



ELEMENT
SUSTAINABILITY

**804-806 OLDHAM ROAD,
MANCHESTER**

ENVIRONMENTAL STANDARDS STATEMENT

NOVEMBER 2021

REF: 2021.243



ELEMENT SUSTAINABILITY – ISSUE NOTES

Project No: 2021.243

Title: Environmental Standards and Energy Statement

Site: 804-806 Oldham Road, Manchester

Client: Elite Portal Frames Limited

Status: Final

Version:	1.0		
Date:	18 th November 2021		
Prepared by:	Checked by:	Approved by:	
			
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Version	Version Details	Date Issued	Issued
0.0	Draft for client comment	16 th November 2021	LW
1.0	Final	18 th November 2021	LW



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Appendix A – SBEM BRUKL



1. INTRODUCTION

Element Sustainability has been commissioned by Elite Portal Frames Limited to review the sustainability performance of the proposed development at land at 804-806 Oldham Road, Newton Heath, Manchester.

The purpose of this statement is to summarise the relevant policy background and requirements of Manchester City Council (hereafter referred to as the council) and demonstrate the ways in which the design team have sought to address these aims through the scheme proposals, ensuring measures have been taken in order to provide a sustainable development at this site.

This statement reviews the sustainable design features and appraises the energy strategy of the proposed development. Details of the design attributes, specifications and building characteristics are appraised in order to demonstrate how the proposals contribute to sustainable development in Manchester, align with the adopted and emerging planning policy requirements, and seek to mitigate the environmental impacts of the scheme.

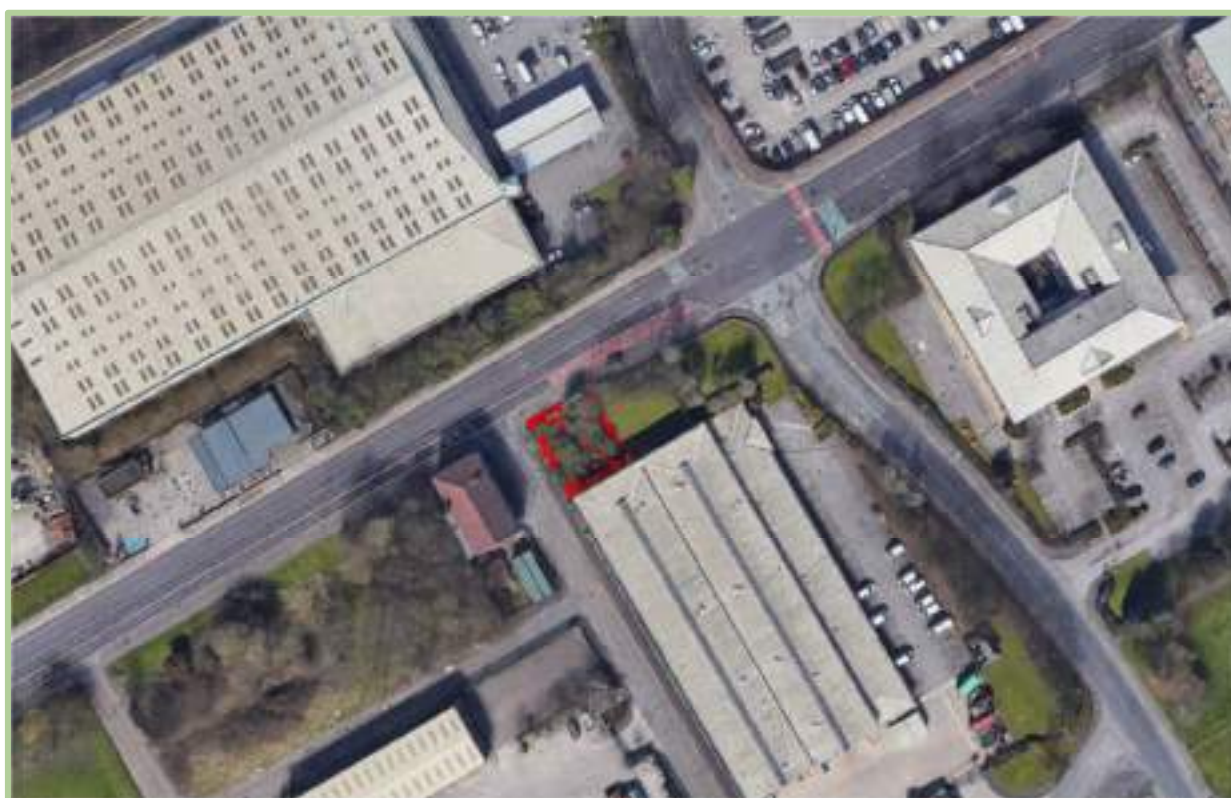


2. DEVELOPMENT PROPOSALS

2.1 Development Site Description

The application site is located on the A62 Oldham Road, Newton Heath at the junction with Ridings Street and is 3 miles (4.9km) to the east of Manchester City Centre and 5.7 miles (9.2km) to the centre of Oldham. The application site is surrounded by commercial properties within this locality comprising of factories, industrial and office buildings fronting onto Oldham Road, which is the main corridor connecting Oldham to Manchester City Centre.

Figure 2.1 – Pre-development Site



2.2 Development Proposals

The proposals include the construction of a showroom, storage and office building (including parking and landscaping) on land at 804-806 Oldham Road, Newton Heath.

The ground floor plan and front (north) elevation is presented in Figures 2.2 and 2.3



