

**Post-completion Energy and Environmental
Standards Statement**

Ref: Z47744A

**Kampus – Listed Buildings,
Aytoun Street,
Manchester**

for

TUV SUD



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Document Status - Final

Reference: Z47744A			Date
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1.0 Introduction

This Energy and Environmental Standards Statement (EESS) has been prepared to demonstrate how the completed development relates to the environmental standards defined in Manchester City Council's (MCC) Guide to Development in Manchester, Supplementary Planning Document and Planning Guidance Adopted April 2007 and the objectives in the adopted Core Strategy Development Plan Document 2012.

This document also incorporates an Energy Statement for the development (Section 4) detailing the energy saving and efficiency measures incorporated within the completed development, based on the post-construction information available.

The Environmental Standards Statement and Energy Statement, both planning validation requirements, have been combined into this single document.

This report should be read in conjunction with the full suite of supporting documents and drawings that form the As-built installation.

Our approach has been to influence the building design and equipment selection to ensure a low energy demand and high levels of energy efficiency. The priority has been to reach the optimum energy efficiency before considering the provision of on-site zero / low carbon technologies / district solutions.

Our approach has utilised sustainability in a holistic methodology to embed the following key environmental principals into the development:

- Energy Efficiency
- Renewable Energy
- Environmental Design
- Water Management and Weather Resilience
- Waste Management
- Biodiversity
- Waterways

2.0 Outline Project Information

2.1 Project Description

This report has been prepared for the Kampus listed buildings development which consists of the conversion and reuse of the two Grade II Listed Buildings; Minshull House and the Minto and Turner Building. The development is residential led, though mixed use, and will deliver 58 residential units and commercial floorspace at ground and lower ground floor, landscaping and public realm improvements.

The site is located between Chorlton Street and the Rochdale Canal and existing buildings of the former Manchester Metropolitan University Aytoun Street Campus.

A number of commercial retail units have been provided as part of the development. The retail units have been constructed to a shell standard for future fit out by the occupiers.

3.0 Environmental Standards

3.1 Environmental Design

The design for the Kampus development applies a wide range of environmental design principles and achieves high levels of fabric energy efficiency and water efficiency, as described throughout this EESS.

As detailed, the CSH has been withdrawn. This means that Policy DM 1 of the Manchester Core Strategy which required new residential dwellings to meet CSH Level 4, subject to viability, has been superseded.

The strategy for reducing energy consumption within the development has followed the energy hierarchy below.

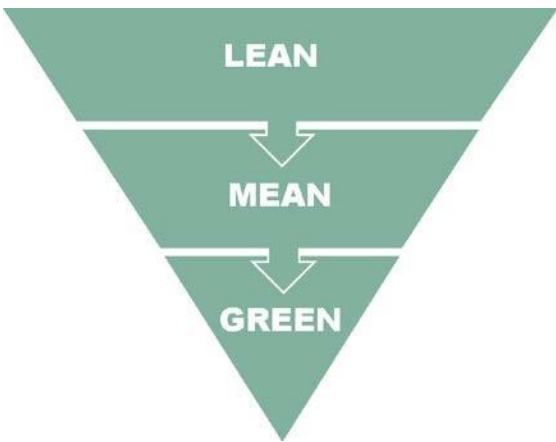


Figure 1.0 Energy Hierarchy

Energy consumption and carbon emissions arising from building operation represents a substantial and dominant portion of the total building environmental footprint. Therefore, minimising energy demand and carbon emissions represent the core environment and sustainability strategies.

Detailed consideration of efficiency measures and their deployment within the design also fosters a deeper knowledge and understanding of the energy performance of a building. This knowledge and understanding is the fundamental starting point for the development of a renewable energy strategy to meet the demand.

3.2 Lean – Building Passive Measures

3.2.1 Reducing Energy demands and driving energy efficiency

The passive design measures included for the development are as follows:

- Solar shading
- Glazing selection

3.3 **Mean – High Efficiency Systems, Plant and Controls**

High efficiency systems, plant, controls and equipment have been incorporated.

