RIDGE

PROPERTY & CONSTRUCTION CONSULTANTS

ENERGY STRATEGY REPORT

to

SUPPORT MINOR MATERIAL AMENDMENT APPLICATION

to

PLANNING PERMISSION115871/FO/2017

for

ASK CENTRAL LTD

May 2020

Prepared by

Ridge and Partners LLP
5th Floor
Belvedere House
12 Booth Street
M2 4AW
Tel: 0161 833 9579

VERSION CONTROL

Project Name	Manchester Central
Project No.	5002469

VERSION	DATE	DESCRIPTION	CREATED BY	REVIEWED BY
1.0	24.02.2011		CB	CN
2.0	1.05.2020	As Deloitte comments	PD	CB
3.0	06.05.2020	Fabric Data updated	PD	CB
4.0	07.05.2020	Updated as Deloitte comments	PD	CB

CONTENTS

1. INTRODUCTION **1**
1.1 Overview 1
1.2 Site Description 1
2. EXECUTIVE SUMMARY **3**
2.1 Overview 3
2.2 Government Policy 3
2.3 Manchester Energy Hierarchy 4
2.4 Manchester Climate Change Framework 2020 -25 5
2.5 Summary of Technologies Adopted 7
3. SITE APPRAISAL **9**
4. UK POLICY DRIVERS FOR ENERGY EFFICIENCY AND LZCT ENERGY **11**
5. BASELINE ENERGY ASSESMENT **14**
5.1 Residential 14
5.2 Commercial Offices 16
5.3 Retail (Shell & Core) 17
6. IDENTIFY FABRIC EFFICIENCY DESIGN MEASURES – "BE LEAN" **17**
6.1 Appraisal of Solutions 17
6.2 Residential – Be Lean Design 19
6.3 Commercial Offices 21
6.4 Retail Spaces 22
7. IDENTIFY ENERGY EFFICENY MEASURES 'BE CLEAN' **22**
7.1 Residential 22
7.2 Commercial Offices 23
8. LOW TO ZERO CARBON TECHNOLOGIES – "BE GREEN/BE CLEAN" **23**
8.1 Low/Zero Carbon Technologies (LZT) Discounted 30
9. DISTRICT HEATING NETWORK **31**
10. PROPOSED ENERGY STRATEGY **32**
11. SUMMARY OF TECHNOLGIES ADOPTED **33**
11.1 Residential 33
11.2 Commercial Offices 35

11.3 Retail Spaces 37

1. INTRODUCTION

1.1 Overview

This report has been prepared by Ridge in support of an application to vary the planning permission for Viadux as approved by the LPA on 27 July 2017 (Application Reference: 115871/FO/2017) in light of minor amendments proposed by the Applicant. These are explained in full within the application documentation but principally consist of: alterations to a phasing plan, rationalisation of the building's massing, footprint, and layout, alteration to the structural strategy, reduction in number of car parking spaces, alterations to the elevations, and refinement of the energy strategy.

Version 1.2 of this report includes for the implications of these amendments on the ventilation report, specifically for the reduced number of car parking spaces with the following sections amended:-

- Section 1.2 – Areas schedule updated
- Section 2.3 - Updated.
- Section 5.1 – Updated to reflect All Electric system for Residential

This report should be read in conjunction with the Covering Letter prepared by Deloitte and its enclosures submitted as part of this application.

This energy statement provides supporting information for the proposed Low or Zero Carbon (LZC) technologies considered on site in accordance with Manchester City Council's Planning Policies.

In response to Manchester City Council's (MCC) Planning Policies, this assessment has been undertaken to strategically look at the technical and economic feasibility of Low or Zero Carbon Energy sources. Purpose of this report is to provide a description of the Energy Strategy for the proposed Manchester Central Development.

1.2 Site Description

The Site is located in Manchester City centre and extends to approximately 0.72 hectares. It is bound by the former Manchester Grade II central Railway Station (now Manchester central) to the north, Albion Street to the east, the rear service courtyard to Beetham Tower to the west, and Castlefield Deansgate Tramstop and Deansgate Locks to the south.

The Site comprises the eastern –most section of Castlefield Viaduct. At street level it comprises railway arches underneath the viaduct accommodating the former Bauer Millet car showroom and forecourt fronting onto Albion Street, now in temporary use as a multi-arts venue, and public car parking accessed via Trafford Street. On top of the viaduct is a car park and service deck serving the adjacent Manchester Central conference and vehicular and pedestrian access routes across the site.

Vehicular access to the site is via Trafford Street, which incorporates a ramp up to the deck on top of the viaduct, and via the car showroom forecourt on Albion Street. Pedestrian access to the viaduct deck is taken via the Metrolink Station or great Northern Warehouse.

Key statistics:-

Current Schedule of Areas		
	NIA m^2	**GIA m^2**
Residential	24,974	35,558
Offices	23,570	32,424
Retail 1 & 2		527

2. EXECUTIVE SUMMARY

2.1 Overview

This Energy Statement has been developed to evaluate the technical and economic feasibility of using low and zero carbon technologies. The following technologies have been evaluated: –

- Biomass
- Wind
- Biogas
- Geothermal
- Ground Source Heat Pump
- Air Source Heat Pumps
- Combined Heat & Power (CHP)
- Solar Hot Water
- Solar Photo-voltaic
- Anaerobic Digestion
- Energy Sharing
- District Heating Solutions

2.2 Government Policy

The UK government is expanding the low carbon economy and has set legally binding targets to achieve net zero Co2e by 2050.

One of the key intentions of the government is to phase out heating systems that use fossil fuels in all new and existing buildings during the 2020s. The government has projected that the carbon intensity of the grid will continue to fall to below 150g CO_2e/kWh, eventually falling to 108g CO2e/kwh by 2025.

The challenge is to halve energy consumption by 2030 on which a wide range of policies and incentives will be adopted including the Clean Ground Grand Challenge, The Future Homes Standard, Electrification of Heat Demonstration Project and others**.**

With the UK Governments policy for decarbonisation of the National Grid, electricity generation will become established as a low carbon fuel source, developments that specify electric heating systems will benefit greatly from the updated version of Part L and will contribute to a sustainable and low carbon economy of the future.

SAP calculations are used to asses the energy performance of dwellings in the UK and are part of Building Regulations compliance. The latest version of SAP is SAP10 with the most significant change being CO2 and primary energy factors being reduced for electricity related carbon emissions reducing from 0.519kgCO2/kWh to 0.233kgCO2/kWh, which is only slightly higher than gas (0.21). Other changes included in SAP10 are:-

- Lighting Energy calculation to give more accurate assessment

- Assumed Heating patterns
- Thermal Bridging with ACD's removed
- Hot Water Consumption with showers and baths included
- PV Panels applying to flats directly connected (not a fixed proportion)
- Overheating Risk more accurate and allows for leaving windows open during hot weather

From initial calculations based on SAP10 it indicates a significant improvement could be achieved based on an all-electric system although this would need to be validated as there are many different conventions between the SAP versions i.e. SAP10 considers many more issues that are not SAP2012.

As a rough estimate the Viadux project could achieve about a 30 -40% improvement on the TER in the current Building Regulations.

