
McCauls Group

Operational Energy Strategy Report

Laystall Street Office Block

06 October 2022

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1 Executive Summary

This operational Energy Strategy Report has been prepared by Watt Energy on behalf of McCauls Group to support a planning application for the development at Laystall Street. The statement specifically addresses the following Manchester City Council approved climate change action plans in addition to planning policies, as stipulated in the Manchester Core Strategy (July 2012):

- **Planning condition 16 – Energy Use Intensity**

In order to demonstrate these reductions in carbon emissions, resource efficiency measures and the application of Low / Zero Carbon technologies have been considered.

The figures used within this report have been based on the most recent issue of drawings and modelled using the simplified building energy model (SBEM) to accurately predict Energy Usage and CO₂ reductions.

In relation to the planning documents above, the development is required to achieve a energy use intensity of **206kWh/m²/yr.**

In order to achieve compliance, the development has been designed with a holistic low energy design concept involving a fabric first approach. The U-values, design air permeability and ventilation targets all aspire to Passive House design standards along with the consideration and application of low zero carbon renewable technologies. Following a LZC assessment, it is proposed that there will be no additional LZC technologies due to the listed nature of the site.

Following the analysis, the proposed development is achieving an energy intensity of **169.2 kWh/m²/yr.** This surpasses all of Manchester City Council's planning targets and therefore allows compliance to be reached.

2 Planning Statement

The following report relates to the proposed new conversion and extension to the existing office block at Laystall Street, Manchester.

2.1 The Site and Proposed Development

The site is located in the centre of Manchester, towards the north-eastern region of the Northern Quarter and New Islington. A ground floor plan, with the site's extents denoted by the red outline seen in Figure 1 (shown later in this subsection).

The site is bounded to the northwest by Laystall street, Pigeon Street to the southwest and Brock Street to the northeast. The site is currently occupied by an existing Listed three storey office block and parking space.

The proposal is for a renovation of the existing office block and new side extension, featuring two new offices and ground floor café area (use class E).