Internal lighting within the apartments and any external lighting and lighting within communal space has been provided through the use of energy efficient LED lighting.

The lighting scheme within the commercial retail space will be developed by the tenant and as such the design team are not able to confirm energy reduction measures proposed associated with lighting and lighting controls. The fit-out will be designed to comply with the listed building conservation requirements, and where possible meet the criterion within Part L2B 2013. A large percentage of the carbon emission comes from the lighting installation and therefore it is unlikely that the fit-out scheme will not include low energy light fittings.

As part of the energy reduction strategy the apartments include mechanical ventilation with heat recovery. The ventilation system chosen has a low specific fan power to minimise the energy required by the fans. The heat recovery minimises energy being lost through exhaust air. This approach ensures a consistent ventilation provision all year round irrespective of external conditions.

Sanitaryware has been selected to minimise water use within the apartments. Dual flush WCs, Low flow showers and taps, and small capacity baths have been installed.

Heating zones – each apartment is a separately metered and controlled zone to ensure specific areas can run, without requiring unoccupied spaces to be operated unnecessarily.

Lighting controls – lighting controls have been provided to communal / landlord’s areas utilising presence detectors wherever practical. Manual override has also been incorporated where appropriate.

3.4 **Renewable Energy**

The buildings have been connected to the central Energy Centre for the combined new build and listed buildings development. The CHP and boilers within the energy centre combine to provide Low Carbon energy to heat the buildings. The LTHW supply from the Energy Centre is routed via a Plate Heat Exchanger and distributed around the Listed Buildings to serve radiators in each area.

3.5 **Water Management**

Cold water is stored in another block on the development then a Boosted Cold Water Supply (BCWS) is distributed to each individual apartment where a water meter is installed, this metering system is monitored and forms part of the residential letting usage strategy. Any ancillary areas such as bin stores, irrigation or window washing supplies are also metred on the BMS system.

Any leaks would be quickly detected as all metering is live and available on ether the BMS head end or the ISTA metering platform.

Water use in the development has been minimised by flow reduction and usage controls. The measures detailed below are included in the installation.

These measures have resulted in significant savings in water use (as demonstrated by the Part G Water Efficiency calculations) and reduce the annual cost of water for the building.

Water Use – Measures included in the design	
Area	Measures
Flow Reduction	Low water capacity WC’s and flushing units
	Low flow taps
	Low flow showers
	Low water consumption white goods
Controls	Dual flush WCs
	User operated
	BMS monitored water metering for all uses

3.5.1 **Landscape**

The character of Little David Street has been preserved. The existing cobbles had to be replaced as they were contaminated, however reclaimed cobbles were installed in their place.

The green spaces/soft landscaping area within Chorlton Square will provide an area of permeable surface, enabling the interception, filtration and absorption of rainwater, coupled with the moderation of runoff.

These habitats store rainwater through the plants and substrate, and releases water back into the atmosphere through evapotranspiration.

Water use within the landscape strategy has been minimised through a combination of good practice design and the specification of planting that relies solely on precipitation, during all seasons of the year or restricted to contextually appropriate species that thrive without irrigation and will continue to do so in those conditions likely as a result of climate change, i.e. typically warmer and drier conditions.

3.5.2 **Flood Risk**

A site-specific Flood Risk Assessment (FRA) has been conducted to determine the potential risk of flooding from all sources. This data has been used to inform the design and create an appropriately flood resilient and resistant development.

The EA Flood Map for Planning has confirmed that the Site is within Flood Zone 1. Based on the flood zone extents identified on the EA map for Risk of Flooding from Rivers and Sea, the risk of flooding to the proposed development from rivers is considered to be very low. The Site is located in an area of low susceptibility to groundwater flooding.

