



HOMETEL PICCADILLY

Sustainability Services

Energy Statement

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Contents

EXECUTIVE SUMMARY	1
1. INTRODUCTION	2
1.1 Background	2
1.2 Description of the Site and Building	2
2. RELEVANT PLANNING POLICIES.....	7
2.1 National Planning Policy	7
2.2 Regional Policy – Core Strategy Development Plan Document (2012)	8
3. NEW BUILD EXTENSION	12
3.1 Energy Efficient Design.....	12
3.2 Efficient Energy Use.....	15
3.3 Renewable Energy Implementation	15
4. REFURBISHMENT OF EXISTING BUILDING	19
4.1 Energy Efficient Design.....	19
4.2 Renewable Energy Implementation	20
5. ENVIRONMENTAL STANDARDS STATEMENT	22
6. CONCLUSION.....	23

Figures

Figure 1: Proposed Development Location	3
Figure 2: Proposed Development Location (3D view), existing building in red	4
Figure 3: Ground Floor Layout	5
Figure 4: Level 5 Floor Layout.....	5
Figure 5: Level 6-20 Floor layouts.....	6
Figure 6 : The Government's Preferred Energy Hierarchy.....	10

Tables

Table 1: Total CO ₂ Reduction Across the Development, based on Part L 2021	1
Table 2: Proposed Floor Space	4
Table 3: Proposed Floor Space	9
Table 4: CO ₂ Emissions Factors	11
Table 5: MEP Efficiencies – New Build	12
Table 6: Fabric Thermal Performance	13
Table 7: Proposed Lighting performance – New Build	14
Table 8: Total CO ₂ savings and percentage reduction.	15
Table 9: LZ Technologies considered.....	16
Table 10: Energy and CO ₂ Breakdown following Green Measures- New Build Extension	18
Table 11: Total CO ₂ reduction (Tonne) for New Build	18
Table 12: MEP Efficiencies – Refurbished.....	19
Table 13: Proposed Lighting performance – Refurbished	20

Contents

Table 14: Energy and CO₂ Breakdown following Green Measures - Refurbishment21

Table 15: Total CO₂ Reduction Across the Development, based on Part L 202122

Table 16: Total CO₂ Reduction Across the Development, based on Part L 202123

Appendices

- A. Renewable Energy Technologies - Viability

EXECUTIVE SUMMARY

This report has been prepared by Waterman Building Services on behalf of Northside (Manchester) Ltd (trading name – Lamington Group) to support a full planning application and Listed Building Consent for an aparthotel development (hereafter referred to as the ‘Proposed Development’) at 12-16 Manchester Piccadilly, Manchester M1 3AN (hereafter referred to as ‘the Site’).

The aim of this report is to document is to evaluate the energy performance of the proposed development while incorporating energy efficiency measures and the feasibility of on-site decentralised and renewable or low carbon energy sources.

The Proposed Development is described as the following:

“Full planning permission for the erection of a 34-storey building (land at no. 14-16 Piccadilly) and conversion of adjacent building (no.12 Piccadilly) (basement to fourth floor) to create an aparthotel, including a ground floor cafe (Use Class E (b), first floor exhibition hall (Use Class F1) and a rooftop bar and restaurant (Use Class E (b)), and associated works”.

The site is located within the Manchester City Centre on the west side of Piccadilly, to the south of Piccadilly Gardens and north of Piccadilly train station. The site is located at 12 – 16 Piccadilly, Manchester M1 3AN.

Following a review of the relevant National and Local Planning Policies, this Energy Assessment proposes a strategy that positively responds to Policies EN4, EN6, EN7, EN8 of Manchester’s Core Strategy and the Guide to Development in Manchester Supplementary Planning Document.

The performance of the proposed development was demonstrated against Part L 2021. The proposed scheme shows a 7% improvement over the notional building and at least 52% of the on-site energy demand is met via the use of renewable technologies in new build areas.

The proposed scheme shows a 93% improvement over the existing building and at least ~ 45% of the on-site energy demand is met via the use of renewable technologies in refurbished building areas.

The energy efficiency measures include good fabric insulation, high quality glazing, improved air tightness, high efficiency heat recovery ventilation units within each room, low energy lighting throughout and wastewater heat recovery devices to all showers. Common areas will be fitted out with low energy light fittings with photocell controls where possible and energy efficient ventilation systems.

The proposed development now includes replacement of the existing system serving the historic section of the building with a MVHR system served from an air source heat pump and high efficiency chiller. This enhances the performance of the refurbished portion delivering a saving of 93%. This equates to ~ 65% savings across the site.

Table 1: Total CO₂ Reduction Across the Development, based on Part L 2021

Be Lean Building Performance	Regulated carbon dioxide savings (tonnes CO ₂ /year)	
	New Build Extension	Refurbished Existing
Notional Baseline/Existing	144.7	310.03
New emission rate	134.6	20.9
Improvement	7%	93%

1. INTRODUCTION

1.1 Background

This report has been prepared by Waterman Building Services on behalf of Northside (Manchester) Ltd (trading name – Lamington Group) to support a full planning application and Listed Building Consent for an aparthotel development (hereafter referred to as the ‘Proposed Development’) at 12-16 Manchester Piccadilly, Manchester M1 3AN (hereafter referred to as ‘the Site’). The aim of this report is to document and evaluate the energy performance of the proposed development while incorporating energy efficiency measures and the feasibility of on-site decentralised and renewable or low carbon energy sources.

