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MECHANICAL AND ELECTRICAL ENGINEERING SERVICES

SERVICES STRATEGY REPORT

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**MECHANICAL AND ELECTRICAL ENGINEERING SERVICES
ENVIRONMENTAL STANDARDS STATEMENT**

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AMENDMENTS MADE

Revisionn	Date	Section	Description
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MECHANICAL AND ELECTRICAL ENGINEERING SERVICES ENVIRONMENTAL STANDARDS STATEMENT

1.0 INTRODUCTION

1.1 Brief

This report has been produced to provide an Environmental Standards Statement in accordance with the requirements of Manchester City Council's Core Strategy. The following key areas are addressed:

1. Energy Efficiency
2. Renewable Energy
3. Environmental Standards

1.2 Proposed Development

The site is proposed for redevelopment as a mixed use building providing food and beverage and residential accommodation.

The basement will provide plant and utility space for landlord services. The lower ground and upper ground floors will provide food and beverage units. The upper floors will be converted to residential apartments.

2.0 ENERGY EFFICIENCY

2.1 Policy Requirements

Manchester City Council's Core Strategy provides the following requirements relating to energy efficiency and sustainability:

Policy EN4

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:

1. All development must follow the principle of the Energy Hierarchy, being designed:
 - a. to reduce the need for energy through design features that provide passive heating, natural lighting and cooling
 - b. to reduce the need for energy through energy efficient features such as improved insulation and glazing
 - c. to meet residual energy requirements through the use of low or zero carbon energy generating technologies

2. 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.
3. 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.
4. 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.
5. The use of building materials with low embodied carbon in new development and refurbishment schemes.

Policy EN5

New development, regeneration and retrofit projects, will be expected to take place in the context of more detailed proposals for decentralised low and zero carbon energy infrastructure in the form of energy proposals plans. The Council will work with all relevant stakeholders, which may include developers, landowners, residents, community groups, private sector partners, utilities companies, neighbouring authorities and other public sector bodies, as appropriate, to bring forward such plans.

Where investment or development is being undertaken into or adjacent to a public building/asset or district heating network, full consideration shall be given to the potential role that these can have in providing an anchor load within a decentralised energy network or in creating opportunities for CO₂ reduction funded by contributions.

Policy EN6

Applications for residential development of 10 or more units and all other development over 1,000 m² will be expected as a minimum to meet the target shown in Tables 12.1 or 12.2, unless this can be shown not to be viable. This should be demonstrated through an energy statement, submitted as part of the Design and Access Statement.

Such a statement will be expected to set out the projected regulated energy demand and associated CO₂ emissions for all phases of the development.

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

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.

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

Non-domestic CO₂ emissions reduction targets

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 a high proportion of emissions from electricity use (>45 kg CO ₂ /m ²))	+10%increase on Part L 2010
Target 3: Micro generation area	+15% increase on Part L 2010

2.2 Design Intent

Government guidance for carbon performance suggests a hierarchy of good practice in low carbon design. *Figure 2.2* illustrates this hierarchy.