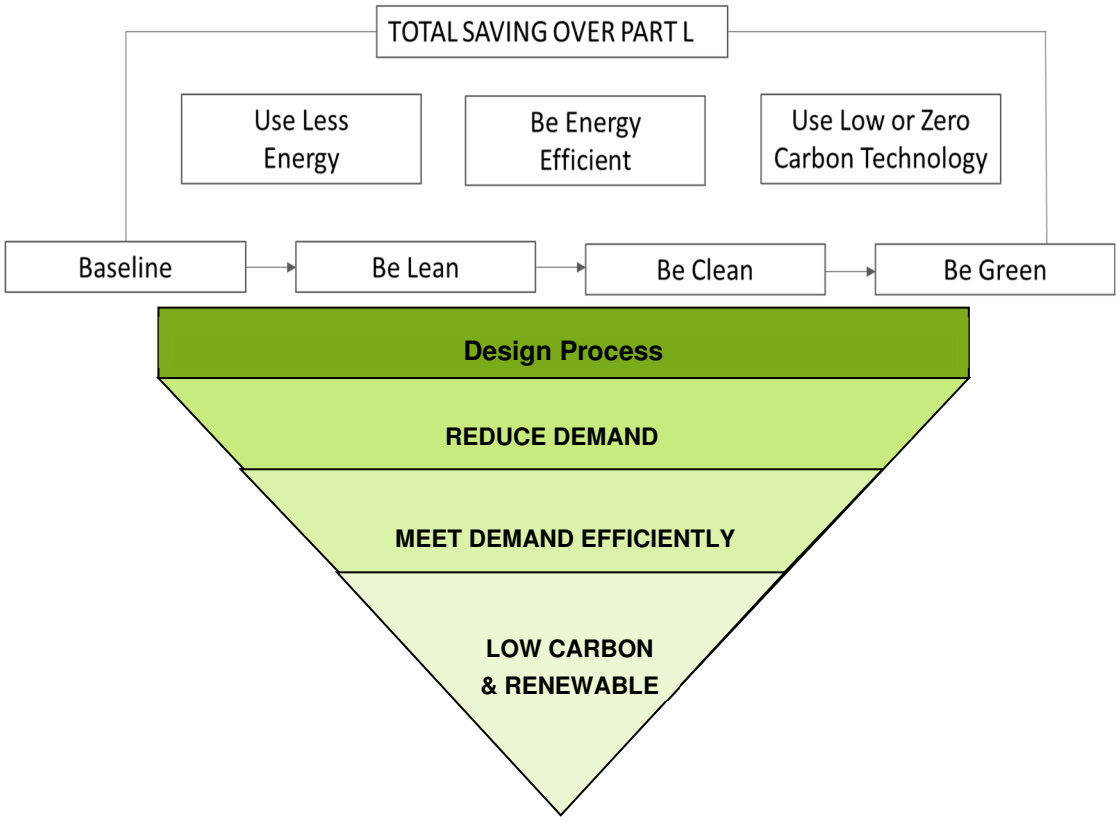
An important feature is to future proof the development for the changes in legislation to embrace the UK governments targets.

2.3 Manchester Energy Hierarchy

In line with Manchester's energy hierarchy the strategy further considers the need to reduce energy use first, then use clean, efficient non-renewable systems and finally use Low or Zero Carbon technologies for the remaining energy requirements –

BE LEAN, BE CLEAN, BE GREEN

The development has been provided with energy savings through the use of low and zero carbon technologies. Other improvement measures such as improved energy efficiency will complement the integrated approach to the sustainable energy objectives of Manchester City Council's policies and reflects the aspirations of the regional and national policies. The Energy Hierarchy principle is as follows:



2.4 Manchester Climate Change Framework 2020 -25

This is Manchester's high-level strategy for meeting their commitment on climate change and builds on the Draft Manchester Zero Carbon Framework 2020 -38 and their declaration of climate emergency in July 2019. This will develop over the next five years, in line with changes in policy, climate science, rate of progress and other factors. The Manchester frameworks sets out four objectives to achieve this:-

Objective 1 – Staying within carbon budgets by the following actions:

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

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

- Increase the amount of urban green infrastructure cover, aiming for a 10% increase by 2038from 2018 levels.
- Respond to these risks by incorporating adaption and resilience within our plans and strategies, and acting to make necessary changes to our buildings, infrastructure and our natural environment.

Objective 3 – Health and Wellbeing, seeks to improve the Health and wellbeing of everyone in Manchester through actions that contribute to our objectives for reducing CO2 and adaptation and resilience.

- Improving efficiency of the city's homes and providing affordable, secure supplies of renewable energy are essential to help Manchester households out of fuel poverty.
- Adapting the city's built and natural environment and prepare residents to become more resilient to the changes. Increasing the amount and quality of green spaces to enable residents to benefit from the improved physical and mental health that will come as a result.

Objective 4 – Inclusive, Zero Carbon and Climate resilient economy. This looks to ensure that Manchester establishes an inclusive zero carbon and climate resilient economy where everyone can benefit from playing an active role decarbonising the city.

6No priority areas have been identified to help meet the above objectives, these are:-

1. Buildings (New and Existing)
2. Renewable Energy
3. Transport and Flying
4. Food
5. Things that we buy and throw away
6. Green infrastructure and natural based solutions

New Buildings – Ensure that new developments in the city don't significantly increase the limited carbon budgets. Developments need to be built and operate to zero carbon standards ASAP.

Renewable Energy – In recent years there has been a significant increase in the de-carbonisation of the National Grid with a view to becoming fully de-carbonised by 2030.

Gas – Requirement to reduce our reliance on Fossil fuels and natural gas. This can be assisted by improving the energy efficiency of buildings to reduce the heating demand. The government is working with utility providers to ensure that moving to electric based heating is affordable and reliant.

2.5 Summary of Technologies Adopted

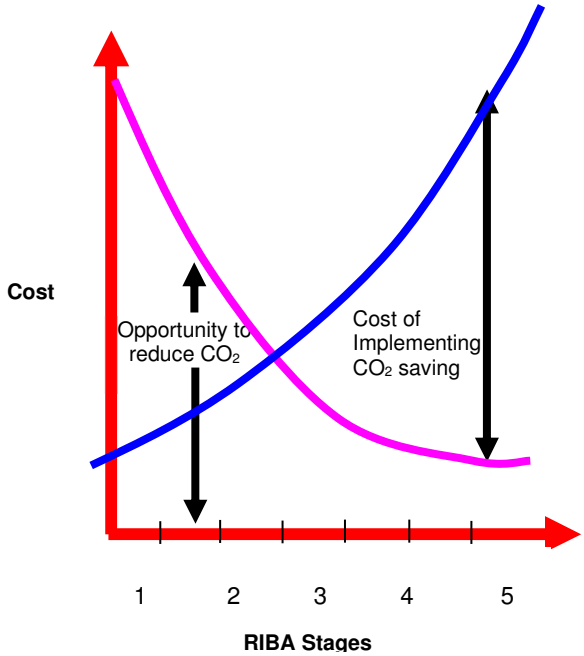
The whole of the development has been subjected to the same approach in terms of the strategic method of low carbon solutions but on the development has mixed use then the specifics solutions proposed in each building vary:-

Lean		
Reduced Demand	Office	Residential
High Levels of Insulation	✓	✓
Improved Air Tightness	✓	✓
Natural Ventilation	✗	✓
Low G Value Glass	✓	✓
Good Levels of Daylight	✓	✓
A Rated Goods	✓	✓

Clean		
Energy Efficiency	Office	Residential
Heat Recovery	✓	✓
Low Energy Lighting	✓	✓
Demand Operated Systems	✓	✓
Variable Speed Drives Pumps & Fans	✓	✓

Be Green		
Low/Zero Carbon Technology	Office	Residential
Photovoltaics	✓	✗
Energy Sharing	P	P
ASHP (Gym & Reception)	**P**	✓

An essential part of the design has been to focus on the initial 'Reduction of Demand' at the early planning stages as investment in the design at this stage results in 'good value' energy reduction and subsequent carbon savings.
The cost of implementing carbon reduction measures increase the further along the design process.



Beyond the initial reductions in demand by passive measures the focus of design has been to introduce energy efficiency such as heat recovery variable speed drives and demand operated systems.

