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Airport City Manchester Premier Inn – Plot H5

H5PI-CPW-XX-XX-RP-ME-00004

Energy Strategy Report



Sustainability at our core.

Document Revision History			Ref	H5PI-CPW-XX-XX-RP-ME-00004	
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Energy Strategy



1.0 Introduction

CPW are appointed by The Manchester Airport Group (MAG) as the Mechanical and Electrical design consultants for the development of Plot H5. This Energy Strategy is intended to support the planning condition for the Proposed Premier Inn hotel.

The Proposed development consists of a new build hotel. The proposed new building is 9 storey with a single storey plant and ancillary building adjoining the ground floor.

The development requires a single regulation to be taken into account, Part L2A. Based on this, a SBEM calculation was undertaken for the development. The analysis was carried out using a Government Authorised Software package.

- a) Integrated Environmental Solutions IESVE (Version 2024 VE Compliance)

To achieve the resultant carbon emission reduction for the proposed development the following initiatives are to be implemented;

- a) High performance building fabric, U-values and G-Values;
- b) High efficiency space heating system;
- c) High efficiency DHW provision;
- d) Low-energy demand lighting system;
- e) High efficiency renewable energy sources (PV)

Table 1 below displays the results from the Part L assessment of the building, and if a betterment above Part L of the Building Regulations.

Target Emission Rate (TER)	Building Emission Rate (BER)	Part L2A	Betterment above Building Regulations Part L2A
kgCO ₂ /m ²	kgCO ₂ /m ²	PASS or FAIL	%
12.61	11.35	BER<TER = PASS	10%



Figure 1 - Architects' Vision of Constructed Proposed Building
Image courtesy of 5 Plus Architects

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2.0 Assessment Criteria

This report will demonstrate compliance with the current Building Regulations and planning policy at national, regional and local level for all parts of the building.

The Building Regulation document sets out minimum building fabric and services standards, limitations on the amount of acceptable solar gain and a Target CO₂ Emission Rate (TER) that must not be exceeded by the actual Building Emission Rate (BER), and Target Primary Energy Rate (TPER) that must not be exceeded by the actual Building Primary Energy Rate (BPER). This calculation of BER/TER and BPER/TPER forms the basis of further improvements required by regional and local planning policy and conditions stated in the following:

2.1 MCC Core Strategy 2012-2027

2.2 Manchester Core Strategy 2012

Policy EN6 of the Core Strategy requires the submission of an Energy Statement for developments over 1,000 sqm. The Statement should set out the projected regulated energy demand and associated CO₂ emissions for all phases of the development. The targets set out in the policy have now been replaced by the policy in the 2024-adopted Places for Everyone document (JP-S2) detailed below.

2.2.1 Places for Everyone (PfE) Policy JP-S2: Carbon and Energy

The 'Places for Everyone Joint Development Plan Document for Bolton, Bury, Manchester, Oldham, Rochdale, Salford, Tameside, Trafford and Wigan 2022 To 2039' was adopted on 21 March 2024.

"Development proposals should set out how this has been achieved in an energy statement in accordance with the energy hierarchy, which in order of importance seeks to:

- i. Minimise energy demand;*
- ii. Maximise energy efficiency;*
- iii. Use renewable energy;*
- iv. Use low carbon energy; and*
- v. Utilise other energy sources."*

This is the manner in which this energy strategy is presented in order to demonstrate how the scheme reduces the energy demand before then supplying what is required via highly efficient plant, equipment and systems, and only then are renewable technologies implemented in order to achieve full compliance.

"For renewable energy generation priority should be given to PV installation where technically feasible, alternative technologies will be appropriate where the equivalent generation is evidenced.

- e. For non-residential developments, achieve at least BREEAM excellent standard (or equivalent) for the 'Ene 01 – reduction of energy use and carbon emissions' category rising to 'BREEAM outstanding' equivalent for ENE 01 from 2028."*

This scheme has a target of BREEAM excellent (please see separate BREEAM pre assessment) and it has been demonstrated that the results of this energy strategy achieves excellent standard for ENE01.

"As an interim measure, development should be consistent with the 2022 Part L Building Regulations unless superseded by changes to building regulations and/or national or local planning policies."