The EA website Flood Risk map showing Risk of Flooding from Surface Water indicates that there is a low to medium risk of surface flooding which appears to be associated with the Rochdale Canal which forms the northern boundary of the Site. Although CaRT have confirmed two overtopping events upstream of the Site the SFRA “Canal

Hazard Zones” map indicates that the Site is not at risk of breach or overtopping. Based on the available information, it is considered that the probability of the Site flooding from most sources is low.

The Site is considered to be at low risk of flooding from all sources (except surface water flooding possibly associated with the Rochdale Canal). As the buildings are existing and listed the scope for changing levels to provide additional flood protection is limited. However, finished external levels have been engineered to ensure falls are away from buildings and building access points as demonstrated by the Buro Happold Flood Routing drawing. The risk of accumulation of standing water against the buildings has therefore been minimised.

As there appears to be a risk of flooding associated with surface water flows within the canal finished external levels have been engineered to provide containment where possible, and where not possible, levels ensure that surface water is directed away from the existing and proposed buildings, whilst ensuring the ultimate flood route does not cause flooding of buildings off site.

3.6 Waste Management

Secure refuse stores have been designated for residential waste only. Commercial waste is proposed to be kept with each unit demise. Residential bins will be moved on collection day by on-site management staff to a designated area located on Chorlton Street.

Commercial waste will be off street collection in line with guidance from Manchester City Council and taken out by individuals unit tenants.

The total quantity of residential storage has been calculated from guidance provided in Manchester City Councils document ‘GD04 Waste Storage and Collection Guidance for New Developments V2.00 -0 Citywide Support - Environmental Protection (September 2014)’. Compliance with this Waste Strategy by the completed development has ensured that there is sufficient waste storage areas across the development to enable residents to segregate their recyclables and waste, and provide appropriate access for refuse collection vehicles (RCVs).

All refuse stores are naturally ventilated.

3.6.1 Waste in Use

Residents are able to easily transport waste to the ground floor stores via lifts. Refuse storage within apartments will encourage residents to recycle waste and store general waste temporarily until it is transferred to the central recycling and waste storage area. Each residential property has included space for a 5-litre kitchen caddy.

All refuse stores have been designed to be accessible internally via the entrance lobby by residents and via management staff to provide direct routes to the designated collection point.

3.7 Construction Management

3.7.1 Demolition and Construction

A dedicated Resource Management Plan (RMP) has been developed covering the non-hazardous waste related to on-site construction and dedicated off-site manufacture or fabrication (including demolition and excavation waste) generated by the building’s design and construction. This RMP has taken the form of a detailed Site Waste Management Plan (SWMP) covering all phases and has been designed to not only monitor and record, but to manage, inform and benchmark the developments waste performance. The SWMP is a contractor operated system and enabled live analysis of the developments waste performance throughout construction.

The contents of the final plan are outlined below;

1. Revision records and Contractor Team Responsibility

2. Overview of SWMP

- Waste Hierarchy
 - Project Stage and Project Planning Actions
 - Site Operations and Post-completion Actions
 - Pre-start Estimate and Benchmarking
 - Identified Waste Generated
 - Site Operations Waste Streams
3. Introduction, Updating the Plan and Duties
4. Project Description
5. Total Gross Development Area
6. Estimate of Types and Quantities of Waste
- a Demolition Waste
 - b Excavation Waste
 - c Construction Waste
 - d Guide to European Waste Codes
7. Management of Waste
- a Waste Control and Disposal
 - b Reduce and Reuse Measures
 - c Recycle / Recover Measures
 - d All other waste
 - e Disposal Responsibilities
 - f Management of Hazardous Waste
8. Waste Carrier Details and Disposers
9. Record of Waste Removed / Recycled
10. Post Contract Review
- a Estimate of Cost Saving
 - b Explanation of any deviation from the original plan
 - c Post Project Waste Figures

Any and all non-hazardous waste related to on-site construction and dedicated off-site manufacture or fabrication (including demolition and excavation waste) generated by the building’s design and construction has been minimised.

In order that the waste targets have been met, all waste materials have been sorted into separate key waste groups (according to the waste streams generated by the scope of the works) either on-site or through a licensed contractor for recovery.