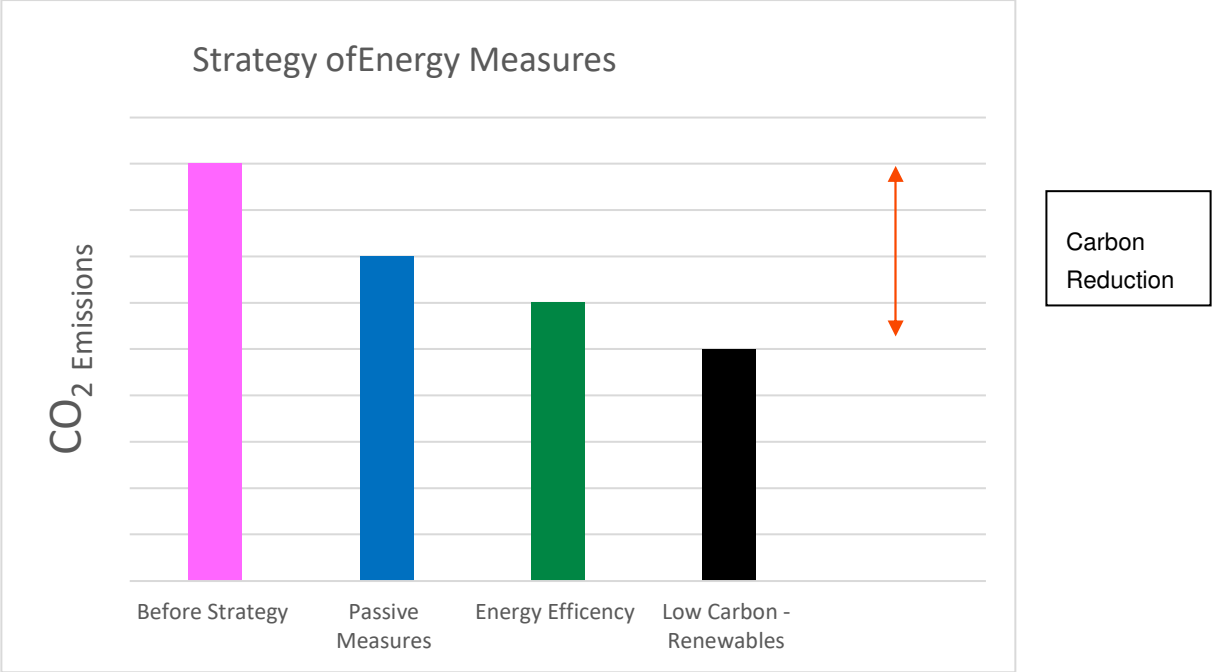
The final stage of the design process it was to implement the low carbon and renewable energy technologies appropriate to the site.

These solutions have been adopted to match the specific functionality of the development matching the energy demand requirements.

Although the client brief has been to provide each of the demises with independently fed services the possibility of energy sharing has not been ruled out. The offices will experience a nett cooling load throughout the year (and therefore heat rejection) whereas the Residential block a nett heat loss and therefore heat requirement.

Further information is required to develop the design of any Energy sharing system before the commitment to a define solution however the possibility and potential have not been ruled out at this stage.

In Summary:-



3. SITE APPRAISAL

All sites offer opportunities of limitations in terms of low carbon sustainable design.

The key fundamental considerations when appraising the site being:-

What opportunities are available to promote sustainable design?

What are the 'restrictions' and challenges of the site?

The site investigations directly being undertaken have focuses on the opportunities namely:-

- Existing Acoustic and Air Quality Environment – to focus on the desire to naturally ventilate the student residences.
- Mean Wind Speeds
- Site orientation to assess site sun paths and influence the mass and form of the development.
- Available land – to investigate the use of below ground pipework for ground source heat pumps
- District heating – investigate the exporting of excess heat to surrounding buildings
- Energy Sharing – the opportunities to Energy share with surrounding developments
- Proximity to water sources
- Existing Transport Links

Building Orientation

The orientation of the buildings have been set out to make due consideration of the effects of the solar gain and where possible exploit the use of passive solar heat gain (to offset the water heating loads) but at the same time keep out the unwanted heat gain in the summer. This design approach is reflected in the type of Glazing specifications for the windows and the extract opening panels/windows on the residential block. Furthermore, the buildings have been set out to maximize natural daylight and to ensure that good views and line of sight are achieved for the occupants.

Due to the different nature of the buildings different approaches have been required. With the office block more emphasis has been paid on keeping out solar gain and heat losses to reduce the building cooling load but at the same time providing good levels of natural daylight. On that basis the G value of the glass is of a higher specification than the residential block.

The residential block has been taken a different approach as the effects of solar gains in the cooler months has a more positive impact of the overall annual energy equation.

On that basis higher specification G value glazing is only adopted on the elevations where overheating is predicted (without the higher specification G value)

Energy Sharing/Heat Networks

Mixed use developments offer the opportunity to consider the different types of energy use and subsequent carbon emissions. The modern offices by nature will have a predominantly high level of heat rejection throughout the year with the cooling load demand and the residential building will have conversely high heating and hot water demand. This provides an opportunity to utilise the rejected heat from the offices to be adopted/utilised in the residential demise of the scheme. This could be in the form of the water cooled condensers from the offices transporting the rejected heat to the incoming water supply to the residential demise for pre-heating water purposes.

Utility Services

All major Utility Services have been identified as being available to the site being fed from Great Bridgewater Street.

4. UK POLICY DRIVERS FOR ENERGY EFFICIENCY AND LZCT ENERGY

All National Policy

The UK government is expanding the low carbon economy and has set legally binding targets to achieve net zero Co2e by 2050.

One of the key intentions of the government is to phase out heating systems that use fossil fuels in all new and existing buildings during the 2020s. The government has identified decarbonisation of the National Grid and the production of "Green Electricity" as a major contributor to achieving its energy targets.

National Planning Policy Framework March 2012 section 10 – Meeting the challenge of climate change, flooding and coastal change' sets out the following relevant standards for new developments:

- When setting any local requirement for a building's sustainability, do so in a way consistent with the Government's zero carbon buildings policy and adopt nationally described standards.
- comply with adopted Local Plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable
- Take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.

Local Policy

Manchester City Council has an adopted Core Strategy and a Supplementary Planning Document. The development should aspire to meet the demands of this document; it refers to the following relevant policy:

Supplementary Planning Document

4.6 To reduce energy demand and the harmful impact of using energy from non-renewables, in line with UDP Part 1 Policy E1.5, developers should aim for at least 20% of final site energy demand to be met by on-site renewable energy technologies. Renewable energy targets can be achieved more readily by undertaking the measures suggested above reducing the total energy demand of the building. It is possible to produce developments that use 50% and even 100% energy from renewable sources.
To achieve this, developers should:

- Assess opportunities for integrating small and large scale renewable energy generation systems to improve the energy security of occupants and the neighbourhood, including siting of energy generation businesses on-site and export of surplus energy

- Use a mix of technologies to help generation patterns match demand
- Investigate energy generation opportunities before designing building envelopes or fixing their location, to optimise utilisation of wind, solar and geothermal resources
- Consider final energy demand rather than building energy consumption in the selection and sizing of generation equipment
- Explore opportunities to tackle waste and energy issues collectively through use of anaerobic digesters linked to CHPs (Combined Heat and Power devices)
- Consider private wire networks as an alternative to grid connection and availability charges on larger developments

Core Strategy Policy EN 4
Reducing CO2 Emissions by Enabling Low and Zero Carbon Development

The Council will seek to reduce fuel poverty and decouple growth in the economy, growth in CO2 emissions, and rising fossil fuel prices, through the following actions:
All development must follow the principle of the Energy Hierarchy, being designed:

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

Wherever possible new development and retrofit projects, including energy generation plant, must be located and designed in a manner that allows advantage to be taken of opportunities for low and zero carbon energy supplies.

Where possible new development and retrofit projects will be used as a mechanism to help improve energy efficiency and provide low and zero carbon energy supplies to existing buildings. Where appropriate new development and retrofit projects will be required to connect to and/or make contributions to low or zero carbon energy schemes and/or to incorporate provision to enable future connection to any existing / potential decentralised energy schemes. The project will consider the use of building materials with low embodied carbon for new developments and refurbishment schemes.

12.25 Reduction in CO2 emissions is seen as a major component in mitigating climate change. In this regard, areas of Government policy give rise to the following two national and regional targets:

- A national reduction in CO2 emissions by 34% in 2020 and by 80% in 2050, (from a 1990 baseline) to which buildings will need to make a proportionately higher contribution, as set out in the Climate Change Act 2008.
- A national increase in renewable energy capacity by 15% by 2020 as set out in the UK Renewable Energy Strategy, which will require uplift in current levels.
- [Note – the government's zero carbon policy and targets for housing by 2016 has been shelved].

12.26 The vision for the City to be a growing economy in the front rank of European and world cities will inevitably mean increased development and an increasing population. In this context there are three main challenges for the Council in seeking to reduce CO2 emissions:

- To achieve growth in the economy in a sustainable manner which reduces CO2 emissions from energy and transport in line with national targets;
- To protect the future competitiveness of the economy by taking measures to insulate it from further fossil fuel price rises and increase energy security;
- To position the City as a low carbon investment location, in line with Manchester City Region's designation as a Low Carbon Economic Area.

Policy EN 6
Target Framework for CO2 reductions from low or zero carbon energy supplies

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

The target framework relates to three broad development locations and their potential for low and zero carbon, decentralised energy.