For this reason we have demonstrated by the contents, calculations and conclusions within this energy strategy that the proposed development is compliant with the previous targets within MCC Core Strategy EN6.

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2.2.2 MCC Core Strategy EN6 Table 12.2

MCC EN6 Table 12.2 states Non-Domestic CO2 emission reduction targets: Target 2 Electrical Intense Buildings (locations where predominant building type has an all electric fit-out such as retail units and leisure complexes) are required to improve upon Part L 2021 +10%.

This report demonstrates how the proposed scheme is also compliant with this previous policy target now replaced by the new PfE Policy JP-S2.

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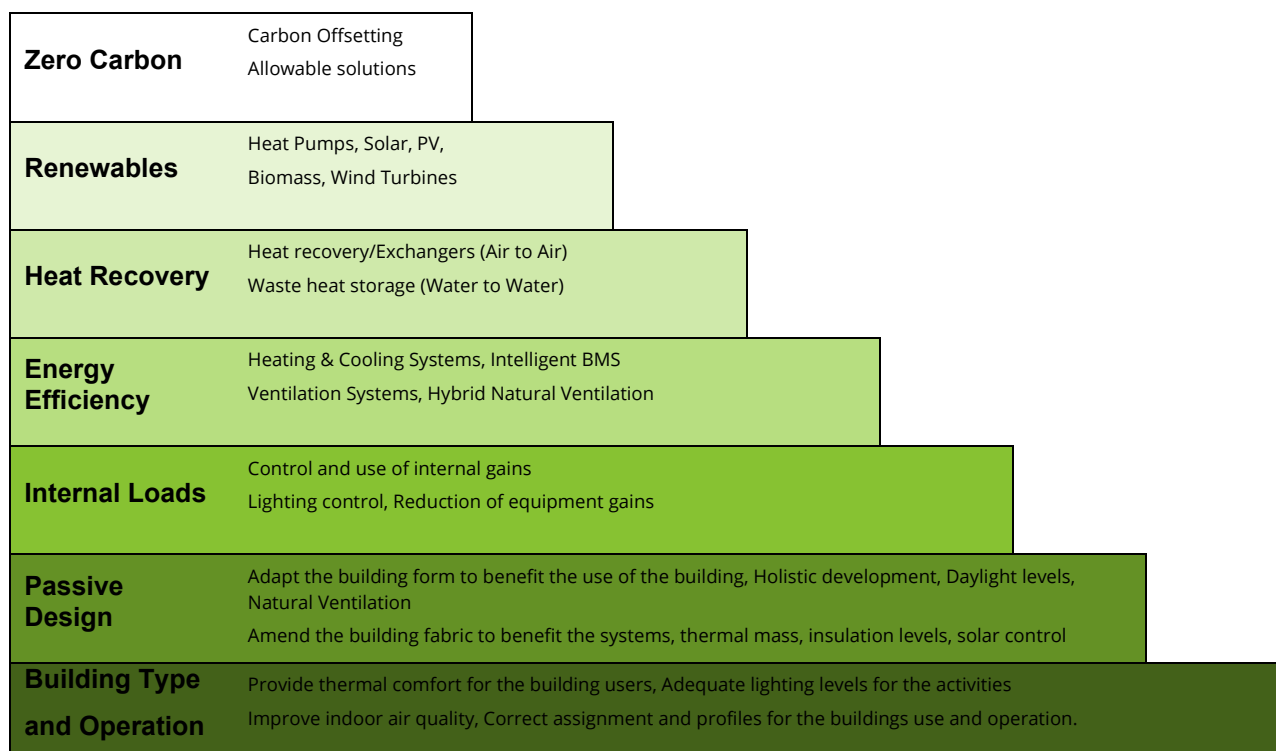


3.0 Carbon Reduction Strategy

3.1 Strategic Approach

The aim of this study is to develop an energy strategy for the building using an energy hierarchy approach of reducing energy demand, applying efficient building services and finally utilising decentralised and/or renewable energy sources where appropriate. A hierarchal approach has been adopted addressing the energy requirements in three stages;

- 1) LEAN Use less energy
- 2) CLEAN Supply energy efficiently
- 3) GREEN Adopt Renewable Technologies



The above figure 3.1 displays the hierarchal approach towards energy efficiency of the building in order to reduce carbon dioxide emissions.