Figure 2.0 Waste Hierarchy

3.7.2 Construction site environmental management

The principal contractor registered the site with the Considerate Constructor Scheme (CCS) and has completed the works in accordance with the standard. Sites registered with CCS are monitored against a Code of Considerate Practice, designed to encourage best practice beyond statutory requirements. The Considerate Constructors Scheme aims to minimise waste, reduce a developments carbon footprint, ensure a good relationship with neighbours and maximise resource usage.

During construction, best practice measures have been implemented to minimise potential impacts to sensitive local receptors resulting from emissions to air and water, noise and vibration and from site lighting. The development has achieved a ‘Performance Beyond Compliance’ certificate.

The principal contractor has monitored and recorded energy use, water consumption and transport data resulting from all on-site construction processes and dedicated off-site monitoring throughout the build programme to manage, inform and benchmark the developments construction process. This level of monitoring has enabled the contractor to minimise consumption and maximise resource use.

3.7.3 Reuse of Materials from the Strip-out or Partial Demolition

Due to the nature of the refurbishment process, there is an opportunity to recycle much of the material on site. To determine the viability of this approach, a pre-refurbishment audit of all existing buildings, structures or hard surfaces within the scope of the refurbishment or fit-out zone was completed to determine if, in the case of any demolition, reuse is feasible and, if not, to maximise the recovery of material from refurbishment for subsequent high grade/value applications.

The majority of structure and internal masonry walls have been retained with any other strip out sent via specialist waste contractors to be recycled off site. The external fire escape stairs were also retained and repaired where required. None of the other existing material stripped out was of sufficient standard to be reused on site.

3.8 Biodiversity

A full ecological appraisal of the site has been carried out. This is written up and submitted as part of the planning application documents.

Ecology is vital to creating a more sustainable, greener and pleasant development. Plants provide a wealth of benefits, improving the micro-climate, air and water quality, increasing biodiversity and enhancing the visual and amenity value of the landscape. Plants also humanise urban spaces and provide a natural seasonal sense of time.

Biodiversity and green infrastructure are key to the Minto and Turner Building and Minshull House development. The scheme aims to protect existing species, enhance the ecological value of the site and has a rich variety in vegetation to emphasize the different atmospheres.

The planting provided includes species of varying heights that considers the entire lifecycle of bees and butterflies, to provide breeding places and a succession of food, it focuses where possible on nectar rich and burying species to support wildlife. Where possible native species have been planted.

3.8.1 Protection

All existing features of ecological value surrounding the construction zone and site boundary area have been adequately protected from damage during clearance, site preparation and construction activities.

The principal contractor constructed ecological protection prior to any preliminary site construction or preparation works (e.g. clearing of the site and erection of temporary site facilities). All flora habitats that existed on site have been protected by the contractor through appropriate programming of site works to minimise disturbance to wildlife.

Pollution prevention guidelines produced by the Environment Agency have been followed (as demonstrated by the Mount Anvil Environmental Management Plan) to ensure that botanical species of nature conservation interest located in the canal system were not impacted.

3.8.2 Ecological Features

A new ecologically valuable habitat, appropriate to the local area (preferably of local provenance), has been created that supports important biodiversity in line with the Government’s planning policies for England and Wales. Policies that relate to conserving and enhancing the natural environment include ‘minimising impacts on biodiversity and providing net gains in biodiversity where possible, contributing to the Government’s commitment to halt the overall decline in biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures’.

Introduced trees/planting will be maintained and managed as part of the overall scheme strategy and incorporated in the habitat management plan.

3.9 Waterways and Drainage

The nearest open watercourse to the Site is the River Medlock c. 350 m to the southwest of the Site, which is designated as Main River. Due to the distance, existing buildings and infrastructure, a direct connection to the watercourse is not considered viable.

