

Warwick Mill
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Energy and Climate Change Strategy

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1. Preamble

This Energy and Climate Change Strategy has been prepared in support of the planning application for the conversion of the existing Grade II listed cotton mill, Warwick Mill, into residential properties, and the construction of an adjacent new ten storey residential building.

This document will be superseded by a report including dynamic modelling results for calculations demonstrating compliance with Approved Documents L and O as detailed below.

The Warwick Mills conversion will comprise 135 flats, a commercial unit on the lower ground floor and a restaurant / function room. The new building, The Loom, will have 146 flats with 3 commercial units on the ground floor.

The Loom will also house the energy centre for the entire development.

2. Executive Summary

This report describes how the proposed development will respond to the objectives of reducing energy consumption and CO₂ emissions and to mitigating the effects of climate change.

The approach seeks to take into account National and Regional guidance and to exceed the minimum requirements of the Building Regulations.

As Warwick Mill is listed the improvements possible to the fabric are limited, but every opportunity will be taken where practical to improve thermal performance.

The Loom building is new build and therefore will be constructed to meet and where possible improved upon current requirements.

The planning policy requirement is that new developments should conserve energy by implementing energy efficient and renewable energy strategies using a defined energy hierarchy implemented in the following order;

- Use less energy (Be Lean)
- Supply energy efficiently (Be Clean)
- Use renewable energy (Be Green)
- Monitor efficiency (Be Seen)

Our analysis consists of;

- Setting realistic targets for the thermal and environmental properties of the buildings to determine U-values, air permeability and glazing specifications.

- Using software modelling to calculate the energy demand and CO₂ emission reductions that can be achieved in the development by employing energy efficient techniques.
- Investigating the viability of low and/or zero carbon technologies and their contribution to achieving CO₂ emission reductions.

The design features to be adopted include;

- U values at least as good as those required by Approved Document L Volume 1.
- The inclusion of high specification glazing to minimise heat losses, reduce summer overheating and mitigate the future effects of climate change.
- The use of a combination of air source heat pumps (ASHP) and water source heat pumps (WSHP) for heating and domestic hot water generation, with gas fired boilers only for peak lopping.
- The use of a central Energy Centre providing hot water to heat interface units in all areas of the site.
- Extensive use of low energy lighting and controls.
- The use of photovoltaic panels (PV).

The adoption of these features are expected to better the improvements in Carbon Dioxide generation shown in the table below;

	Change over AD L 2021
The Loom	-10%
Warwick Mill	-10%

The flats within the Loom building are expected to achieve an EPC rating of B.

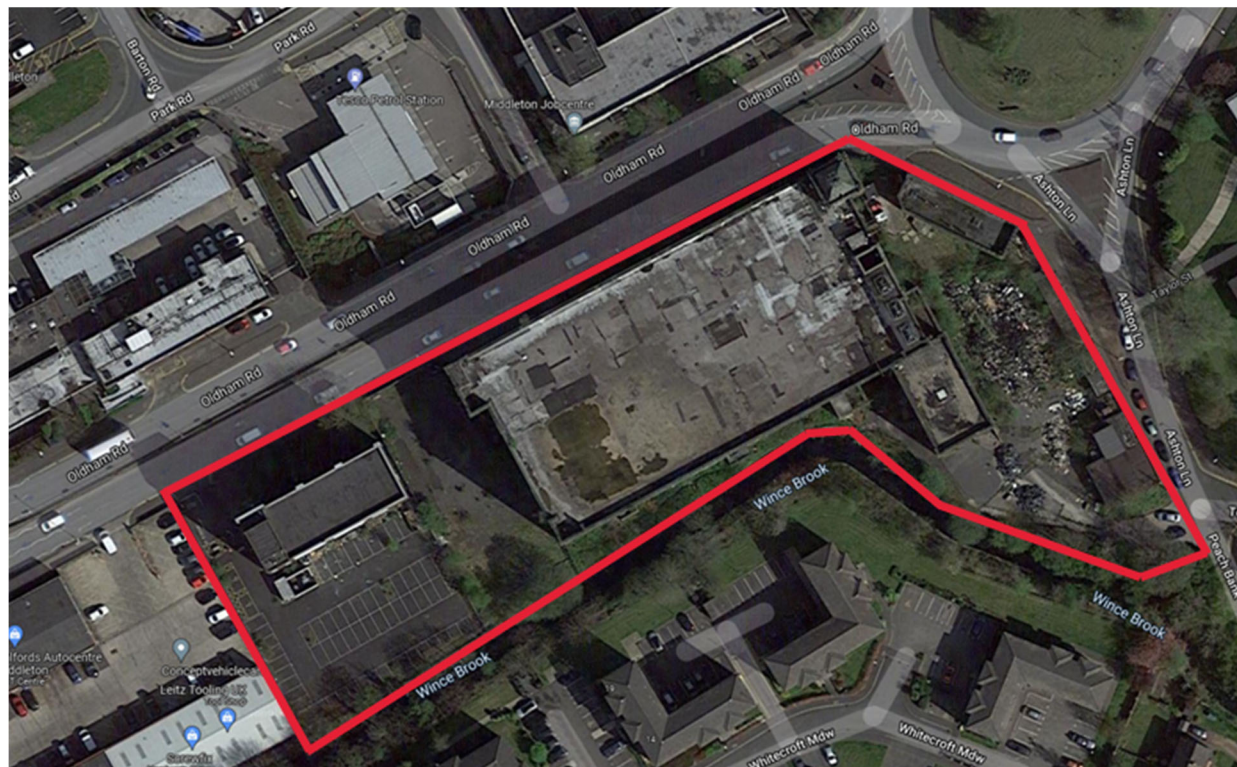
The flats within the Mill are, because of the listed status and therefore the limited improvements that can be made to the fabric, expected to achieve at least an EPC rating of D. The new flats within the Mill will achieve an EPC rating of B.