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4.0 Building Compliance Modelling

The predicted energy efficiency and emissions ratings have been informed and assessed via SBEM calculation using Dynamic Simulation Modelling.

The energy efficiency and emissions ratings detailed have been assessed at the current level of design and are taken as reasonable estimates at this stage of the design, based on the following strategies and equipment specifications. The energy model produced utilises the latest industry standard energy modelling software, which has been tested and validated by the manufacturer with regard to the accuracy of results obtained.

The three dimensional modelling and complex data entry with regard to occupancy levels, internal gains, window operation. etc. has been input to match the anticipated profiles of the actual building within the limitations of the software engine.

The report details the assumptions made in terms of internal gains, occupancy, opening hours etc. used in producing the energy model. Deviations from these assumptions will change the outcome of the energy model. The energy model is a design tool to be used for evaluation of solutions in a comparative manner.

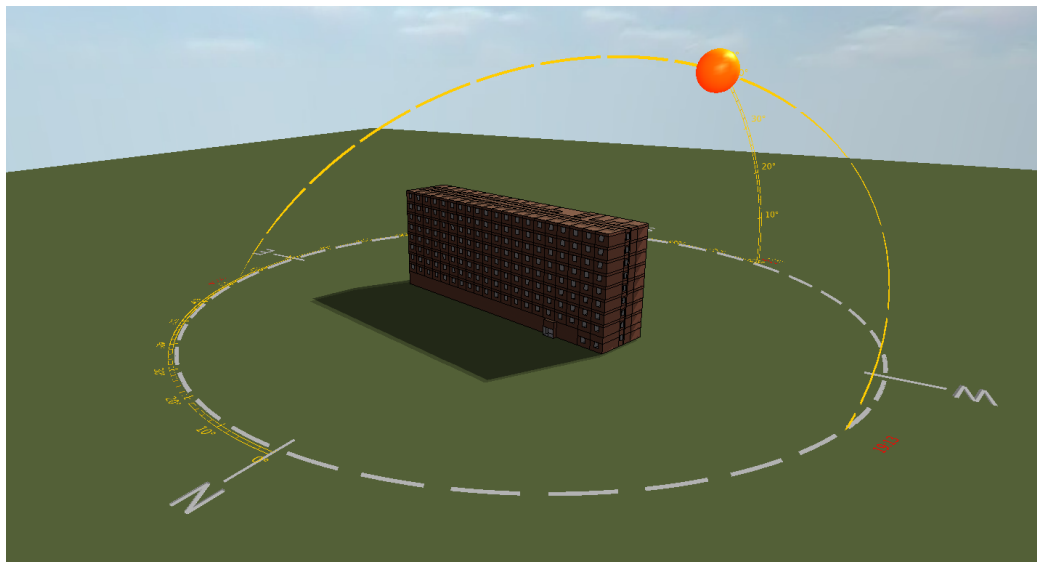


Figure 2 – IES VE Compliance and Thermal Dynamic Simulation Model

4.1 Calculations of CO₂ Emissions

In accordance with Part L2A of the Building Regulations dynamic simulation modelling (DSM) has been used to assess the buildings energy performance. A virtual 3D model of the building geometry has been created using approved AM11 Compliant Software, Integrated Environmental Solutions Virtual Environment. Data on the building's fabric and services performance is entered into the model to estimate energy consumption.

All results are based on the results found in the Building Regulations UK part L output document (BRUKL for commercial units). The Building Emission Rate (BER) is calculated in accordance with National Calculation Methodology (NCM).

For the purpose of this report NCM methodology has been used to calculate the energy contribution and CO₂ saved. Operational profiles, heating and cooling set points are therefore based on NCM standardised templates and may be different in the real building. The closest NCM activity type has however always been selected to represent the commercial activities in each area.

The following tables and descriptions will provide information on the services and inputs used in the model to assess the buildings against Part L of the Building Regulations, which include the calculation of their CO₂ emissions.

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4.2 Location Data

The building has been modelled using the closest available weather data set for the site; i.e. Birmingham.

