, internal blinds and curtains which could be adopted on the Proposed Development Solar shading is not proposed on the scheme, however low G-Value glass will help to prevent unwanted solar gain entering the spaces of the Proposed Development
Thermal Mass 	Thermal mass describes a materials capacity to absorb, store and release heat. For example, water and concrete have a high capacity to store heat and are referred to as 'high thermal mass' materials. Insulation foam, by contrast, has very little heat storage capacity and is referred to as having 'low thermal mass'. A common analogy is thermal mass as a kind of thermal battery. Though thermal mass has always been an aspect of buildings, only in recent years has it evolved as a tool to be deployed in the conservation of energy. However thermal mass does not offer a 'one size fits all' concept.	**N**	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.
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.	**Y**	All goods and appliances should be highly energy efficient to reduce energy demand.
Sub-metering 	Building submetering is a meter within your building or facility for specific energy measurements.	**Y**	Power, lighting, major plant and separate areas will be individually metered to allow energy consumption to be pinpointed and reviewed if it is excessive. Baselines and targets will also be set to help reduce energy use. The individual apartments will be metered individually, the buildings as a whole will be bulk metered.
Adaption to climate change 	Average temperatures for central England have risen by approximately 1°C since the 1970s and this has resulted in higher temperatures, changing rain patterns, rising sea levels, in addition to unpredictable extreme weather events such as floods, droughts and freezing winters. Risks of climate change include the increased likelihood of increased external temperatures which could lead to staff illness and therefore lower productivity, damage to equipment due to the high internal building temperatures in addition to increased cooling demand.	**Y**	An uplift in fabric improvements on a development can maximise the retention of heat in winter and reduce heat gains in summer. These improvements will help combat the extremes expected as a result of climate change. G-Values will be carefully selected to maximise natural light and thus reduce reliance on artificial lighting without introducing unwanted thermal gain during the summer months.

7.3. Meeting Demand Efficiently - (Be Clean)

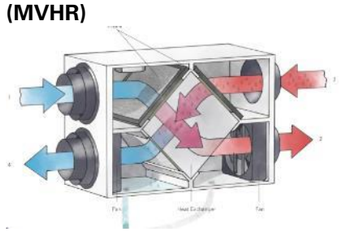
This section looks at technologies that will be used to ensure that energy demand is further reduced and met efficiently:

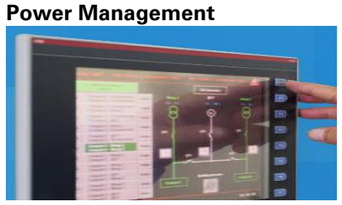
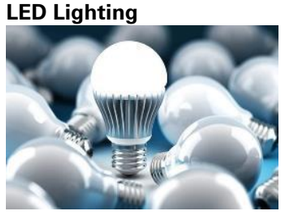
- Ventilation
- Heat recovery
- Demand Operated Systems
- Variable Speed Drives on fans and pumps
- Power Management
- LED Lighting
- Waste Water Heat Recovery
- BMS

Key:

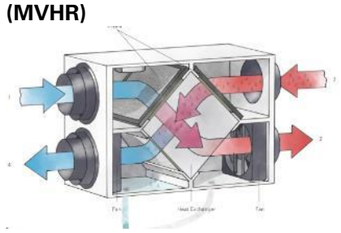
Y – Yes could be incorporated
P – Possible
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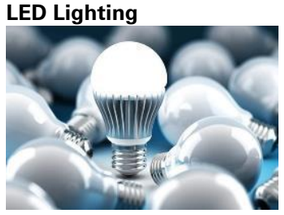
7.3.1. Meeting Demand Efficiently- Hotel

Technology	Description	Suitable For Consideration	Commentary
Mechanical Ventilation with Heat Recovery (MVHR) 	Mechanical Ventilation with Heat Recovery provides fresh filtered air into a building whilst retaining most of the energy that has already been used in heating the building. Heat Recovery Ventilation is the solution to the ventilation needs of energy efficient buildings.	**Y**	Where fresh air is supplied, and stale warm air extracted by mechanical ventilation, heat recovery will be used to recycle a minimum of 85% of the heat from the extracted air to warm the incoming air. The re-use of waste heat in the mechanical ventilation systems provides a significant step towards reducing CO_2 emissions. The hotel will incorporate both MVHR units in the amenity, gym, meeting room and other spaces and a central AHU with heat recovery serving the bedrooms. MVHR units also work to pre-cool warm fresh air during summer months (summer by-pass) in order to reduce the cooling energy required in air-conditioned spaces.
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.	**Y**	Where ventilation, heating and cooling is provided to spaces that may not always be in use such as back of house areas, occupancy sensors will be used to shut down the systems serving the space and turning them on instantly when they are required. This is fundamental to the energy efficiency of the building. 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, 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.
Variable Speed Drives 	Variable speed drives and controls allow an energy system to modulate during periods of low demand. Using variable speed drive pumps therefore uses less energy than traditional pumps, which run at a constant speed.	**Y**	All pumps and fans will 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.

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 switching of devices in various power modes, each with different power usage characteristics related to device performance.	**P**	Power factor correction could be used on the electrical supplies of the Proposed Development to improve energy efficiency. Provision including allocation of spare plant space will be made for future introduction of power factor correction into 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	**Y**	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.
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.	**P**	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, Private Dining, Gym and Reception areas to minimise energy use.

7.3.2. Meeting Demand Efficiently- Residential

Technology	Description	Suitable For Consideration	Commentary
Mechanical Ventilation Heat Recovery (MVHR) 	MVHR provides fresh filtered air into a building whilst retaining most of the energy that has already been used in heating the building. Heat Recovery Ventilation is the solution to the ventilation needs of energy efficient buildings.	**Y**	Where fresh air is supplied, and stale warm air extracted by mechanical ventilation, heat recovery will be used to recycle a minimum of 85% of the heat from the extracted air to warm the incoming air. The re-use of waste heat in the mechanical ventilation systems provides 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 and communal spaces.
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.	**Y**	Where ventilation, heating and cooling is provided to spaces that may not always be in use, occupancy sensors will be used to shut down the systems serving the space and turning them on instantly when they are required. This is fundamental to the energy efficiency of the building. 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, 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.
Variable Speed Drives 	Variable speed drives and controls allow an energy system to modulate during periods of low demand. Using variable speed drive pumps therefore uses less energy than traditional pumps, which run at a constant speed.	**Y**	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.
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 switching of devices in various power modes, each with different power usage characteristics related to device performance.	**P**	Power factor correction could be used on the electrical supplies of the Proposed Development to improve energy efficiency. Provision including allocation of spare plant space will be made for future introduction of power factor correction into 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	**Y**	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.
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.	**P**	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, Private Dining, Gym and Reception areas to minimise energy use.