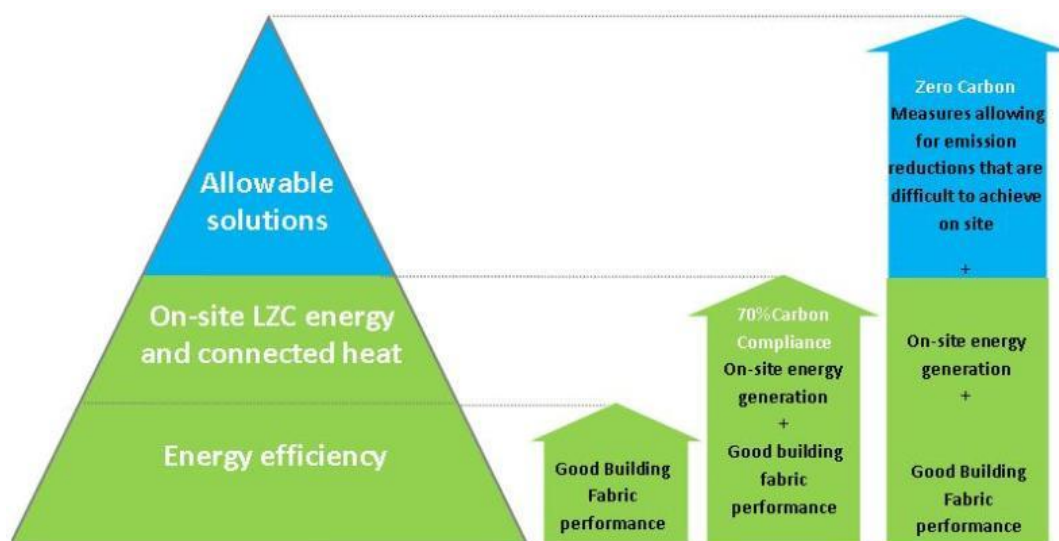


Figure 2.2: Low Carbon Design Hierarchy

Energy efficiency is achieved through the use of high performance building materials to ensure thermal efficiency of the building envelope. This, along with the implementation of

efficient fixed services design and low and zero carbon technologies, should allow designers to meet most carbon compliance requirements.

The last element of the hierarchy is the use of renewable energy solutions to generate the energy used on site. Ideally, these renewable energy sources should be installed locally. However, if this is not possible then 'Allowable Solutions' can be used to provide off-site renewable energy sources to offset carbon emissions from the site.

The development will be designed in line with the hierarchy illustrated above. Passive design measures and envelope efficiency will be maximised where possible. The heritage status of the building are likely to limit opportunities for fabric intervention to improve thermal performance.

Opportunities for the implementation of renewable energy generation and Low and Zero Carbon technologies are reviewed in section 2.3.

2.3 Sustainable Technologies

2.3.1 General

There are various sustainable technologies, such as photovoltaic panels, wind turbines and CHP etc available on the market. However, not all are feasible due to capital expenditure, pay-back periods, availability, logistics and respective CO₂ emission reduction. It's often not feasible to outlay significant capital expenditure which has high payback periods and will save limited CO₂ emissions.

Condensing Boilers

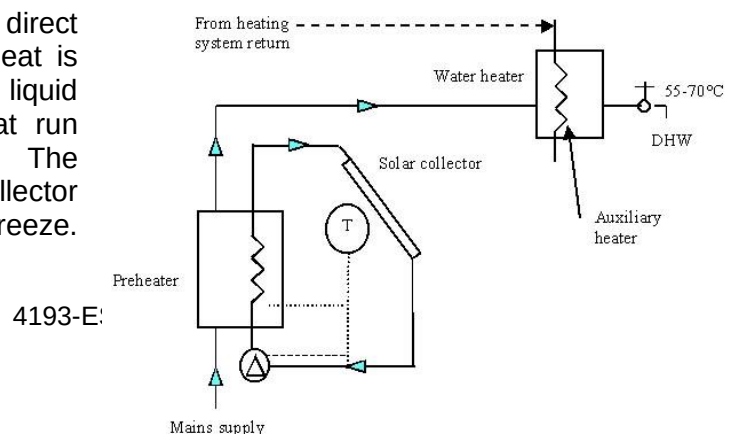
A high efficiency condensing boiler works on the principle of recovering as much as possible of the waste heat which is normally rejected to the atmosphere from the flue of a conventional (non-condensing) boiler.

This is accomplished by using two heat exchangers within the boiler which maximises heat transfer from the burner as well as recovering useful heat which would normally be lost with the flue gases. When in condensing mode (condensing boilers do not condense all the time) the flue gases give up their 'latent heat' which is then recovered by the heat exchanger within the boiler. As a result the temperature of the gases exiting the flue of a condensing boiler is typically 50-60°C compared with 120-180°C in a non-condensing boiler. At the same time an amount of water or 'condensate' is produced.

The result of using the exhaust flue gas means less primary gas demand. This subsequently reduces CO₂ emission

Solar Collectors

Solar collectors, collect both direct and diffuse solar radiation. Heat is transferred to the circulating liquid via heat exchange pipes that run through the solar collector. The circulating fluid in the solar collector is a mixture of water and antifreeze.



This is to enable operation in winter and maximises efficiency similar to run around coils in a ventilation system which use the same water and antifreeze mix. The water and antifreeze mixture is used to cool the panels, so increasing the temperature of the water/circulating fluid. The water is then used to pre-heat the building domestic hot water as shown in the diagram above. The preheated water is then heated through a condensing boiler prior to delivery to the building.