The weather data files used by the modelling software are provided based on recorded data for the nearest geographical location, these provide details on temperature, solar irradiation, wind speed, wind direction etc, which is simulated dynamically within the model. The data has been interpreted by the issuing authority such that it gives the anticipated maximum loads for a current design summer year.

The energy modelling software is the industry recognised standard for predicting if summertime temperatures will be acceptable. However, caution must be exercised in interpreting results as actual temperature experienced in practice will deviate from the predicted values, particularly if weather data / internal occupancy and heat gain profiles / usage patterns differ from the assumptions made.

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5.0 Energy Strategy

5.1 Energy Hierarchy

CPW's design philosophy for reducing energy consumption, implemented on Plot H5 is demonstrated in the image below and is aligned with the Whitbread specification and CIBSE guidelines:



Figure 3 – Proposed environmental strategy.

The subsequent sections describe how the proposed design aligns with the Energy Hierarchy.

5.2 ‘Be Lean’ - Energy Demand Reductions

The project energy strategy is to maximise a fabric first energy strategy whereby the construction budget is focussed on reducing energy consumption and using it efficiency and not in expensive renewable energy technologies for the new build.

The new proposed extensions Thermal Efficiency of each construction element on average is approximately 30% better than the Part L minimum: -

Construction	Part L2 2021 Maximum Value [W/(m²K)]	Plot H5 [W/(m²K)]
External Wall	0.18	0.15
Floor	0.18	0.15
Flat Roof	0.26	0.10
Glazing	1.6	0.92
Air Tightness	8m³/m²/hr @ 50Pa	5m³/m²/hr @ 50Pa

The weather file/scenario used to simulate the climate in all Part L compliance simulations in the Dynamic Simulation Modelling software was ManchesterTRY.

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The table below shows some of the other 'Be Lean' measures incorporated within the design: -

Design Measure	'Be Lean' Benefits
Building Geometry	Multi storey building reduces exposed surface area to internal volume, reducing heat and improving efficiency.
Reduce cold and hot water consumption	By utilising water efficient fittings, the amount of energy consumed for water consumption is much reduced.
Maximise Useful Daylight	Daylight-dimming lighting controls, helps eliminate the need for artificial lighting energy consumption.
Heat recovery ventilation	As discussed, the ventilation system utilises heat recovery ventilation is deployed to maximise energy efficiency.
On-demand control	The room-by-room ventilation controls ensure that energy efficiency is maximised in every space where the amount of air delivered is variable to suit the space.
Automatic monitoring of all energy sub-metering	Out of range alarms shall be triggered when the energy consumption of the building exceeds the typical consumption levels to highlight to the facilities staff that excessive energy use has occurred.
Efficient Air Source Heat Pumps	The proposed plant is highly efficient ensuring that energy is not wasted in the heat generation process
Variable speed pumping	Variable speed pumping on all secondary circuits reduces energy consumption associated with distribution significantly

5.2.1 Resultant CO₂ Reductions from 'Be Lean' Measures

The proposed Fabric First strategy reduces the space conditioning associated CO₂ emissions. The image below shows the BRUKL output of the design stage Part L compliance model for the Plot H5 Model.

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Energy Strategy



BRUKL Output Document



HM Government

Compliance with England Building Regulations Part L 2021

Project name

Premier Inn Manchester Airport - Base Case

As designed

Date: Tue Mar 12 04:24:39 2024

Administrative information

Building Details

Address: Plot H5, Manchester City Airport, Manchester, M91 1QX

Certifier details

Name: CPW

Telephone number: Phone

Address: Street Address, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.24

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.24

BRUKL compliance module version: v6.1.e.1

Foundation area [m²]: 796.2

The CO₂ emission and primary energy rates of the building must not exceed the targets

Target CO ₂ emission rate (TER), kgCO ₂ /m ² :annum	12.61
Building CO ₂ emission rate (BER), kgCO ₂ /m ² :annum	12.45
Target primary energy rate (TPER), kWh _{eq} /m ² :annum	136.44
Building primary energy rate (BPER), kWh _{eq} /m ² :annum	134.87
Do the building's emission and primary energy rates exceed the targets?	BER ≤ TER BPER ≤ TPER