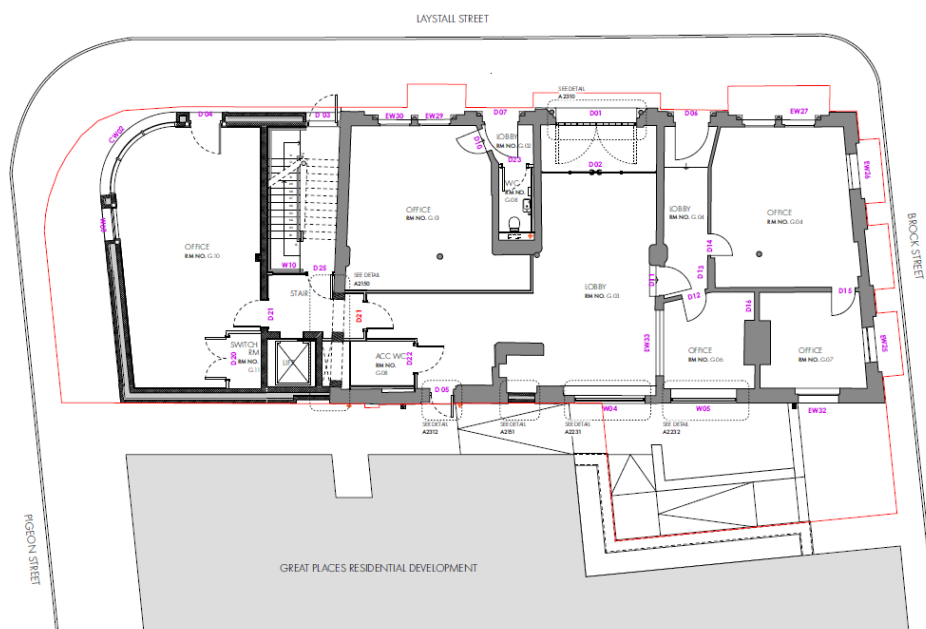


Figure 1: Ground floor plan

2.1.1 Planning Condition 16

Prior to commencement of the office element of the development, an Operational Energy Strategy Report shall be submitted to and approved in writing by the City Council as Local Planning Authority. The report shall the strategy for the reduction and limiting of operational energy consumption and how this will be embedded within the process of design construction and stewardship/ building management and monitoring. The development shall aim for an energy use intensity of 206kWh/m²/yr or lower which is in accordance with The RIBA 2030 Climate Challenge interim date net zero carbon target metrics for the development.

3 Sustainable Design Strategy

3.1.1 Energy and Carbon Emissions

Building Services Strategy

In response to the policy requirements and climate change plan targets set out in section 2.2, developments should aim to assist and achieve the following carbon reduction targets:

1. Achieve a minimum of 10% CO₂ reduction over the Part L 2013 Target Emission Rate (TER), as per Target 2 (Electricity intense buildings) in Table 12.1 of Policy EN6.
2. Aim for an energy use intensity of 206kWh/m²/yr or lower

To achieve the most accurate calculations and estimates, the proposed units have been modelled using SAP 2012 the governments Standard Assessment Procedure for residential dwellings.

The proposed strategy for minimising energy use and carbon emissions is based on the energy hierarchy described in CIBSE Guide F 2012 (Energy efficiency in buildings). The energy hierarchy has been adopted for the development to ensure that the correct approach to design is taken to promote an energy-efficient low carbon solution (see figure 2). This has ensured that the benefits of effective methods of energy use reduction have been maximised first. The approach adopted is as follows:



Fig 2: Energy Hierarchy

Minimise energy demand – Implement passive design measures and optimise the building envelope in terms of orientation, air tightness, and insulation. For example, the proposal is targeting a low carbon classification through a holistic low energy design concept as it will be designed with a fabric first approach whereby standards designed to exceed Building Regulations compliancy are aspired to for all fabric U-values and air permeability targets.

Meet demands efficiently – Specification of energy efficient decentralised plant, heating, ventilation, lighting, and system controls to facilitate efficient operation.

Particular attention is being paid to the wellbeing of occupants. The ventilation strategy has been developed to minimise noise ingress from the proposed location as far as possible while minimising the risk of overheating.

Additional Renewable Energy Measures

Opportunities for incorporating low and zero carbon technologies (LZCT) have been considered for this development. Due to the Listed status of the building no external LZC technologies could be incorporated into the development.

Efficient and Sustainable Design Measures

In line with the above Sustainable Design Strategy, the following Energy Efficient design measures are specified.

- High levels of insulation throughout with minimal thermal bridges
- Passive solar gains and internal heat sources
- Excellent level of airtightness
- Good indoor air quality by openable windows