Figure 2.2 – Proposed Ground Floor Plan

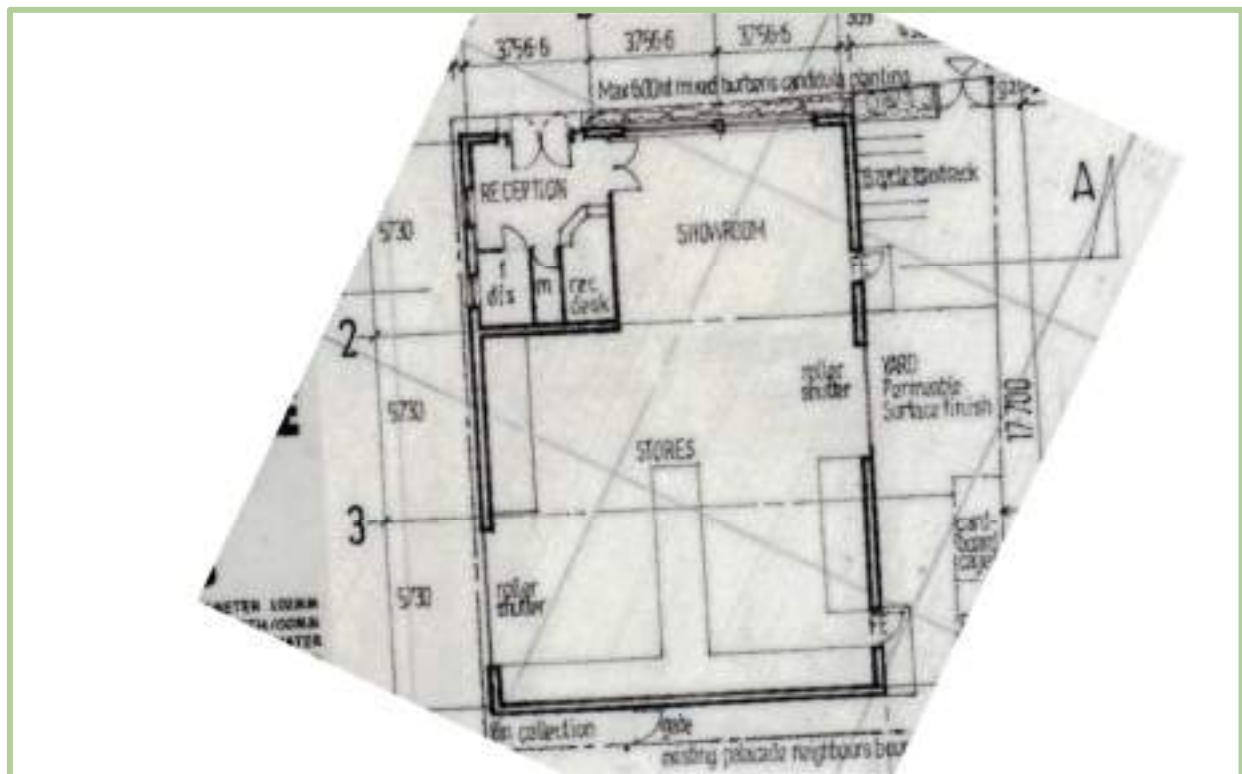


Figure 2.3 – Proposed North Elevation



3. POLICY REVIEW

3.1 Local Planning Policy

3.1.1 Manchester Core Strategy

Manchester's Core Strategy (CS) was adopted on 11th July 2012 and is the key Development Plan Document in the Local Development Framework (LDF).

CS Policy DM 1 - Development Management requires all development to have regard to a number of development principles.

CS Policy EN 4 - Reducing CO₂ Emissions by Enabling Low and Zero Carbon Development requires all development to 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; and,
- To meet residual energy requirements through the use of low or zero carbon energy generating technologies.

Further details of the building regulation requirements are provided in the section below.

CS Policy EN 6 - Target Framework for CO₂ Reductions from Low or Zero Carbon Energy Supplies requires applications for residential development of ten or more units and all other development over 1,000m² to meet, as a minimum, the targets shown in the tables below, unless unviable.

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.

Table 3.1 – Policy EN6 CO₂ Emissions Reduction Targets; Non-Domestic

Target	% Minimum Requirements
Target One: Network development area	CHP/District heating anchor or connection or where not feasible a 15% increase on Part L 2010
Target Two: Electricity intense buildings	+10% increase on Part L 2010
Target Three: Micro generation area	+15% increase on Part L 2010

The proposed development are deemed to be **located within a Target 3: Micro generation area** and must also comply with Part L2A (2013).



The emission reductions targeted within policy EN6 relate to Building Regulation Part L 2010. As a consequence of the reduction in emission rates required by current building regulations (Part L 2013) relative to Part L 2010, the revised equivalent target CO₂ emission reductions for the scheme are presented below:

- Non-domestic >6% building emission rate reduction over Part L 2013.

Further details of the building regulation requirements are provided in the section below.

3.1.2 Guide to Development in Manchester, Supplementary Planning Document

The Core Strategy requires that all new residential developments should accord with the design guidance set out in the Supplementary Planning Documents (SPD). The Guide to Development in Manchester SPD was adopted on 11th April 2007 and supports and enhances the ongoing shaping of the City by providing a set of reasoned principles which will guide developers, designers and residents. These principles include a number of environmental standards, and includes the following categories which are identified in the SPD:

- Energy efficiency;
- Renewable energy;
- Environmental design;
- Water management and weather resilience;
- Waste management;
- Construction management;
- Biodiversity; and,
- Waterways.

3.1.3 Climate Emergency

A **Climate Emergency** was declared by Manchester City Council on the 10th of July 2019 in response to the findings of the Intergovernmental Panel on Climate Change (IPCC) report. The City Council believe that there is serious risk to Manchester's people of climate change affecting economic, social and environmental well-being, supply chains – including food security, financial systems and local weather, among many others. Therefore, the target for becoming a zero-carbon city has been accelerated by 12 years, setting 2038 as the new target for the city.

Manchester Climate change Framework 2020 – 25 is Manchester's high-level strategy for meeting their commitment on climate change that builds on the **Draft Manchester Zero Carbon Framework 2020-38**, which was published in February 2019, and Manchester City Council's declaration of a climate emergency in July 2019. This was endorsed by MCC at the Executive meeting in March 2020 and will develop over the next five years, in line with changes in policy, climate science, rate of progress and other factors. The framework contains the following relevant objectives:

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

- Increasing the amount of urban green infrastructure cover, aiming for a 10% increase by 2038 from 2018 levels, in line with the Greater Manchester aim.



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

- Adapt the city's built and natural environment and prepare residents to become more resilient to these changes. Increasing the amount and quality of green space to enable residents to benefit from the improved physical and mental health that will come as a result.
- Improving the energy efficiency of the city's homes and providing access to affordable, secure supplies of renewable energy, which are essential to help get 38,000 Manchester households out of fuel poverty.

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

Priority Areas

Six priority areas have been established in order to help meet the above objectives and include:

1. Buildings (existing and new)
2. Renewable energy
3. Transport and flying
4. Food
5. The things we buy and throw away
6. Green infrastructure and nature-based solutions

Urgent Climate Change Framework Actions Identified to Help Meet the Commitments:

- New Buildings – To ensure that new developments in the city don't eat into the limited carbon budgets and add to the already significant retrofit challenge developments need to be built and operated to zero carbon standards as soon as possible.
 - The ideal way to do this is through UK Government *establishing a national zero carbon definition*, and methodology for its implementation, and for Manchester City Council to implement this standard as quickly as possible through the local planning system.
 - This should include applying zero carbon standards to all developments where the Council has additional influence, with a view to all new development needing *to be zero carbon from 2023 at the latest*.
- Renewable Energy – The National Grid has been decarbonising in recent years; we need this to continue but at an accelerated rate, with a view to being fully decarbonised as soon as possible.
- Gas – The following actions are needed to help reduce the reliance on natural gas:
 - Improve the energy efficiency of our buildings as far as possible to reduce our demand for gas.
 - Replace our natural gas-based heating systems with renewable energy-based heating technologies as soon as possible.
 - Work with Government to ensure that moving to electricity-based heating systems is affordable and doesn't push even more people into fuel poverty.