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

Fabric element	U _{s-Limit}	U _{s-Calc}	U _{i-Calc}	First surface with maximum value
Walls*	0.26	0.15	0.15	L0000003:Surf[1]
Floors	0.18	0.15	0.15	L0000003:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.1	0.1	L000002B:Surf[1]
Windows** and roof windows	1.6	0.92	0.92	L0000024:Surf[1]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors ^Δ	1.6	-	-	No personnel doors in building
Vehicle access & similar large doors	1.3	-	-	No vehicle access doors in building
High usage entrance doors	3	-	-	No high usage entrance doors in building
U _{s-Limit} = Limiting area-weighted average U-values [W/(m ² :K)] U _{s-Calc} = Calculated area-weighted average U-values [W/(m ² :K)] U _{i-Calc} = Calculated maximum individual element U-values [W/(m ² :K)] * Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows. ** Display windows and similar glazing are excluded from the U-value check. *** Values for rooflights refer to the horizontal position. Δ For fire doors, limiting U-value is 1.8 W/m ² :K NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.				
Air permeability	Limiting standard	This building		
m ³ /(h.m ²) at 50 Pa	8	5		

Figure 4 - BRUKL Report for Baseline Building

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5.3 ‘Be Clean’ - Heating Infrastructure

Element or System	Efficiency / Values Used
Heating Systems	a) VRF Heating: 368 % efficient b) Electric Panel Radiators: 100% efficient
Cooling System	c) VRF Cooling: 335 % efficient d) Server Room DX Cooling System: 250% efficient
Domestic Hot Water	e) Air Source Heat Pumps (Q-Tons): 400% efficient
Ventilation Systems	f) Local MVHR Units: 1.11 W/l.s @ 83% HR (FoH & BoH) g) Local Dirty Extract Ventilation: 0.5 W/l.s (BoH)
Lighting Systems	h) Efficacy: 120 lm/cW

5.3.1 Existing District Heating Infrastructure

There is not currently a district heating network in proximity to the site and therefore no connection proposals are included within the design.

5.4 ‘Be Green’ – Renewable Technology

The project is required to achieve a BREEAM rating of excellent. In order to achieve sufficient credits within BREEAM ENE01 renewable technology is included within the design proposals.

Renewable technology such as photovoltaic (PV) panels would be suitable to reduce CO₂ emissions for this building to achieve sufficient carbon reduction in order to satisfy ENE01.

In addition to a PV array, Air Source Heat Pumps (ASHP) have been used instead of gas heating systems to further reduce carbon emissions. These would be considered as a less cost-effective means to reduce emissions. Using a 21% efficient PV array of 400m² sited on the roof will be sufficient to achieve the credits requires to support the BREEAM excellent targeted and provide the required betterment over Part L for local planning policy compliance.

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BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

Premier Inn Manchester Airport - 400m²
PV

As designed

Date: Wed Oct 16 17:37:20 2024

Administrative information

Building Details

Address: Plot H5, Manchester City Airport, Manchester, M91 QX

Certification tool

Calculation engine: Apache
Calculation engine version: 7.0.26
Interface to calculation engine: IES Virtual Environment
Interface to calculation engine version: 7.0.26
BRUKL compliance module version: v6.1.e.1

Certifier details

Name: CPW
Telephone number: Phone
Address: Street Address, City, Postcode

Foundation area [m²]: 798.2

The CO₂ emission and primary energy rates of the building must not exceed the targets

Target CO ₂ emission rate (TER), kgCO ₂ /m ² annum	12.61
Building CO ₂ emission rate (BER), kgCO ₂ /m ² annum	11.35
Target primary energy rate (TPER), kWh _{eq} /m ² annum	136.44
Building primary energy rate (BPER), kWh _{eq} /m ² annum	122.34
Do the building's emission and primary energy rates exceed the targets?	BER =< TER BPER =< TPER

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

Fabric element	U _{s-Limit}	U _{s-Calc}	U _{s-Calc}	First surface with maximum value
Walls*	0.26	0.15	0.15	L0000003:Surf[1]
Floors	0.18	0.15	0.15	L0000003:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.1	0.1	L000002B:Surf[1]
Windows** and roof windows	1.6	0.92	0.92	L0000024:Surf[1]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	-	-	No personnel doors in building
Vehicle access & similar large doors	1.3	-	-	No vehicle access doors in building
High usage entrance doors	3	-	-	No high usage entrance doors in building