The domestic hot water can be provided for the building via a central plant room. The primary heat source for this hot water can be provided via a solar collector system. Hot water requirements could be served via evacuated-tube solar collectors on the roof of the building. The evacuated tube solar collector consists of a series of metal rods contained inside glass tubes, which are heated by the sun, and conduct their heat to water passing through a header at the ends of the rods. The hot water is then circulated into the building and utilised.

Heat Pumps

There are a multitude of air and ground source heat pumps available in the construction industry, each installed differently and subsequently perform differently, however the principle of operation is fundamentally the same.

Air source heat pumps remove residual, low grade heat from ambient air and, via the vapour compression cycle, transfer this to high grade heat for use within the building. Air source heat pumps typically output heat at 45°C, but can output up to 65°C.

A GSHP removes heat from the earth or ground water in cold weather and transfers it to the building through an underground piping system. The process reverses in warm weather as heat is transferred to the ground. GSHP's work by circulating water or a water/antifreeze solution, generally through a closed loop of pipe that is buried in the ground or set beneath water. The refrigerant cycle within a GSHP system can comprise a two phase process, operating in the vapour and liquid phases. A GSHP can be categorised as having closed or open loops and these loops can be installed in three ways:

- horizontally,
- vertically,
- in a river / pond or lake.

The selection process for a GSHP depends on the area of the site / land, soil and rock type at the project. These factors will help determine the most economical choice for installation of the ground loop.

Wind Catchers



The windcatcher principle, of encapsulating any prevailing wind, originated some 2,000 years ago in the Middle East, where " Wind Towers " were often a common sight. The modern windcatcher is an extension of this principle but is also a development of the Vertical Balanced-flue system.

A windcatcher system is an effective method of providing natural ventilation to

a building, by encapsulating the prevailing wind from any direction. Clean, fresh air, relatively free from contamination or traffic pollution, is entrained at roof level and is carried down to the rooms below through a controlled damper arrangement.

Heat Recovery In Ventilation System

There are various methods of recovering heat from a mechanical ventilation installation. This varies from thermal wheels, heat recuperators and run around coils etc. The recovered heat is then utilised back into the installation and thus reduces the primary energy demand for the building and subsequent CO₂ emissions. On a smaller scale fresh air/extract ventilator units with heat recovery coils will pre-heat or pre-cool the fresh air.

Demand Controlled Ventilation

This type of system is best suited to a central ventilation system serving a number of rooms or apartments. Demand controlled ventilation basically operates through a series of passive infra red detectors which control the ventilation installation in the building. If the space is unoccupied then the ventilation would not operate. However, once the space is occupied the ventilation operates. This reduces the primary energy demand and subsequently reduces the building CO₂ emission rate

Biomass Boilers

Biomass is all non-fossil organic materials that have intrinsic chemical energy content. This includes all water and land-based vegetation and trees or virgin biomass, such as log wood or thinning from local forests, prunings from roadsides or parks, grasses and energy crops and in some countries residues from agriculture or food processing e.g. nutshells or olive pits, wood chips, recycled untreated wood or palletising residues from wood processing. Also all waste biomass such as municipal solid waste, municipal bio solids (sewage) and animal wastes (manures), forestry and agricultural residues, and certain types of industrial wastes. Through using these resources a possible disposal problem can be turned into a high quality fuel and local suppliers of wood fuels will gain extra income and enhance local economic turnover.

Biomass can be used on a domestic or industrial scale. For a biomass power plant, the chipped, shredded and dried fuel is fed into a boiler or gasifier, from where the gas is collected and used.

The boilers could operate via biofuel. Biofuel is any fuel that derives from biomass - recently living organisms or their metabolic byproducts, such as manure from cows. It is a renewable energy, unlike other natural resources such as petroleum, coal and nuclear fuels. The carbon in biofuels was recently extracted from atmospheric carbon dioxide by growing plants, so burning it does not result in a net increase of carbon dioxide in the Earth's atmosphere.

The use of biofuel would mean the requirement for a biofuel storage tank and regular deliveries. A hard standing is therefore required for the delivery truck.

In urban environments careful consideration must be given to local restrictions on the use of biomass such as smoke control zones, clean air requirements and interaction with surrounding buildings.

Biomass flues are normally required to terminate above the roof line of the property being served, as well as any nearby buildings which could be affected by exhaust fumes. This can be a particular concern for tall, multi-storey buildings.