1.2 Description of the Site and Building

The proposed description of development is as following:

“Full planning permission for the erection of a 34-storey building (land at no. 14-16 Piccadilly) and conversion of adjacent building (no.12 Piccadilly) (basement to fourth floor) to create an aparthotel, including a ground floor cafe (Use Class E (b)), first floor exhibition hall (Use Class F1) and a rooftop bar and restaurant (Use Class E (b)), and associated works”.

The site is located within the Manchester City Centre on the west side of Piccadilly, to the south of Piccadilly Gardens and north of Piccadilly train station. The site is located at 12 – 16 Piccadilly, Manchester M1 3AN.

The proposal comprises the conversion of the Grade II Listed Building Union Bank, including internal alterations, and the construction of a new 34 storey building on the ‘gap site’ which adjoins the Listed Building to form an aparthotel and associated ancillary spaces including ground floor café, first floor exhibition space, restaurant and rooftop amenities.

The site boundary is shown in Fig 1 below:

Figure 1: Proposed Development Location



Figure 2: Proposed Development Location (3D view), existing building in red



The key development parameters areas are recorded below:

Table 2: Proposed Floorspaces

Land Use	Proposed GIA (m ²)	Proposed GEA (m ²)
Hotel	12,357.1	13,927.1
Café & restaurant	1,001	1,027.7
Exhibition	216	254.4
Total	13,574.1	15,209.20

Figure 5: Level 6-20 Floor layouts



2. RELEVANT PLANNING POLICIES

This Energy Strategy responds to the broader set of national, and regional policies outlined below.

2.1 National Planning Policy

The Government has set out a planning policy framework guidance in the National Planning Policy Framework (NPPF) (July 2021), within which planning authorities can prepare and apply their development plans. Fundamental to this guidance is the requirement to meet sustainable development objectives.

The NPPF covers a wide range of planning issues from promoting sustainable transport to facilitating the sustainable use of minerals. Climate change is covered in section 14 'Meeting the challenge of climate change, flooding and coastal change'. In summary the framework advises:

"Plans should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, coastal change, water supply, biodiversity and landscapes, and the risk of overheating from rising temperatures. Policies should support appropriate measures to ensure the future resilience of communities and infrastructure to climate change impacts, such as providing space for physical protection measures, or making provision for the possible future relocation of vulnerable development and infrastructure.

New development should be planned for in ways that:

- Avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure; and
- Can help to reduce greenhouse gas emissions, such as through its location, orientation and design. Any local requirements for the sustainability of buildings should reflect the Government's policy for national technical standards.

To help increase the use and supply of renewable and low carbon energy and heat, plans should:

- Provide a positive strategy for energy from these sources, that maximises the potential for suitable development, while ensuring that adverse impacts are addressed satisfactorily (including cumulative landscape and visual impacts).
- Consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development.
- Identify opportunities for development to draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co-locating potential heat customers and suppliers."

Local planning authorities should support community-led initiatives for renewable and low carbon energy, including developments outside areas identified in local plans or other strategic policies that are being taken forward through neighbourhood planning.

In determining planning applications, local planning authorities should expect new development to:

- Comply with any development plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable.
- Take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.

When determining planning applications for renewable and low carbon development, local planning authorities should:

- Not require applicants to demonstrate the overall need for renewable or low carbon energy, and recognise that even small-scale projects provide a valuable contribution to cutting greenhouse gas emissions.
- Approve the application if its impacts are (or can be made) acceptable. Once suitable areas for renewable and low carbon energy have been identified in plans, local planning authorities should expect subsequent applications for commercial scale projects outside these areas to demonstrate that the proposed location meets the criteria used in identifying suitable areas.”

Refer to: National Planning Policy Framework (2021)¹ for further details.

2.2 Regional Policy – Core Strategy Development Plan Document (2012)

The Core Strategy is part of Manchester's Local Development Framework, meaning that the policies in the Strategy should inform decisions on planning applications across the city.

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

The Council will seek to reduce fuel poverty and decouple growth in the economy, growth in CO2 emissions, and rising fossil fuel prices, through the following actions:

- All development must follow the principle of the Energy Hierarchy and breakdown, being designed:
 - to reduce the need for energy through design features that provide passive heating, natural lighting, and cooling.
 - to reduce the need for energy through energy efficient features such as improved insulation and glazing.
 - to meet residual energy requirements through the use of low or zero carbon energy generating technologies.
- Wherever possible new development and retrofit projects, including energy generation plant, must be located and designed in a manner that allows advantage to be taken of opportunities for low and zero carbon energy supplies.
- Where possible new development and retrofit projects will be used as a mechanism to help improve energy efficiency and provide low and zero carbon energy supplies to existing buildings.
- Where appropriate new development and retrofit projects will be required to connect to and/or make contributions to low or zero carbon energy schemes and/or to incorporate provision to enable future connection to any existing / potential decentralised energy schemes.
- The use of building materials with low embodied carbon in new development and refurbishment schemes.

¹ [National Planning Policy Framework \(publishing.service.gov.uk\)](https://www.gov.uk/policy-framework)

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

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

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

The target framework relates to three broad development locations and their potential for low and zero carbon, decentralised energy. The areas are defined as follows:

Target 1 Network development areas: Locations where the proximity of new and existing buildings, the mix of uses and density of development provide the right conditions to support district heating (and cooling).

Target 2 Electricity intense areas: Locations where the predominant building type has an all-electric fit-out such as retail units and leisure complexes.

