
Holiday Inn Express, Manchester

Energy Statement

December 2023



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Executive Summary

Primary Energy Reduction	= 11.5%
CO ₂ Reduction	= 11.2%

As part of the drive to improve the energy and carbon efficiency of new and refurbished buildings, Manchester City Council require all new developments to reduce their CO₂ emissions through considerate design, paying particular attention to energy efficiency measures and appropriate LZC technology.

This document investigates the use of renewable technologies and energy efficient design to achieve the required target savings of the proposed development's predicted annual CO₂ emissions.

In order to optimise the design of equipment and renewable technologies, it has been necessary to generate a 3D building model of the proposed building. Once generated, dynamic simulations have been run on the building model for the considered energy efficiency measures and possible renewable technology options.

The modelling carried out for the building has highlighted that improvements on Part L2 2021 Target Rates can be achieved by implementing energy efficient measures whilst utilising a centralised air source Variable Refrigerant Flow heat recovery system (VRF) providing space heating and cooling. The energy efficient measures include high thermal performance of the building fabric, mechanical ventilation with heat recovery to the hotel bedrooms and low energy lighting throughout.

Index

- 1. Introduction**
- 2. Description of the Building**
- 3. Methods of Forecasting CO₂ Emissions**
- 4. Energy Hierarchy**
 - 4.1. Be Lean – Energy Efficiency
 - 4.2. Be Clean – Decentralised Energy Technology
 - 4.3. Be Green – Renewable Energy Technology
- 5. Forecasting CO₂ Emissions**
- 6. Conclusion**

1. Introduction

The issue of sustainability will be with us for some considerable time and will certainly increase in profile. Increasing emphasis is being put on good design to reduce the environmental impact new build residential developments have. This document shall demonstrate how the proposed extension of Holiday Inn Express on Oxford Road in Manchester will reduce its environmental impact through energy efficient design and use of renewable technology.

The proposed development is required to fulfil the compliance conditions set out by Part L2 of the 2021 Building regulations. The development will achieve the reduction targets for Primary Energy and CO₂ emissions through a combination of energy efficiency measures and renewable technology.

2. Description of the Building

This report specifically deals with the proposed two storey extension of Holiday Inn Express on Oxford Road in Manchester. The existing building is a 10-storey hotel situated adjacent to the River Medlock.

The proposal is to retain all the plant on the existing roof and construct 2 additional storeys above the plant deck. The plant deck will become the 11th floor and will have an open façade all around its periphery. The new 12th and 13th floors will have an additional 24 bedrooms between them.

3. Methods of Forecasting CO₂ Emissions

The latest (2021) Building Regulations Part L came into effect 15th June 2022 and incorporate changes to the metrics used to demonstrate the efficiency of buildings. This development will be assessed under Part L2 2021.

The proposed development is required to fulfil the compliance conditions set out by Part L2 of the Building regulations to reduce CO₂ emissions through the use of energy saving measures and implementation of renewable technology.

In order to accurately calculate the predicted energy demands of the proposed building and associated CO₂ emissions, 3D dynamic simulation modelling is required. The DSM software used for this investigation was the IES Virtual Environment. The DSM creates a virtual building, incorporating:

- all of the fabric details (glazing, wall construction, floor construction, etc.)
- solar shading (from the constructed building and local obstructions)
- solar gain through glazing and other solar heating
- internal room data (including occupancy, heating, lighting, etc. for each room)
- infiltration (effectively the building air leakage rate)
- required heating and cooling demands for each room of the building
- all installed equipment requiring energy (heating, cooling, lighting, pumps, motors, operational equipment, etc.)

Utilising this sophisticated software, the renewable energy options can be trialled to measure its performance and contribution to the building's needs.

4. Energy Hierarchy

To design the building to the current notional building specification used to create the Target Emissions Rate (TER) would lead to compliance with ADL2 and Planning Policy EN6. However practical limitations on some parameters do not make this possible and a more holistic approach to the design must be undertaken to ensure these targets can be achieved. It is appropriate, in this case, to follow the widely recognised energy hierarchy to determine the most practical and economically feasible design available to this development.