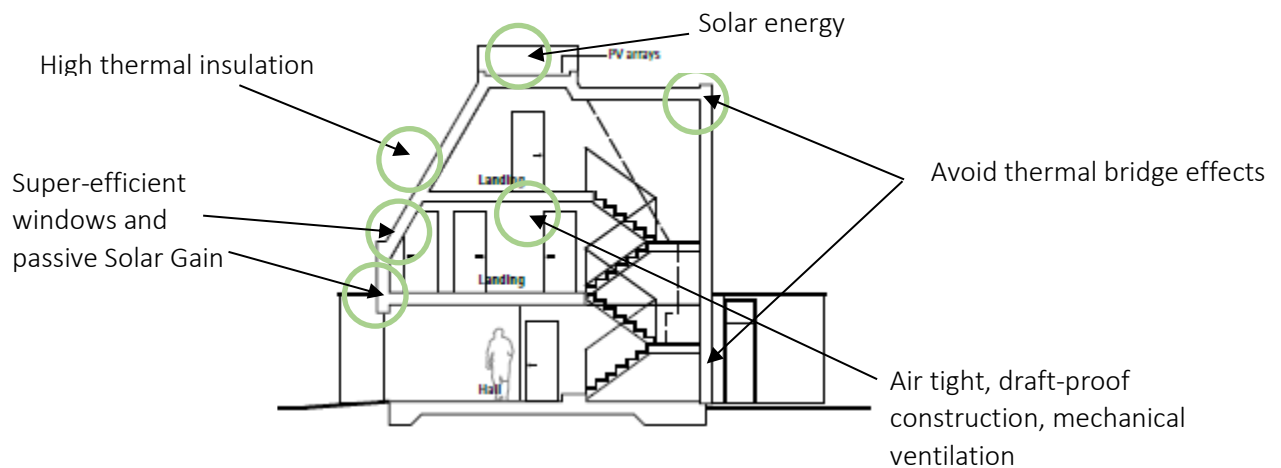


Fig 3. Efficient Design Measure examples

The Proposed specifications and key energy efficient design measures are as follows:

New elements

- New Exposed Upper Floor (above basement) U-values of $0.25 \text{ W/m}^2\text{K}$
- New External Wall U-values of $0.35 \text{ W/m}^2\text{K}$
- New Flat Roof U-values of $0.25 \text{ W/m}^2\text{K}$
- New Single-glazed Window U-values of $4.8 \text{ W/m}^2\text{K}$
- 100% low energy lighting throughout
- High efficiency gas boiler
- Air Permeability Rate of $15\text{m}^3/\text{hm}^2$

Existing elements

- Upgraded Exposed Upper Floor (above basement) U-values of $0.25 \text{ W/m}^2\text{K}$
- External walls U-values of $1.15 \text{ W/m}^2\text{K}$
- Upgraded flat roof over existing $0.25 \text{ W/m}^2\text{K}$
- Single-glazed windows U-values of $4.8 \text{ W/m}^2\text{K}$

3.1.2 Energy and CO₂ Reduction Summary

A summary of all stages of the energy demand assessment from baseline figures to final carbon reduction are shown in Figures 1 & 2 below:

Summary of CO ₂ Emission Reductions	Total CO ₂ emissions (kgCO ₂ /year)
Baseline emissions	26070
Improved emissions (after application of energy efficiency measures) and LZC contributions - residual emissions	22811
% CO ₂ displaced in total	12.5%

Table 1: Summary of CO₂ Reductions



	Energy demand (kWh pa)	Energy saving achieved (%)	Regulated CO ₂ emissions (kg pa)	Saving achieved on residual CO ₂ emissions (%)
Building Regulations Part L compliance ("Baseline" energy demand & emissions)	128819.9		26070	
Proposed scheme after energy efficiency measures & LZC technology contribution ("Residual" energy demand & emissions)	113305.0	12.0%	22810.7	12.5%
Proposed scheme offset for financial contribution or other "allowable solution"			0	0
Total savings on residual emissions				12.5%

Table 2. Total Energy and Carbon Emissions Savings Based on SAP 9.0 Car



4 Operational Energy Use Summary

With regards to pre-commencement planning conditions 16 (outlined in section 3) the table below details how the operational energy use intensity per m² exceeds the current planning policy requirement of 206 kWh/m²/yr.

Operational Energy Use Summary	
Total Energy Use (kWh pa)	113305.0
Total Floor Area of Heated Space (m ²)	669.5
Operational Energy Use Intensity (kWh/m ² /yr)	169.2

Table 4. Summary of Operational Energy Use

The prioritisation of a fabric first approach has resulted in a low total energy demand for the office block. Therefore, the Laystall Street development meets the Manchester City Council pre-commencement planning conditions 16.