3.2 Emerging Policies

The Greater Manchester Spatial Framework 2019 (Draft) will set out how Greater Manchester should develop up until 2037 and is currently on hold. However, it contains the following relevant emerging policies:

Policy GM - S 2 Carbon and Energy aims to deliver a carbon neutral Greater Manchester no later than 2038, with a dramatic reduction in greenhouse gas emissions. There is an expectation that new development will:

- a) Be zero net carbon from 2028 by following the energy hierarchy (with any residual carbon emissions offset), which in order of importance seeks to:
 - I. Minimise energy demand;
 - II. Maximise energy efficiency;
 - III. Utilise renewable energy;
 - IV. Utilise low carbon energy; and,
 - V. Utilise other energy sources.

3.3 National Planning Policy

In addition to the local planning policies, the **National Planning Policy Framework 2019** is a material consideration. The National Planning Policy Framework (amended July 2019) replaces all previous PPSs and PPGs.

The NPPF states that the planning system should play an active role in guiding development to sustainable solutions. There are three dimensions to sustainable development, as stated within the NPPF: economic, social and environmental. These dimensions give rise to the need for the planning system to perform a number of roles:

An economic role – contributing to building a strong, responsive and competitive economy, by ensuring that sufficient land of the right type is available in the right places and at the right time to support growth and innovation; and by identifying and coordinating development requirements, including the provision of infrastructure;

A social role – supporting strong, vibrant and healthy communities, by providing the supply of housing required to meet the needs of present and future generations; and by creating a high-quality built environment, with accessible local services that reflect the community's needs and support its health, social and cultural well-being; and

An environmental role – contributing to protecting and enhancing our natural, built and historic environment; and, as part of this, helping to improve biodiversity, use natural resources prudently, minimise waste and pollution, and mitigate and adapt to climate change including moving to a low carbon economy.

These roles should not be undertaken in isolation, because they are mutually dependent. Economic growth can secure higher social and environmental standards, and well-designed buildings and places can improve the lives of people and communities. Therefore, to achieve sustainable development, economic, social and environmental gains should be sought jointly and simultaneously through the planning system.

Pursuing sustainable development requires careful attention to viability and costs in plan-making and decision-taking. To ensure viability, the costs of any requirements likely to be applied to development, such as requirements for affordable housing, standards, infrastructure contributions or other requirements should,



when taking account of the normal cost of development and mitigation, enable the development to be deliverable.

At the heart of the National Planning Policy Framework is a **presumption in favour of sustainable development** - for decision-taking this means approving development proposals that accord with the development plan without delay.

3.4 Regulatory Framework

3.4.1 Building Regulations

Building Regulations, Part L - Conservation of Fuel and Power sets the compliance standards for energy demand and carbon dioxide emissions from buildings.

Approved Document L2A addresses the conservation of fuel and power in new non-domestic buildings. The proposed development will be registered against Building Regulations, Part L (2013) which requires all newly constructed buildings to comply with the 5 criteria set out in Approved Document L2A:

- I. Achievement of an acceptable Building CO₂ Emission Rate. i.e. the BER is less than the TER (target emission rate for a notional building);
- II. Limits on design flexibility – including U-values, air permeability, air handling plant efficiency, duct leakage, insulation, lighting system efficiency;
- III. Limiting solar gains in summer;
- IV. Construction quality and commissioning - The BER must be recalculated as constructed; and
- V. Provision of information - Information must be provided to the building operator.

3.5 Applicable Targets

Based upon a review of relevant planning policy requirements, legislative drivers, and client priorities, the following list provides a brief precis of the key criteria that should be targeted for this development:

- **CS Policy EN 4** – Following the principles of the Energy Hierarchy to reducing CO₂ Emissions;
- **CS Policy EN 6** >6% building emission rate reduction over Part L 2013;
- **Emerging Policy GM-S 2 Carbon and Energy**; and,
- **Approved Document L2A** will guide the compliance standards for energy demand and carbon dioxide emissions from this building.



4. ENVIRONMENTAL PERFORMANCE

This section provides an appraisal of the development proposals and details the specific approach, design features and specifications which will contribute to reducing the environmental impact of the proposed development. This section outlines those commitments that have been made by the client to ensure this development contributes to sustainable development, meets the council's current and emerging policies, and examines the following categories identified in the Guide to Development in Manchester, Supplementary Planning Document (SPD):

- Energy efficiency;
- Renewable energy;
- Environmental design;
- Water management and weather resilience;
- Waste management;
- Construction management;
- Biodiversity; and,
- Waterways.

The key specifications, site characteristics and design measures of the proposed development are considered below. They will mitigate the environmental impact of the scheme throughout both the construction stage and the future occupation of the development.

4.1 Energy

In order to limit energy demand and carbon dioxide (CO₂) emissions from the operation of the commercial unit, the following design features will be integrated within the scheme.

4.1.1 Energy Efficiency Strategy

- The proposed approach to emissions reduction at this site will be through a fabric led energy strategy and efficient servicing in accordance with the principles of the Energy Hierarchy;
- The proposed energy strategy will provide improvements in the energy performance of the building above national building regulations Part L2A (2013) criteria in relation to heating energy demand, primary energy consumption and carbon dioxide and will incorporate the following measures:
 - A Part L compliant building fabric specification;
 - Efficient mechanical and electrical systems and,
 - Low-carbon energy technology.

Further details of the proposed approach to reducing the energy demand and associated carbon dioxide emissions of these units are presented in the Sections 5 (Energy Strategy) and Section 6 (Climate Emergency).

4.2 Water

The units will be designed to reduce mains/potable water consumption and will include water efficient devices and equipment.



- At present, appliances are graded on a scale from G (the least efficient) up to A++ (the most efficient). A water efficiency strategy will be determined for the site and will include for the provision of 'A' rated appliances as a minimum;
- Specification of efficient water fixtures throughout the scheme (low flow taps and showers and dual flush WCs); and,
- Any landscaped areas of the development will be irrigated solely by precipitation throughout all seasons of the year to reduce unregulated water consumption.

4.3 Resource Management and Pollution

4.3.1 Pollution Control

To reduce emissions of gases with high global warming potential (GWP) and nitrogen oxide (NOx) into the atmosphere, the new build commercial units will be specified with:

- Insulating materials that have a GWP of less than 5 throughout the development to reduce the construction phase impact of this scheme upon climate change.