Target 3 Micro-generation areas: Locations where lower densities and a fragmented mix of uses tend to mean that only building scale solutions are practical.

Table 3: Proposed Floor Space

Target	% Minimum requirement
Target 1: Network development area	CHP/district heating anchor or connection or where not feasible, a 15% increase on Part L 2010
Target 2: Electricity intense buildings (Applies to commercial uses with a high proportion of emissions from electricity use (>45 kg CO ₂ /m ²))	+10% increase on Part L 2010
Target 3: Micro generation area	+15% increase on Part L 2010

Where the CO₂ emissions reduction required under any future revision to Part L of the building regulations becomes greater than the '% Minimum requirement', the reduction required under building regulations would apply.

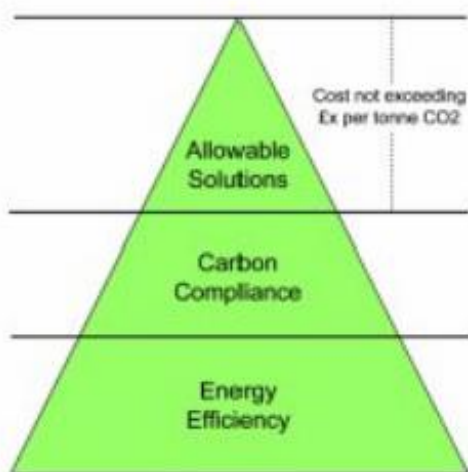
Where the Council identifies an 'allowable solution', for example within an energy proposals plan, that would produce higher carbon reductions at no extra cost than that of achieving the '% Minimum requirement' (or required under building regulations if greater) the higher percentage reduction will be required. The cost comparison is based on the cost of incorporating the 'allowable solution' at design stage.

The energy statement will be required to be submitted at the outset of any proposed development (outline application or before). Developers will be permitted to use green infrastructure elements such as green roofs, green walls, street trees and waterways to contribute to compliance with CO₂ mitigation, subject to the energy statement incorporating evidence such as modelling to demonstrate compliance.

Energy Hierarchy

"Under Policy EN4 developers will initially be expected to secure high levels of energy efficiency and low energy demand. This is followed by the incorporation of on site measures where these exist, such as zero carbon energy technologies and directly connected heat (not necessarily on-site). However, in order to achieve the highest level of carbon reductions for the least cost it is intended that developers will be able to contribute to or co-ordinate investment in near or off-site infrastructure. This could include, for example, the connection of existing buildings to district heating networks and investment in low or zero carbon technologies on buildings owned by the City or by public and community institutions. Further guidance on these 'allowable solutions', possibly in the form of a Supplementary Planning Document (SPD), will be given following further national guidance on this matter expected from the Government."

Figure 6 : The Government's Preferred Energy Hierarchy



2.2.3 Policy EN 7 Energy Infrastructure opportunities

There will be a general presumption in favour of low and zero carbon decentralised energy schemes, subject to the following considerations:

- That any new generating plant capable of producing heat and cooling as well as electricity should be located in a way that facilitates future connection to a local distributed energy system.
- That any energy centre, including generating plant, standby/boiler plant and substations, shall be located and designed to a high quality so as to integrate with and contribute to the townscape.
- Biofuels should be obtained from sustainable sources and processes and in a way that minimises transport impacts, following a sequential approach in order to minimise CO2 emissions – firstly prioritising local and regional sources, followed by national, European and international.
- Consideration should be given to biofuel delivery by rail and waterways where possible. Where large-scale fuel or feedstock delivery is required by road the energy centre must be located in or adjacent to light industrial, industrial or leisure uses with any impact on local residential amenity minimised.
- The cumulative impact of energy schemes will be taken into account when considering applications, to include modelled impacts on air quality and landscape character, with reference

to Policy EN16.

- Flood risk, through the Manchester-Salford-Trafford Strategic Flood Risk Assessment.

2.2.4 Guide to Development in Manchester Supplementary Planning Document

The guide provides further details on the existing Core Strategy Policies.

Energy Efficiency

"In the Environmental Standards Statement, developers should show how they have considered the steps necessary to reduce energy demand at the earliest stages of design. Developers should aim to reduce CO₂ emissions by at least 25% more than the requirements of the current Building Regulations, which at present are Building Regulations: Approved Document L (2006) – 'Conservation of Fuel and Power.'"

Renewable Energy

"To reduce energy demand and the harmful impact of using energy from non-renewables, in line with UDP Part 1 Policy E1.5, developers should aim for **at least 20% of final site energy demand** to be met by on-site renewable energy technologies. Renewable energy targets can be achieved more readily by undertaking the measures suggested above to reduce the total energy demand of the building. "

Environmental Standards Statement

As outlined within the City Council's Guide to Development in Manchester SPD/SPG, (chapter 4) and Core Strategy policies EN4 and EN6 an Environmental Standards Statement should be submitted with your application, which addresses sustainability ratings and the provision of renewable energy within the development (Please refer to Appendix A of the Core Strategy for guidance on preparing this statement). This should include a BREEAM pre-assessment rating through the submission of a pre-estimator report which should demonstrate that a rating level of at least Very Good would be achieved. Where this standard is not achievable clear reasons why need to be set out within the submission. This statement must address the guidance within Chapter 4 of the 'Guide to Development in Manchester and policies EN4 and EN6 of the Core Strategy for the City of Manchester, confirm the proposals for the provision of onsite renewable energy to provide 20% of final site energy demand and CO₂ reduction.