The areas are defined as follows:

- Target 1 Network development areas: Locations where the proximity of new and existing buildings, the mix of uses and density of development provide the right conditions to support district heating (and cooling).
- Target 2 Electricity intense areas: Locations where the predominant building type has an all-electric fit-out such as 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.

Non-domestic CO2 emissions reduction targets
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

Non-domestic CO2 emissions reduction targets
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 a high proportion of emissions from electricity use (>45 kg CO2/m2))	+15% increase on Part L 2010
Target 3: Micro generation area	+15% increase on Part L 2010

5. BASELINE ENERGY ASSESMENT

Before detailed analysis the methods of Energy Reduction can be adopted it is important to establish the baseline details of design sand the energy characteristics of the building.

The baseline assessment can be split into the various demises being:

- Residential
- Commercial offices
- Retail (shell & core)

Each demise have differing energy demand characteristics due to the different functions. It is important establish these characteristics and to match the carbon reduction approaches and technologies with the characteristics.

5.1 Residential

A significant way of reducing CO2e levels in domestic dwellings is by passive design to reduce heat losses. An electric system offers instantaneous heating as a means of offsetting these heat losses, by delivering instantaneous heat at the location it is required, unlike a wet system which generates high levels of residual heat loss within the general distribution throughout corridors etc. Electric heating is 100% efficient at the point of consumption. Furthermore, wet systems impact of the efficiency of the building by requiring additional plant rooms and risers impacting on the net lettable floor area.

A way of measuring and monitoring the move towards net zero CO2e is the use of a national calculation methodology called Standard Assessment Procedure (SAP).

In July 2019 a beta version of SAP (SAP 10) was issued, with the final version due to go operational Oct 2020.

One of the key changes in SAP 10 is the methodology used to calculate CO2e factors for electricity.

For the first time, SAP10 calculations will recognise the decarbonisation of the grid, and in broad terms will apply a carbon factor 0.233kg CO2e per kWh – in contrast to the current figure of 0.519kg CO2e per kWh.

The reduction in CO2e levels in SAP10 against SAP2012 appears to demonstrate approximately a 30 -40% betterment could be achieved for the Viadux project on a like for like basis. The use of SAP10 shows the Governments direction of travel and it is being asked for and applied to projects in London as it is recognised as an appropriate approach considering changes in methodology and the overall push for net carbon zero across the UK. It should be understood, that a like for like comparison on percentage improvements cannot be validated at present until guidance is formalised later this year.

In accordance with UK Governments policy for decarbonisation of the National Grid, electricity will become established as a low carbon fuel source, developments that specify electric heating systems will benefit greatly from the updated version of Part L and will contribute to a sustainable and low carbon economy of the future.

To reflect the government's policy and the increased progress of decarbonising the National Grid, the client has taken the positive step to future proof the design for Viadux to encompass an all-electric system. The benefits of an electric solution are as follows:-

- Giving the user individual control in each room
- Quick response times
- LOT 20 compliant and easy to have control cut out
- Directly metered. Single point of supply for metering
- Less Risk of over-heating – electric space heating delivers virtually instantaneous heating at the location unlike a wet system. Electric heating as proposed for the dwellings is 100% efficient at the point of consumption.
- Optimised use of space is required within risers, therefore allowing for more generous dwelling dimensions to be realised.
- A fully electric heating system is much more cost effective in terms of installation than communal gas and requires much lower maintenance.

An overall Multiple Compliance check on flats modelled across the typical floor layouts, as shown in the below table, indicate that the dwellings pass the Part LIA requirements based on SAP2012 methodology.

Multiple Compliance Check	DER $kgCO_2/m^2/yr$	TER $kgCO_2/m^2/yr$	% Improvement on TER	DFEE	TFEE	% Improvement on TER	Pass/ Fail
20No. Typical Flats	20.64	21.26	0.5	27.93	31.72	1.00	Pass

The client has committed now to investing in electricity for the generation of heat and domestic hot water with savings being generated in the medium to long term. In addition, the scheme will also embrace additional improvements going beyond industry standards including

- air permeability for Viadux is reduced to 3m3/hm2 (see section 6.2).
- Significant improvements on Building Regulations Standard U values (see Section 6.2).
- Use of MVHR units with 95% efficiency

- LED high efficiency lighting and controls

In conclusion, although the scheme passes marginally based on the increasingly out of date SAP2012 methodology if we follow the incumbent SAP10 methodology to the Viadux all electric scheme we can expect to achieve a significant improvement of 30-40% on the TER figure.

5.2 Commercial Offices

The baseline analysis has been undertaken using part L 2014 incorporating commercially viable solutions appropriate for office development of this type in Manchester.

Typically the offices will be heated & cooled using 4-pipe fan and systems with central mechanical ventilation systems utilising a high level of heat recovery.

Lighting will be high efficiency LED utilising perimeter daylight dimming and occupancy controlled elsewhere.

Heating will be generated from central high efficiency low NOx boilers with cooling sourced from central air cooled chillers.

Energy Saving Measures will feature:-

- LED Lighting and controls
- Demand based ventilation
- High Efficient motors for fans and pumps
- Ventilation plant with high efficient heat recovery
- Heat Pumps with high COP efficiencies

Typical Energy Use:

Energy Consumption by End Use [kWh/m^2]		
	Actual	**Notional**
Heating	8.14	1.58
Cooling	3.65	11.37
Auxiliary	14.12	10.36
Lighting	8.61	20.8
Hot Water	2.79	2.88
Equipment*	38.78	38.78
Total**	**37.57**	**46.99**

This indicates that a 20% improvement on the Notional Building will be achieved.

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

5.3 Retail (Shell & Core)

Although these areas are Shell & Core at this stage it is anticipated that these spaces will be served with reverse cycle heat pumps to provide heating and cooling. It is anticipated that theses spaces will have high level of mechanical ventilation to deal with the type of occupancy levels and functionality of the spaces.

Key features will consist of:

- LED Lighting
- VRV Heat pumps with high COP efficiency
- Ventilation incorporating heat recovery, high efficient motors
- Demand ventilation

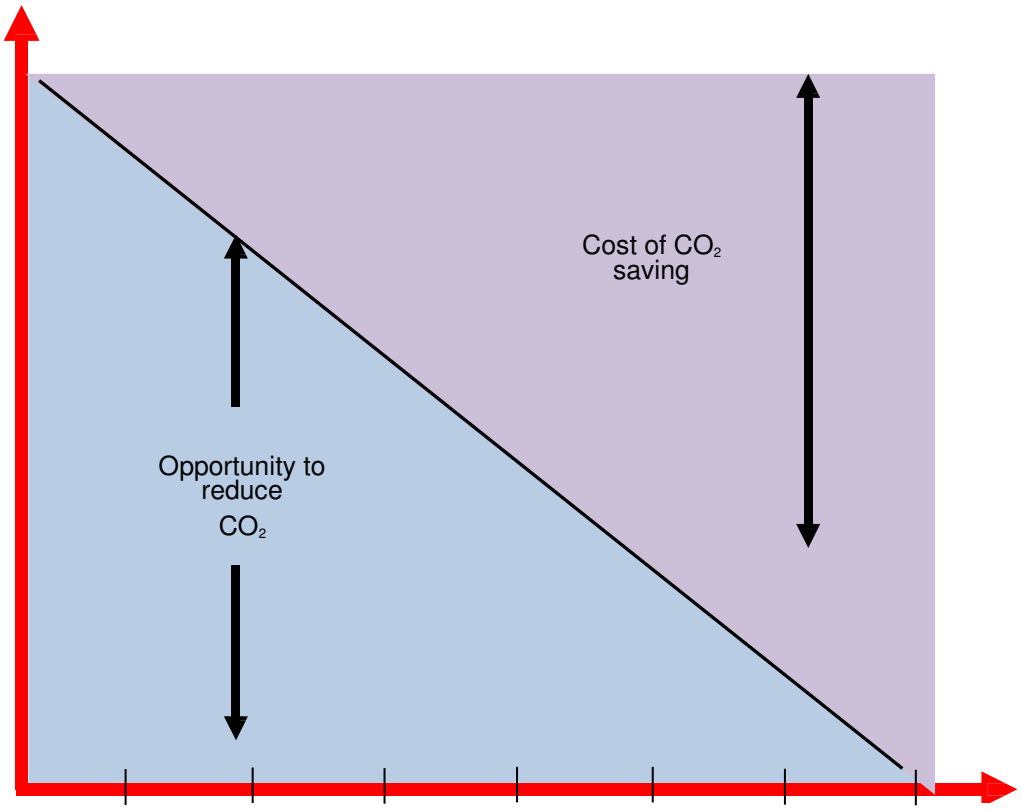
6. IDENTIFY FABRIC EFFICIENCY DESIGN MEASURES – "BE LEAN"

6.1 Appraisal of Solutions

The strategic approach outlined, follows a specific appraisal of technologies at each stage of design and to achieve the overall goal of CO2 reduction.
As on the whole it becomes more expensive to implement carbon reduction measures the further along the design process as the opportunities to reduce demand diminish.