Additionally, the following measures will be implemented:

- Pollution Prevention Guidance will be adhered to in respects of air (dust) and water (ground and surface) pollution during the demolition and construction phase;
- External light fittings will be controlled through a time switch, or daylight sensor, to prevent operation during daylight hours to limit the impact of artificial lighting for the surrounding environment;
- Where necessary, temporary drainage and pollution prevention measures will be in place on site, this may include, for example, bunded areas and spill kits to prevent harmful chemicals / materials from draining to natural watercourses; and silt traps to ensure that suspended solids are removed from the drainage water;
- Dust suppression measures will also be put in place as part of the contractor's Environmental Management Plan, such that any potential risks to watercourses or the neighbouring properties are minimised; and,
- Sound insulation will be specified to achieve Building Regulation Part E compliance standard (this will be verified by pre-completion testing) in addition to meeting the requirements of the council.

4.3.2 Materials

This development will contribute towards making more efficient use of non-renewable material resources and to reducing the lifecycle impact of materials used in construction. This is demonstrated by the selection of:

- Materials with low environmental impact throughout their lifecycle will be selected;
- Materials responsibly sourced from suppliers operating an Environmental Management System or procuring timber verified by either the Forest Stewardship Council (FSC) or Programme for the Endorsement of Forest Certification standard (PEFC); will be prioritised; and,



- Construction materials will be selected to match the existing surrounding structures and robust materials will be utilised for hard landscaping that reflect the local vernacular therefore, minimising the frequency of replacement.

4.4 Surface Water Run-off

4.4.1 Flood Risk

The proposed site is located within Flood Risk Zone 1 and therefore has a low probability of flooding. Data provided on the Environment Agency website confirms the Flood Risk Zone classification for the site (see Figure 4.1).

Figure 4.1 – Flood Risk Map



4.5 Waste Management

4.5.1 Construction Waste

Best practice techniques to prevent and minimise waste during the design and construction phases of the development will be adopted, as follows:

- Prior to commencement of the above ground construction phase, a site waste management plan (SWMP) will be produced by the developer to limit the on and off-site environmental impacts of construction. The SWMP will detail:
 - Recycled and secondary materials;
 - Waste reduction;
 - Waste segregation;
 - Waste recovery; and,
 - Waste disposal.



- This scheme will promote the minimisation of waste in site development and seek to maximise the use of recycled materials in construction. A site waste management plan will identify opportunities to minimise waste generation and divert at least 85% of total construction waste from landfill.

4.5.2 Waste

The development will provide infrastructure and facilities that meet the need of the building users for segregated waste storage, thereby optimising the ability to recycle waste. A waste management strategy will be developed, ensuring that adequately sized bin storage areas for each unit will be designed into the development at an early stage of the design. The strategy will allow for storage of general waste, recyclable materials and food waste in order to optimise the recycling rates achieved by Manchester City Council.

4.6 Health and Wellbeing

The security needs of the development will be considered, and the site will adopt crime prevention measures to assist in reducing the opportunity for, and fear of crime including:

- Photocell lighting to be installed on building entrances and within parking areas;
- Intruder alarms present in all units; and,
- Installation of attack resistant glazing.

4.7 Management

In order to minimise the impact of the development during construction and operation, the proposals include for the following provision:

- Construction site impacts will be minimised, and measures implemented to protect water courses, as well as to prevent impacts upon the local area in terms of dust and noise pollution during construction works.

4.8 Biodiversity

The pre-developed greenfield site consists of vacant grassland, trees and shrubs. A limited amount of soft landscaping will be implemented to soften the threshold between the main Oldham Road and the proposed unit.

4.9 Transport

The proposed development is located within five kilometres of Manchester city centre, which is one of the most sustainable locations in the north west, particularly in relation to key pedestrian, rail and bus transport routes.

The site is well located in terms of non-car modes of transport with basic amenities all within easy walking distance of the site.



5. ENERGY STRATEGY

Details of the proposed energy strategy for the development are reviewed below.

5.1 Local Planning Policy Targets

Manchester's Core Strategy (CS) includes the following relevant policies:

CS Policy EN 4 - Reducing CO₂ Emissions by Enabling Low and Zero Carbon Development requires all development to 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; and,
- To meet residual energy requirements through the use of low or zero carbon energy generating technologies.

CS Policy EN 6 - Target Framework For CO₂ Reductions From Low or Zero Carbon Energy Supplies stipulates a >6% building emission rate reduction over Part L 2013 where viable.

Further to this, the **Greater Manchester Spatial Framework 2019 (Draft)** contains the following relevant emerging policies:

Policy GM-S 2 Carbon and Energy aims to deliver a carbon neutral Greater Manchester no later than 2038, with a dramatic reduction in greenhouse gas emissions. There is an expectation that new development will be zero net carbon from 2028 by following the energy hierarchy.

5.2 Build Fabric and Thermal Performance

A combination of enhanced building fabric specification (significantly beyond the regulatory compliance standard), efficient mechanical and electrical systems, and controls, will achieve compliance with the emission reduction targets stipulated by Building Regulations Part L2A (2013).

The standard measurement of heat transfer through a given building material or construction type is the U-value (W/m²K). In buildings, heat loss generally occurs through the following areas and elements of the construction:

- | | |
|--|--|
| <ul style="list-style-type: none"> • Ground Floor; • External Walls; • Roofs; • Doors and Windows; | <ul style="list-style-type: none"> • Thermal (cold) Bridging (heat loss through construction joints); and, • Uncontrolled Ventilation. |
|--|--|

The lower the U-value, the more slowly heat transfers and is lost out of a building. Table 5.1 presents the proposed material specification that will be incorporated to limit heat loss and ensure efficient operation of the units.



Table 5.1 – Proposed Building Specification

Construction Element	Proposed Fabric Specification
Ground Floor	U=0.18 W/m ² K
External Wall	U=0.27 W/m ² K
Roof	U=0.16 W/m ² K
Windows	U=1.40 W/m ² K, g=0.4 <i>Double Glazed, UPVC, Low-E</i>
External Doors	U=1.40 W/m ² K
Air Permeability	5.0m ³ /hm ² (@50Pa.)

These specifications and design attributes will provide the following benefits:

- **High performance thermal insulation** will ensure low U-values for all heat loss elements. Energy demand for space heating will be significantly reduced through the provision of an effective thermal envelope;
- **Thermally efficient, double glazed windows** will be specified to limit heat loss through the panes. Thermal breaks will be incorporated within the frame to limit heat loss. The glazing g-value will be specified to optimise beneficial solar gains but limit the propensity for the buildings to overheat;
- **Air permeability** of 5.0m³/hm² (@50Pa.) is targeted for the build in order to minimise uncontrolled ventilation. This will reduce heat losses and provide high levels of occupant comfort. Focus on the quality of the build is vital to deliver airtight buildings; and,
- **Attention to cold bridging junctions** including the provision of insulation to reduce heat and limit heat losses that occur at the junctions between building elements and around openings and will significantly improve the emission rate of the buildings.