2.2.5 Dynamic Energy Modelling

The building has been modelled using IES dynamic simulation software.

The energy consumption values illustrated within this report are generated from the approved software applying the National Calculation Methodology² and is not a prediction of the actual energy consumption.

Emissions within this report are based on the following CO₂ emission rates as detailed within SAP version 10.2 – Table 4.

Table 4: CO₂ Emissions Factors

Fuel	CO ₂ Emission Factors (kgCO ₂ /kWh)
Natural Gas	0.219
Grid Electricity	0.136
Grid Displaced Electricity	0.136

² [NCM Modelling Guide 2021 Edition England \(uk-ncm.org.uk\)](http://uk-ncm.org.uk)

3. NEW BUILD EXTENSION

3.1 Energy Efficient Design

To ensure that the development incorporates energy efficiency measures that are in keeping with the changes in regulations, the following enhancements are recommended in keeping with the energy hierarchy.

Summary of energy efficiency and carbon reduction improvements

The measures highlighted below indicate the enhancements to the energy strategy for the proposed development that result in further savings in operational energy and increased carbon savings for the new build extension.

Table 5: MEP Efficiencies – New Build

System Type		Proposed System	
Heating System Type	Heating System 1	Heating system	HVRF & FCUs
		Fuel type / Heat source	Electric / ASHP
		SCoP	3.5
		Served Areas	Bedrooms, Reception, Offices, and Restaurant (shell and core)
	Heating System 2	Heating system	Panel Heating
		Fuel type / Heat source	Electric
		SCoP	1
		Served Areas	Circulation, Common WCs,
Cooling System Type	Cooling System 1	Cooling Type	HVRF & FCUs
		SEER	5.0
		Served Areas	Offices, Receptions, Bedrooms, Restaurant (shell and core)
Ventilation System Type	Ventilation System 1	Ventilation Units	MVHR SEP
		Heat Recovery Efficiency	90%
		Areas served by system	Decentralised, local MVHR serving ensembles
		Specific Fan Power (SFP)	1.0 W/l/s
	Ventilation System 2	Ventilation Units	AHU SEP
		Heat Recovery Efficiency	(90%)
		Areas served by system	Restaurant Bar Area (shell and core), kitchen
		Specific Fan Power (SFP)	2.0 W/l/s

System Type		Proposed System	
	Ventilation System 3	Ventilation Units	Extract with fan remote from zone
		Heat Recovery Efficiency	(90%)
		Areas served by system	Communal WCs
		Specific Fan Power (SFP)	0.5 W/l/s
DHW System Type	DHW System 1	System Type	CO2 Heat Pump
		DHW system CoP	3.8
		Efficiency	3.8
		Areas served by system	Whole building
		Hot water storage volume (l)	estimated 9000 litre daily usage and 4500 litres storage
		Loop length(l)	200M
		Storage loss factor (kWh/litre per day)	0.005

The extension will be served by new dedicated HVAC plant plus modern lighting systems.

3.1.1 Passive Design Measures - Energy Use Reduction

The building design will target highly efficient U-values and air tightness within normally occupied spaces.

Exposed element U values to unheated spaces are not detailed within the table below. The fabric performance criteria will be enhanced from what was proposed in the consented scheme as follows:

Table 6: Fabric Thermal Performance

Element	Notional Building Regulations, Part L 2021	Proposed Measures	
		New	Existing
Air Tightness	8.0 m ³ / h.m ²	2.0 m ³ / h.m ²	2.0 m ³ / h.m ²
Roof	0.18 W/m ² K	0.13 W/m ² K	0.18 W/m ² K
Façade Weighted U-Value	1.6 W/m ² K or Window Energy Rating band 9B	External Wall – 0.15 W/m ² K External Glazing – 1.3 W/m ² K	External Wall – 1.15 W/m ² K External Glazing – 2 W/m ² K
Glazing G-Value	0.4	Ground & lower floor – 0.45 Upper floors – 0.35	0.6

Element	Notional Building Regulations, Part L 2021	Proposed Measures	
		New	Existing
Glazing LT	0.7	Ground & lower floor – 60% Upper floors – 55%	70%

Heating, Cooling and Ventilation & Domestic Hot Water

The proposed solution for the building includes air source heat pumps therefore for the majority of space heating and domestic hot water.

Lighting

Energy Efficient LED lamps will be used throughout the development. Based on recent developments energy efficient lighting fixtures it is proposed to improve the lighting efficacy levels from the consented scheme to deliver a further improvement in the energy performance of the building.

Lighting technology has improved since planning consent was granted in 2019 and it is proposed to improve the lighting efficacy compared to that in the original energy strategy.

The refurbishment of the existing building gives the opportunity to improve the lighting efficiency in areas of the existing building, as set out in the table below:

Table 7: Proposed Lighting performance – New Build

Area	Proposed Measures		
	Efficacy (luminaire Lumens/circuit Watt) *	Occupancy sensing	Daylight Control
Front of house	110	auto on/off	Daylight dimming and PIR
Reception	110	auto on/off	Daylight dimming and PIR
Display	80		-
Back of house areas	110	auto on/off	PIR

Electric power factor

Lighting systems have provision for metering? ☒

Lighting systems metering warns of 'out-of-range' values? ☒

3.1.2 Energy Use Reduction Results

The notional baseline for the refurbished section of the building was taken as the current EPC registered which has an EPC rating of G with an BER as 204.08 KgCO₂/m²/annum. The existing buildings main source of fuel for heating is electricity and the building is predominately naturally ventilated.