Developing energy efficient, low carbon buildings is a key objective of national policy and recent changes to the Building Regulations support the reduction of energy demand through efficient building design.

The development will be designed with a fabric first approach, utilising lifetime passive design measures, before applying low and zero carbon technologies to those consumed energies. With the latter it recognises the errors in the gas energy strategy previously pursued by the UK government and the substantial advances now made in reducing the electrical supply carbon footprint.

4.1. Be Lean – Energy Efficiency

Before immediately amending the design to incorporate a raft of renewable technology to reduce the development's CO₂ emissions it is important to ensure the design has optimised the development's energy performance by considering the following energy hierarchy:

1. **Be lean** – use less energy through energy efficient design.
2. **Be clean** – supply energy efficiently through use of decentralised energy.
3. **Be green** – use on-site renewable energy technologies.

4.1.1. Building Fabric

The insulation values of the building must also be addressed to ensure the optimum envelope construction and reduce the heating requirement of the building. Part L2 building regulations require certain minimum values of fabric thermal performance (U-values) be met for all components of the building's external thermal envelope. Improvement on these values will reduce heat loss from the building and therefore reduce the heating requirement. It is proposed that the building is designed by the architect, with U-values for external walls, floors, roof areas, windows, and doors in excess of the current building's fabric standards, thereby improving the overall thermal performance of the building.

Building Element	Existing Building U-Value Standards	Proposed Extension U-Values
	W/m ² K	W/m ² K
Wall	0.35	0.26
Ground/Exposed Floor	0.25	0.18
Roof	0.25	0.18
Glazing	2.2	1.6
Air Permeability	10 m ³ /m ² h	3 m ³ /m ² h

4.1.2. Overheating

The issue of overheating and the effect it has on the cooling requirements within buildings has been highlighted for a number of years. This development will require cooling to the bedrooms and communal areas for the comfort of the hotel guests but it is desirable to reduce the cooling capacity of the building through good design. Passive measures such as external solar shading devices will reduce the influence of solar gains during summer months whilst not reducing desirable solar gains in the winter months.

4.1.3. Lighting

Lighting has a major and direct impact on carbon emissions and is one area where they can be reduced effectively through considered design. Therefore, there is more incentive to examine lighting design and specifically with this building, emphasis shall be given to:

- **Prevention of Overlighting** - Areas with high levels of natural daylight will be zoned separately and a control strategy implemented to allow more consistent lighting levels across rooms.
- **Lighting Efficacy** - Installed lighting efficacy will have an efficacy in excess of 100 lm/W, greater than the current Building Regulations minimum standards.
- **Control** - All store rooms and “back of house” areas shall employ occupancy detection to switch lighting. Similarly, other areas such as public toilets, changing rooms, shower rooms; etc. (subject to Health & Safety concerns) shall be fitted with this type of control. Lighting to bedroom corridors shall be controlled by occupancy detection, with lighting levels being reduced by half when not occupied.

4.1.4. Heat Recovery Technology

Local bedroom ventilation is provided by a mechanical ventilation heat recovery (MVHR) system which has supply and exhaust fans, cross flow heat exchanger and filters. The recuperation process reduces heat losses and improves energy efficiencies.

4.2. Be Clean – Decentralised Energy Technology

4.2.1. CHP

In order for a CHP installation to be feasible, a large continuous demand for heating and domestic hot water would be required. CHP units rely on a continuous load to maximise their efficiency and impact on conserving energy. Therefore, CHP units are usually sized on the base load of the development’s heating or domestic hot water demands to reduce excess heat being wasted to atmosphere.

The hotel extension has been designed to improve on current building regulations concerning thermal performance of the building and as such reduce heat loss and therefore reduce the heating demand of the building. This reduced base heating load would reduce the required size of CHP plant considerably, so a large domestic hot water demand would be required to lend potential to the possibility of installing a CHP unit.

The studied domestic hot water from other hotels demonstrates there is high demand for domestic hot water during the morning around breakfast and also during the early evening when rooms first become occupied. Between these two peaks domestic hot water demand is minimal and represents a small base load from which to size an appropriate CHP unit. An appropriately sized CHP unit would therefore only pre-heat domestic hot water and the energy savings and CO₂ reduction from such a unit would be minimal in comparison to the capital cost.