Target Operational Energy Use Intensity = 206 kWh/m²/yr

Proposed Operational Energy Use Intensity = 169.2 kWh/m²/yr

Project name

Laystall Street**As built****Date:** Thu Oct 06 11:05:51 2022

Administrative information

Building Details

Address: Manchester, Postcode

Certifier details

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

Certification tool

Calculation engine: SBEM**Calculation engine version:** v6.1.b.0**Interface to calculation engine:** Virtual Environment**Interface to calculation engine version:** v7.0.15**BRUKL compliance check version:** v6.1.b.0**Foundation area [m²]:** 1The CO₂ emission and primary energy rates of the building must not exceed the targets

The building does not comply with England Building Regulations Part L 2021

Target CO ₂ emission rate (TER), kgCO ₂ /m ² annum	10.84
Building CO ₂ emission rate (BER), kgCO ₂ /m ² annum	32.61
Target primary energy rate (TPER), kWh/m ² annum	67.98
Building primary energy rate (BPER), kWh/m ² annum	190.49
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	0.86	1.15	FF000000_W7
Floors	0.18	0.77	1.09	FF000008_F_A0
Pitched roofs	0.16	-	-	No heat loss pitched roofs
Flat roofs	0.18	0.67	1.09	FF000004_C_A0
Windows** and roof windows	1.6	4.8	4.8	FF000000_W7_O0
Rooflights***	2.2	-	-	No external rooflights
Personnel doors^	1.6	2.2	2.2	ST000000_W4_O0
Vehicle access & similar large doors	1.3	-	-	No external vehicle access doors
High usage entrance doors	3	-	-	No external high usage entrance doors

U_{a-Limit} = Limiting area-weighted average U-values [W/(m²K)]U_{i-Calc} = Calculated maximum individual element U-values [W/(m²K)]U_{a-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

N.B.: 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	10

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	<0.9

1- Main system

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.9	-	-	-	-
Standard value	0.93*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for gas single boiler systems <=2 MW output and overall for multi-boiler systems. For single boiler systems >2 MW or any individual boiler in a multi-boiler system, limiting efficiency is 0.88.					

1- SYST0000-DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	Hot water provided by HVAC system	0.01
Standard value	N/A	N/A

"No zones in project where local mechanical ventilation, exhaust, or terminal unit is applicable"

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
Office Lobby		50	-	-
Cafe/ office space		50	-	-
Acc WC		50	-	-
Lift		50	-	-
Stairs		50	-	-
Office 2		50	-	-
Office 1		50	-	-
Corridor		50	-	-
Cupboard		50	-	-
Acc WC		50	-	-
Corridor		50	-	-
Meeting room		50	-	-
Office 3		50	-	-
Office 4		50	-	-
Acc WC		50	-	-
Lift		50	-	-
Acc WC		50	-	-
Office 5		50	-	-
Office 6		50	-	-
Acc WC		50	-	-
Lift		50	-	-
Acc WC		50	-	-
Corridor		50	-	-
Stair		50	-	-

General lighting and display lighting		General luminaire	Display light source	
Zone name		Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m ²]
	Standard value	95	80	0.3
Corridor		50	-	-
Stair		50	-	-

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?
Office Lobby	YES (+215.3%)	NO
Cafe/ office space	NO (-22.7%)	NO
Acc WC	N/A	N/A
Lift	N/A	N/A
Stairs	N/A	N/A
Office 2	YES (+38.1%)	NO
Office 1	YES (+15%)	NO
Corridor	N/A	N/A
Cupboard	N/A	N/A
Acc WC	N/A	N/A
Corridor	N/A	N/A
Meeting room	YES (+77.9%)	NO
Office 3	YES (+14.6%)	NO
Office 4	YES (+12.7%)	NO
Acc WC	N/A	N/A
Lift	N/A	N/A
Acc WC	N/A	N/A
Office 5	YES (+14.6%)	NO
Office 6	YES (+12.7%)	NO
Acc WC	N/A	N/A
Lift	N/A	N/A
Acc WC	N/A	N/A
Corridor	N/A	N/A
Stair	N/A	N/A
Corridor	N/A	N/A
Stair	N/A	N/A