Table 8: Total CO₂ savings and percentage reduction.

	Regulated carbon dioxide savings (tonnes CO ₂ /year)	
	New Build	Refurbished Building
	Part L 2021	Part L 2021
Notional Baseline	144.7	315.18
Proposed	134.6	24.38
Improvement	7%	92%

This will provide savings in both energy demand through an improved efficiency, as well as additional carbon emission savings from the carbon emission factors of electricity compared to gas.

3.2 Efficient Energy Use

In accordance with Manchester Core Strategy – Guide to Development, the following design principles were followed to achieve energy efficiency targets:

1. Minimise reliance on energy-using equipment for heating, cooling, lighting and natural ventilation.
2. Position trees and soft landscaping on and around the development and within buildings to provide natural shading, insulation and air conditioning.
3. Integrate energy efficient micro-generation and community heating schemes, such as combined heat and power (CHP).
4. Site layout and building design principles should maximise the capture and use of daylight and passive solar energy, whilst avoiding excessive solar gain in summer.
5. Specify energy and water efficient appliances and systems.

In a communal energy system, energy in the form of heat, cooling, and/or electricity is generated from a central source and distributed via a network of insulated pipes to surrounding residencies and commercial units.

3.3 Renewable Energy Implementation

The use of energy conversion technologies using renewable energy have been reviewed and summarised below. The main technologies available for on-site renewable energy generation are:

- Biomass
- Ground Source Heat Pumps
- Air Source Heat Pumps
- Photovoltaic Panels
- Solar Thermal Hot Water Generation
- Wind

Refer to Appendix A for more details and a brief explanation of renewable energy technologies.

Preliminary Technology Appraisal

Based on this preliminary evaluation, the table below provides a summary of the low carbon technologies assessed for the development.

Table 9: LZ Technologies considered

Technology	Feasibility*			Comments
	H	M	L	
Biomass			✓	Not suitable for the site on grounds of fuel storage and deliveries within city center site and wider issues relating to high levels of NOx and particulate matter generated from combusting biomass fuels.
Ground Source Heat Pumps			✓	Ground source heat pumps extract heat from the ground and convert it to low grade heat for space heating and hot water. The building plot is extremely small, and it would not be possible to make a meaningful contribution to the building heat demand for the significant investment cost.
Air Source Heat Pumps	✓			Air source heat pumps extract heat from the air and convert it to heat for space heating and hot water. Air source heat pumps are generally more cost effective than ground source heat pumps. In addition to space heating air to water heat pumps can generate hot water at temperatures suitable for domestic hot water generation.
Solar Hot water			✓	Solar thermal installations are a well-established renewable energy system and can be one of the most cost-effective renewable energy systems available. A solar thermal installation would not be suitable for this development for the same reasons as photovoltaic panels described below
Photovoltaic Panels		✓		Photovoltaic modules convert daylight directly into DC electricity and can be integrated into buildings PV panels are widely used and have become affordable means to generate renewable on site energy. The feasibility and deployment of PV panels will be reviewed during design development to better understand the embodied carbon deployment and payback periods.
Wind			✓	The urban environment and the close proximity of other buildings are not favorable conditions for the installation of wind turbines. The uneven air flow caused by surrounding buildings and the potential negative impact on the visual and noise amenity of the area militate against the use of wind turbines for this development.

H - High Feasibility - No obvious restrictions

M - Medium feasibility - Significant issues that need to be addressed

L - Low feasibility – Site unlikely to support technology

Air Source Heat Pump

The technology makes use of the energy available in the ambient air. Essentially, heat pumps take up heat at a certain temperature and release it at a higher temperature. This is achieved by means of a simple heat exchanger in the case of air source heat pumps.

The efficiency of any type of heat pump is very much dependent on the temperature level at which it has to provide the heat: the lower the temperature level, the better the coefficient of performance.

Almost all heat pumps in operation are based on the vapour compression cycle, which combines efficiency, safety and reasonable cost. The efficiency of heat pumps is measured by the ratio of the heating capacity to the power input, referred to as the Coefficient of Performance (COP).

A Variable Refrigerant Flow (VRF) ASHP system is proposed for the development, the system is designed to incorporate further efficiencies in comparison to the consented scheme as shown below:

ASHP Energy Reduction

Separate air source heat pumps are proposed to meet the heat demand from space heating and domestic hot water.

Heat pumps for space heating will operate at a low temperature and is estimated to deliver heat with a SCOP of 3.5 using the CIBSE Test Reference Year for Manchester as the source temperature.

High temperature heat pumps will be selected for hot water generation designed to operate with a flow temperature of 65°C supplying heat to a central hot water storage system. The CoP is calculated to be 3.0, using the CIBSE Test Reference Year for Manchester weather data as source temperatures for the heat pumps.

Photovoltaic Panels

Photovoltaic modules convert daylight directly into DC electricity and can be integrated into buildings. Photovoltaics (PVs) are distinct from other renewable energy technologies since they have no moving parts to be maintained and are silent. PV systems can be incorporated into buildings in various ways: on sloped roofs and flat roofs, in facades, atria and shading devices. Modules can be mounted using frames or they can be fully incorporated into the actual building fabric; for example, PV roof tiles are now available which can be fitted in place of standard tiles. Since PVs generate DC output, an inverter and other equipment is needed to deliver the power to a building or the grid in an acceptable AC form. The cost of the inverter and these components can approach 50% of the total cost of a PV system.