The ‘Shooters Brook’ is located within the vicinity of the site but is outside the site boundary and is indicated as being 600 mm diameter clay pipes. Additionally, the Dukes Tunnel is present within the vicinity of the site but also outside the site boundary. It is understood that both of these features are hydraulically connected to the River Medlock. It is confirmed that there are no known existing connections from the site to either the Brook or the tunnel that can be utilised for development of the scheme. The Listed Buildings do not currently discharge to these features, however as there is no increase in impermeable area there will be no additional water discharged from the site. Therefore, there is no increased risk of flooding either on the site or elsewhere in the wider catchment.

The northern boundary to the site is formed by the Rochdale Canal which is understood to be subject to surface flooding. No connections exist to the Canal and as a result it is considered additional flows from the site to the Canal could increase the risk of flooding.

CCTV survey information has shown the site to discharge surface water to the existing public sewers in the vicinity of the site. Given the above the existing connections have been maintained for the development of the Kampus Site.

3.9.1 Surface Water Discharge Control & Attenuation Storage

The Site was originally entirely formed from impermeable surfaces and no additional impermeable areas were added to the scheme. Due to the constraints of the Site (the existing listed buildings, existing and proposed utilities) there is no available space for the inclusion of attenuation to reduce surface water flow rates and provide a betterment to the existing sewers. As such, attenuation and reduced flow rates from these buildings are not considered viable and the existing regime of unrestricted flows to the existing sewers has been utilised.

3.9.2 Water Treatment and Quality

Surface water run-off can contain contaminants such as oil, organic matter and toxic metals. These pollutants, even at low levels, can have a cumulative impact upon water quality. This affects biodiversity, amenity value and in some cases potential water abstraction value. The quality of surface water run-off is a particular issue for small rainfall events which is due to the flush of debris and sediment from paved surfaces being 'washed off' in the first part of the event together with sediment deposits in the pipe network. This is compounded by the fact that this highly concentrated initial flow enters the receiving water at base flow conditions, thus providing a minimum level of dilution.

Although the Site includes Little David Street, it is not envisaged that this will be utilised for parking. As such oil separators are not envisaged due to the limited potential for pollution. Little David Street is also the only available outdoor space on the site and has no potential for the inclusion of an interceptor due to the existing and proposed utilities.

3.9.3 Foul Drainage Strategy

Foul water disposal is in accordance with the Building Regulations Part H 2002.

During discussions with the Water Authority, UU confirmed that "Foul will be allowed to drain to the public combined sewer network at an unrestricted rate. The connection to the public sewer can be at a point convenient to yourself".

Disposal has been to the public combined sewers using existing connections present on Site. These existing connections have been utilised to reduce the extent of off-site works and gaining approval for new connections to the existing sewer system, avoiding disruption to existing traffic on the busy highways infrastructure and also to reduce health and safety issues associated with connecting the existing deep drainage.

3.10 Reuse of Existing Building and Materials

There are significant benefits when reusing an existing building and associated materials from an environmental perspective. These benefits include the cutting of embodied carbon (greenhouse gas (GHG) emissions) that arise from the energy and industrial processes used in the extraction of raw materials, processing, manufacture and delivery of the materials, products and components required to construct a building.

The reuse of existing structures and associated materials enables a development to reduce the volume of waste materials including packaging sent to landfill. Landfilled waste is particularly harmful to the environment through the release of methane gas emissions, and to human health via highly toxic leachate.

The reuse of onsite materials and the procurement of locally sourced material has a direct effect on the volume of transport within the vicinity of the development and on the wider transport infrastructure.

4.0 Energy Statement

Policy EN 6 of the Manchester Core Strategy requires that developers prepare an Energy Statement. Although the emissions targets contained within this policy have now been superseded, this Energy Statement has been prepared in order to demonstrate the total regulated energy that the completed development is predicted to use and the associated carbon emissions.

It should be noted that under Building Regulations Part L1B 2013, listed buildings and buildings in conservation areas are exempt from the energy efficiency requirements (see 4.2).