Because of the high external ambient noise levels it is not possible to rely on opening windows to provide nighttime cooling and therefore alternative measures including comfort cooling will be used.

3. Introduction

3.1. Location

The proposed development is located at Warwick Mill, Middleton, Manchester M24 1AZ. The site comprises a Grade 2 Listed cotton spinning mill constructed in 1907, together with a 1970's office block known as London House. Both buildings are in a state of disrepair and London House is to be demolished to make way for The Loom. North of the site is Oldham Road, to the East Ashton Lane, to the south Wince Brook and to the West a commercial estate. The nearest residential area is believed to be the housing to the South of the Wince Brook on Whitecroft Meadow.



3.2. Building Characteristics

The existing London House building is to be demolished and replaced with The Loom Building, which will consist mainly of residential apartments, with three commercial units on the ground floor and 9 residential floors above.

The proposed development has the following characteristics;

The Loom Building

• Ground	Commercial Unit 1	66.4m ²
	Commercial Unit 2	67.9m ²
	Commercial Unit 3	67.9m ²
• First	Dwellings	980.6m ²
• Second	Dwellings	980.6m ²
• Third	Dwellings	980.6m ²
• Fourth	Dwellings	980.6m ²
• Fifth	Dwellings	980.6m ²
• Sixth	Dwellings	980.6m ²
• Seventh	Dwellings	515.5m ²
• Eighth	Dwellings	515.5m ²
• Ninth	Dwellings	515.5m ²
• Common Areas		1400.40m ²

Warwick Mills, which is Grade 2 listed, comprises 5 floors. These are being converted into residential units, with an additional new floor being constructed at 4th floor level. Some commercial units are provided on the lower ground floor.

Warwick Mill

• Lower Ground	Commercial	1,403.00m ²
	Commercial/Restaurant	330.40m ²
	Dwellings	243.20m ²
• Upper Ground	Dwellings	1,687.22m ²
• First	Dwellings	1,736.50m ²
• Second	Dwellings	1,736.50m ²
• Third	Dwellings	1,736.50m ²
• Fourth	Dwellings	1,305.20m ²
• Common areas		781.00m ²

4. Policy Context

4.1. General

Our approach is informed by national, regional and local planning policy. These encourage the conservation of energy in buildings by a defined energy hierarchy which should be implemented in the following order;

- **Lean** by using less energy, in particular by adopting sustainable design and construction measures.
- **Clean** supply of energy efficiently, in particular by prioritising decentralised energy generation.
- **Green** by using low and/or zero carbon energy generation technologies.
- **Seen** the performance and output of the system will be monitored and recorded, and action taken to tune the system as a result.

The hierarchy has been used in parallel with the requirements of Approved Document L Volume 1 for new residential buildings and L Volume 2 for commercial buildings, which set out specific benchmarks for the performance of the basic building design.