For PV to work effectively it should ideally face south and at an incline of 30° to the horizontal, although orientations within 45° of south are acceptable. It is essential that the system is unshaded, as even a small shadow may significantly reduce output.

The availability of horizontal roof space is very limited. Therefore, transparent PVs are proposed to the tower sloping glazed roof, with a total net area of 210 m². This technology is recommended for inclusion in the design and is proposed as part of this application.

3.3.1 Renewable Energy Implementation Results

The tables below indicate the performance of the development with air source heat pumps providing space heating and hot water, further supplemented by PV systems.

Table 10: Energy and CO₂ Breakdown following Green Measures- New Build Extension

Item	Part L 2021
	kWh/m ² /yr
Heating (HP)	11.94
DHW (HP)	42.76
Cooling	2.45
11Auxiliary Energy	21.34
Lighting	8.25
CHP Heat	0

Table 11: Total CO₂ reduction (Tonne) for New Build

Regulated carbon dioxide savings (tonnes CO ₂ /year)	
Part L 2021 (SAP 10.2)	
Notional Baseline	144.7
Proposed (After Be Green Measures)	134.6
Improvement	7%

The performance of the proposed development was demonstrated against Part L 2021. The proposed scheme shows a 7% improvement over the notional building and at least ~ 52% of the on-site energy demand is met via the use of renewable technologies in new build areas.

4. REFURBISHMENT OF EXISTING BUILDING

4.1 Energy Efficient Design

Summary of energy efficiency and carbon reduction improvements

The following table sets out the reduction in operational energy and carbon usage through the replacement of building services systems in the existing building.

Table 12: MEP Efficiencies – Refurbished

System Type		Proposed System	
Heating System Type	Heating System 1	Heating system	HVRF & FCUs
		Fuel type / Heat source	Electric / ASHP
		SCoP	3.5
		Served Areas	Bedrooms, Reception, Offices, and Restaurant (shell and core)
	Heating System 2	Heating system	Panel Heating
		Fuel type / Heat source	Electric
		SCOP	1
		Served Areas	Circulation, Common WCs,
Cooling System Type	Cooling System 1	Cooling Type	HVRF & FCUs
		SEER	5.0
		Served Areas	Offices, Receptions, Bedrooms, Restaurant (shell and core)
Ventilation System Type	Ventilation System 1	Ventilation Units	MVHR SEP
		Heat Recovery Efficiency	90%
		Areas served by system	Decentralised, local MVHR serving ensembles
		Specific Fan Power (SFP)	1.0 W/l/s
	Ventilation System 2	Ventilation Units	AHU SEP
		Heat Recovery Efficiency	90%
		Areas served by system	Café & Kitchen, Net Zero Museum, Auditorium and Offices
		Specific Fan Power (SFP)	2.0 W/l/s
	Ventilation System 3	Ventilation Units	Extract with fan remote from zone

System Type		Proposed System	
DHW System Type	DHW System 1	Heat Recovery Efficiency	(90%)
		Areas served by system	Communal WCs
		Specific Fan Power (SFP)	0.5 W/l/s
		System Type	CO2 Heat Pump
		DHW system CoP	3.8
		Efficiency	3.8
		Areas served by system	Whole building
		Hot water storage volume (l)	estimated 9000 litre daily usage and 4500 litres storage
		Loop length(l)	200M
		Storage loss factor (kWh/litre per day)	0.005

The refurbished existing buildings with a range of functions and lighting efficacy will be as set out in table 14.

Table 13: Proposed Lighting performance – Refurbished

Proposed Measures			
Area	Efficacy (luminaire Lumens/circuit Watt) *	Occupancy sensing	Daylight Control
Front of house	110	manual on/off	Daylight dimming and PIRs
Reception	110	auto on/off	PIR
Display	80		
Back of house areas	110	auto on/off	PIR

Electric power factor

>0.95

Lighting systems have provision for metering?
☒

Lighting systems metering warns of 'out-of-range' values?
☒

4.2 Renewable Energy Implementation

The feasibility of the various renewable energy technologies has been assumed to be consistent for both the New Build Extension and the Refurbishment portion of the Proposed Development.

Renewable Energy Implementation

The tables below indicate the performance of the development with air source heat pumps providing space heating and hot water, further supplemented by PV systems.

Table 14: Energy and CO₂ Breakdown following Green Measures - Refurbishment

Item	Proposed Refurbishment		
	kWh/m ² /yr	kWh/yr	kgCO ₂ /yr
Heating (HP)	28.27	44,779	6,090
DHW (HP)	36.24	57,404	7,807
Cooling	1.12	1,774	241
Auxiliary Energy	21.08	33,390	4,541
Lighting	10.24	16,220	2,206
CHP Heat	0	0	0
Total	96.97	153,600	20,890

Environmental Standards Statement

As outlined within the City Council's Guide to Development in Manchester SPD/SPG, (chapter 4) and Core Strategy policies EN4 and EN6 an Environmental Standards Statement should be submitted with your application, which addresses sustainability ratings and the provision of renewable energy within the development (Please refer to Appendix A of the Core Strategy for guidance on preparing this statement). This should include a BREEAM pre-assessment rating through the submission of a pre-estimator report which should demonstrate that a rating level of at least Very Good would be achieved. Where this standard is not achievable clear reasons why need to be set out within the submission. This statement must address the guidance within Chapter 4 of the 'Guide to Development in Manchester and policies EN4 and EN6 of the Core Strategy for the City of Manchester, confirm the proposals for the provision of onsite renewable energy to provide 20% of final site energy demand and CO₂ reduction.