Following the publication of the Ministerial Statement setting out the conclusion of the Housing Standards Review, the Government's policy is that local authorities can continue to set and apply performance policies related to energy and CO₂ emissions that exceed Building Regulations (though not exceeding CSH Level 4) where they have referenced the Code for Sustainable Homes in policy. Given that MCC has existing policies in place, they are able to apply this interim measure which corresponds to an approximate 25% reduction in CO₂ emissions compared with the requirements of Part L (2010). However, as was the case with policies EN 6 and DM 1, MCC are likely to continue to consider the impact on viability so as not to unnecessarily stall or otherwise stifle development.

Appendix A of the Manchester Core Strategy provides a guide to assist in completing the Energy Statement and sets out the methodology that should be followed. This consists of the following steps:

1. Set out baseline information including proposed uses and floor space.
2. Calculate regulated energy demand and associated CO₂ emissions of completed development assuming only compliance with Part L.
3. Apply the appropriate emissions reduction target.
4. Apply the energy hierarchy to identify opportunities to design out energy consumption and emissions and set out reductions achieved by each measure.
5. Consider appropriate low carbon, renewable or decentralised technologies.
6. Assessment of least cost option of meeting the reduction target.

This section provides information in relation to these steps for proposed Kampus development.

4.1 Development information

The proposed new Kampus development comprises of the conversion of two vacant listed buildings to create 58 apartments and c1,300 sq.m of commercial floor space, divided into a number of small retail units. The retail units will be constructed to a shell standard for future fit out by the occupiers.

4.2 Building Regulations

The Manchester Core Strategy Policy EN 6 requires that domestic developments of above 10 units achieve at least a 15% improvement over the emissions reduction required by Part L (2010), equivalent to a 9% improvement over Part L (2013).

As stated in the Building Regulations Part L1B, listed buildings and buildings in conservation areas are exempt from the energy efficiency requirements where compliance would unacceptably alter their character or appearance.

The Approved Document states: “the aim should be to improve energy efficiency as far as is reasonably practical. The work should not prejudice the character of the host building or increase the risk of long-term deterioration of the building fabric or fittings.”

Consequential improvements have been undertaken to make the existing buildings more energy efficient where possible. As stated in the Building Regulations Part L1B, improvements have been carried out to the extent that they are technically, functionally and economically feasible. This includes fabric improvements and connection to the Energy Centre to make use of Low Carbon Technology, i.e. CHP.

Due to the listed status of the development, limitations on fabric improvements mean it is not feasible to meet the requirements of Building Regulations Part L1B, 2013 ‘Conservation of fuel and power in existing dwellings’, however, energy efficiency has been maximised as far as practicable within these constraints.

4.2.1 Criterion 1 ‘Achieving the TER and TFEE rate’

As discussed in section 4.2, listed buildings are not required to achieve criterion 1 where the alterations would unacceptably alter the character or appearance of the listed elements. However, SAP calculations have been undertaken to minimise the CO₂ emissions associated with the dwelling’s usage. The strategy includes:

- Improved U-values over the allowable values stated within Building Regulations Part L1B for all elements but the existing walls which are listed.
- The use of high efficiency low energy lighting.
- Heat recovery on whole house ventilation systems.
- The use of CHP technology by utilising the Energy Centre to provide space heating and Domestic Hot Water.

4.2.2 Criterion 2 ‘Limits on design flexibility’

The fabric parameters proposed within the dwellings have, where possible met the threshold values or bettered the improved U-values as set out in Building Regulations Part L1B. Reasonable provision has been to upgrade those thermal elements whose U-value is worse than the threshold value in column (a) of the following table to achieve the U-values given in column (b) of the following for all elements except the external walls which are protected by listed building status.

Building Element	a. Threshold U-value W/(m ² ·K)	b. Improved U-value W/(m ² ·K)
Wall – Listed Building Status	0.70	2.10 (as existing)
Wall – Upgraded	0.70	0.18
Floor	0.22	0.17-0.25
Pitched roof	0.35	0.18
Flat roof or roof with integral insulation	0.35	0.18
Windows	1.80	1.30-1.80

Each fixed building service meets or exceeds the minimum acceptable value as set out in the Domestic Building Services Compliance Guide.