5.3 Building Services Specification

Table 5.2 presents the current proposed mechanical and electrical specification that is anticipated to be part of the design to ensure efficient and comfortable operation of the commercial units.

Table 5.2 – Proposed Mechanical and Electrical Specification

Item	Specification
Ventilation	Natural intermittent extract ventilation
Lighting	100% 'Low E' or LED
Space Heating	Air Source Heat Pumps (ASHP) (<i>SCOP 3.5 and SEER 3.0</i>)
Heating Controls	Local controls including central programmer and thermostats
Water Heating	Standalone water heaters (<i>electric instantaneous POU</i>)



This specification will deliver an energy efficient development that achieves a carbon dioxide emission rate reduction beyond the requirements set by Building Regulation (Part L2A, 2013). The specification will provide the following benefits:

- **Low energy and LED lighting** will be specified throughout the scheme in order to maximise operational efficiencies and lifespan of the fittings. LEDs operate with an estimated energy efficiency of up to 90% when compared to traditional lighting and conventional light bulbs. This means that about c.90% of the electrical energy is converted to light, rather than wasted heat as in conventional bulbs;
- **Variable Refrigerant Flow (VRF) heat pump systems** providing heating and cooling to the units benefit from high seasonal efficiencies for both heating and cooling modes. Additionally, these systems allow precise control of the necessary refrigerant circulation amount required according to the system load, facilitating a comfortable environment by use of smooth capacity control;
- **Sophisticated heating controls** including programmer and room thermostats will ensure the efficient delivery of heat from the heat pumps to further reduce the buildings' energy demand; and,
- **Electric instantaneous hot water** systems will meet the commercial units' hot water load. The water flows immediately to the desired temperature therefore conserving water with little energy or circulation losses.

5.3.1 Heating Strategy Rationale

- The commercial units will improve upon the current Building Regulation Part L2A 2013 criteria in terms of Building CO₂ Emission Rates;
- The systems specified above will also ensure high levels of occupant comfort coupled with low heating energy bills;
- There will be no local emissions associated with the proposed full electric heating strategy;
- A fully electric heating system is much more cost effective in terms of installation than a gas boiler and requires much lower maintenance. Therefore, this will keep service charges down for the building's occupants; and,
- Electric heating, as proposed for the development at Oldham Road, is 100% efficient at the point of consumption. The UK government is committed to reducing the country's emissions and has legislated to do so within the Climate Change Act. As the UK's electricity grid becomes less carbon intense over time the carbon emissions associated with full electric heating will become less.

5.4 Renewable Energy Feasibility

A number of renewable/ low-carbon energy technologies have been considered for this site, including:

- | | |
|-----------------------|--------------------|
| • District Heating; | • Wind; |
| • Solar Hot Water; | • Heat Pumps; and, |
| • Photovoltaics (PV); | • Biomass heating. |

A review of the proposals and site location has been completed to determine the appropriate option(s) for this development, as detailed in Table 5.3 below.



Table 5.3 – Renewable Energy Feasibility Study

Technology	Description	Advantages	Limitations	Feasibility
Combined Heat and Power (CHP)	CHP is effectively an on-site, mini power plant providing both electrical power and thermal heat energy. It is an energy efficient, low carbon measure rather than a renewable energy technology.	✓ Buildings with high heat / hot water demands and constant power demands lend themselves to CHP. ✓ Can be linked to a district heating scheme. ✓ Efficient use of fuel and excess electricity can be exported to the grid.	✗ Only viable for buildings with high heat / hot water demands and constant power. ✗ Plant space required. ✗ Maintenance intensive.	No - Given there will be low space heating and hot water demand from the development, the commercial viability of this type of system cannot be proven.
District Heating	District Heating systems provide multiple buildings or dwellings with heat and hot water from a central boiler house, or 'energy centre'. The system can provide heating or cooling which is transferred from the energy centre through a network of highly insulated pipes to each dwelling.	✓ Efficient use of fuel. ✓ Eliminates the need for gas to be installed.	✗ Relies upon the installation of nearby heat networks.	No - It has been determined that there are no existing or proposed heat networks/energy centres within a moderate radius from the development and there are no existing networks local to the site.
Solar Hot Water	The solar collector absorbs the radiant energy of the sun and converts it to heat energy for use as hot water in buildings.	✓ Feasible for small scale developments. ✓ Low maintenance.	✗ Panels ideally facing south at 30° tilt for optimum efficiency.	No - Solar thermal is not considered to be a technically feasible option for the buildings due to the expected low hot water demand.



Photovoltaics (PV)	PV panels harness solar thermal energy and convert it into electricity which can then be used within a building. The panels may be roof or floor mounted.	✓ Low maintenance. ✓ Easy to integrate into building design. ✓ Cost of PV is constantly dropping.	✗ Panels ideally facing south at 30° tilt for optimum efficiency. ✗ Overshadowing will reduce performance. ✗ Can require significant roof space.	Potentially – This technology is considered to be a feasible option for this site however, it is the developer's preference to secure a reduction in carbon emissions utilising heat pump technology.
Biomass Heating	Biomass boilers typically burn wood chips or pellets as fuel to provide space heating and hot water.	✓ Almost a carbon neutral technology.	✗ Frequent and large fuel deliveries. ✗ Large fuel store required. ✗ Regular maintenance. ✗ Air quality issues in urban areas.	No – This technology would be capable of delivering the target CO ₂ emission reductions but is considered inappropriate for this type of development due to the low water heating demand coupled with the need for a large fuel storage facility and frequent, large fuel deliveries combined with regular maintenance.
Wind	Wind generation equipment harness the wind to turn a propeller and in doing so, drive an alternator to generate electricity. The turbines may be pole or roof mounted.	✓ Low maintenance. ✓ Excess electricity can be exported to the grid. ✓ Vertical Axis Turbines able to operate at wind speeds as low as 2m/s.	✗ A wind speed of at least 6m/s is typically required for traditional turbines to operate efficiently. ✗ Visual and noise impact risk.	No – The NOABL wind speed database records a wind speed of approximately 4.7m/s at 10m above ground level for this site. In order to operate efficiently a wind speed of at least 6m/s is typically required.
Ground Source Heat Pumps (GSHP)	GSHPs collect low-grade heat from the ground to supply useful heat for space and water heating requirements by applying additional energy input (in the form of electricity).	✓ Flexible installation methods - vertical ground collector boreholes can be used when space is more limited. ✓ Can provide both heating and cooling as well as hot water.	✗ Full ground survey required to determine suitability/ geology. ✗ Large area required for horizontal ground collector loops. ✗ Prohibitive costs.	No – Such technology is considered unsuitable for this site due to prohibitive costs and technical complexity of installing the vertical ground collector boreholes within the site boundary.