U_{s-Limit} = Limiting area-weighted average U-values [W/(m²K)]
U_{s-Calc} = Calculated area-weighted average U-values [W/(m²K)]
* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
** Display windows and similar glazing are excluded from the U-value check. *** Values for rooflights refer to the horizontal position.
^ For fire doors, limiting U-value is 1.8 W/m²K
NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

U_{s-Calc} = Calculated maximum individual element U-values [W/(m²K)]

Air permeability	Limiting standard	This building
m ³ /(h.m ²) at 50 Pa	8	5

Figure 5 - BRUKL Report for Proposed Building

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5.4.1 Heat Pump Technologies

Electric driven air source heat pumps extract thermal energy from the surrounding air and transfer it to the working fluid (air or water). They can provide both heating and cooling to buildings and have an associated Coefficient of Performance (COP). This is typically around 3 to 4 for heat pumps driven by inverter driven compressors powered by electronic controlled (EC) motor technology.



Care should be taken when mounting the units to avoid any acoustic problems associated with operating the fans. The outdoor units normally operate with sound levels typically in the range 55 - 60dB(A).

A downside of electric driven air source heat pumps is that they require a defrost cycle in extreme conditions which impacts on the system efficiency. Heating capacity also falls off as the ambient temperature drops below 5°C but still maintains 80% capacity at -5°C.

Air source heat pump systems are scaleable to meet the specific demands of the development and have the potential to offer good CO₂ reduction as the grid electricity supply is decarbonised.

In order to achieve compliance with the environmental requirements stated earlier air source heat pump systems have been adopted to provide:

- Space heating for the building

5.4.2 Solar Photovoltaic (PV) Panels

Solar photovoltaic panels convert solar radiation into electrical energy through semiconductor cells. They are not to be confused with solar panels which use the sun's energy to heat water (or air) for water and space heating.



Photovoltaic panels are available in a number of forms including mono-crystalline, polycrystalline, amorphous silicon (thin film) or hybrid panels (discussed later). They are fixed or integrated into a building's un-shaded south facing façade or pitched roof ideally at an incline of 30° to the horizontal for maximum energy yield.

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It is essential that the panels remain un-shaded, as even a small shadow can significantly reduce output. The individual modules are connected to an inverter to convert their direct current (DC) into alternating current (AC) which is usable in buildings.

Although sloping rooftops provide an ideal site for fixing PV panels using traditional mounting frames, there are a number of alternative solutions whereby PV panels can be incorporated into the actual building fabric of the development.

Solar louvres use PV panels to provide solar shading on the south façade of buildings as part of the brise soleil (see above), and this can be a highly effective way of controlling overheating and help reduce glare.

Solar glazing uses a combination of solar PV and glass, where the PV cells are laminated between two panes of

specialised glazing (see above). The resulting glass laminate serves the dual function of creating energy and shade at the same time, reducing the risk of overheating.



Solar glazing can be used wherever conventional glass would be specified, especially in atria. Bespoke designs allow for varying light penetration by changing the spacing between individual cells. Typically, a combination of 50% PV and 50% translucent glazing is used.

Vertical solar facades can be used to directly replace conventional rain screen cladding materials providing a smooth, flat facade surface for the building. Where circumstances allow, the PV panels can be tilted towards the sun to maximize the energy yield.

As mentioned earlier, there are a number of types of PV cell:

Mono-crystalline Silicon Cells: These are made using cells saw-cut from a single cylindrical crystal of silicon. The principle advantage of mono-crystalline cells is their high efficiency, typically around 18 to 24%, although the manufacturing process required to produce mono-crystalline silicon is complicated, resulting in slightly higher costs than other competing technologies.

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Polycrystalline Silicon Cells: These are made from cells cut from an ingot of melted and re-crystallised silicon. In the manufacturing process, molten silicon is cast into ingots of polycrystalline silicon. The ingots are then saw-cut into very thin wafers and assembled into complete cells giving a granular textured finish. Polycrystalline cells are cheaper to produce than mono-crystalline types, due to the simpler manufacturing process but tend to be slightly less efficient, with average efficiencies of circa 12 – 18%.