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

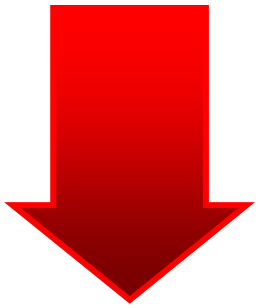
The next stage is to adopt 'efficient technologies' such as heat recovery and variable speed drives etc to meet the demand efficiency with the final approach of applying 'renewable and low carbon' technologies accordingly.



RIBA Stage

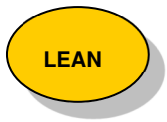
Our approach has followed the following route:-

Reduce Demand

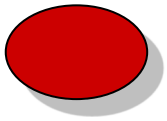


Passive design
- Thermal insulation
- Natural ventilation
- Natural daylight
- Thermal mass
- Air tightness
- Solar shading/Glass Specification

- Low energy fit out



Reduce Energy Demand



Supply Energy Cleanly and Efficiently

Incorporate Renewable Energy

Meet demand efficiently

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

Supply energy from low and zero carbon technology

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

6.2 Residential – Be Lean Design

The development objectives are to ensure that the project achieves high environmental and energy efficiency credentials with the actual objective of reducing “the demand”.

The Scheme has been developed to a high standard in order to achieve these levels, a number of sustainable design and construction techniques will need to be explored and where feasible incorporated into design:

- Improved building fabric performance
- Using natural ventilation techniques to avoid the need for comfort cooling night cooling etc.;
- Minimising internal gains through good specification of lighting and low energy consuming equipment.
- Controlling unwanted ventilation and draughts by minimising air leakage;
- Ensuring buildings are comfortable and secure for occupants;
- Reducing the thermal transmittance of the building envelope by adding high performance insulation.
- Optimising window design through the type of glazing specified, along with the shape, location and functionality of the building.

Passive Design

Principally energy requirements at the development have been lowered through passive design features such as:

- improving insulated fabric of the main construction materials will reduce energy demand thus flattening space heating peaks

	Limiting Fabric U Value Standards	Proposed U Value	Percentage Improvement %
Curtain walling system*	1.15	1.0	14.0
Party Wall	0.20	0.00	100.0
Ground /Podium Floor	0.25	0.18	28.0
Roof	0.20	0.11	45.0
Windows	2.00	1.40	30.0

* based on average limiting fabric U value for external wall and external glazing.

- keeping air-leakage levels as low as possible with quality airtight construction using accredited construction details

Limiting Air Tightness m3/m2.hr	Proposed Air Tightness m3/m2.hr	Percentage Improvement %
10	3	70

- reducing other energy demands - in the case of lighting, by the maximization of day lighting levels and solar gain (in winter) and the fitment of low energy light fittings where practicable
- Adopting natural ventilation methods and therefore the avoidance of mechanical systems.
- Specification of low G value glazing systems on particular elevation to limit unwanted solar gain.

Energy Efficient Appliances and Residents Guidance

The development will -

- Encourage the use of low energy appliances (fridges, freezers, washing machines, etc.) through information and education
- Provide guidance on efficient use and operation of the buildings and building services

As is typical of dense urban locations, the development site places significant constraints on the potential for employing good practise passive design as a result of physical restrictions. Those spaces, which benefit most from the solar gain and daylight e.g. living spaces have been placed on the building perimeters to optimise the passive design.

6.3 Commercial Offices

As with the residential element of the development strong emphasis has been placed on the initial reduction in demand with focus on:

- Improved building fabric performance against part L
- Maximising natural daylight to optimise the use of daylight controls and reduce the reliance on artificial lighting
- High levels of air tightness and reduction in building air leakage
- High solar performance glass (G Value) to reduce excessive solar gain but at the same time maintain good levels of daylight
- Balance the office floor plate depth of plan to maximise the natural daylight into the space
- Maximise the floor to ceiling heights to optimise natural daylight into the space

Building fabric

Element	$U_{a\text{-Limit}}$	$U_{a\text{-Calc}}$	$U_{i\text{-Calc}}$	Surface where the maximum value occurs*
Wall**	0.35	0.35	0.35	External Wall
Floor	0.25	0.25	0.25	Exposed Floor
Roof	0.25	0.25	0.25	Roof
Windows***, roof windows, and rooflights	2.2	1.55	1.55	lev0 curtain walling
Personnel doors	2.2	-	-	No personal doors in project
Vehicle access & similar large doors	1.5	-	-	No vehicle doors in project
High usage entrance doors	3.5	-	-	No high usage entrance doors in project

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

* There might be more than one surface where the maximum U-value occurs.
** 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.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m³/(h.m²) at 50 Pa	10	5

6.4 Retail Spaces

The energy use in the retail spaces is very much dictated by the functionality of the spaces being high occupancy spaces with potential of kitchen facilities for food and beverage outlets.

At the development stage the retail spaces will be shell only with riser and space provision for future tenant fit out.

It is important that this space and riser provision promote:

- Efficient routing for ductworks and pipework to limit system resistance and therefore energy use
- Flexible and sufficient space to facilitate the instillation of energy efficient plant such as reverse cycle heat pumps
- Local louvre provision to allow the installation of localised mechanical ventilation systems.
- The provision of gas & electricity provision to allow tenant flexibility for the future fit out

The provision of these features will facilitate and promote tenants fitting out energy efficient plant equipment. Initial energy baseline modelling has been based on reverse cycle heat pumps:

7. IDENTIFY ENERGY EFFICENY MEASURES ‘BE CLEAN’

Adoption of low energy technologies is the next important step in the design process. Different technologies are appropriate for different functions and the important feature to ensure that the functionality of the space is maintained and not compromised.

7.1 Residential

Although natural ventilation is to be widely adopted there are areas of each apartment that will require mechanical ventilation namely the bathroom and kitchen areas. It is therefore proposed to adopt low energy mechanical ventilation utilising heat recovery systems in each apartment being commonly known MVHR system having efficiencies of 95%. These units will be located in each apartment and heat incoming fresh air by crossing the air across a heat exchanger with the outgoing exhaust air.

It is proposed that the heating & hot water demand will be generated by utilising electricity.

Lighting will be extensively low energy lighting with the use of LED lighting and demand operated systems throughout.

7.2 Commercial Offices

Unlike the residential block offices will be extensively mechanically ventilated to meet the overheating requirements and functional requirements of the space. This will be achieved by the use of roof mounted air handling plant with high efficiency motors and extensive heat recovery from the exhaust air to heat the incoming fresh air.

The air handling plant will contain variable speed drives to match occupancy demands and have low specific fan and power in accordance with the Building Regulations.

Primary heating will either be generated from the Manchester Central District Heating Scheme or by dedicated rooftop mounted low NO_x boilers. The heating system will serve four pipe fan coil units located on each of the floor plates in a regular grid not exceeding the requirements of BCP guide for offices. Lighting will be extensively low energy lighting with daylight and occupancy control to match demand.

Cooling will be provided to the offices, but this will be mitigated to a minimum by high performance glazing systems which will limit solar gain and reduce cooling loads on the building.

8. LOW TO ZERO CARBON TECHNOLOGIES – "BE GREEN/BE CLEAN"

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

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

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

Biomass

Biomass is a generic name for any fuel produced from organic sources and falls into mainly two categories:

- Woody biomass- forest products, untreated wood products, energy crops and wood pellets
- Non-wood biomass – liquid biofuels (such as biodiesel, bioethanol) or animal waste industrial municipal products and high energy crops such as rape seed, sugar cane and maize.