7.4. Low Zero Carbon Technologies - (Be Green)

The following Low Zero Carbon (LZC) technologies have been identified and reviewed against their suitability on the Viadux Plot 2a site:

- Solar Water Heating
- Ground Source Heat Pumps
- Water Source Heat Pumps
- District Heating
- Biomass
- Wind Power
- Photovoltaic Electricity Generation
- Combined Heat and Power
- Air Source Heat Pumps
- Battery Storage
- Ambient Loop

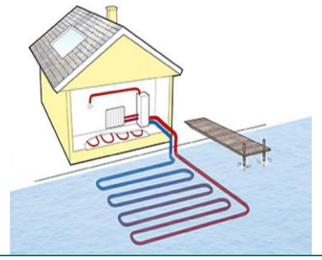
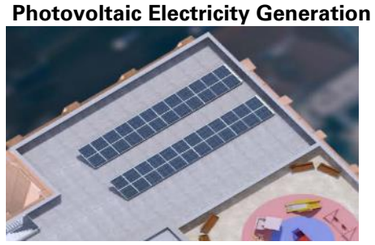
These services are described in more detail below and their suitability discussed.

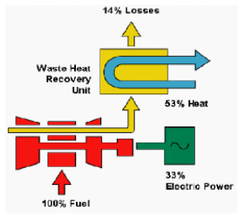
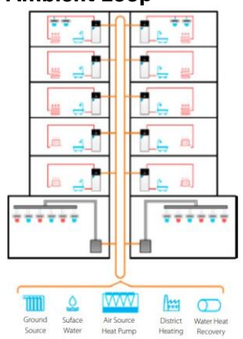
Key:

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

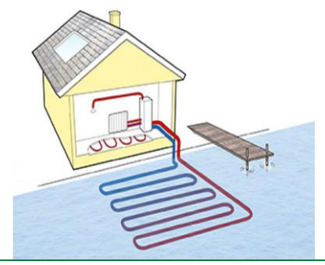
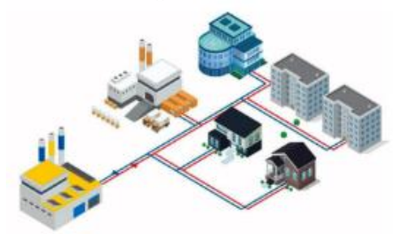
7.4.1. Low Zero Carbon Technologies – Hotel

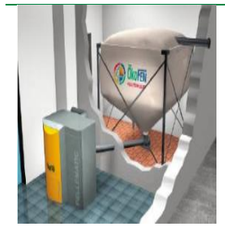
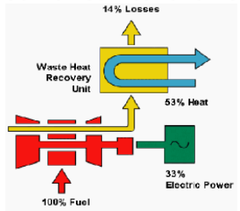
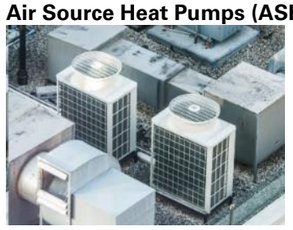
Technology	Description	Suitable For Consideration	Commentary
Solar Thermal Water Heating 	Solar thermal water heating systems use heat from the sun to pre-heat domestic hot water. Solar thermal water heating systems are generally composed of solar thermal collectors and a fluid system to move the heat from the collector to a storage tank to store the heat for subsequent use. The system requires solar panels on the roof, ideally south facing, linked to hot water storage cylinders.	**N**	The available roof area, pitch and orientation is critical. The solar energy collection and pipework distribution strategy would centre on collecting and storing thermal energy in cylinders or tanks in plant rooms. Solar thermal alone will not meet the scheme's targets and would require large roof areas to make any meaningful contribution to the energy strategy. Additionally domestic hot water loads are relatively large given the predominant water load are showers that will see peak usage in the morning and at night. The roof space would be better utilised for PV panels and plant equipment as such there would be limited space to utilise this technology therefore not considered for the Proposed Development
Ground Source Heat Pumps 	Ground Source Heat Pumps (GSHP) can be used to extract heat from the ground by circulating a fluid through a system of pipes buried underground to a heat exchanger which transfers the energy to the distribution network. This can provide space heating and/or domestic hot water. Ground source heat pumps have the advantage that they can act as a source of both heating and cooling for the buildings. Ground source heat pumps are either open-loop (abstracting and rejecting water to the aquifer below the site) or closed-loop using boreholes and energy piles.	**N**	Low grade heat is generated with the efficiency of the system dependant on low distribution temperatures. The average Co-efficient of Performance (CoP) will be circa 4-6, meaning that for every unit of electricity used to pump the heat, 4-6 units of heat will be produced. The extensive underground boreholes and pipework will be difficult to install due to availability of land therefore this technology can be discounted for the Proposed Development

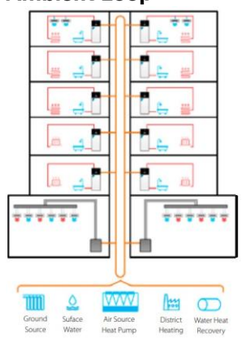
Water Source Heat Pumps 	Water Source Heat Pumps (WSHP) work in a similar way to GSHP, with the exception that the pipes are submerged into a river, stream, lake or the sea. The fluid is pumped through the system and absorbs energy from the surrounding water. WSHP can be either an open-loop or closed-loop system.	**N**	No suitable water courses nearby with enough volume therefore water source heat pumps are discounted.
District Heating 	Energy sources include heat from CHP and to a lesser extent, geothermal. Manchester City Council has a district heating scheme with the possibility of connection, however the feasibility and viability of connection to the district heating mains is related to both the proximity of the network and the forecasted annual heat demand.	**P**	Lower carbon emission factors than traditional fuel sources. Potentially able to achieve renewable targets without other technologies. The Manchester district heating mains is in very close proximity to the site, however as the system is fuelled via gas, alternative methods of space heating and hot water generation are considered for the Proposed Development and therefore this technology is discounted. Please see Section 8 of this report for further details.
Biomass 	Biomass heating systems burn biomass material in a biomass boiler to heat water in the same way that gas boilers burn gas. Biomass materials include all land and water-based vegetation, e.g. wood chips, wood pellets, wood waste and fast growing coppice trees such as willow. The carbon dioxide emitted from burning biomass is balanced by that absorbed during the fuel's production. Biomass heating therefore approaches a low carbon process. Biomass boilers require fuel storage for the fuel source.	**N**	Could be adopted to offset heating and hot water however high NO_x levels would be a concern in city centre environment. Sourcing of materials and transporting large volumes of fuel to site would also be prohibitive due to the location of the site. The biomass boilers and their associated wood store that would be required to serve the Proposed Developments energy demands would be too large to be considered viable. Maintenance requirements and reliability would also be a cause for concern. Not considered for the Proposed Development.
Wind Power 	Wind power is one of the cleanest and safest methods of generating electricity. Wind turbines use the wind's forces to turn a rotor which in turn generates electricity. Wind power is used in large scale wind farms for national electrical grids as well as in small individual turbines or building integrated turbine.	**N**	As the UK is one of the windiest countries in Europe, wind power is one of the best sources of renewable energy – dependent upon location. There will be relatively low daytime electricity demand for the building and therefore battery storage will need to be incorporated to store the generated electricity for the peak morning and evenings. Wind power is unfeasible due to the fact the Proposed Development is in an urban area and local wind conditions may not be sufficient to provide enough power.
Photovoltaic Electricity Generation 	Photovoltaic (PV) modules are devices or banks of devices that use the photovoltaic effect to generate electricity directly from sunlight. PV can be included on the roof or incorporated into curtain walling systems and louvred external shading devices. Typically, photovoltaics would be installed on a south facing roof.	**P**	There will be relatively low daytime electricity demand for the building however, due to the limited space, the array will be smaller. Whilst not significantly contributing to energy reduction, the PV could offset some communal energy usage.