Thick-Film Silicon: This is another polycrystalline technology where the silicon is deposited in a continuous process onto a base material giving a fine grained, sparkling appearance. Like all crystalline PV, this is encapsulated in a transparent insulating polymer with a tempered glass cover and usually bound into a strong aluminium frame.

Thin-Film Amorphous Silicon: Amorphous silicon cells are composed of silicon atoms in a thin homogenous layer rather than a crystalline structure. Amorphous silicon absorbs light more effectively than crystalline silicon, so the cells can be thinner. For this reason, amorphous silicon is also known as a 'thin film' PV technology. Amorphous silicon can be deposited on a wide range of substrates, both rigid and flexible, which makes it ideal for curved surfaces and 'fold-away' modules. Amorphous cells are, however, less efficient than crystalline based cells, with typical efficiencies of around 6%, but they are easier and, therefore, cheaper to produce.

Other Thin Films: A number of other promising materials such as cadmium telluride (CdTe) and copper indium diselenide (CIS) are now being used for PV modules. The attraction of these technologies is that they can be manufactured by relatively inexpensive industrial processes, certainly in comparison to crystalline silicon technologies, yet they typically offer higher module efficiencies than amorphous silicon. New technologies based on the photosynthesis process are at early stages of commercialisation.

Roof mounted Photovoltaic technology is considered feasible on this project however there is limited roof space available due to location of other ventilation plant items.

5.4.3 Energy production from LZC

As described above the adopted LZC's within this scheme are: Photo voltaic panels and ASHPs. The energy produced by the heat pumps serves the space heating for the proposed building.

5.4.4 Feasibility of Exporting Heat

The cooling requirements of the site are relatively low and, in most cases, free cooling via heat exchangers and fresh air ventilation are expected to maintain the internal environment. Additionally, there are no major heat producers in the building. Hence, based on the above, the site does not have a considerable potential to export any type of heat generated within the building.

5.4.5 Energy storage

The building does not include any significant energy storage.

5.4.6 Renewable Energy Technology Proposed

The third stage of the energy hierarchy refers to the production of renewable energy, which relates to the reduction in carbon emissions from on-site or near site renewable.

A range of approved renewable energy technologies have been appraised, examining the size and cost of each system required to meet this target.

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6.0 Recommendations and Conclusion

CPW LLP Consultant Engineers study into the low carbon design and energy strategy for a proposed Plot H5 Development has found that the proposed strategy utilises the following initiatives:

- a) High performance building fabric,
- b) High performance U-values;
- c) High efficiency space heating system;
- d) High efficiency DHW provision;
- e) Low-energy demand lighting system;
- f) Heat recovery on mechanical ventilation systems.
- g) Roof mounted Photovoltaic arrays to produce renewable energy on site.
- h) High efficiency air source heat pump technology

The building emission rate (BER) has reduced to below the target emission rate (TER) which results in a compliant building and one that will be in compliance with pass the local and national planning policy. The energy hierarchy carbon emissions for the Building taken from the IES software model, and shown in the table below:

Target Emission Rate (TER)	Building Emission Rate (BER)	Part L2A	Betterment above Building Regulations Part L2A	EPC rating
kgCO ₂ /m ²	kgCO ₂ /m ²	PASS or FAIL	%	
12.61	11.35	BER<TER = PASS	10%	A7

Through the measures listed above, the sustainable design strategy described throughout this report and the results shown in the table, it has been shown that the scheme can provide a strategy in accordance with Part L2A of the Building Regulations. The strategy maximises energy efficiency, reduces consumption and harnesses the benefits from renewable technologies and resources.

Airport City Manchester– Plot H5

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Appendix A1 - Further Carbon Reduction Measures