For domestic properties the fuel used is normally wood pellets, wood chips or wood logs. For larger applications, biomass boilers replace conventional fossil fuel boilers and come with an automated feed by screw drives from hoppers.

Biomass systems require more cleaning than gas or oil boilers and they must be capable of being taken out of service for cooling and cleaning whilst maintaining the building heating supply particularly in communal heating systems. Centralised gas boilers are therefore still required to support the biomass boiler, which would be the lead boiler. The size of the dedicated plant rooms is substantial. Fuel availability, delivery and storage are also important issues to consider.

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

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

expensive than mains gas, and woodchip is approx. 30% cheaper, however prices are fluctuating rapidly in the bio-fuel market at the present time creating uncertainty over their take up. The biomass boilers, fuel storage and associated equipment require significantly more plant space than a standard gas fired boiler.

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

Wind Power

Wind power is one of the cleanest and safest methods of generating electricity. However, wind power is unfeasible due to the fact the development is in an urban area and local wind conditions would not be sufficient to provide enough power. Most small wind turbines generate Direct Current (DC) electricity. Systems that are not connected to the national grid require battery storage and an inverter to convert DC electricity into Alternating Current (AC) which is mains electricity.

There are two types of wind turbine available:

- Roof mounted – These are mounted on the roof of buildings
- Mast mounted – Which are free standing Important issues to consider when using wind turbines are:

Wind speed increases with height so it's best to have the turbine high on a mast or tower.
Generally speaking the ideal site is a smooth top hill with a flat, clear exposure, free from excessive turbulence and obstructions such as large trees, houses or other buildings.
Small scale wind power is particularly suitable for remote off grid locations where conventional methods of supply are expensive or impractical.
Where the local annual average wind speed is 6 m/s or more.
Where there are no significant nearby obstacles such as buildings, trees or hills that are likely to reduce the wind speed or increase turbulence

As this development is in an urban area there will be obstacles which reduce wind speed. The average wind speed in this area is 2.4 m/s which is much less than the 6 m/s required. Therefore, wind is not a viable technology for this development.

Biogas/ Anaerobic Digestion (AD)

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

Biogas typically refers to a mixture of different gases produced by the breakdown of organic matter in the absence of oxygen. Biogas can be produced from raw materials such as agricultural waste, manure, municipal waste, plant material, sewage, green waste or food waste. It is a renewable energy source and in many cases exerts a very small carbon footprint.

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

Biogas is primarily methane (CH4) and carbon dioxide (CO2) and may have small amounts of hydrogen sulphide (H2S), moisture and siloxanes. The gases methane, hydrogen, and carbon monoxide (CO) can be combusted or oxidized with oxygen. This energy release allows biogas to be used as a fuel; it can be used for any heating purpose. It can also be used in a gas engine to convert the energy in the gas into electricity and heat. It qualifies for renewable energy subsidies in the UK. Biogas can be cleaned and upgraded to natural gas standards, when it becomes bio methane.

The opportunity to use Biogas/ AD on this site would need further investigation but at the present time the spatial requirements for the fuel, transport and equipment are significantly more than currently proposed which would impact on financial viability.

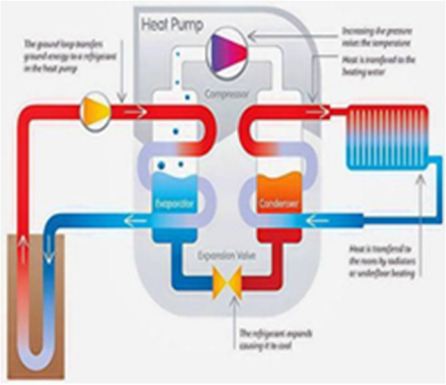
Refer to CHP section for Biomass CHP.

Geothermal

Geothermal energy is thermal energy generated and stored in the Earth. The geothermal energy of the Earth's crust originates from the original formation of the planet and from radioactive decay of materials. The geothermal gradient, which is the difference in temperature between the core of the planet and its surface, drives a continuous conduction of thermal energy in the form of heat from the core to the surface. Geothermal power is cost effective, reliable, sustainable, and environmentally friendly, but has historically been limited to areas near tectonic plate boundaries. Recent technological advances have dramatically expanded the range and size of viable resources, especially for applications such as home heating. As a result, geothermal power has the potential to help mitigate global warming if widely deployed in place of fossil fuels. The geothermal energy can be used to heat homes directly or can be used to drive steam turbines to generate electricity.

The ground conditions for this site are unknown and therefore it is not known if a geothermal system would be suitable for this site. However, from a financial viability perspective a geothermal system is very expensive due to the need for deep boreholes and for this reason it is discounted.

Ground Source Heat Pump (GSHP)



GSHP's have been developed specifically for the housing market and are now considered to be an established reliable technology. The GSHP would be sized to cater for the heating and domestic hot water requirements. Typically, they are more suited to apartments as a centralised system would be installed with multiple bore holes to a depth of up to 125 metres depending on the ground conditions. GSHP's use a heat exchanger to extract heat from the earth.

The efficiency of ground source heat pumps is measured by Co-efficient of Performance (CoP), this is the ratio of units of heat output for each unit of electricity used to drive the compressor and pump for the ground loop. Average CoP is around 2-4 although some systems may produce a greater rate of efficiency. This means that for every unit of electricity used to pump the heat, 2-4 units of heat are produced, making it an efficient way of heating a building. If grid electricity is used for the compressor and pump, then there is the opportunity to consider a range of energy suppliers to benefit from the lowest running costs, for example by choosing an economy 10 or economy 7 tariff.

Although they reduce CO2 emissions they rely directly on electricity for power and therefore are not fuel or energy efficient. The cost and practicalities to install GSHP's on this type of scheme is also prohibitive. GSHP are typically £12k per borehole. There is insufficient space at ground level to accommodate the number of boreholes to service the development, which makes this option unviable. GSHP's are not considered appropriate for this scheme.

Air Source Heat Pump (ASHP)

Air source heat pumps work in a similar way to GSHP. Air source heat pumps can be fitted outside the each house, on the external façade or in the roof space. An air source heat pump uses small amounts of electricity to take in large quantities of air and extract heat. The efficiency of ASHP is measured by Coefficient of Performance (CoP); this is the ratio of units of heat output for each unit of electricity used to drive the system. Average CoP is around 2-4 although some systems may produce a greater rate of efficiency.

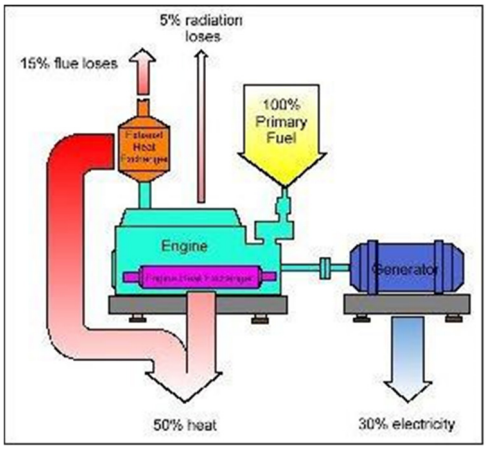
ASHP's are considered appropriate for this scheme for Reception and Gym comfort cooling. Due to the de-carbonisation of the National Grid, the future energy savings with mains electric ASHP are considerable when compared to the baseline energy analysis which uses gas as the main fuel source. This is due to the future fuel factors apportioned to mains electric and mains gas. The future carbon emissions are significantly lower using mains electricity compared to mains gas.

Combined Heat & Power (CHP)

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

The main components of a typical system are:

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



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

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

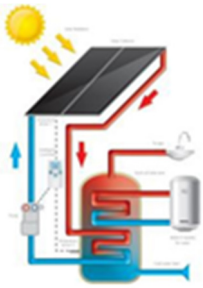
- CHP typically has an efficiency of 80-90%
- Operators typically saving around 20% on energy bills
- Significant carbon dioxide emission savings can be made
- Transmission and distribution losses are reduced
- Increases fuel supply security

Gas fired CHP is a viable low carbon technology for the office development and is the proposed solution to meet planning policy. Further details are provided in section 4.0 and section 7.2 provides further information regarding the CHP equipment and NOx emissions etc.

Biomass CHP uses a biofuel for the CHP engine in lieu of a finite fuel source such as natural gas. The biofuel has the same advantages/ disadvantages as standard biomass plant, combined with the co-generation of CHP technology.