Combined Heat and Power (CHP) 	A CHP unit provides heating as well as electrical power. The electricity generated by the CHP plant can be distributed around a development and into the electrical network if needed. The use of this co-generation improves the overall efficiency of the primary energy delivered to the site with a corresponding reduction in the development's CO_2 emissions. The amount of thermal energy provided by the CHP unit will be dependent on the calculated thermal base load for the buildings.	**N**	Relatively low cost of CHP unit if integrated into a gas boiler and domestic water cylinder strategy. High maintenance costs result in marginal returns on small to medium sized installations. Not considered as is not compatible with future de-carbonisation of the grid and reduction of use of fossil fuels.
Air Source Heat Pumps (ASHP)  	Air Source Heat Pumps work in a similar way to GSHPs but extract thermal energy from the surrounding air and transfer it into water. Air source heat pumps can be fitted on the façade or on the roof, but care should be taken when mounting the units to avoid any acoustic problems associated with operating the fans as the outdoor units typically operate with sound levels in the range 55 - 60dB(A). 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 2.5-4 although some systems may have a greater rate of efficiency.	**Y**	The ASHP system offers an attractive solution in terms of the de-carbonisation of the grid and the omission of natural gas to the site. The average CoP of air source heat pumps is around 2.5-4 although some systems may produce a greater rate of efficiency. This means that for every kW of electric power the heat pumps use, 2.5-4 kW of heat energy is generated, this results in reduced carbon emissions and operational energy. Following the appraisal of the Proposed Development and site, Air Source Heat Pumps (ASHP) have been selected as the preferred low carbon technology and will be used to generate heating, cooling & hot water in conjunction with an ambient loop. ASHP's will also provide space heating and cooling to the amenity areas of the proposed development via a Variable Refrigerant Flow (VRF) system.
Ambient Loop 	An ambient loop circulates water at 25°C, the ambient temperature, minimising heat gain into the spaces where the pipework is distributed, from central plant such as reverse cycle Air Source Heat Pumps or dry coolers. The second stage utilises water to water and water to VRF heat pumps which top up the water from 25°C to provide domestic hot water. The ambient loop can also be used to provide heating and cooling via Water to VRF Heat Pumps.	**Y**	The hotel will utilise an ambient loop to provide hot water, heating and cooling to the hotel rooms and amenity spaces from a central Air to Water reversible heat pump Air Source. The ambient loop results in lower temperature pipework distributed through the building which can reduce the amount of cooling needed

7.4.2. Low Zero Carbon Technologies – Residential

Technology	Description	Suitable For Consideration	Commentary
Solar Thermal Water Heating 	Solar thermal water heating systems use heat from the sun to pre-heat domestic hot water. Solar thermal water heating systems are generally composed of solar thermal collectors and a fluid system to move the heat from the collector to a storage tank to store the heat for subsequent use. The system requires solar panels on the roof, ideally south facing, linked to hot water storage cylinders.	**N**	The available roof area, pitch and orientation is critical. The solar energy collection and pipework distribution strategy would centre on collecting and storing thermal energy in cylinders or tanks in plant rooms. Solar thermal alone will not meet the scheme's targets and would require large roof areas to make any meaningful contribution to the energy strategy. Additionally domestic hot water loads are relatively large given the Proposed Development is predominantly residential based. The roof space would be better utilised for PV panels and plant equipment as such there would be limited space to utilise this technology therefore not considered for the Proposed Development
Ground Source Heat Pumps 	Ground Source Heat Pumps (GSHP) can be used to extract heat from the ground by circulating a fluid through a system of pipes buried underground to a heat exchanger which transfers the energy to the distribution network. This can provide space heating and/or domestic hot water. Ground source heat pumps have the advantage that they can act as a source of both heating and cooling for the buildings. Ground source heat pumps are either open-loop (abstracting and rejecting water to the aquifer below the site) or closed-loop using boreholes and energy piles.	**N**	Low grade heat is generated with the efficiency of the system dependant on low distribution temperatures. The average Co-efficient of Performance (CoP) will be circa 4-6, meaning that for every unit of electricity used to pump the heat, 4-6 units of heat will be produced. The extensive underground boreholes and pipework will be difficult to install due to availability of land therefore this technology can be discounted for the Proposed Development
Water Source Heat Pumps 	Water Source Heat Pumps (WSHP) work in a similar way to GSHP, with the exception that the pipes are submerged into a river, stream, lake or the sea. The fluid is pumped through the system and absorbs energy from the surrounding water. WSHP can be either an open-loop or closed-loop system.	**N**	No suitable water courses nearby with enough volume therefore water source heat pumps are discounted.
District Heating 	Energy sources include heat from CHP and to a lesser extent, geothermal. Manchester City Council has a district heating scheme with the possibility of connection, however the feasibility and viability of connection to the district heating mains is related to both the proximity of the network and the forecasted annual heat demand.	**P**	Lower carbon emission factors than traditional fuel sources. Potentially able to achieve renewable targets without other technologies. The Manchester district heating mains is in very close proximity to the site, however as the system is fuelled via gas, alternative methods of space heating and hot water generation are considered for the Proposed Development and therefore this technology is discounted. Please see Section 8 of this report for further details.
Biomass	Biomass heating systems burn biomass material in a biomass boiler to heat water in the same way that gas boilers burn gas. Biomass materials include all land and water-based vegetation, e.g. wood chips, wood pellets, wood waste and fast growing coppice trees such as willow. The carbon dioxide emitted from burning biomass is balanced by that absorbed during the fuel's	**N**	Could be adopted to offset heating and hot water however high NO_X levels would be a concern in city centre environment. Sourcing of materials and transporting large volumes of fuel to site would also be prohibitive due to the location of the site.