Lighting Control

Presence Detection

A presence detector is a switching device which detects persons within an area, thus switching electrical loads as a result, i.e. switching lighting and extract fans etc.

Presence detection utilises a motion detector, typically a passive infra red or microwave technology to detect the presence of persons in a given area.

Upon detection of persons the presence detector acts as a switch enabling the lighting to switch “on” for a pre determined duration i.e. 15 minutes. After this predetermined duration the lighting will be switched “off”.

Absence Detection

Absence detection utilises the same principles of operation as presence detection, however rather than the detector switching lighting circuits on automatically a manual switch has to be engaged. For example upon walking to a room with a presence detector installed a person has to physically switch on a switch to enable the lighting to switch “on”. As with presence detection, after a pre-determined duration of no presence in an area the lighting will switch off.

Performance

A typical Passive Infra Red detector when mounted at 2.7m above finished floor level will give coverage of circular diameter 6.5m. Microwave detectors generally provide greater coverage than Passive Infra Red Detectors. However, they are sensitive and may cause nuisance switching if installed in areas of heavy traffic.

2.3.2 Sustainable Element Feasibility

The following section of this report aims to identify potential technologies for more detailed analysis and justify and technologies being excluded at this stage. A traffic light system has been adopted to represent the anticipated feasibility of these measures prior to undertaking modelling of the site.

The traffic light system should be interpreted as follows:

Red	Technology not suitable.
Amber	Technology may be suitable depending on building energy demands.
Green	Technology may be suitable subject to payback and operational constraints.

No.	SUSTAINABLE ELEMENT	FEASABILITY COMMENT	FEASIBLE Yes/No/
1	Wind Turbines	Wind Turbines generate electrical power for the earth's natural wind resource. The location of any wind turbines would need to be carefully considered as there are a number of buildings within the vicinity of this building which could prevent/block wind potential. Planning could also be a consideration. It is generally considered that wind turbines do not operate well in urban environments unless they are tall enough to be unaffected by the deflection of wind by surrounding buildings. This is not likely to be possible in an urban area.	No
2	Photovoltaic Panels	Photovoltaic (PV) panels could be installed however capital expenditure is high for relatively low outputs and therefore the equipment has long pay-back periods. The existing north light roof is a key heritage of the building and does not provide suitable roof space or the necessary maintenance access to install a PV system.	No
3	High Efficiency/ Condensing Boilers	Any new boiler installed could be of high efficiency condensing type. The provision of gas boilers would require a centralised plant room or individual boilers to each apartment. In order to reduce fire risk and penetrations through the external façade for boiler flues, the intention is to avoid the use of gas fired boilers. Gas fired boilers are also not favoured, as an alternative electric heating system would help reduce reliance on fossil fuels on the site.	No
4	Solar Collectors	Solar collectors provide a mechanism to collect heat energy from the sun and transfer this to the water supply to the building, thus reducing the primary domestic hot water demand and subsequent energy consumption. The solar collectors could be mounted on the roof of the building. The system output would be dependent on the orientation of the solar array. The existing north light roof is a key heritage of the building and does not provide suitable roof space or the necessary maintenance access to install a solar hot water system.	No
5	CHP	Combined Heat and Power (CHP) installations require careful sizing against the base loads of the building they are to serve. In order to operate efficiently it is preferable to have a steady base load. As the building's energy demand is unlikely to be steady CHP will not be viable.	No

6	ASHP	Air source heat pump (ASHP) systems offer a more practical alternative to GSHP's in that, generally, they offer much greater flexibility with regards to their installation and do not require the prior geological work needed by GSHP's. With a seasonal efficiency of 300% or more, they are not quite as efficient as GSHP's. They do, however, offer a renewable energy source to provide low grade hot water for suitable for domestic hot water or heating installations. There is insufficient space on the roof, or within the building's footprint, for heat pumps to be used to service the apartments. However, the commercial units are likely to require comfort cooling. This can be provided via a reverse cycle heat pump system to provide heating and cooling to the commercial units.	Yes
7	GSHP	The installation of a ground source heat pump (GSHP) needs to be carefully considered. The building's location and the size of the site are likely to require that boreholes be dug rather than a more traditional slinky arrangement. This would drastically increase the cost thus potentially making the installation economically prohibitive. Given the urban setting of the site and available ground area outside of the proposed building footprint ground source heating will not be viable.	No
8	Wind Catchers	These are unlikely to be applicable for this project. The height of the building would render wind catchers ineffective on lower floors.	No
9	Biomass Boilers	The use of a central boiler plant utilizing biofuel would mean the requirement for a biofuel storage tank and regular deliveries. Biomass boilers could be installed to provide the necessary energy for heating and domestic hot water. However, transportation and storage of fuel make the suitability of biomass highly dependent on available space. Further investigation of local planning, clean air and smoke control requirements would also be required to fully assess feasibility. Given the urban nature of the site, there are likely to be planning restrictions on the use of biomass systems. The requirements to dissipate exhaust gases is likely to require an extensive flue dilution system or large flue. Biomass flues must exhaust above the ridge-line of a building. The current plans do not provide any storage space for biomass fuel. Storage requirements would be difficult to accommodate given the close proximity of	No