Solar Thermal HW Panels

Solar panel heating uses the radiant energy from the sun to heat hot water, most commonly for domestic hot water needs. There are two types of collectors used for solar water heating – flat plate collectors and evacuated tubes collectors. The systems function successfully in all parts of the UK, as they can work in diffuse light conditions. The collector should be mounted on a 10-60 degrees pitch facing south, although other variations can be used, south is the most efficient.



The cost of installing the system is dependent on the distance between the solar collector and the hot water storage. The closer the collectors are to the hot water

storage, the less pipe work is required. Annual maintenance checks are recommended. The solar collectors are connected to a condensing boiler via a HW cylinder with twin coil. A typical installation in the UK has a panel size of 3-5m2 which is used in conjunction with a HW storage tank of 180-300litres, of which a minimum of

90-150 litres must be dedicated to solar hot water storage. For the reasons aforementioned this is not an appropriate option for this scheme.

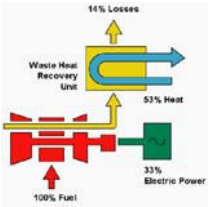
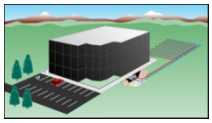
They are a 'simple' and guaranteed technology which will act as a pre-heat for the Hot Water and Heating usage. Payback between capital cost and energy saving can normally be achieved within 12 – 20 years, subject to usage and dwelling type. They work best on individual singular dwellings with a small HW cylinder. For the reasons aforementioned this is not an appropriate option for the Residintial scheme.

Photovoltaic (PV)

Photovoltaic panels use cells to convert light into electricity. A PV cell normally consists of 1 or 2 layers of a semi conducting material such as silicon. When light shines on a cell it generates energy causing electricity to flow, the higher the light intensity is, the more electricity flows.

The amount of energy PV cells generate is referred to as Kilowatt Peak (KWp). PV arrays now come in a variety of shapes and colours, ranging from grey 'solar tiles' that look like roof tiles to panels and transparent cells that you can use on conservatories and glass to provide shading as well as generating electricity. Panels can be mounted flat or on A-frames to give the optimum angle. The optimum panel inclination for solar collection is 35°, oriented due south; however panels that are inclined between 35° and 45° and oriented south of west or east are also generally suitable. If solar collectors are oriented away from due south then a larger surface area will be required to generate a set amount of energy.

The cost to install PV is typically approx. £1000-£2,000 per kWp depending on type.

LOW OR ZERO CARBON TECHNOLOGY		TYPICAL ANNUAL ENERGY GENERATED	FEASIBILITY OF EXPORTING	TYPICAL PAYBACK PERIOD	LIFE SPAN	LIFE CYCLE IMPACT
CHP		LOW / MED	LOW	15-20 yrs	10-15 yrs	LOW / MED
GROUND/ WATER HEAT PUMPS		LOW	N/A	4-10 yrs	15-20 yrs	LOW / MED
AIR SOURCE HEAT PUMPS		LOW	N/A	6-12 yrs	12-15 yrs	LOW
BIOMASS		LOW	N/A	5-10 yrs	15 yrs	LOW
WIND POWER		MEDIUM	HIGH	20 yrs	12-15 yrs	MEDIUM
SOLAR PV		V.LOW	HIGH	25-40 yrs	15 yrs	LOW / MED
SOLAR THERMAL		LOW	N/A	10-15 yrs	15 yrs	LOW

8.1 Low/Zero Carbon Technologies (LZT) Discounted

- Solar Thermal Hot Water is not a foreseeable option as carbon savings produced by this (LZT) are minimal, and generally a second LZC would need to be specified. Typically a singular 4m2 panel would cost circa £2k (1.2M total) and would provide CO2 savings of approx. 4-5% for a single flat, which is a relatively small emission saving and equates to a payback of circa 40 years.

- Biomass has been discounted as it poses problems in terms of air quality, delivery of fuel, storage and transportation for deliveries etc. It would require a larger plant space for storing fuel, which is not currently included and is not conducive to city centre developments.

- Wind turbines are not seen to work particularly well on this type of development due to problems with wind turbulence and mounting of the units. The wind speeds in the area are not conducive to wind power electricity generation and there would be issues with shading, noise and air traffic.

- Ground Source Heat Pump's (GSHP) are not viable for site because of spatial constraints and financial costs. There is insufficient space to install GSHP vertical bores, ground conditions are unknown and the systems are very costly. It may release harmful gases from deep within the Earth. Typically a singular borehole would cost £12k per 5 flats and therefore there would need to be 125No. boreholes to serve the development – estimate £1.5M total, subject to further site investigation and variables. Payback is typically 10-25 years, site dependent.

- Geothermal. Availability of suitable location poses serious problem in adopting a geothermal solution and ground conditions are unknown. Extensive research is required prior to investing to ensure the location is suitable and sites do not 'run out of power' over a period of time. It may release harmful gases from deep within the Earth. High installation and investigation costs make the technology unviable. It requires boreholes as per GSHP and the capital costs are higher, leading to an estimated cost to serve the development of £2.5M.

- Biogas/ Anaerobic Digestion (AD). Emissions are likely to cause local air pollution and compliance with the Clean Air Act is problematic. Finding a secure supply of fuel can be difficult. The environmental impact of fuel transportation can be expensive. AD used to generate gas for heat or electricity requires pollution prevention and a control permit or waste management license. Digester, storage areas and delivery areas can cause problems via escape of odour and liquids. High installation costs make the technology unviable.

- Biomass CHP. As with standard biomass, this technology problems in terms of air quality, delivery of fuel, storage and transportation for deliveries etc. It would require a larger plant space for storing fuel, which is not currently included and it is not conducive to city centre developments.

9. DISTRICT HEATING NETWORK

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

De-Centralised/ District Heating Networks (DHN)

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

One of priorities for reducing CO2 emissions is to reduce the city's reliance on centralised power stations. This means increasing the use of local, low-carbon energy supplies through de- centralised energy systems.

Decentralised plant generally means any heating and hot water and/or electricity generation provided on a site or district wide basis. District heating is generally provided from Combined Heat and Power equipment (CHP). CHP is an engine which, when running, generates electricity and heats water which can then be distributed around a development.

The proposed location is the Manchester central Building with proposed routes heading North from the site along Albert Square and South towards Bridgewater Hall. The proximity of the site does offer opportunities to link the proposed development into district heating scheme however there are a number of key aspects that we as a development team need to understand before this could be considered for incorporation into the scheme:-

- What is the precise location of the proposed District Heating mains?
- What is the cost of bringing the mains to the project?
- What is the procurement timetable for the works?
- What is the available capacity?
- What will the carbon factors of the heat available?
- What will be the tariff be KW/hr of energy from the district heating?
- What is the resilience of the system?

At this stage it is not feasible to depend on the District heating Network and therefore this system has been discounted for the Residential Development.

10. PROPOSED ENERGY STRATEGY

A fundamental driver of the Energy Strategy has been to consider the site as an overall development and not just individual buildings. Each of the main demises have individual energy uses:

ENERGY USE	RESIDENTIAL	OFFICE	RETAIL
Heating Demand	Low	Low	Low
Hot Water Demand	Med	Low	Low/Med
Lighting	Low	High	Med/High
Small Power	Low	High	Low/Med
Cooling	Low	High	High
Mechanical Ventilation	Low	High	High

An important factor is to consider the opportunity to energy share between the separate demises.

The Residential building offers limited potential for the inclusion of PV technologies at roof level where an area of approx. 140m2 has been identified for the addition of PV's. The office development however could offer substantially more opportunities to incorporate PV which could contribute to the overall site energy strategy.

The District Heating scheme could be considered along with low NOx gas boilers / CHP as the primary heating medium of the Commercial office development to serve the 4-pipe fan coil units, AHU's etc. "Waste Heat" from the Commercial Development could be utilised to preheat the Residential Development mechanical services systems.

A CHP unit could also provide the opportunity to contribute towards the electrical demands of both the Residential and Commercial office developments.

Residential
Has high water demand but is important to understand the peaks and troughs. These peaks can be flattened out by thermal storage within each apartment and therefore direct electrical immersion heaters are proposed to meet the demand.

As a result of modern thermal insulation standards annual heat losses are generally lower in comparison but will experience peaks in the colder months and particularly the morning periods.