As Warwick Mill is Grade 2 listed it does not need to comply fully with the energy efficiency requirements where to do so would unacceptably alter the building's character or appearance.

The structure of this report follows the ordered approach of the hierarchy, illustrating compliance with the Approved Documents and using less energy, supplying energy efficiently, and deploying an effective renewable energy solution to the building.

4.2. National Policy

The National Planning Policy Framework was amended and reissued in July 2021.

- **Achieving Sustainable Development** - to achieve sustainable development the economic, social and environmental objectives are to be pursued in mutually supportive ways.
- **Planning for climate change** – to provide a positive strategy through the use of appropriate renewable and low carbon energy and heat.

4.3. Regional Policy

Rochdale Adopted Core Strategy document (October 2016), section G2 'Energy and New Development' states:

All new development will be expected to adhere to the following energy hierarchy to the extent that policy G2 reflect national policy, targets and requirement for that type of development:

1 Demand Reduction

2 Energy efficiency and low/zero carbon technologies and networks

3 Allowable solutions

Rochdale Borough Unitary Development Plan (Adopted June 2006) section EM/13 'Energy Efficiency and New Development' encourages projects to be designed to conserve energy and use sustainable power systems.

The requirements of both documents are included in the Lean, Clean and Green strategy as detailed above. Therefore for the purposes of this report the Lean, Clean and Green terminology will be utilised.

5. Calculation Methodology

5.1. Commercial Areas

The commercial elements must show compliance with Approved Document L Volume 2. To do this we are constructing a model using the standard Simplified Building Energy Model (SBEM), which outputs data in the form of a BRUKL report.

These procedures calculate the predicted carbon emissions (the DER) from the regulated loads of the building; compliance is achieved when the predicted annual carbon emissions are lower than a notional value (the TER), as set out in the SBEM documentation.

Regulated energy is building energy consumption resulting from the specification of controlled, fixed building services and fittings, including space heating and cooling, hot water, ventilation, fans, pumps and lighting. Such energy uses are inherent in the design of a building.

Unregulated energy is building energy consumption resulting from a system or process that is not 'controlled'. This may include energy consumption from systems integral to the building and its operation, e.g. IT equipment, lifts, external lighting, servers, printers, photocopiers, laptops, cooking, audio-visual equipment and other appliances. Some buildings can have unregulated energy accounting for 50% of total energy use.

5.2. Residential Areas

The residential elements must show compliance with Approved Document L Volume 1. To do this we are carrying out calculations using the standard SAP10.2 worksheets to provide predicted results for each type of unit, and carried out floor area weighted averaging of the TER/DER and also the Target fabric energy efficiency (TFEE)/Design fabric energy efficiency (DFEE) to produce results for all units in the building.

Nine representative types of flats are being modelled in Warwick Mill, including a studio, 1 bed, 2 bed and 3 bed flats to provide typical TER and DER per flat.

Twelve representative types of flats are being modelled in The Loom Building, including flats of different occupancies on different elevations and levels.

6. The Energy Analysis

6.1. Compliance with Building Regulations

The first stage of our energy analysis ensures compliance with the Building Regulations by following the energy hierarchy;

- Use less energy – be lean.
- Supply energy efficiently – be clean
- Use renewable energy – be green

Approved Document L requires that the annual CO₂ building emission rate (BER), calculated using the approved SAP or SBEM methodology should not exceed the target emission CO₂ emission rate (TER). The TER is based upon the performance of a newly defined Notional Building, which is the same size and shape as the proposed building but constructed according to reference values, e.g. U-values, heating system etc. which are more rigorous than the 2021 Approved Document. The comparison between the BER and TER is measured in terms of kgCO₂/m²/year.

6.2. Be Lean

Complying with the first stage of the energy hierarchy may be achieved by incorporating 'passive' energy efficiency measures to reduce the demand for energy rather than meeting a larger demand from other sources.

6.2.1. Building Elements

Warwick Mill

As Warwick Mills is a Grade 2 listed building, there is no scope for changing or upgrading the existing external wall structure. All existing windows are being replaced with modern double glazed units, the walls of flats facing the atrium will be insulated to AD L 2021 standards and the new 4th floor extension will be constructed to AD L 2021 standards.