	production. Biomass heating therefore approaches a low carbon process. Biomass boilers require fuel storage for the fuel source.		The biomass boilers and their associated wood store that would be required to serve the Proposed Developments energy demands would be too large to be considered viable. Maintenance requirements and reliability would also be a cause for concern. Not considered for the Proposed Development.
Wind Power 	Wind power is one of the cleanest and safest methods of generating electricity. Wind turbines use the wind's forces to turn a rotor which in turn generates electricity. Wind power is used in large scale wind farms for national electrical grids as well as in small individual turbines or building integrated turbine.	**N**	As the UK is one of the windiest countries in Europe, wind power is one of the best sources of renewable energy – dependent upon location. There will be a relatively high anticipated electricity demand for the building and therefore there are no potential issues with utilisation. Wind power is unfeasible due to the fact the Proposed Development is in an urban area and local wind conditions may not be sufficient to provide enough power.
Photovoltaic Electricity Generation 	Photovoltaic (PV) modules are devices or banks of devices that use the photovoltaic effect to generate electricity directly from sunlight. PV can be included on the roof or incorporated into curtain walling systems and louvred external shading devices. Typically, photovoltaics would be installed on a south facing roof.	**P**	Relatively high anticipated daytime electricity demand for the Proposed Development. Therefore, no potential issues with utilisation, i.e. availability will match demand. The PV panels are used to generate electricity reducing CO2 emissions. Potential for PV panels to be installed at roof space however this will be a relatively small array due to available space and will not contribute significantly to energy reduction.
Combined Heat and Power (CHP) 	A CHP unit provides heating as well as electrical power. The electricity generated by the CHP plant can be distributed around a development and into the electrical network if needed. The use of this co-generation improves the overall efficiency of the primary energy delivered to the site with a corresponding reduction in the development's CO_2 emissions. The amount of thermal energy provided by the CHP unit will be dependent on the calculated thermal base load for the buildings.	**N**	Relatively low cost of CHP unit if integrated into a gas boiler and domestic water cylinder strategy. High maintenance costs result in marginal returns on small to medium sized installations. Not considered as is not compatible with future de-carbonisation of the grid and reduction of use of fossil fuels.
Air Source Heat Pumps (ASHP) 	Air Source Heat Pumps work in a similar way to GSHPs but extract thermal energy from the surrounding air and transfer it into water. Air source heat pumps can be fitted on the façade or on the roof, but care should be taken when mounting the units to avoid any acoustic problems associated with operating the fans as the outdoor units typically operate with sound levels in the range 55 - 60dB(A). 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 2.5-4 although some systems may have a greater rate of efficiency.	**Y**	The ASHP system offers an attractive solution in terms of the de-carbonisation of the grid and the omission of natural gas to the site. The average CoP of air source heat pumps is around 2.5-4 although some systems may produce a greater rate of efficiency. This means that for every kW of electric power the heat pumps use, 2.5-4 kW of heat energy is generated, this results in reduced carbon emissions and operational energy. Following the appraisal of the Proposed Development and site, Air Source Heat Pumps (ASHP) have been selected as the preferred low carbon technology and will be used to generate heating, cooling & hot water. Each apartment will have a localised air source heat pump hot water cylinder meeting the apartments hot water needs.

			ASHP's will also provide space heating and cooling to the amenity areas of the proposed development via a Variable Refrigerant Flow (VRF) system.
Ambient Loop 	An ambient loop circulates water at 25°C, the ambient temperature, minimising heat gain into the spaces where the pipework is distributed, from central plant such as reverse cycle Air Source Heat Pumps or dry coolers. The second stage utilised individual water to water heat pumps located in each apartment which top up the water from 25°C to provide heating and domestic hot water. The individual water to water heat pumps can also be used to provide cooling.	**Y**	Each apartment will have individual Air Source Heat Pumps to provide domestic hot water, heating and cooling. These units work on one "function" at a time as such heating hot water can provide "free cooling" into the ambient loop with the opposite also being true.

8. AMBIENT LOOP

An Ambient Loop is similar to a traditional communal heating system in that it uses water as a distribution medium. An ambient loop is still regulated within the operating parameters of the centralised heating and cooling plant.

The ambient loop uses water at a temperature of 25°C, close to the ambient temperature which makes it suitable for incorporating other low and zero carbon heat sources such as air source heat pumps, ground source heat pumps, connection into a district heating network and solar hot water panels. For systems that require cooling, chillers, reverse cycle air source heat pumps or ground and water source heat pumps or cooling towers and adiabatic dry air coolers can be used.

The ambient loop comprises of two stages; the first stage utilises central plant to heat water to a lower temperature than a conventional system. This requires less energy to both heat up the water and to maintain the temperature of the water.

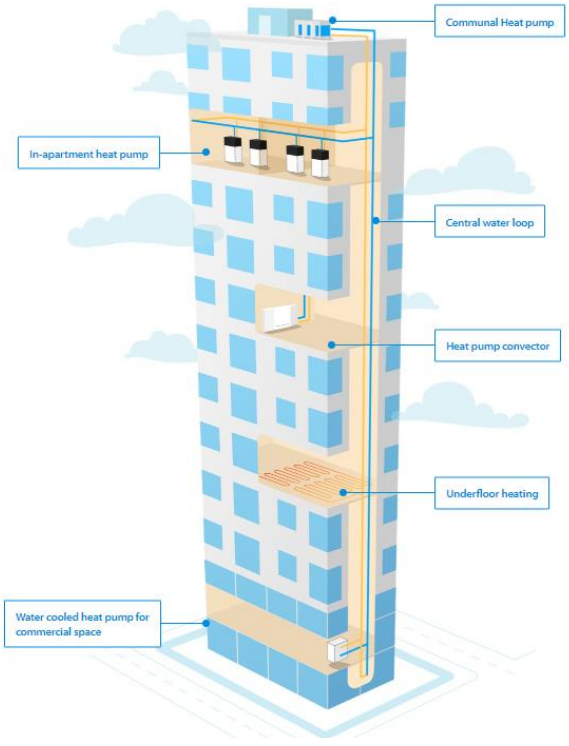


Diagram of ambient loop within a high rise building (Image credit: Daikin)

This is important because the improved envelope of modern buildings make it challenging to remove this heat, increasing the internal air temperature of the building particularly in corridors where the distribution pipework predominantly runs, which subsequently leads to overheating in the corridors.