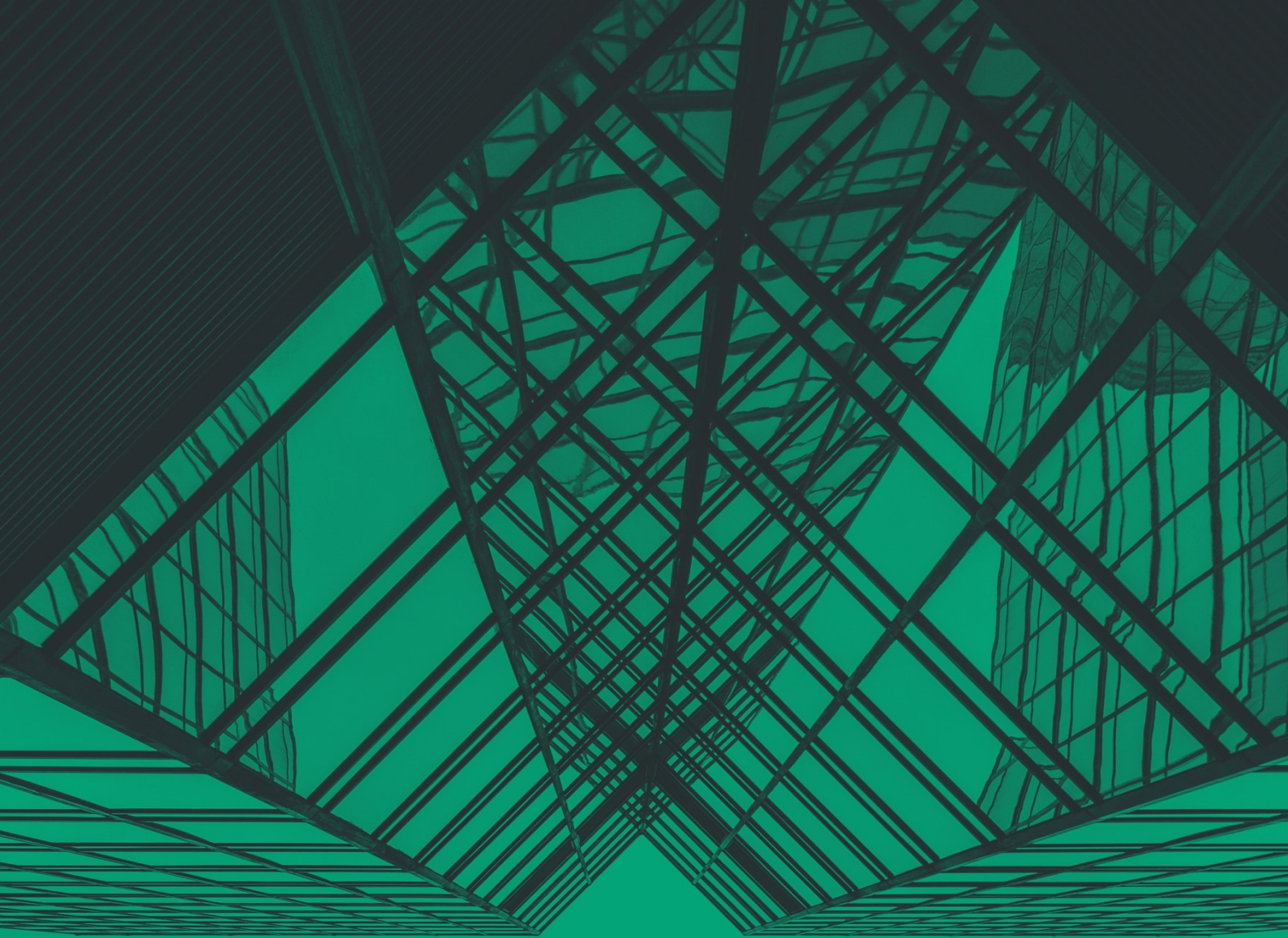
Reduction in Hot Water Demand

The use of water recycling systems have been carefully considered and discounted due to the nature of the proposed new hotel. Potable water efficiency and water conservation shall therefore be managed by the careful specification and use of water efficient components and fittings.

Water efficiency of the building shall be in line with the relevant LAPP Policy CC1 water usage measures to not exceed the 100 litres/person/day limiting threshold.; to determine water efficiency (measured in litres/person/day and m³/person/yr) based on the building's actual component specification and default usage patterns for the building type and its activity areas.

The following strategies shall be adopted:

- Low flow tap outlets (litres/minute) shall be used at wash
- Dual flush low volume cisterns used at all WC's.



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+44 (0) 115 924 3348

nottingham@cpwp.com

www.cpwp.com

39 Stoney Street
Nottingham
NG1 1LX
t Johns House

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