We believe therefore, that other options for reducing CO₂ emissions are better suited to this development for the following reasons:

- Hotels operate with a small base load and two high peaks (morning and early evening). Therefore, to operate a CHP continuously to maximise efficiency, it must be sized on the small base load, reducing its influence.
- High efficiency gas-fired water heaters can have efficiency 10% better than that found on CHP units, reducing the potential benefit on CO₂ emissions through electric generation from CHP.

4.3. Be Green – Renewable Energy Technology

Within the framework of the energy hierarchy, major developments should reduce regulated CO₂ emissions through the use of energy efficiency measures, decentralised technology, and on-site renewable energy generation. All renewable energy systems should be positioned and designed responsibly to minimise negative impact on the local environment.

Planning Policy encourages the use of a full range of renewable energy technologies, which should be incorporated wherever site conditions make them feasible and where they contribute to the highest overall and most cost-effective CO₂ emissions savings for a development proposal.

There is a presumption that all major development proposals will seek to reduce CO₂ emissions by at least 15% over 2010 Part L by implementing renewable technology. The implementation of the new Part L 2021 targets is more onerous than this reduction and as such supercedes the 2010 target.

The design of new developments should consider the use of renewable energy technologies such as: biomass heating; renewable energy from waste; photovoltaic; solar water heating and heat pumps. The Core Strategy encourages the use of a full range of renewable energy technologies, which should be incorporated wherever site conditions make them feasible and where they contribute to the highest overall and most cost-effective CO₂ emissions savings for a development proposal.

4.3.1. Biomass

In instances where no gas supply is present biomass boilers have been considered as an alternative to CHP systems. Wood chip boilers have been used extensively in other Countries and also in Scotland. Typically, wood chips are delivered regularly to fill up a storage hopper, with these chips being fed automatically, as required, to a suitably designed boiler. The ash is disposed of and removed in a similar manner.

There is no space available for a storage hopper within the building and as such the ability to operate a biomass boiler to provide heating and hot water to the building is compromised. Security of supply would be another issue with a lack of local suppliers meaning fuel must be sourced from further afield, increasing logistical issues and CO₂ emissions associated with transportation. The rising price of oil will also clearly have an effect on transportation costs for the supplier which will be passed onto the customer, making other options more cost-efficient and secure.

Biomass boilers together with biomass CHP can therefore be ruled as unsuitable for this development.

4.3.2. Hydrogen Fuel Cells

There are high hopes for the emergence of fuel cells as a viable renewable energy technology for the future. However currently there are still issues with hydrogen-fuelled engines and power plants. Transport, storage, and safety problems need to be addressed and as such this emerging technology is not considered robust enough to provide a feasible source of power for the development.

4.3.3. GSHP & Geothermal

Ground Source Heat Pumps (GSHP) provide a robust way of heating (and cooling) buildings. They make use of renewable energy stored in the ground, by using a working fluid combined with a heat pump. Typically, a GSHP can deliver around three times as much thermal energy (heat) as is used in electrical energy to drive the system. The system uses submerged heat collecting pipes in a closed loop, containing water (with a little antifreeze) to extract this stored energy from the ground. The collection loop can either be installed horizontally in a trench several metres below the ground surface over a large area or vertically in the form of boreholes (geothermal), subject to the geological suitability of the site.

For this development there is not enough open space available to install either a horizontal trench loop or vertical borehole system. Furthermore, it has been previously demonstrated that in some instances higher Coefficients of Performance (COPs) are possible from modern air source heat pump (ASHP) systems at a fraction of the installed cost of a GSHP/geothermal system. It is for the reason that GSHP will be discounted in favour of a high efficiency ASHP system.

4.3.4. Photovoltaic (PV) & Solar Thermal

Whilst PVs (or solar cells) started out as a low powered energy source and were uneconomic in the short and medium term, as it has evolved into a more mainstream technology the associated costs have reduced to make PV a viable option.