Air Source Heat Pumps (ASHP)	ASHPs collect low-grade heat from the air to supply useful heat for space and water heating requirements by applying additional energy input (in the form of electricity).	✓ Highly efficient method of producing heat. ✓ Can provide both heating and cooling as well as hot water.	✗ Prohibitive costs. ✗ Internal and external unit space required. ✗ Potential noise issues from external plant.	Yes– This technology is suitable for this development and would ensure significant energy demand and emissions reductions for the buildings.
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5.5 Proposed Renewable Energy Solution

Air Source Heat Pumps

ASHP collect low-grade heat from the air to supply useful heat for space and water heating requirements. It is proposed that a split system, variable refrigerant flow (VRF) heat pump solution could be integrated within the design to meet the heating and cooling demands of the units. Split systems consist of an outdoor unit and an indoor unit. The outdoor unit is typically installed on the roof or exterior wall of building and houses the compressor, condenser coil and the expansion coil or capillary tubing. The indoor unit contains the cooling coil, a long blower and an air filter. This strategy would provide the following benefits:

- This approach will ensure a highly energy efficient heating system is provided from the heat pumps. This technology benefits from a low 'carbon footprint' due to the inherent efficiency of the heat pump process. It is a well-established technology with an anticipated long lifespan - with proper care they can be operational for up to 20 years;
- VRF systems continually adjust the flow of refrigerant from the outdoor condenser to each indoor evaporator. The control is achieved by continually varying the flow of refrigerant which responds to the demand from the indoor units by varying its compressor speed to match the total cooling and/or heating requirements. VRF systems offer a highly energy-efficient, modular energy strategy; and,
- There are no fuel storage issues associated with heat pumps.

5.6 Energy Performance Calculations

The enhanced building fabric specification throughout the scheme, plus efficient mechanical and electrical servicing allied to low-carbon technology will achieve compliance with the emission reduction targets stipulated by Building Regulation, Part L2A (2013).

5.6.1 Methodology

Approved SBEM software (Design Builder v6.7) has been used to calculate energy demand models for the proposed building.

The calculated Building Emission Rate reduction over Part L2A (2013) associated with the proposed specification for the proposed showroom unit is presented in Table 5.4.

Table 5.4 – Calculated Building Emission Rates

Building Emission Rate (kgCO ₂ /m ² /yr.)	25.9
Target Emission Rate (kgCO ₂ /m ² /yr.)	29.0
% BER Reduction over Part L 2013	11.7

The above calculations demonstrate that the Building Emission Rate (BER; carbon dioxide emissions) reductions for this scheme are expected to be at least 11% better than the Part L2A (2013) compliance requirements.

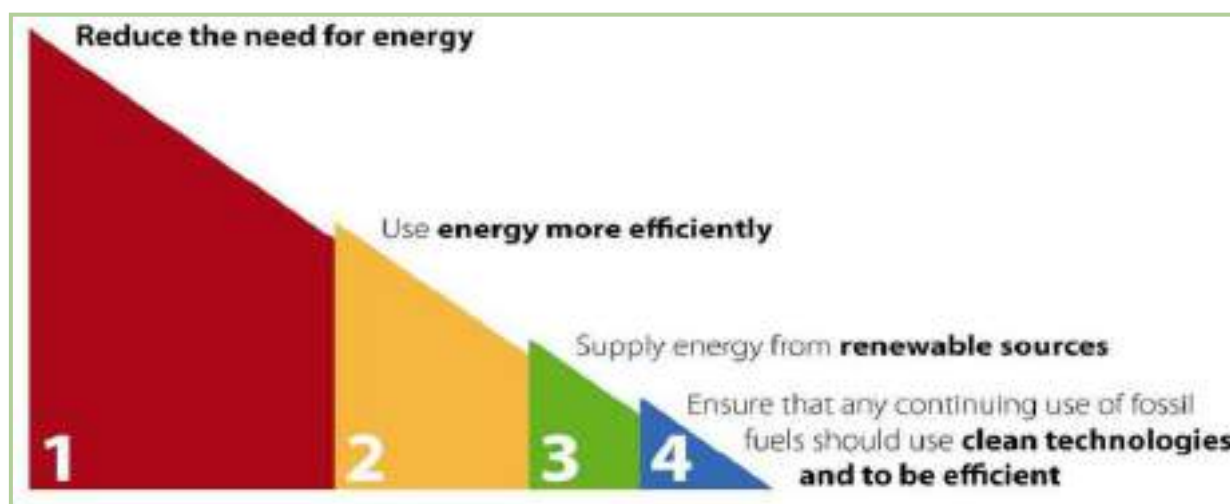


5.7 Energy Hierarchy

The scheme will incorporate an enhanced material specification along with high quality design and construction standards in order to improve energy efficiency through a 'fabric led' energy strategy. The proposed construction, design and specification will deliver a scheme that is inherently efficient and cost-effective during occupation.

The Energy Hierarchy provides a framework to guide energy policy and decision making to achieve practical and cost-effective carbon emission reduction strategies. The hierarchy prioritises demand-side activities to reduce wastage and improve efficiency (see Figure 5.2).

Figure 5.1 – The Energy Hierarchy



First Principle

The following efficiency measures are designed to reduce heat losses and minimise energy demand:

- This 'fabric led' approach to minimising energy demand and associated carbon dioxide emissions is aligned with the first principle of the Energy Hierarchy which states that reduction in energy demand should be achieved initially by energy efficiency. The buildings will be constructed with a material and design specification which exceeds minimum Building Regulation standards and includes numerous efficiency measures designed to reduce heat losses and minimise energy demand, including very good levels of insulation and low u values;
- The design air permeability target for the units is $5.0\text{m}^3/\text{hm}^2$ (@50Pa.). This air permeability target will minimise any uncontrolled ventilation and assist to limit heat loss through the structure of the build; and,
- The g value of the glazing within the extension will be optimised to control solar gain in the summer months and allow beneficial gains in the winter season so as to minimise the overheating risk and limit the heating energy demand within the buildings.

This approach to minimising energy demand and associated carbon dioxide emissions is aligned with the first principle of the Energy Hierarchy.



Second Principle

Combined heat and power technology does not form part of this energy strategy. As per the second principle of the Energy Hierarchy:

- Sophisticated control systems for the space and water heating will ensure that energy consumed by the units is used efficiently;
- Instantaneous hot water systems that avoid long water lines and reduce heat losses will service the commercial units; and,
- 100% LED provision and sophisticated control systems will be incorporated throughout the development. Photocell and automatic presence control of the lighting will be specified in order to further improve the efficiency of the lighting systems.

Third Principle

High efficiency heat pumps will supply heating and cooling on demand as per the third principle of the Energy Hierarchy.