4.2.3 Criterion 3 ‘Limiting the effects of heat gains in summer’

The façade of each block has been optimised where this does not conflict with the listed building status to enable the use of natural daylight. Solar gains are beneficial in winter to offset demand for heating however, they can also contribute to overheating in summer. The SAP calculations indicate the risk of overheating.

4.2.4 Criterion 4 ‘Building performance consistent with DER and DFEE rate’

‘As built’ SAP calculations have been carried out to determine the dwelling emission rate and dwelling fabric energy efficiency.

4.2.5 Criterion 5 ‘Provisions for energy-efficient operation of the dwelling’

Upon completion operating and maintenance instructions aimed at assisting the occupiers of the dwelling achieve the expected level of energy efficiency have been provided.

4.3 Code for Sustainable Homes

Within Manchester City Council’s Core Strategy there is a requirement for new housing developments to be assessed under The Code for Sustainable Homes.

On the 25th March 2015 a written Ministerial Statement was issued which sets out the conclusions to the government’s Housing Standards Review associated with the withdrawal of the Code for Sustainable Homes Assessment Methodology. The Ministerial Statement also notes that planning consents can no longer dictate compliance with the Code for Sustainable Homes.

4.4 Manchester City Council Core Strategy

The Manchester Core Strategy 2012 to 2027 includes specific policies designed to reduce CO₂ emissions. The policies applicable to the proposed development are:

- Policy EN 4 ‘Reducing CO₂ Emissions by Enabling Low and Zero Carbon Development’
- Policy EN 6 ‘Target Framework for CO₂ reductions from low or zero carbon energy supplies’

Policy EN 4 aims to reduce fuel poverty and decouple growth in the economy, growth in CO₂ emissions, and rising fossil fuel prices.

All developments 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 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 retrofit projects will be required to connect to and/or make contributions to low or zero carbon energy schemes and/or to incorporate provision to enable future connection to any existing / potential decentralised energy schemes.

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

4.4.1 Compliance with Policy EN 4 ‘Reducing CO₂ Emissions by Enabling Low and Zero Carbon Development’

The development has complied with the requirements of Policy EN 4 by;

- Minimised the use of artificial lighting through the design of the façade.
- Reduced the heating demand of the dwellings by utilising an enhanced building envelope.
- Reduced the electrical demand of the dwellings through the use of low energy LED light fittings.
- Included Low carbon technology within the heating system by connecting to the Energy Centre.

4.4.2 Compliance with Policy EN 6 ‘Target Framework for CO₂ reductions from low or zero carbon energy supplies’

In accordance with the Part L exemption for listed buildings, where technically, functionally and economically feasible the development will comply with the requirements of Policy EN 6. Connecting to the Energy Centre to provide Heating and Domestic Hot Water to the buildings has enabled the inclusion of Low Carbon technology.

5.0 Renewable Energy

The viability and potential for low carbon technologies has been considered for the development with discussions required with the electricity supply authority and confirmation of the developments base electrical and thermal demand through modelling. The use of central, gas-fired CHP plant from the Energy Centre, with radiators and heat interface units providing space heating and domestic hot water have been included.

The feasibility of different renewable or low carbon technologies was considered from the outset of design as there are various benefits and disadvantages for each technology. The site and usage of the occupants was included within the feasibility study and the findings are outlined below:

5.1.1 Wind Power

Small scale wind turbines can be used to generate electricity for individual dwellings. Wind turbines harness the power of the wind and use it to generate electricity.

Pros	Cons
Wind turbines are eligible for the feed-in tariff and therefore the homeowner will receive an income from generating electricity.	The recommended average wind speed required to make the technology viable for installation is in excess of 5 – 6 m/s. The average wind speed on the site is 4.4 which is below the recommended minimum for turbine installation.
Wind turbines will reduce the dwellings carbon emissions.	Turbines generate noise when in operation. This is not desirable for residential locations.
	Turbines have moving parts and therefore require more maintenance than other renewable technologies.