In the case of solar thermal panels, this is robust technology available to provide a building's hot water supply using roof-mounted solar panels. These panels, either in the form of flat panels or the more efficient evacuated tubes can be up to 96% efficient, emitting just 4% of the solar energy captured. This reduces carbon emissions and energy output through pre-heating the domestic hot water within the building.

In the case of both PV & Solar thermal, the siting of the new external condensers together with the repositioning of the existing condensers from the plant deck up to the new roof will restrict the potential size of any installed array. Due to the large amount of plant required to be sited externally together with other considerations such as building maintenance access around the roof of the building, there is no space available for even a small array to be located and this technology should be discounted as a viable option.

4.3.5. VRF

VRF technology has long been demonstrated to be an energy efficient option for use within hotels. The additional presence of heat recovery within the system reduces the load on the outdoor compressor units and therefore reduces energy consumption of the system. The VRF system is beneficial due to the way it operates and "moves" heat around the building. The VRF system will therefore move excess heat from one area and introduce it to another area where heating is required, instead of dumping the heat to the external condensers.

The system takes advantage of the usage of the various areas of the building and the influence of solar gain (amongst others). For example, occupied rooms with a southerly aspect may require cooling, whilst those facing north are more likely to require heating. The design of the VRF heat recovery system links rooms of varying demand and transfers heat between them, BEFORE demanding grid supplied energy. Clearly this is a more efficient concept compared to other system designs where any excess heat in the south facing bedrooms is dumped to atmosphere.

5. Forecasting CO₂ Emissions

Through 3D modelling of the proposed building a Baseline Primary Energy Consumption can be obtained together with the Baseline Carbon Dioxide Emissions for the building.

These baseline values represent the energy consumption and CO₂ emissions of the building designed to the required standards of Part L2 2021. The notional space heating and domestic hot water requirements are, in this case, supplied by natural gas fuelled installations.

Target Primary Energy Rate	288.4 kWh/m²
Target CO₂ Emissions Rate	52.5 kgCO₂/m²/year

The Baseline design modelled above can then be upgraded to take into account the energy efficiency measures proposed previously (see Section 2.). These energy efficient measures include improved U-values for the external building fabric and a low-energy lighting schedule that exceeds the efficacy constraints documented in Part L2 as well as the MVHR ventilation units supplementing the space heating. Air Source VRF units will provide space heating and domestic hot water to the building.

Building Primary Energy Rate	255.1 kWh/m²
Primary Energy Reduction	11.5%

Dwelling Emissions Rate	46.6 kgCO₂/m²/year
CO₂ Emissions Reduction	11.2%

The implementation of the energy efficiency measures described above will allow the hotel extension to achieve compliance with Approved Document L2.

The new proposed scheme achieves much greater improvements above Building Regulations as highlighted above. This has been achieved by the incorporation of energy efficient systems such as MVHR (Mechanical Ventilation Heat recovery) units in place of simple extract (i.e. significant improvement by recovering heat from extracted air) and VRF providing heating and cooling to the new bedrooms.

6. Conclusion

The calculations carried out indicate that a large reduction in Primary Energy and CO₂ emissions through energy efficiency measures and renewable technology can be achieved through the implementation of a VRF system with heat recovery providing space heating and cooling.

Primary Energy Reduction	= 11.5%
CO ₂ Reduction	= 11.2%

The energy efficient measures incorporated within the design include enhanced building fabric, low energy lighting, MVHR units to the hotel bedrooms together with an air source VRF heat pump system providing both space heating and cooling.

Several other renewable technology options have been discounted due to their unsuitability for this specific development. These include factors such as lack of space for installing the additional plant required and impact on other aspects of the building design.

The lower CO₂ emissions available whilst retaining the ability to provide comfort cooling make the installation of VRF system the optimum design for this development.