Fourth Principle

This energy strategy will ensure that fossil fuels converted and distributed through the National Grid as electrical energy for heating purposes will also be consumed cleanly and efficiently. Furthermore, as the UK electricity grids' CO₂ footprint continues to decarbonise, so too would the carbon dioxide emissions associated with this proposed 'fully electric' building services energy strategy.

The development proposals are therefore aligned with the energy hierarchy promoted within Core Strategy Policy EN 4 and emerging GMSF Policy GM-S 2 Carbon and Energy.

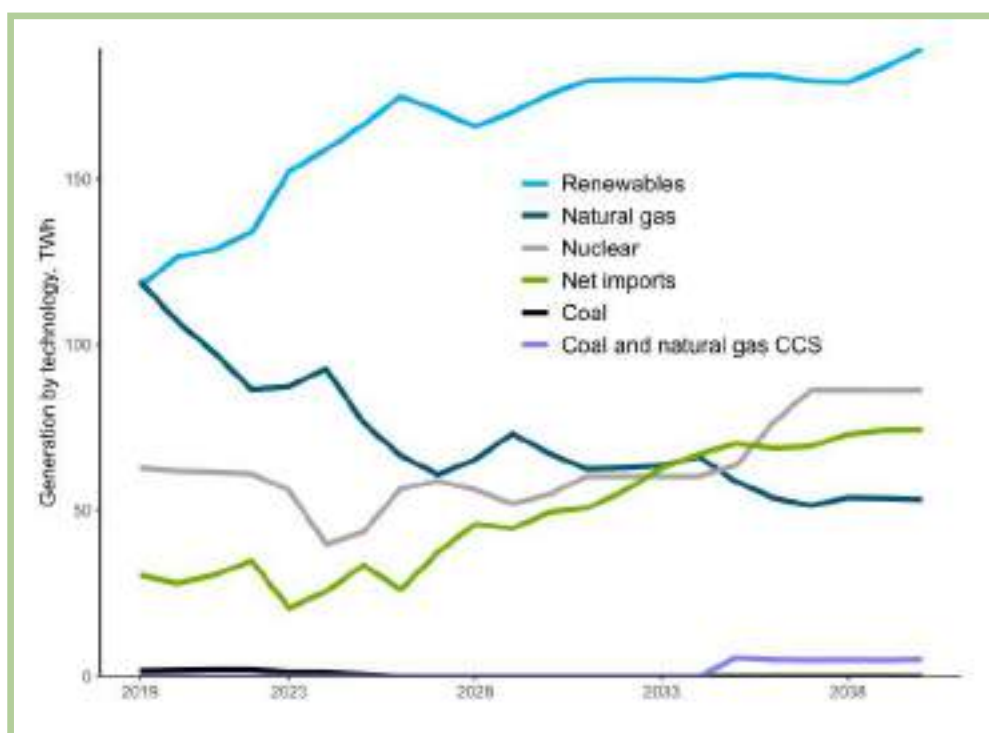


6. CLIMATE CHANGE EMERGENCY

A Climate Emergency was declared by Manchester City Council on 10th July 2019, with a target to make Manchester carbon neutral by 2038. In support of this, the developer wishes to highlight the following measures that will form part of the specification of this development:

- An energy strategy that delivers carbon dioxide emission reductions and renewable energy generation in line with the Energy Hierarchy;
 - A commitment is made to achieving at least 19% improvement in the Building Emission Rate (BER) relative to the current Part L2A (2013) compliance standard for units one, two and three. A commitment is also made to secure an 11% BER improvement for unit four;
 - The low carbon share of electricity generation is projected to rise to 83% by 2040. As the UK's electricity grid CO₂ footprint continues to reduce (see Figure 6.1 sourced from BEIS Energy and Emissions Projections 2019), so too will the carbon dioxide emissions associated with this 'fully electric' building services energy strategy.
 - This would not be the case if the building were heated from fossil fuels (for example, gas boilers and/or CHP); and,
 - ASHP will be utilised in the non-domestic units delivering high efficiency heating. Furthermore, 'full electric' strategies such as this supply electricity on demand, are 100% efficient, and only use what is required.

Figure 6.1 - Energy and Emissions Projections 2019 (BEIS)



- Unregulated energy demand (that is, the energy demand associated with electrical equipment) typically accounts for over half of the total carbon dioxide emissions from non-domestic developments such as this. To limit this:



- Any integrated white goods will have as a minimum an A+ energy rating; and,
 - A welcome pack will be provided to the building tenants to encourage selection of green energy providers to enable them to make informed decisions.
- Waste is a misuse of natural resources and also contributes a large proportion of the UK's carbon footprint;
 - Waste minimisation during construction will reduce raw materials demand, thereby reducing the building's embodied carbon footprint; and,
 - During occupation, the buildings will benefit from recycling facilities to enable the local authority waste reduction targets, diverting more materials away from landfill and reducing the occupant's carbon footprint further.
- The site's location will enable low carbon, sustainable lifestyles. Located minutes away from several bus stops and a railway station, building users have the option to utilise various sustainable modes of transport. This is facilitated by:
 - Basic infrastructure provided such as secure cycle storage on site;
 - Travel options, including local access to transport nodes for bus and rail; and,
 - Local amenities that are within easy walking distance of the site.
- The development will demonstrate resilience to potential climate change effects through the management of surface water:
 - This system will be designed such that the total peak run-off rates from the site will be reduced through the provision of SuDS, flow control techniques and surface water attenuation. The volume of surface water run-off will not exceed 2.5l/s; and,
 - The system will also be designed to withstand a 1 in a 100-year storm event plus a 30% allowance for climate change.
- The units are designed to incorporate features that will serve to reduce energy demand, and in turn, carbon emissions arising from access to the scheme:
 - The lighting provision will include active sensors; and,
 - The fit-out specification of the dwelling will seek to minimise water demand. Water efficiency measures such as dual flush toilets and flow restrictors will limit potable water demand. This will reduce water heating energy loads and also cut the process energy required to supply clean drinking water.

These commitments, in combination, seek to work towards the carbon reduction target of no more than 1.5°C global temperature increase and assist Manchester City Council in meeting their Climate Change Emergency objectives.



7. CONCLUSION

This statement has reviewed the environmental performance of the proposed development site at 804-806 Oldham Road, Manchester against national and local policies. The material specification and servicing strategy for the scheme and the building (carbon dioxide) emission rates have also been reviewed.