Overheating in corridors can lead to the overheating of rooms adjacent to the corridor where mitigations such as cooling or a greater amount of fresh air is required to deal with the overheating. Both of these lead to an increase in the carbon emissions of the building.

As the ambient loop distributes water at a temperature of 25°C, close to the ambient temperature, less insulation is needed to minimise the heat loss through the pipe and the subsequent heat gain into the spaces. The lower temperature can also reduce the diameter of the pipework.

The second stage of the ambient loop within Viadux Plot 2a will utilise water to water and water to VRF heat pumps to top up the temperature from 25degC to provide hot water, heating and cooling to the hotel and amenity spaces.

In summary, adopting an ambient loop can reduce the required central plant, leads to lower summertime corridor temperatures thus lowering the risk of overheating in the adjacent rooms which in turn can minimise the amount of cooling required to each space.

Various benefits of the ambient loop is the reduction in central plant requirements, reduction in summertime corridor temperatures thus lowering the risk of overheating.

9. DE-CENTRALISED / DISTRICT HEATING NETWORK (DHN)

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

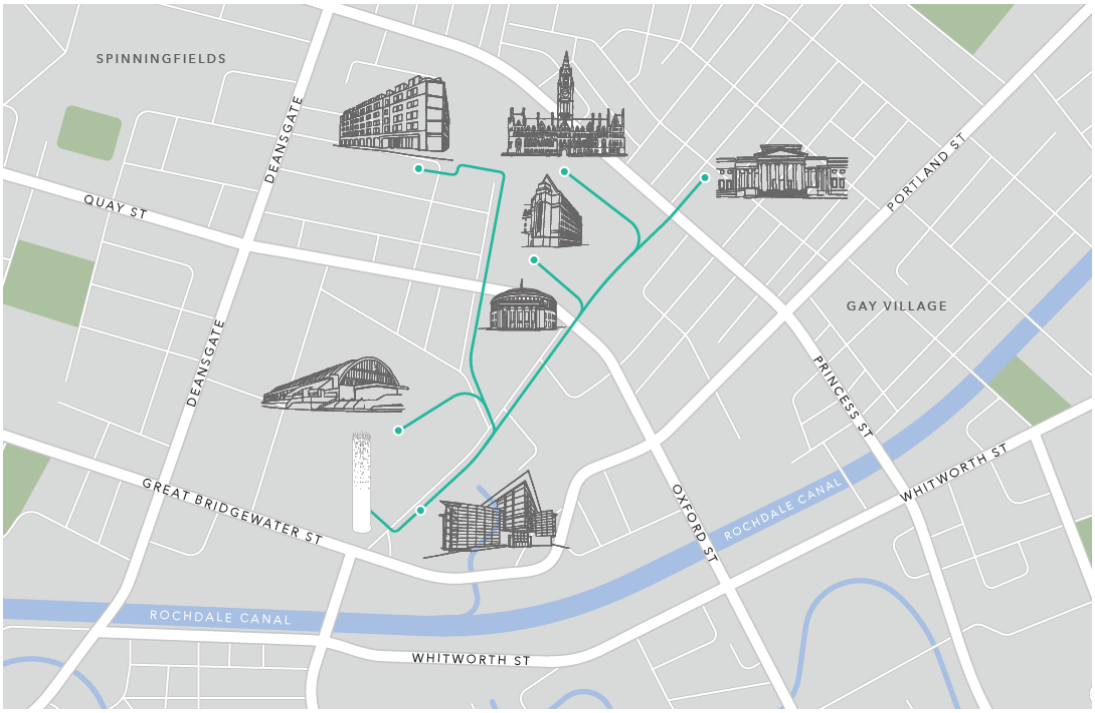
The energy policy reaffirms the view that energy generated by centralised power stations and transmitted through the national grid is highly inefficient and wasteful.

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 have been working in partnership with Vital Energi to create the Manchester Civic Quarter Heat Network. The below image identifies the current extent of the energy network.



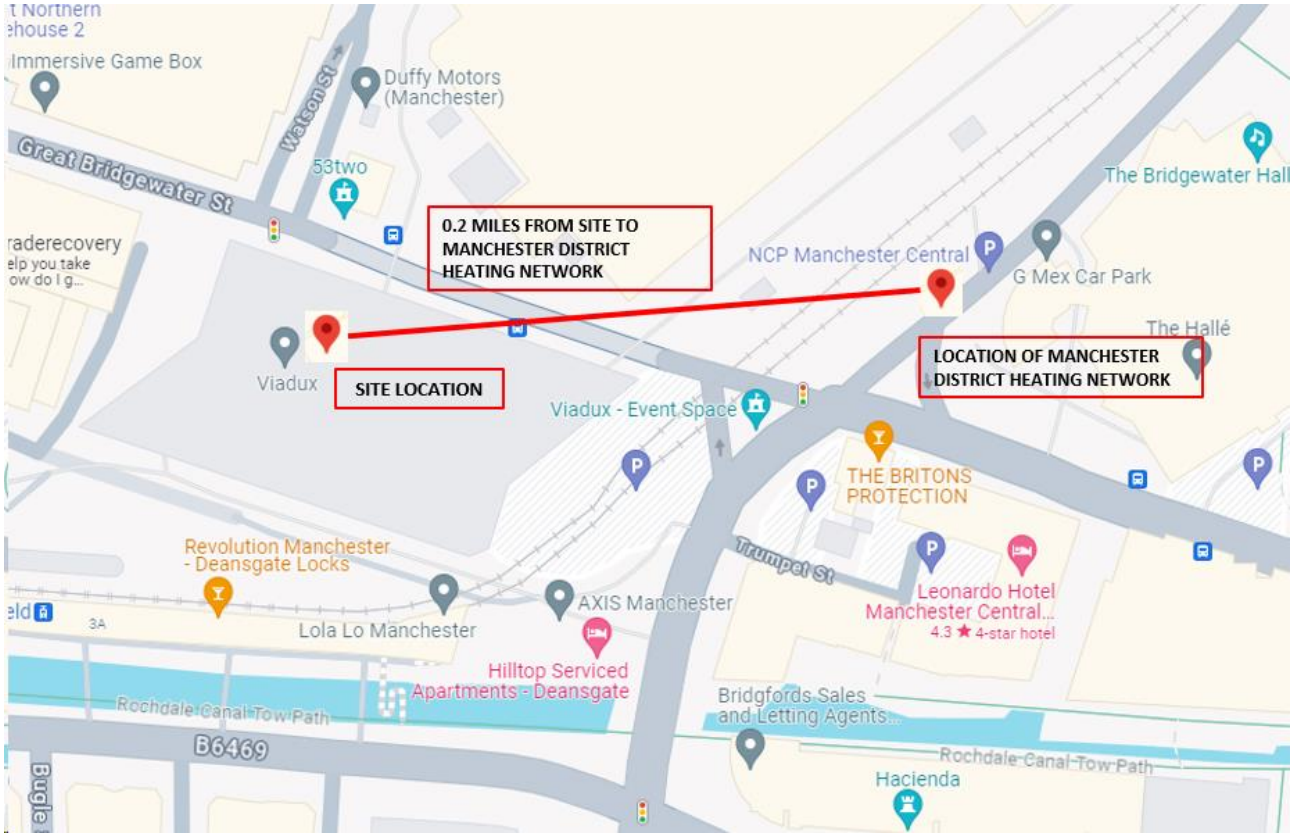
Proposed Manchester Energy Network Route