The technology is not feasible for use within the development due to insufficient wind speed in the area, noise generation and aesthetics.

5.1.2 Photovoltaic Arrays (PV)

PVs are used to generate electricity directly from sunlight. The electricity generated can be used within the dwelling or exported back to the grid.

Pros	Cons
Reduce carbon emissions and electricity bills.	Relatively high capital expenditure.
Eligible for the Feed-in tariff and therefore the homeowner will receive an income for generating electricity.	Solar PV only generates electricity when the sun is shining. For residential properties, while occupants are not within the dwelling during daytime, the electricity will be exported to the grid. Grid exported electricity receives a lower rate under the feed-in tariff and therefore the payback period for the PV array increases.
PV panels have no mechanically moving parts and consequently they require far less maintenance than other renewable technologies.	Overshadowing from the surrounding taller buildings will limit the efficiency of the PV cells.
PV panels are silent and therefore are the preferred solution for urban areas and for residential applications.	
Easy to install.	

The use of PV is a viable option for a development of this type, however the orientation of the roof and overshadowing by surrounding buildings make it unviable.

5.1.3 Solar Water Heating

The process of solar water heating involves the absorption of the sun’s radiation by collectors, via a fluid (usually water and/or antifreeze), and the transfer of the heat to a hot water storage tank. This is then made available through the building’s hot water system.

Pros	Cons
Solar collectors used for heating are a mature technology offering a high energy contribution.	External area required for locating the solar collectors. These would be sited on the roof and Would have a visual impact.
Solar system can easily store thermal energy by use of storage tanks and use it when it is required.	Relatively high capital expenditure.
A typical system will provide virtually all the hot water required by the dwelling in the summer but only around 50% of the annual hot water demand.	Additional plant space required within the dwelling for the storage tank, in addition to the space required for the boiler.
	Additional maintenance is required for the pumps.

Solar hot water heating is not proposed for use within the dwellings as the proposed design does not allow for accommodating hot water storage and overshadowing by surrounding buildings make it unviable.

5.1.4 Biomass Heating

Biomass, also known as bio fuels or bio energy, is obtained from organic matter, either directly from plants or indirectly from industrial, commercial, domestic or agricultural products.

Pros	Cons
The use of biomass is generally classed as a ‘carbon-neutral’ process because the carbon dioxide released during the generation of energy is balanced by that absorbed by plants during their growth.	Space is required for storing fuel.
	High capital expenditure
	Availability of biomass fuel local to the development would need to be established.
	Increased maintenance requirements over conventional systems.
	A back-up boiler would be required in case of fuel shortage.
	High biomass fuel costs

The technology is not considered viable for use within the dwellings due to space required for additional plant and high capital expenditure.

5.1.5 Combined Heat and Power (CHP)

The principal is that a gas or oil-fired engine drives a generator that produces electricity. The heat from the engine block and exhaust are absorbed into a coolant and this is used as a heat source within the building.

Pros	Cons
CHP provides security of electrical supply.	Carbon savings in most smaller, newer domestic properties are insignificant.
Domestic micro-CHP systems typically generate electricity at times which correspond with peaks in demand.	On average, 50% of electricity generated in domestic applications is surplus. There is currently a shortfall of available export reward tariffs for excess electricity directed to the grid.
Local generation of electricity is usually cheaper than buying off-grid.	Current life expectancy of micro-CHP units is reported to be relatively low.
Eligible for the feed in tariff.	High installation costs.
Delivers central heating, hot water and electricity.	Extended payback period.
	Require a hot water demand to operate
	Increased maintenance requirements over a standard boiler.
	Noise from the CHP would need to be assessed.
	Flues would need to comply with the clean air act.

CHP has been installed in the Energy Centre to produce electricity and provide the base heating load for the domestic hot water and space heating for the whole site.

The use of CHP combined with the fabric improvements will significantly reduce the energy consumption and CO₂ Emissions when compared to the existing buildings prior to development.