Element	Limiting U-values (W/m ² K)	Actual/Proposed U-values (W/m ² K)
Existing Walls		1.40
New Walls	0.26	0.18
Existing Floor		0.20
Roof	0.16	0.11
Windows	1.60	1.20
Air permeability (new building)	8 m ³ /hm ² @50Pa	5 m ³ /hm ² @50Pa
Thermal bridging		Calculated

The Loom

As The Loom is a new building all elements and construction methods will be designed to achieve performance levels greater than the minimums required by AD L 2021.

Accredited construction details will be used to reduce unwanted air infiltration, certified air-tight windows will be specified and post completion air-pressure testing will be carried out to ensure compliance with design standards.

Double glazed windows with a U-value of 1.20 W/m²K, will be installed to minimise heat losses through openings.

Element	Limiting U-values (W/m ² K)	Proposed U-values (W/m ² K)
Walls	0.26	0.18
Roof	0.16	0.11
Floor	0.18	0.13
Windows	1.60	1.20
Air permeability	8 m ³ /hm ² @50Pa	3 m ³ /hm ² @50Pa
Thermal bridging		Calculated

6.3. Be Clean

6.3.1. District Heating Network

A district heating network allows an efficient and low carbon central plant room to distribute heat and if necessary cooling to a large number of users in an area. For this project a '5th Generation' Ambient Loop type system is being considered, where rather than being distributed at 80°C water is distributed at <30°C and small heat pumps are installed in every flat. This results in hugely reduced heat losses from the distribution pipework, reduced running costs and reduced issues with overheating within flats and common parts.

The Ambient Loop system also allows the connection of cooling units which may be required by the commercial and restaurant units, the energy from these being used to heat the rest of the building.

6.3.2. Combined Heat and Power

To be viable, Combined Heat and Power (CHP) systems require a year-round base demand for the heat produced, and this cannot be provided by winter space heating alone. The economic justification for CHP is dependent on the value of the electricity generated. With the reduced carbon emission factors for grid electricity given in SAP10.2 the environmental benefit of CHP is considerably less clear.

The energy usage patterns and relatively small scale of the proposed development will not provide a base demand for heating that would make CHP viable.

6.4. Be Green

6.4.1. Low/Zero Carbon Technologies

Once energy efficiency measures have been applied, the next step is to consider the introduction of low and zero carbon technologies (LZCT) to reduce the CO₂ emissions produced by the energy consumed by the building.

LZCT harness non-fossil fuel energy (for example sun, wind and water power) to generate heat or electricity whilst not producing any CO₂ emissions and include;

- Photovoltaic panels
- Solar thermal panels
- Wind turbines
- Hydropower

Low carbon technologies use fossil fuels to generate heat or power more efficiently, or use fuels that have a low CO₂ footprint, such as biofuel. These technologies result in lower CO₂ emissions than traditional mains gas or electricity use, and include;

- Geothermal and ground source heat pumps
- Air source heat pumps
- Biomass heating and CHP

6.4.2. Air Source Heat Pumps

Air source heat pumps (ASHP) extract heat from the outside air and transfer it to water, which is then used either to heat a building or to heat domestic hot water. ASHPs use a refrigerant system involving a compressor and a condenser to absorb heat at one place and release it at another, the compressor being driven by electricity.

ASHP can achieve a coefficient of performance of between 3 & 4, meaning that for every kW of electricity used by the heat pump, 3 to 4 kW of heat will be transferred to the building.

The site will be provided with 750 kW ASHPs. The external condenser units for ASHP system do produce noise and therefore these will all be located in a roof plant area on The Loom Building and provided with acoustic screening.

The ASHP will also be used to provide cooling using their primary return water; this will very considerably reduce the amount of energy required for cooling.



6.4.3. Water Source Heat Pumps

Water source heat pumps (WSHP) extract heat from a river, lake etc and transfer it to a sealed water system, which is then used either to heat a building or to heat domestic hot water.

Directly adjacent to the site is Wince Brook which, subject to the Environment Agency approval, could be used as a water source for the WSHPs. Water would be taken from the Wince Brook, energy extracted and the water returned to the brook at a slightly lower temperature. Whilst an initial appraisal suggests that this system is viable, data logging will be required to confirm

the seasonal variation of water temperature and flow before this can be confirmed. For the purposes of this report it has been assumed 300 kW of WSHPs can be used on this site.