Appendix

Holiday Inn Express, Manchester

BRUKL Output Document



HM Government

Compliance with England Building Regulations Part L 2021

Project name

Holiday Inn Express

As designed

Date: Tue Dec 19 10:09:31 2023

Administrative information

Building Details

Address: 2-4 Oxford Road, Manchester, M1 5QA

Certifier details

Name: August Consulting Group

Telephone number: 0161 641 1184

Address: MIOC, Styal Road, Manchester, M22 5WB

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]: 295.89

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	52.52
Building CO ₂ emission rate (BER), kgCO ₂ /m ² :annum	46.58
Target primary energy rate (TPER), kWh _{ed} /m ² :annum	288.45
Building primary energy rate (BPER), kWh _{ed} /m ² :annum	255.15
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 _{a-Limit}	U _{a-Calc}	U _{i-Calc}	First surface with maximum value
Walls*	0.26	0.26	0.26	RM000001:Surf[0]
Floors	0.18	0.18	0.18	RM000001:Surf[44]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.18	0.18	RM000001:Surf[45]
Windows** and roof windows	1.6	1.6	1.6	RM000002:Surf[23]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	1.6	1.6	RM000001:Surf[20]
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 _{a-Limit} = Limiting area-weighted average U-values [W/(m ² K)] U _{a-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. ^ 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	3

Building services

For details on the standard values listed below, system-specific guidance, and additional regulatory requirements, refer to the Approved Documents.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	>0.95

1- VRF

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	5.8	11.57	0	-	0.89
Standard value	2.5*	5	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

1- DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.98	0.005
Standard value	0.91	N/A

Zone-level mechanical ventilation, exhaust, and terminal units

ID	System type in the Approved Documents
A	Local supply or extract ventilation units
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal balanced supply and extract ventilation system
E	Local balanced supply and extract ventilation units
F	Other local ventilation units
G	Fan assisted terminal variable air volume units
H	Fan coil units
I	Kitchen extract with the fan remote from the zone and a grease filter
NB: Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.	

Zone name	SFP [W/(l/s)]										HR efficiency	
	ID of system type	A	B	C	D	E	F	G	H	I	Zone	Standard
	Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1		
Bedroom		-	-	-	0.6	-	-	-	-	-	-	N/A
Bedroom		-	-	-	0.6	-	-	-	-	-	-	N/A
Bedroom		-	-	-	0.6	-	-	-	-	-	-	N/A
Bedroom		-	-	-	0.6	-	-	-	-	-	-	N/A
Bedroom		-	-	-	0.6	-	-	-	-	-	-	N/A
Bedroom		-	-	-	0.6	-	-	-	-	-	-	N/A
Bedroom		-	-	-	0.6	-	-	-	-	-	-	N/A
Bedroom		-	-	-	0.6	-	-	-	-	-	-	N/A
Bedroom		-	-	-	0.6	-	-	-	-	-	-	N/A
Bedroom		-	-	-	0.6	-	-	-	-	-	-	N/A
Bedroom		-	-	-	0.6	-	-	-	-	-	-	N/A
Bedroom		-	-	-	0.6	-	-	-	-	-	-	N/A
Bedroom		-	-	-	0.6	-	-	-	-	-	-	N/A
Bedroom		-	-	-	0.6	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]										HR efficiency	
	ID of system type	A	B	C	D	E	F	G	H	I	Zone	Standard
	Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1		
Bedroom		-	-	-	0.6	-	-	-	-	-	-	N/A
Bedroom		-	-	-	0.6	-	-	-	-	-	-	N/A
Bedroom		-	-	-	0.6	-	-	-	-	-	-	N/A
Bedroom		-	-	-	0.6	-	-	-	-	-	-	N/A
Bedroom		-	-	-	0.6	-	-	-	-	-	-	N/A
Bedroom		-	-	-	0.6	-	-	-	-	-	-	N/A
Bedroom		-	-	-	0.6	-	-	-	-	-	-	N/A
Bedroom		-	-	-	0.6	-	-	-	-	-	-	N/A
Bedroom		-	-	-	0.6	-	-	-	-	-	-	N/A
Bedroom		-	-	-	0.6	-	-	-	-	-	-	N/A