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

The buildings currently connected are:

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

The network contains power cables to distribute the electricity generated and underground pipes that deliver heat and hot water to connected buildings. The network has been designed to enable future expansion, with efficiency and carbon savings increasing as more buildings join.



Proximity of District Heating Network to Site

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

The Manchester district heating mains is in close proximity to the site, however as the system is fuelled via gas, alternative methods of heating and hot water generation are considered for the Proposed Development and therefore this technology is discounted.

10. PROPOSALS

10.1. Hotel

Energy modelling for the hotel has been carried out in IES Virtual Environment to assess the RIBA Stage 2 planning design against Approved Document Part L Volume 2, 2021.

10.1.1. Passive Measures (Be Lean)

Designing the hotel with U-values and Air Permeability that are lower than the minimum Building Regulations values from the outset is essential to reducing the energy consumption and therefore CO_2 emissions of the Proposed Development as less energy will be required for the space heating and space cooling requirements.

The team have maximised passive design measures by adopting the following measures:

BUILDING FABRIC ELEMENT	LIMITING U-VALUE (W/M2K)	TARGET U-VALUE (W/M2K)	% BETTERMENT
Walls	0.26	0.15	42%
Floors	0.18	0.15	16%
Roof (flat)	0.18	0.15	16%
Windows	1.6	1.4	12%

AIR PERMEABILITY	LIMITING AIR PERMEABILITY	TARGET AIR PERMEABILITY	% BETTERMENT
$M_3/(h.m_2)$ at 50 Pa	8	3	62%

For the proposed hotel, U-values and Air Permeability that exceed the minimum stated within Building Regulations have been used, essential to the development using less energy to maintain comfortable conditions. Glazing with a G-value of 0.4 has been used to limit the amount of unwanted solar gain to avoid occupied rooms from overheating.

Adopting passive design measures will allow the proposed development to maximise natural sources of cooling and ventilation in addition to allowing the heating systems to perform more efficiently.

10.1.2. Energy Efficiency Measures (Be Mean)

The next stage of the design development was to establish energy efficiency measures to meet the demand of the Proposed Development.

High efficiency fans with low specific fan powers (SFP's) will be selected to reduce the energy consumption of the ventilation systems.

High efficiency LED will be installed throughout the development. Lights within communal and amenity areas will be coupled with daylight dimming and absence / presence detection, where appropriate, to reduce the energy consumption and CO_2 emissions associated with lighting.



Variable speed controls will be installed to mechanical plant equipment throughout the development to reduce the regulated energy demand. The mechanical systems shall also be controlled via a Building Management System.

10.1.2.1. Heat Recovery on Mechanical Ventilation

Heat recovery will be adopted on all ventulation systems that provide supply and extract ventilation. This includes both centralised Air Handling Units and localised Mechanical Ventilation with Heat Recovery (MVHR) units serving the amenity spaces.



Typical Exposed MVHR configuration

Both centralised AHUs and MVHR units are similar in principle whereby they have similar components, including a heat recovery cell where the indoor heat is extracted and supplied into the outside air coming into the building; fans which pull in and blow out the air; and filters for filtering outside air from dust and particles inside the unit, protecting longevity and efficiency.

The units work by extracting the stale air inside the building and feeding it through filters whilst also extracting the heat energy so that it's not exhausted to the outside but transferred back into the building with the filtered incoming air.

Centralised Air Handling Units will serve the hotel bedrooms, commercial kitchen areas and the swimming pool and associated areas. MVHR units will serve the hotel amenity spaces including meeting spaces.

By including heat recovery, the required heating and cooling load can be minimised which can reduce the CO_2 emissions.

10.1.3. Renewable and Low Carbon Technologies (Be Green)

The final aspect of the design been to establish what renewable and low carbon technologies can be adopted within the hotel.

Following the appraisal of the proposed hotel and site, Variable Refrigerant Flow (VRF) reverse cycle heat pumps with heat recovery will provide the heating and cooling to the hotel bedrooms and hotel amenity spaces. This will be delivered via the ambient loop.

The VRF condensers, which typically have a co-efficient of performance (CoP) of 3-4 depending on the season and internal loads, will serve indoor fan coil units.

Fan coil units in the bedrooms will work in conjunction with the centralised Air Handling Units and in the amenity spaces, the fan coil units will alongside the localised Mechanical Ventilation with Heat Recovery (MVHR) units.



Typical VRF Fan Coil to Amenity Spaces



Typical MVHR Units to Amenity Spaces

Hot water within the hotel development will be generated via heat pumps. The hot water heat pumps have a typical co-efficient of performance (CoP) of 2.5 - 4.

10.2. Residential

Energy modelling for the residential apartments has been carried out using Elmhurst Energy to assess the RIBA Stage 2 planning design against Approved Document Part L Volume 1, 2021.

10.2.1. Passive Measures (Be Lean)

Designing the residential apartments with U-values and Air Permeability that are lower than the minimum Building Regulations values from the outset is essential to reducing the energy consumption and therefore CO_2 emissions of the Proposed Development as less energy will be required for the space heating and space cooling requirements.

The team have maximised passive design measures by adopting the following measures:

BUILDING FABRIC ELEMENT	LIMITING U-VALUE (W/M2K)	TARGET U-VALUE (W/M2K)	% BETTERMENT
Curtain Walls*	1.6	0.9	43%
Floors	0.18	N/A	N/A
Roof (flat)	0.16	0.15	16%
Windows*	1.6	0.9	43%

*Included within curtain walling

AIR PERMEABILITY	LIMITING AIR PERMEABILITY	TARGET AIR PERMEABILITY	% BETTERMENT
$M_3/(h.m_2)$ at 50 Pa	8	3	62%

For the proposed residential apartments, U-values and Air Permeability that exceed the minimum stated within Building Regulations have been used, essential to the development using less energy to maintain comfortable conditions. Glazing with a G-value of 0.4 has been used to limit the amount of unwanted solar gain to avoid habitable rooms from overheating.