WSHP can be expected to be more efficient than ASHP, producing perhaps 4 times more heat energy than the electrical energy consumed.

6.4.4. Solar Photovoltaic Panels

Solar photovoltaic (PV) power takes advantage of the photovoltaic effect to generate electricity. It is anticipated that the flat roof on the Loom Building may be utilised for PV, installed over a suitable green or blue roof. A total of 76 south-facing panels at an inclination of 40° are proposed.

Grid connected inverters will be installed to the ASHP to offset the energy usage of the mechanical systems. It is unlikely that any energy will be exported.

Utilising high performance modules with a nominal power of 390W/panel, the peak output of the 149m² array is estimated to be 29.640kW(p).

The expected performance in this area for a PV array is about 875kWh of electricity will be generated each year for each kW(p). Therefore the proposed installation could generate 25,935kWh/year.

Capital cost of system @ £1150/kW(p)	£34,000
Average cost per unit of electricity	£0.1649/kWh
Electricity generated by system per annum	25,935kWh
Saving on electricity from utility per annum	£4,277.00
Simple payback	7.9 yrs.

Using SAP10.2 carbon factors the PV system is estimated to save 3.53 tonnes of CO₂ per annum.

6.4.5. Discounted LZCT

The following low and zero carbon technologies have also been considered, but discounted for this project

Ground Source Heat Pumps work in a similar way to air source heat pumps, but extract heat from an array of pipes buried either horizontally or vertically in the ground. For a properly designed system the ground remains at a relatively stable temperature (about 10 - 14°C) and the heat pumps therefore operate more efficiently than for air source. This technology has been discounted due both to the lack of available ground area and its greater cost than air source.

Solar thermal panels use heat from the sun to heat domestic hot water. Solar thermal realises very little benefit when compared to the additional complexities of installation involved and its low conversion efficiency. Therefore this technology is not considered economically viable.

Wind turbines use the wind's lift forces to turn aerodynamic blades that turn a rotor thus generating electricity. Wind turbines have a significant visual impact and can create noise and vibration issues. Therefore a wind turbine installation is not recommended.

Hydro-based technologies use power from water flow to generate energy. For this development it is proposed the adjacent water way is used to provide heat to the building via WSHPs and therefore this option has been discounted.

Biomass boilers use natural resources as fuel for combustion. Biomass heating is considered a carbon neutral process, as the carbon emissions from burning biomass are balanced by those absorbed during its growth. The urban location and area of the proposed development does not allow sufficient space to house a biomass boiler, its fuel delivery system and fuel storage, and therefore deemed unviable.

6.4.6. Green CO₂ Emissions

The buildings CO₂ emissions will be calculated based on the U values previously detailed and a split of ASHPs, WSHPs and gas fired boilers, to meet the heating load of the buildings. The buildings require a maximum of 1.8 MW of heat input, this will be provided by:

WSHP	300kW
ASHP	750kW
Gas	1200kW

The majority of the time the heating will be provided by the WSHPs and ASHPs, with gas fired boilers used only to meet peak loads. The additional gas boiler output will also be used when servicing and maintenance is required on the WSHPs and ASHPs. The boilers will be a minimum of 95% efficient

6.4.7. Ventilation and Overheating

For The Loom the flats will be served by individual Mechanical Ventilation Heat Recovery Units (MVHR), these will connect to outside air via the external facades of the building.

The Acoustic Report prepared by Sandy Brown notes that the North, West and East facades are at high risk of sound levels higher than are acceptable and that windows will therefore need to be closed overnight.

This means that open windows cannot be relied upon to reduce overheating and to achieve compliance with Approved Document O Overheating

Approved Document O Overheating requires that, for complex situations such as this, an overheating study is undertaken as described in CIBSE TM59. This work is underway, but we believe it very likely that overheating will occur and that the design must therefore incorporate measures to ameliorate this.

It might be possible to control overheating by increasing the quantities of cooler external nighttime air introduced to each flat. If not then a low level of cooling might be necessary, this can be provided by an MVHR unit with integral cooling.

For Warwick Mill the flats will be served by individual MVHR units, with intake and discharge ducts connected to the atrium side of each flat. Again measures may be needed to mitigate overheating. The atrium will be open to outside air at top and bottom and will therefore provide adequate ventilation for the MVHR units.

For the Commercial units the calculations are based on a supply and extract ventilation system for the fresh air requirement, with heat recovery.