Energy Strategy –

Full compliance with the key criteria of the Manchester Core Strategy have been achieved by the proposed energy strategy while also taking MCC's declaration of a Climate Emergency into consideration and responding positively to the emerging GMSF Climate Change Framework criteria, as follows:

- The proposed energy strategy will incorporate a 'fabric led' material specification, along with high quality design and construction standards to improve the energy efficiency of the buildings.
- The development will be designed and specified in accordance with the principles of the Energy Hierarchy in line with the adopted Core Strategy Policy EN 4.
- The proposed scheme has been demonstrated to significantly improve upon the current Part L2A (2013) compliance standards in accordance with adopted Core Strategy Policy EN 4, EN6 and GMSF Policy GM-S 2:
 - High efficiency heat pumps will supply space heating and cooling for all units within the scheme.
 - This strategy, combined with a high-quality fabric and servicing design, will secure a 11% Building Emission Rate (BER) reduction over Part L2A

These proposals will deliver a scheme that is inherently efficient and cost-effective during occupation. As a consequence of the decarbonised status of the UK's electricity grid, the actual emissions are 45% lower than the current out-of-date carbon factors used for building regulation compliance purposes. In line with Manchester City Council's Climate Change Framework, this development will take advantage of the decarbonating status of the electricity grid with its full electric heating strategy, ultimately facilitating a 'near-zero' or zero carbon scheme, as the grid mix electricity supply is decarbonised over time.

Sustainability Performance -

The key issues of Manchester City Council's Supplementary Planning Document (Environmental Standards) in accordance with the Core Strategy Policy DM 1 have been achieved by the proposals. These are as follows:

- Water consumption of the development will be minimised through the specification of efficient water fixtures.
- The development site is located within Flood Risk Zone 1.
- Waste arising during construction and occupation/operation will be minimised. A site waste management plan will be adopted during construction and a comprehensive waste management plan for the site will accord with the local authority recycling scheme ensuring that adequately sized bin storage areas for the site are provided.



- Construction site management procedures will minimise adverse impacts on the environment and control pollution generated during the construction phase. These include a waste management strategy to reduce the quantity of waste generated, and to increase re-use and recycling of materials. A commitment will be made to minimise waste and pollution.
- The impact of sound associated with the development will be mitigated by the design/specification of the building. Sound insulation will be specified to comply with acoustic performance compliance standards, and mitigation measures will be implemented, where required, to reduce the noise arising from the development.
- The landscaping scheme is minimal, however the development will provide an opportunity to provide an enhancement to the aesthetic and ecological value of the site. The landscaping scheme could be designed to attract wildlife by including biodiversity enhancing measures such as bird and bat boxes.
- Materials will be responsibly sourced and materials with low environmental impact will be selected and local suppliers will be prioritised. In combination, this procurement strategy will minimise and conserve energy and thus carbon emissions associated with transportation and waste generation. This meets the council's objectives in addressing the recently declared Climate Emergency.
- The site is located in a highly sustainable location with basic facilities all within easy walking distance of the site. Therefore, reliance upon traditional methods of transport such as the car will be reduced.

Furthermore, the proposals accord with the aims of the National Planning Policy Framework, as follows:

- Construction practices that minimise adverse impacts on the environment will be adhered to including a waste management strategy to reduce the quantity of waste generated, and to increase re-use and recycling, a commitment will be made to minimise waste and pollution; and,
- The development will significantly improve upon the regulatory compliance criteria of Building Regulation Part L2A and will assist in mitigating the impact of climate change and its environmental impact.

In conclusion, the proposals reviewed within this statement for the commercial scheme at Oldham Road, Manchester will accord with the guidance provided within the Manchester City Council's adopted and emerging policies.



APPENDIX A – SBEM BRUKL



Project name

Building 1

As designed

Date: Mon Nov 08 09:31:13 2021

Administrative information

Building Details

Address: 804 - 806 Oldham Road, Manchester, M1

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.6.b.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v6.1.8

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: Colin Sowerbutts

Telephone number: 07415 922970

Address: , ,

Criterion 1: The calculated CO₂ emission rate for the building must not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	29
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	29
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	25.9
Are emissions from the building less than or equal to the target?	BER ≤ TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _{a-Limit}	U _{a-Calc}	U _{i-Calc}	Surface where the maximum value occurs*
Wall**	0.35	0.27	0.27	"Block 3 - Store_W_3"
Floor	0.25	0.18	0.18	"Block 3 - Store_S_5"
Roof	0.25	0.16	0.16	"Block 3 - Store_R_14"
Windows***, roof windows, and rooflights	2.2	1.4	1.4	"Block 3 - Store_G_4"
Personnel doors	2.2	1.4	1.4	"Block 3 - Store_D_8"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

U_{a-Limit} = Limiting area-weighted average U-values [W/(m²K)]U_{a-Calc} = Calculated area-weighted average U-values [W/(m²K)]U_{i-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
m ³ /(h.m ²) at 50 Pa	10	5

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- ASHP

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.5	3	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

1- Elite HW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
Standard value	1	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]										HR efficiency	
	ID of system type	A	B	C	D	E	F	G	H	I	Zone	Standard
	Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1		
Block 3 - F Toilet		0.3	-	-	-	-	-	-	-	-	-	N/A
Block 3 - M Toilet		0.3	-	-	-	-	-	-	-	-	-	N/A

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
	Luminaire	Lamp	Display lamp	
	Standard value	60	60	22
Block 3 - Store		90	-	105
Block 3 - F Toilet		-	90	28
Block 3 - M Toilet		-	90	16
Block 3 - Reception		-	90	50
Block 3 - Showroom		-	90	50

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Block 3 - Store	NO (-22.4%)	YES
Block 3 - F Toilet	N/A	N/A
Block 3 - M Toilet	N/A	N/A
Block 3 - Reception	NO (-3.6%)	YES
Block 3 - Showroom	NO (-1.4%)	YES

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	178.7	178.7
External area [m ²]	697.6	697.6
Weather	MAN	MAN
Infiltration [m ³ /hm ² @ 50Pa]	5	5
Average conductance [W/K]	290.2	227.06
Average U-value [W/m ² K]	0.42	0.33
Alpha value* [%]	16.62	12.87

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

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
77	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
23	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	27.12	31.45
Cooling	8.65	4.98
Auxiliary	0.26	0.35
Lighting	13.65	20.28
Hot water	0.25	0.29
Equipment*	4.92	4.92
TOTAL**	49.94	57.34

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

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

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	384.76	339.57
Primary energy* [kWh/m ²]	153.31	171.08
Total emissions [kg/m ²]	25.9	29

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

HVAC Systems Performance

System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity									
Actual	318.4	66.4	27.1	8.7	0.3	3.26	2.13	3.5	3
Notional	275.1	64.5	31.4	5	0.3	2.43	3.6	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.27	"Block 3 - Store_W_3"
Floor	0.2	0.18	"Block 3 - Store_S_5"
Roof	0.15	0.16	"Block 3 - Store_R_14"
Windows, roof windows, and rooflights	1.5	1.4	"Block 3 - Store_G_4"
Personnel doors	1.5	1.4	"Block 3 - Store_D_8"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{i-Typ} = Typical individual element U-values [W/(m²K)]		U _{i-Min} = Minimum individual element U-values [W/(m²K)]	
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	5