General lighting and display lighting		General luminaire	Display light source	
Zone name		Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
	Standard value	95	80	0.3
Plant		95	-	-
Stairs		100	-	-
Corridor		100	-	-
Stairs		100	-	-
Plant		100	-	-
Corridor		100	-	-
Room 007		100	-	-
Lift		100	-	-
Lift		100	-	-
Room 003		100	-	-
Lift		100	-	-
Stairs		100	-	-
Room 001		100	-	-
Room 013		100	-	-
Room 014		100	-	-
Ensuite		100	-	-
Corridor		100	-	-
Store		100	-	-
Bedroom		100	-	-
Bedroom		100	-	-
Bedroom		100	-	-
Bedroom		100	-	-
Bedroom		100	-	-
Bedroom		100	-	-
Bedroom		100	-	-
Bedroom		100	-	-
Room 003		100	-	-
Lift		100	-	-

General lighting and display lighting		General luminaire	Display light source	
Zone name		Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
	Standard value	95	80	0.3
Corridor		100	-	-
Bedroom		100	-	-
Bedroom		100	-	-
Linen		100	-	-
Lift		100	-	-
Lift		100	-	-
Stairs		100	-	-
Room 027		100	-	-
Ensuite		100	-	-
Room 018		100	-	-
Ensuite		100	-	-
Ensuite		100	-	-
Ensuite		100	-	-
Ensuite		100	-	-
Ensuite		100	-	-
Ensuite		100	-	-
Ensuite		100	-	-
Ensuite		100	-	-
Ensuite		100	-	-
Room 041		100	-	-
Room 009		100	-	-
Room 010		100	-	-
Room 016		100	-	-
Room 017		100	-	-
Room 029		100	-	-
Room 015		100	-	-
Corridor		100	-	-
Stairs		100	-	-
Room No 26		100	-	-
Room No 41		100	-	-
Room No 22		100	-	-
Ensuite		100	-	-
Corridor		100	-	-
Store		100	-	-
Corridor		100	-	-
Room No 44		100	-	-
Room No 43		100	-	-
Room No 42		100	-	-
Room No 45		100	-	-
Room No 46		100	-	-
Room No 40		100	-	-
Room No 27		100	-	-
Ensuite		100	-	-

General lighting and display lighting		General luminaire	Display light source	
Zone name		Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
	Standard value	95	80	0.3
Room No 17		100	-	-
Ensuite		100	-	-
Ensuite		100	-	-
Ensuite		100	-	-
Room No 21		100	-	-
Ensuite		100	-	-
Ensuite		100	-	-
Ensuite		100	-	-
Lift		100	-	-
Ensuite		100	-	-
Lift		100	-	-
Ensuite		100	-	-
Room No 29		100	-	-
Ensuite		100	-	-
Ensuite		100	-	-
Corridor		100	-	-
Lift		100	-	-
Linen		100	-	-
Bedroom		100	-	-
Bedroom		100	-	-
Bedroom		100	-	-
Bedroom		100	-	-
Bedroom		100	-	-
Bedroom		100	-	-
Bedroom		100	-	-
Bedroom		100	-	-
Bedroom		100	-	-
Stairs		100	-	-
Bedroom		100	-	-
Bedroom		100	-	-
Bedroom		100	-	-
Ensuite		100	-	-
Bedroom		100	-	-