Adopting passive design measures will allow the proposed development to maximise natural sources of cooling and ventilation in addition to allowing the heating systems to perform more efficiently.

The residential apartments within the development will adopt perforated opening panels to facilitate purge ventilation coupled with Mechanical Ventilation Heat Recovery (MVHR) with summer-by-pass, mitigating the need for artificial cooling in the majority of residential areas. The panels are designed to be utilised for peak summer conditions with rapid ventilation with the MVHR utilised for general background ventilation. An example of perforated opening panels is shown in in the image adjacent.



Perforated Ventilation Opening Panels

Please see Ventilation Strategy Report 5022344-RDG-XX-XX-RP-M-570000 for further details.

10.2.2. Energy Efficiency Measures (Be Mean)

The next stage of the design development was to establish energy efficiency measures to meet the demand of the Proposed Development.

High efficiency fans with low specific fan powers (SFP's) will be selected to reduce the energy consumption of the ventilation systems.



High efficiency LED will be installed throughout the development. Lights within communal areas will be coupled with daylight dimming and absence / presence detection, where appropriate, to reduce the energy consumption and CO_2 emissions associated with lighting. Absence/ presence detection will not be installed within the individual apartments.

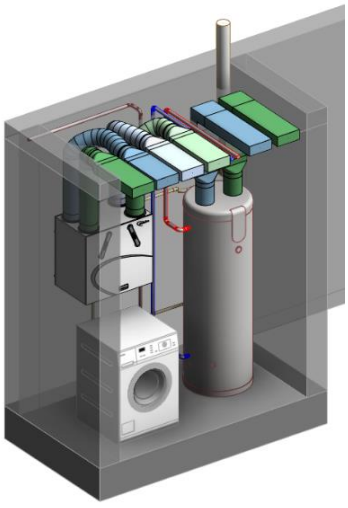
Variable speed controls will be installed to mechanical plant equipment throughout the development to reduce the regulated energy demand. The mechanical systems shall also be controlled via a Building Management System.

10.2.2.1. Mechanical Ventilation with Heat Recovery

Mechanical Ventilation with heat recovery (MVHR) is a mechanical system that ensures there is minimal heat loss when ventilating a room.

MVHR units are proposed for all apartments, these units will provide fresh air and heat recovery to the individual bedrooms, bathrooms, living/kitchens and residential amenity spaces.

The units work by extracting the stale air inside the building and feeding it through filters whilst also extracting the heat energy so that it's not exhausted to the outside but transferred back into the building with the filtered incoming air.



Typical Apartment MVHR configuration

The main components of an Mechanical Ventilation Heat Recovery (MVHR) unit is a heat recovery cell where the indoor heat is extracted and supplied into the outside air coming into the building; fans which pull in and blow out the air; and filters for filtering outside air from dust and particles inside the unit, protecting longevity and efficiency.

In addition to this, the MVHR units will come with a summer bypass which rejects the heat instead of recovering it, thus warming up the air even more. This will be used to avoid summertime overheating as during the warmer months of the year, heat recovery will not be required in the habitable spaces.

This reduces any required cooling load which can significantly reduce the CO_2 emissions of the Proposed Development and will also assist in providing comfortable living conditions.

Benefits of mechanical ventilation with heat recovery include, filtered air, minimal heat losses, mitigates overheating, and retains heat that would usually be exhausted to the outside environment.

10.2.3. Renewable and Low Carbon Technologies (Be Green)

The final aspect of the design been to establish what renewable and low carbon technologies can be adopted within the residential apartments.

Following the appraisal of the proposed development and site, Air Source Heat Pumps (ASHPs) will be used to generate heating and cooling (if necessary).

Each apartment will have a localised Air Source Heat Pump hot water cylinder which will provide the apartments hot water needs.

The average co-efficient of performance (CoP) of Air Source Heat Pumps are typically 2.5-4, although greater efficiency units are available. The CoP means that for every 1kW of electrical power the heat pumps use, 2.5-4kW of heat energy is generated, reducing the carbon emissions and operational energy.



Typical ASHP Cylinder in Utility Cupboard

11. PREDICTED CARBON EMISSIONS AND OPERATIONAL ENERGY SAVINGS

The following SAP and BRUKL results relate to a RIBA Stage 2 design and will be subject to a design development at the next stages. The SAP and BRUKL results are shown in Appendix 2.

11.1. Hotel (BRUKL Results)

In summary, the building emission rate is lower than the target emissions rate and the building primary energy rate is lower than the target primary energy rate.

Target CO2 emission rate (TER), $kgCO_2/m^2$. annum	10.59	
Building CO2 emission rate (BER), $kgCO_2/m^2$. annum	8.79	
Target primary energy rate (TPER), kWh/m^2.	114.97	
Building primary energy rate (BPER), $kWh/m^2/yr$	95.81	
Do the buildings emission and primary energy rates exceed the targets?	BER = < TER	BPER = < TPER

The proposed option provides a 17% betterment on the target CO_2 emission rate and 16.67% betterment on primary energy rate.

11.2. Residential Areas (SAP Results)

In summary, the building emission rate is lower than the target emissions rate and the building primary energy rate is lower than the target primary energy rate. The dwelling fabric efficiency rate is also lower than the target fabric energy efficiency rate.

Target dwelling CO_2 emission rate (TER), $kgCO_2/m^2$.	12.91	
Dwelling CO_2 emission rate (DER), $kgCO_2/m^2$	2.92	
Dwelling primary energy rate (TPER), $kgCO_2/m^2$.	72.22	
Dwelling Target primary energy rate (DPER), $kgCO_2/m^2$	30.92	
Dwelling Fabric Energy Efficiency (DFEE) $kgCO_2/m^2$	22.30	
Target Fabric Energy Efficiency (TFEE) $kgCO_2/m^2$	25.10	
Do the buildings emission and primary energy rates exceed the targets?	PASS	PASS

The proposed option provides a 77.42% improvement on the target CO_2 emission rate and a 57.18% improvement on the target primary energy rate. The dwelling fabric energy efficiency is also at a 11.17% betterment over the target fabric energy efficiency.

12. CONCLUSION

This report has set out the methodology in which the design team have approached the design of the proposed Viadux Plot 2a development and how the strategies of Manchester City Council and the Government guidelines have been adopted. As the current proposals all pass Approved Building Regulations Part L 2021, they will more than exceed the MCC Core Strategy of passing Part L 2013 by 15%.

Our strategy has sought to reduce the carbon emissions for the building using a Lean, Mean & Green approach and these findings have been applied to the Proposed Development.