		surrounding buildings and public areas. In this case the use of biomass is non-viable.	
10	Heat Recovery Ventilation Units	Heat recovery systems allow energy from extracted air to be transferred to incoming air before it is supplied to the occupied space. Heat recovery ventilation will be provided to the apartments.	Yes
11	High Efficiency Lighting & Lighting Control	Modern low energy light fittings such as LEDs or compact fluorescents should be considered. These are many time more efficient and can significantly reduce building energy consumption in comparison to tungsten type fittings commonly installed in residential and retail spaces in recent years. There are various lighting control systems available. Consideration should be given to their installation in common and circulation areas and the commercial spaces.	Yes

2.4 Energy Export & District Energy Distribution

No existing district energy systems are known to exist nearby, eliminating the possibilities for extension of existing infrastructure. As the building's energy demand profile is unlikely to be continuous, CHP is unlikely to be cost effective.

2.5 Design Intent

2.5.1 Passive Measures

To minimise building energy demand the thermal performance of existing fabric will be improved where impact on the building's aesthetic is minimal and appropriate. New thermal elements will be specified to meet Part L requirements (subject to any conservation limitations).

It is assumed that all construction elements for new building elements will be built to accredited details where possible.

2.5.2 Low & Zero Carbon Technologies

Based on the feasibility study for low and zero carbon and renewable technologies and the potential for energy and carbon savings the following have been selected as suitable for implementation into the design:

1. VRF heating and cooling to the commercial units
2. Heat recovery ventilation to the apartments
3. LED lighting throughout

3.0 RENEWABLE ENERGY

3.1 Policy Requirement

In order to meet Core Strategy policies EN4, EN5 and EN6 and in accordance with the Government's low carbon design hierarchy, renewable technologies shall be incorporated into the design to meet, and where possible exceed, the 15% carbon emissions saving target over Part L 2010.

3.2 Design Intent

Refer to section 2.3 of this report for an overview of available renewable generation technologies and an assessment of their suitability for use on this scheme.

The nature of the existing building and its heritage status are unlikely to allow the installation of any renewable energy generation on the site.

4.0 ENVIRONMENTAL DESIGN

4.1 Policy Requirements

The commercial element of the scheme is below the 1,000m² threshold at which a BREEAM assessment is required and the Guide to Development in Manchester Supplementary Planning Document and Planning Guidance makes reference to assessment of domestic units under the now defunct Code for Sustainable Homes.

Despite not falling within statutory requirements for formal environmental assessment the Developer is committed to achieving high levels of energy efficiency in line with the principles of the aforementioned assessment programmes, where practical and appropriate for the development.

4.2 Design Intent

In accordance with the National Energy Hierarchy, it is acknowledged that there is first a need to reduce energy use, then supply energy efficiently and finally to utilise renewable energy where feasible.

In order to reduce energy use the development has been designed and will be constructed to a high specification standard so as to improve the performance of thermal elements where possible, given the heritage status of the building.

In order to supply energy efficiently and use renewable technologies, the use of renewable technologies for this development such as biomass heating, solar hot water and photo-voltaic systems, ground source heat pumps, air source heat pumps and wind power have all been evaluated.

The following Low and Zero Carbon technologies have been selected as suitable for implementation into the design:

1. VRF heating and cooling to the commercial unit
2. Heat recovery ventilation to the apartments

3. LED lighting throughout

The other technologies are largely discounted on the grounds of the practical limitations of the building. Refer to section 2.3 of this report for further analysis.