The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Stairs	N/A	N/A
Corridor	N/A	N/A
Stairs	N/A	N/A
Plant	N/A	N/A
Corridor	N/A	N/A
Room 007	N/A	N/A
Lift	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Lift	N/A	N/A
Room 003	N/A	N/A
Lift	N/A	N/A
Stairs	NO (-92.2%)	NO
Room 001	N/A	N/A
Room 013	N/A	N/A
Room 014	N/A	N/A
Corridor	N/A	N/A
Store	N/A	N/A
Bedroom	NO (-66.4%)	NO
Bedroom	NO (-23%)	NO
Bedroom	NO (-23%)	NO
Bedroom	NO (-23%)	NO
Bedroom	NO (-69.5%)	NO
Bedroom	NO (-73.9%)	NO
Bedroom	NO (-23.1%)	NO
Bedroom	NO (-23%)	NO
Bedroom	NO (-66.4%)	NO
Room 003	N/A	N/A
Lift	N/A	N/A
Corridor	N/A	N/A
Bedroom	NO (-81.8%)	NO
Bedroom	NO (-38.6%)	NO
Linen	N/A	N/A
Lift	NO (-99.9%)	NO
Lift	N/A	N/A
Stairs	NO (-70.9%)	NO
Room 027	N/A	N/A
Room 018	N/A	N/A
Room 041	N/A	N/A
Room 009	N/A	N/A
Room 010	N/A	N/A
Room 016	N/A	N/A
Room 017	N/A	N/A
Room 029	N/A	N/A
Room 015	N/A	N/A
Corridor	N/A	N/A
Stairs	NO (-90.2%)	NO
Room No 26	N/A	N/A
Room No 41	N/A	N/A
Room No 22	N/A	N/A
Corridor	N/A	N/A
Store	N/A	N/A
Corridor	N/A	N/A
Room No 44	N/A	N/A
Room No 43	N/A	N/A
Room No 42	N/A	N/A
Room No 45	N/A	N/A
Room No 46	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Room No 40	N/A	N/A
Room No 27	N/A	N/A
Room No 17	N/A	N/A
Room No 21	N/A	N/A
Lift	NO (-99.9%)	NO
Lift	N/A	N/A
Room No 29	N/A	N/A
Corridor	N/A	N/A
Lift	N/A	N/A
Linen	N/A	N/A
Bedroom	NO (-22.9%)	NO
Bedroom	NO (-22.9%)	NO
Bedroom	NO (-66.4%)	NO
Bedroom	NO (-22.9%)	NO
Bedroom	NO (-22.9%)	NO
Bedroom	NO (-27%)	NO
Bedroom	NO (-23%)	NO
Bedroom	NO (-73.9%)	NO
Bedroom	NO (-66.4%)	NO
Stairs	NO (-62.9%)	NO
Bedroom	NO (-81.8%)	NO
Bedroom	NO (-64.9%)	NO
Bedroom	NO (-52.1%)	NO
Bedroom	NO (-58.5%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters			Building Use	
	Actual	Notional	% Area Building Type	
Floor area [m ²]	1273.6	1273.6	Retail/Financial and Professional Services	
External area [m ²]	2319.9	2319.9	Restaurants and Cafes/Drinking Establishments/Takeaways	
Weather	MAN	MAN	Offices and Workshop Businesses	
Infiltration [m ³ /hm ² @ 50Pa]	3	3	General Industrial and Special Industrial Groups	
Average conductance [W/K]	960.8	1388.91	Storage or Distribution	
Average U-value [W/m ² K]	0.41	0.6	100 Hotels	
Alpha value* [%]	25	10	Residential Institutions: Hospitals and Care Homes	
* Percentage of the building's average heat transfer coefficient which is due to thermal bridging			Residential Institutions: Residential Schools	
			Residential Institutions: Universities and Colleges	
			Secure Residential Institutions	
			Residential Spaces	
			Non-residential Institutions: Community/Day Centre	
			Non-residential Institutions: Libraries, Museums, and Galleries	
			Non-residential Institutions: Education	
			Non-residential Institutions: Primary Health Care Building	
			Non-residential Institutions: Crown and County Courts	
			General Assembly and Leisure, Night Clubs, and Theatres	
			Others: Passenger Terminals	
			Others: Emergency Services	
			Others: Miscellaneous 24hr Activities	
			Others: Car Parks 24 hrs	
			Others: Stand Alone Utility Block	

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	7.34	36.49
Cooling	0.74	1.83
Auxiliary	1.48	1.84
Lighting	4.96	5.41
Hot water	209.88	207.91
Equipment*	110.23	110.23
TOTAL **	224.4	253.48

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
 ** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

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

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	173.42	204.7
Primary energy [kWh _{eq} /m ²]	255.15	288.45
Total emissions [kg/m ²]	46.58	52.52

HVAC Systems Performance									
System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] ASHP, [HFT] Natural Gas, [CFT] Electricity									
Actual	215.6	33.3	10.5	1.1	2.1	5.69	8.65	5.8	11.57
Notional	250	43.7	52.4	2.6	1.3	1.33	4.63	----	----
[ST] No Heating or Cooling									
Actual	0	0	0	0	0	0	0	0	0
Notional	0	0	0	0	0	0	0	----	----

Key to terms

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