The Proposed Development has been designed with U-values and air permeability that are lower than the minimum Building Regulations values which is essential in reducing the initial demand for energy and associated CO_2 emissions of the building from the outset using passive measures. This will result in less energy required to maintain comfortable conditions inside the building as well as the building performing better as an insulator. Adopting this approach will also allow the Proposed Development to maximise the use of natural sources of cooling and ventilation which will assist in maintaining comfortable conditions within the internal spaces and will also allow the heating and cooling system to perform more efficiently.

Energy efficiency measures have then been evaluated to assess which measures suit the Proposed Development best. High efficiency LED lighting will be used throughout coupled with demand operated lighting where appropriate in the form of daylight diming, & absence/presence detection, this will reduce energy consumption and CO_2 emissions associated with lighting within the Proposed Development.

Within the hotel development, both Air Handling Units and Mechanical Ventilation with Heat Recovery (MVHR) will be proposed as the strategy. MVHR units will also be proposed as the strategy for ventilation within the residential apartments.

Mechanical Ventilation with Heat Recovery (MVHR) units will provide fresh air and heat recovery to the individual bedrooms of the development as well as the amenity spaces. Heat Recovery reduces the required cooling & heating load which will in turn reduce CO_2 emissions that the development produces. Alongside this, the proposed ventilation units come with a summer bypass which allows them to bypass the heat exchanger during warmer months, helping maintain thermal comfort.

Various renewable and low zero carbon technologies have been assessed and this report has established the that are best technologies adopted to the Proposed Development are:

- Local Water Source Heat Pump (WSHP) Hot Water cylinders fed from the ambient loop to provide hot water heating and cooling to the residential apartments of the Proposed Development.
- Water to VRF Heat Pumps to provide space heating and cooling to the Hotel rooms and amenity areas of Plot 2a.
- Water to Water Heat Pumps to provide hot water to the Hotel rooms and amenity areas of Plot 2a.

This system was chosen to align with the government's policy on the phasing out of fossil fuels and the subsequent decarbonisation of the National Grid. The proposals presented also support the governments and local authorities' policy on phasing out fossil fuels and as the grid decarbonises will offer further carbon reductions.

In conclusion, this report demonstrates that the proposed development accords with the relevant polices (set out previously within this report). Therefore, it is considered that the proposed development is in accordance with national and local policy, and so energy should not be a material consideration that prevents the grant of planning permission.

13. APPENDICES

Plot 2a Residential Areas (SAP Results)

Predicted Energy Assessment

elmhurst energy

Studio 27.01, Viadux Phase 2, Manchester

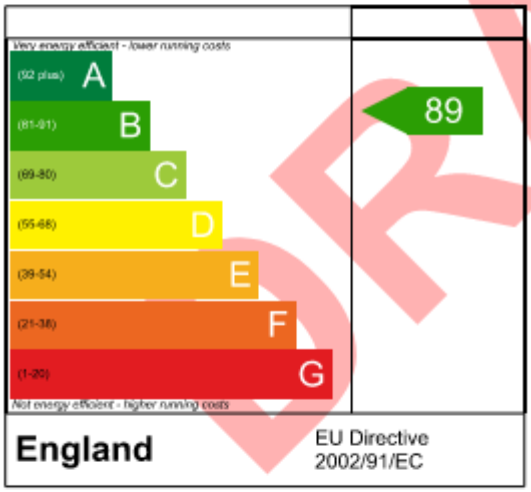
Dwelling type:	Flat, Mid-Terrace
Date of assessment:	28/10/2024
Produced by:	Adrian Farnell
Total floor area:	70 m²
DRRN:	

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

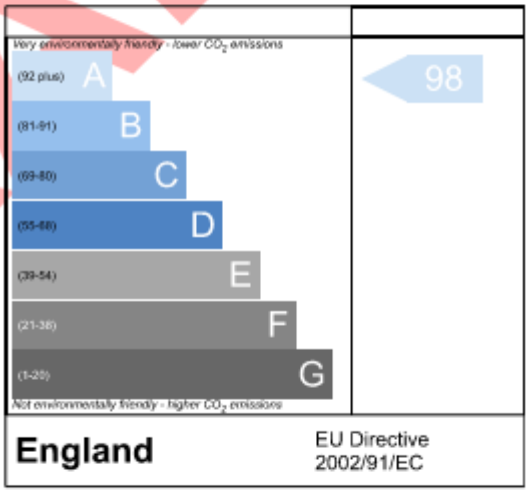
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Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

Sample SAP result for typical apartment in Viadux Plot 2a

Plot 2a Commercial Areas (BRUKL Results)

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

Viadux Phase 2a — As designed

Date: Thu Oct 17 17:00:49 2024

Administrative information

Building Details

Address: Address 1, City, Postcode

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.26

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.26

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

Foundation area [m²]: 780.9

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	10.59	
Building CO_2 emission rate (BER), $kgCO_2/m^2$annum	8.79	
Target primary energy rate (TPER), kWh_{PE}/m^2annum	114.97	
Building primary energy rate (BPER), kWh_{PE}/m^2annum	95.81	
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	0.15	0.15	00000031:Surf[1]
Floors	0.18	0.15	0.15	00000031:Surf[5]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.15	0.15	00000031:Surf[4]
Windows** and roof windows	1.6	1.4	1.4	00000031:Surf[0]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	0.15	0.15	04000028:Surf[1]
Vehicle access & similar large doors	1.3	-	-	No vehicle access doors in building
High usage entrance doors	3	-	-	No high usage entrance doors in building

$U_{a\text{-}Limit}$ = 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

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Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m²]	22646.2	22646.2
External area [m²]	15407.3	15407.3
Weather	MAN	MAN
Infiltration [m³/hm²@ 50Pa]	3	3
Average conductance [W/K]	8696.66	9467.43
Average U-value [W/m²K]	0.56	0.61
Alpha value* [%]	25.35	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	Retail/Financial and Professional Services
	Restaurants and Cafes/Drinking Establishments/Takeaways
	Offices and Workshop Businesses
	General Industrial and Special Industrial Groups
	Storage or Distribution
93	**Hotels**
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
7	**Residential Spaces**
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
	General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger Terminals
	Others: Emergency Services
	Others: Miscellaneous 24hr Activities
	Others: Car Parks 24 hrs
	Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	4.93	8.17
Cooling	4.11	1.12
Auxiliary	13.07	15.49
Lighting	9	12.05
Hot water	33.83	40.91
Equipment*	80.62	80.62
TOTAL**	**64.93**	**77.74**

* 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.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*0*	*0*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	114.94	100.43
Primary energy [kWh_{PE}/m²]	95.81	114.97
Total emissions [kg/m²]	8.79	10.59



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