5. ENVIRONMENTAL STANDARDS STATEMENT

As per the requirements of the City Council's Guide to development in Manchester SPD/SPG chapter 4 and Core Strategies policies EN4 and EN6 the following section has been produced that identifies the BREEAM Rating targeted by the development and the provision of renewable energy on site.

The BREEAM pre- assessments have been developed by eight versa and targeting a score of '**BREEAM Excellent**' with a predicted score of 78% for the New Build element of the development. For the refurbishment section a target of '**BREEAM Excellent**' with a predicted score of 73.61%. Please refer to the BREEAM pre-assessments for the detailed breakdown of the targeted credits. The Proposed Development, therefore, seeks to better the Core strategy rating level of BREEAM Very Good.

Following a review of the relevant National and Local Planning Policies, this Energy Assessment proposes a strategy that positively responds to Policies EN4, EN6, EN7, EN8 of Manchester's Core Strategy and the Guide to Development in Manchester Supplementary Planning Document and the Environmental Standards.

The performance of the proposed development was demonstrated against Part L 2021. The proposed scheme shows a 7% improvement over the notional building and at least 52% of the on-site energy demand is met via the use of renewable technologies in new build areas.

The proposed scheme shows a 93% improvement over the existing building and at least ~ 45% of the onsite energy demand is met via the use of renewable technologies in refurbished building areas.

The energy efficiency measures include good fabric insulation, high quality glazing, improved air tightness, high efficiency heat recovery ventilation units within each room, low energy lighting throughout and wastewater heat recovery devices to all showers. Common areas will be fitted out with low energy light fittings with photocell controls where possible and energy efficient ventilation systems.

The proposed development now includes replacement of the existing system serving the historic section of the building with a MVHR system served from an air source heat pump and high efficiency chiller. This enhances the performance of the refurbished portion delivering a saving of 93%. This equates to ~ 65% savings across the site.

Table 15: Total CO₂ Reduction Across the Development, based on Part L 2021

Be Lean Building Performance	Regulated carbon dioxide savings (tonnes CO ₂ /year)	
	New Build Extension	Refurbished Existing
Notional Baseline/Existing	144.7	310.03
New emission rate	134.6	20.9
Improvement	7%	93%

6. CONCLUSION

Following a review of the relevant National and Local Planning Policies, this Energy Assessment proposes a strategy that positively responds to Policies EN4, EN6, EN7, EN8 of Manchester's Core Strategy and the Guide to Development in Manchester Supplementary Planning Document.

The performance of the proposed development was demonstrated against Part L 2021. The proposed scheme shows a 7% improvement over the notional building and at least 52% of the on-site energy demand is met via the use of renewable technologies in new build areas.

The proposed scheme shows a 93% improvement over the existing building and at least ~ 45% of the onsite energy demand is met via the use of renewable technologies in refurbished building areas.

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Table 16: Total CO₂ Reduction Across the Development, based on Part L 2021

Be Lean Building Performance	Regulated carbon dioxide savings (tonnes CO ₂ /year)	
	New Build Extension	Refurbished Existing
Notional Baseline/Existing	144.7	310.03
New emission rate	134.6	20.9
Improvement	7%	93%

APPENDICES

A. Renewable Energy Technologies - Viability

Wind Power

Most wind turbines are installed in non-urban areas for environmental and technical reasons. However, it has become more common for smaller devices installed at the point of use, i.e., urban settings. The capacity of wind turbines ranges from 500W to more than 1.5 MW, but, for practical purposes and in built-up areas in particular, machines of more than 1 kW and below 500kW are likely to be considered. Individual building or community wind projects, although smaller, have the advantage of feeding electricity directly into the building's electricity circuit, thus sparing costly distribution network development and avoiding distribution losses. The downside is the still high capital cost per kW installed for smaller turbines, plus location constraints, such as visual intrusion and noise. The wind regime in urban areas is also a concern owing to higher wind turbulence which reduces the potential electricity output.

In most cases, wind turbines are connected to the electricity grid and all generated energy is used regardless of the building demand fluctuations. The output largely depends on the wind speed and the correlation between the two is a cube function. This means that in short periods of above-average wind speeds the generation increases exponentially. As a result, it is difficult to make precise calculations of the annual output of a turbine, but average figures can provide useful guidance.

The cost per kW installed varies considerably by manufacturer and size of machine with an indicative bracket of £2,500-£5,000. With a lifespan of more than 20 years, wind turbines can save money if design and planning are carried out in a robust way.



Wind turbines can be mounted on horizontal or vertical axes. The horizontal mounted turbines are less expensive (around £ 20,000 for a 6kW turbine) but generate more vibrations. The vertical mounted turbines are more expensive (around £ 22,000 for a 5kW turbine), but almost vibration free. The table below shows the most relevant figures for both types of turbines.

Air & Ground Source Heat Pump

The technology makes use of the energy available in the ambient air or stored in the Earth's crust, which comes mainly from solar radiation. Essentially, heat pumps take up heat at a certain temperature and release it at a higher temperature. This is achieved by means of a simple heat exchanger in the case of air source heat pumps, or by means of either horizontal or vertical ground collectors, in which a heat exchange fluid circulates and transfers heat via a heat exchanger to the heat pump, in the case of ground source heat pumps. For the latter, when considering buildings with piled foundations, the pipes can be integrated in the design using several piling systems.