As the intent is to naturally ventilate the buildings then the comfort cooling demand is minimal with the exception of the amenity space at the podium level.

Commercial Office
Similar to the residential element a modern office will experience relatively lower heat losses as a result of modern insulation standards, air tightness and internal heat gains from occupants, lighting and computer equipment.

The electrical load however will be significantly higher due to the lighting loads, cooling demand, computer use and mechanical ventilation requirement.

Any such strategy should therefore focus on reducing these demands and consider the use of the rejected heat from the cooling systems.

Retail Spaces
A key feature if the energy use in these spaces will be the peaks and troughs of energy use to match the occupancy patterns of the spaces.

11. SUMMARY OF TECHNOLGIES ADOPTED

11.1 Residential

REDUCE DEMAND	SUITABLE FOR CONSIDERATION	COMMENTARY
Natural ventilation	Y	Site mostly suitable to adopt natural ventilation with back up MVHR.
Natural daylight	Y	As part of the master-planning. Appropriate levels of glazing to encourage natural daylight into the spaces
Thermal mass	Y	High rise lightweight structure. Concrete roof to help attenuate over heating
Air tightness	Y	Essential to minimise air leakage with the condition of the exposed site and reduce heat losses and exceed the minimum requirements of Part L 2013. Target of 3 – 4.
Solar shading/Low G Value Glass	Y	Specific solar shading not adopted but low 'G' value glass adopted to reduce unwanted solar gain on specific elevations
Thermal Insulation	Y	Essential to minimise heat losses on the exposed site to Part L 2013. Minimum standards exceeded as TFEE
Low 'G Value' glass specification	Y	Important to limit summertime overheating.TM59 compliance and current targets G value 0.4 on appropriate elevations.
'A' Rated White Goods & Appliances	Y	Will be an integral part of the fit-out requirements.
ENERGY EFFICIENCY		
Heat recovery	Y	MVHR adopted on ventilation systems local, both residential and amenity spaces
Low energy lighting	Y	extensively throughout or LED fittings adopted where feasible.
Variable speed drive	Y	Variable speed drives can be adopted on all fan and pump motors where possible to reduce energy consumption (Central Plant)
Demand Operated Systems	Y	The use of passive infra-red (PIR) for lighting,

		heating, ventilation where feasible (typically corridors and amenity spaces)
Electric heating and hot water generation	Y	Lot 20 compliant, fast response system, in line with government strategy for 2020 SAP regulations.
RENEWABLE AND LOW CARBON		
Solar		
Solar hot water	N	Not compatible with multi residential building
Photovoltaics (PV's)	P	Potential to offset electrical demand subject to financial appraisal.- but minimal roof space. To be considered during Stage 3 design available

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

REDUCE DEMAND	SUITABLE FOR CONSIDERATION	COMMENTARY
Water		
Small scale hydro power	N	Not feasible as no significant water source available
Tidal power	N	Not Applicable
Wave power	N	Not Applicable
Wind		
Wind turbines	N	Not suitable for city centre environment
Biomass		
Biomass single room heaters/stoves	N	Not appropriate for Application
Biomass boilers	N	Could be adopted to offset heating and hot water but high No_x levels a concern in city centre environment.
Biomass community heating schemes	P	Could be adopted to offset heating and hot water but high No_x levels a concern in urban environment/city centre.
Combined Heat and Power (CHP) for use with the following fuels:		
Biofuel	N	Gasification process too large for scale of site. Biodiesel considered immature feedstock and unreliable.
Natural gas	N	High emission factors compared to future direct electric due to de-carbonisation of grid.
Sewerage gas and other biogases	N	Scale of site too small.
Heat Pumps		
Ground source heat pumps	N	Extensive underground pipework difficult to install due to availability of land.

Water source heat pumps	N	No significant water sources to reject / absorb heat.
Geothermal heating systems	N	Not available.

REDUCE DEMAND	SUITABLE FOR CONSIDERATION	COMMENTARY
Air source heat pumps (Reception area & Gym)	Y	This technology is feasible; A screened external plant will be located at level 1.
For heat pumps to comply, the heat source (ground or water) must be from a renewable source, for example soil, outside air, ground water, or a river.		
Other		
Fuel cells using hydrogen generated from any of the above 'renewable' sources.	N	Technologies not yet mature enough for application.
Rainwater recycling	N	Rainwater collection system, could be adopted to recycle rainwater for toilet flushing purposes but minimal space to provide below ground tanks.
Green roofs	N	Insufficient available roof

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

11.2 Commercial Offices

REDUCE DEMAND	SUITABLE FOR CONSIDERATION	COMMENTARY
Natural ventilation	N	Mechanical solution adopted for functional operation
Natural daylight	Y	As part of the master-planning. Daylight will be optimised.
Thermal mass	Y	Considered to minimise cyclical energy fluctuations, where appropriate but lightweight cladding systems
Air tightness	Y	Essential to minimise air leakage with the condition of the exposed site and reduce heat losses and exceed the minimum requirements of Part L 2013.
Solar shading/Low G Value Glass	P	Specific solar shading not adopted but low 'G' value glass adopted to reduce unwanted solar gain.
Thermal Insulation	Y	Essential to minimise heat losses on the exposed site to Part L 2013.

Low 'G Value' glass specification	Y	Important to limit summertime overheating.
'A' Rated White Goods & Appliances	Y	Will be an integral part of the fit-out requirements.
ENERGY EFFICIENCY		
Heat recovery	Y	adopted on central ventilation systems.
Low energy lighting	Y	Utilised extensively throughout or LED fittings adopted where for open plan offices.
Power management	Y	System can be adopted to limit excessive over voltage and energy use.
DC motors	Y	Can be adopted on specific systems where appropriate.
Variable speed drive	Y	Variable speed drives can be adopted on all fan and pump motors where possible to reduce energy consumption on central plant.
Demand Operated Systems	Y	The use of passive infra-red (PIR) for lighting, heating, ventilation is feasible and feasible Central core and open plan offices.
RENEWABLE AND LOW CARBON		
Solar		
Solar hot water	Y	Student accommodation will have a high domestic hot water usage to feasible.
Photovoltaics (PV's)	Y	Can be used to offset electrical demand subject to financial appraisal - significant amount of south facing roof space available.

REDUCE DEMAND	SUITABLE FOR CONSIDERATION	COMMENTARY
Water		
Small scale hydro power	N	Not feasible as no significant water source available
Tidal power	N	Not Applicable
Wave power	N	Not Applicable
Wind		
Wind turbines	N	Not suitable for City Centre environment
Biomass		
Biomass single room heaters/stoves	N	Not appropriate.
Biomass boilers	N	Could be adopted to offset heating and hot water but high No_x levels but not suitable.
Biomass community heating	P	Could be adopted to offset heating and hot water

schemes		but high No_x levels a concern of city centre environment.
Combined Heat and Power (CHP) for use with the following fuels:		
Biofuel	N	Gasification process too large for scale of site. Biodiesel considered immature feedstock and unreliable.
Natural gas	P	Generally low baseline heating demand for hot water supply.
Sewerage gas and other biogases	N	Scale of site too small.
Heat Pumps		
Ground source heat pumps	N	Extensive underground pipework could be difficult to install due to availability of land.
Water source heat pumps	N	No significant water sources to reject / absorb heat.
Geothermal heating systems	N	Not available.

REDUCE DEMAND	SUITABLE FOR CONSIDERATION	COMMENTARY
Air source heat pumps	P	This technology is feasible; however, the large amount of external plant would need to be housed at roof level.
For heat pumps to comply, the heat source (ground or water) must be from a renewable source, for example soil, outside air, ground water, or a river.		
Other		
Fuel cells using hydrogen generated from any of the above 'renewable' sources.	N	Technologies not yet mature enough for application.
Rainwater recycling	Y	Rainwater collection system, could be adopted to recycle rainwater for toilet flushing purposes but minimal space to provide below ground tanks.
Green roofs	P	Visual impact, future maintenance consideration.

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

11.3 Retail Spaces

These spaces are currently Shell and Core only however as the probable fit out solution will require heat pumps then current design has accommodated appropriate plant and riser spaces. Heat pumps offer good levels of energy efficiency and provide carbon reduction over and above conventional gas fired solutions.

WWW.RIDGE.CO.UK