The efficiency of any type of heat pump is very much dependent on the temperature level at which it must provide the heat- the lower the temperature level, the better the coefficient of performance.

Almost all heat pumps in operation are based on the vapour compression cycle, which combines efficiency, safety and reasonable cost. The efficiency of heat pumps is measured by the ratio of the heating capacity to the power input, referred to as the Coefficient of Performance (COP). Generally, a COP of around 2.5-3 for air source heat pumps and around 3.5-4 for ground source heat pumps is achievable for heating, assuming low temperature heat emitters such as underfloor heating. When used to generate domestic hot water at 60°C the COP falls for both types of heat pumps by around 1 point. Therefore, when it comes to domestic hot water, heat pumps can be implemented to pre-heat the water up to a certain temperature, before it enters the boiler, rather than to heat up the domestic hot water entirely up to its final required temperature.

The approximate costs for heat pumps amount to £700 per kW_{th} heat output for an air source heat pump, and £1,200 per kW_{th} heat output for a ground source heat pump with horizontal trenches, and £1,400 per kW_{th} heat output for a ground source heat pump with vertical boreholes (including the cost of bore holes).



Biofuels

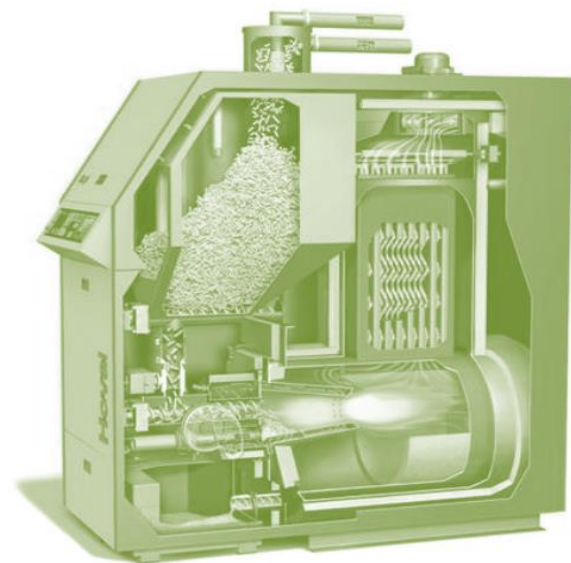
Biomass is an alternative solid fuel to the conventional fossil fuels and has an impact on carbon emissions that is close to neutral. Various types of biomass fuels are in use, the most common being the woody biomass, which includes forest residues such as tree thinning, and energy crops such as willow short rotation coppice. The fuel usually takes the form of wood chips, logs and pellets. Supply and storage of the biomass fuel should be carefully considered especially for larger plants. Modern systems can be fed automatically by screwdriver from fuel hoppers.

The typical applications are:

- a) Biomass boilers replacing standard gas- or oil -fired boilers for space heating and hot water (for individual buildings or district heating systems).
- b) Standalone room heaters for space heating.
- c) Stoves with back boilers, supplying domestic hot water.
- d) Biomass CHP for heat and electricity generation. Appliances can achieve efficiencies of more than 80%.

The capital cost of automated biomass heating systems is significantly greater than that of conventional heating systems, mainly because of the more complicated feeding mechanisms and the currently smaller market for biomass appliances.

There is an ongoing public debate on the true sustainability of using biofuels. Given the number of differing views expressed by academics and engineers and contradictions in publications issued by the Government the theoretical carbon savings offered by biofuels must be treated with extreme caution.



Biomass installations are not acceptable as biomass fired boilers will generate high levels of particulate matter (PM10) and NOx emissions which are both detrimental to air quality.

Photovoltaics

Photovoltaic modules convert daylight directly into DC electricity and can be integrated into buildings. Photovoltaics (PVs) are distinct from other renewable energy technologies since they have no moving parts to be maintained and are silent. PV systems can be incorporated into buildings in various ways: on sloped roofs and flat roofs, in facades, atria and shading devices. Modules can be mounted using frames

or they can be fully incorporated into the actual building fabric; for example, PV roof tiles are now available which can be fitted in place of standard tiles. Since PVs generate DC output, an inverter and other equipment is needed to deliver the power to a building or the grid in an acceptable AC form. The cost of the inverter and these components can approach 50% of the total cost of a PV system.

For PV to work effectively it should ideally face south and at an incline of 30° to the horizontal, although orientations within 45° of south are acceptable. It is essential that the system is unshaded, as even a small shadow may significantly reduce output.



Solar Thermal

Solar thermal and, especially, active Solar Domestic Hot Water (SDHW) heating is a well - established renewable energy system in many countries outside the UK. It can be one of the most cost-effective renewable energy systems available.

It is appropriate for both residential and non-residential applications, and there are currently in the order of 80,000 installations in the UK.

Solar thermal systems in the UK normally operate with a back-up source of heat, such as gas or electricity. The solar system pre-heats the incoming cold water, which is topped up by the back-up heat source when there is insufficient solar energy to reach the chosen target temperature. Solar collectors are best mounted at an incline with a southerly orientation, although orientations between south-east and south-west are acceptable. The panels can be fixed to the roof or walls.

There are three main types of solar collector that can be used in SDHW systems. These are:

- Evacuated tubes.
- Glazed selective surfaced flat plate.
- Glazed non-selective surfaced flat plate.
- Evacuated tube collectors are generally more expensive than flat plate type but offer an improved performance, particularly in the winter.

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