Regulation 25A: Consideration of high efficiency alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m ²]	699.5	699.5
External area [m ²]	1572.9	1572.9
Weather	MAN	MAN
Infiltration [m ³ /hm ² @ 50Pa]	10	3
Average conductance [W/K]	1774.85	580.78
Average U-value [W/m ² K]	1.13	0.37
Alpha value* [%]	10.25	28.3

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	Retail/Financial and Professional Services
	Restaurants and Cafes/Drinking Establishments/Takeaways
100	Offices and Workshop Businesses
	General Industrial and Special Industrial Groups
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	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	136.62	43.08
Cooling	0	0
Auxiliary	2.13	1.01
Lighting	18.3	9.3
Hot water	4.94	2.89
Equipment*	42.19	42.19
TOTAL **	161.98	56.28

* 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	0.05
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
<i>Displaced electricity</i>	<i>0</i>	<i>0.05</i>

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	459.32	202.18
Primary energy [kWh/m ²]	190.49	67.98
Total emissions [kg/m ²]	32.61	10.84

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] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	394.9	64.4	136.6	0	2.1	0.8	0	0.9	0
Notional	133.4	68.8	43.1	0	1	0.86	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

Project name

Laystall Street**As built****Date:** Thu Oct 06 11:08:47 2022

Administrative information

Building Details

Address: Manchester, Postcode

Certifier details

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

Certification tool

Calculation engine: SBEM**Calculation engine version:** v6.1.b.0**Interface to calculation engine:** Virtual Environment**Interface to calculation engine version:** v7.0.15**BRUKL compliance check version:** v6.1.b.0**Foundation area [m²]:** 1The CO₂ emission and primary energy rates of the building must not exceed the targets

The building does not comply with England Building Regulations Part L 2021

Target CO ₂ emission rate (TER), kgCO ₂ /m ² annum	10.84
Building CO ₂ emission rate (BER), kgCO ₂ /m ² annum	37.27
Target primary energy rate (TPER), kWh/m ² annum	67.98
Building primary energy rate (BPER), kWh/m ² annum	215.46
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	1.15	1.15	FF000000_W7
Floors	0.18	0.82	1.09	FF000008_F_A0
Pitched roofs	0.16	-	-	No heat loss pitched roofs
Flat roofs	0.18	0.67	1.09	FF000004_C_A0
Windows** and roof windows	1.6	4.8	4.8	FF000000_W7_O0
Rooflights***	2.2	-	-	No external rooflights
Personnel doors^	1.6	2.2	2.2	ST000000_W4_O0
Vehicle access & similar large doors	1.3	-	-	No external vehicle access doors
High usage entrance doors	3	-	-	No external high usage entrance doors

U_a-Limit = Limiting area-weighted average U-values [W/(m²K)]U_i-Calc = Calculated maximum individual element U-values [W/(m²K)]U_a-Calc = Calculated area-weighted average U-values [W/(m²K)]

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** 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

N.B.: 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	10

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	<0.9

1- Main system

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.84	-	-	-	-
Standard value	0.93*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for gas single boiler systems <=2 MW output and overall for multi-boiler systems. For single boiler systems >2 MW or any individual boiler in a multi-boiler system, limiting efficiency is 0.88.					

1- SYST0000-DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	Hot water provided by HVAC system	0.01
Standard value	N/A	N/A

"No zones in project where local mechanical ventilation, exhaust, or terminal unit is applicable"

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
Office Lobby		50	-	-
Cafe/ office space		50	-	-
Acc WC		50	-	-
Lift		50	-	-
Stairs		50	-	-
Office 2		50	-	-
Office 1		50	-	-
Corridor		50	-	-
Cupboard		50	-	-
Acc WC		50	-	-
Corridor		50	-	-
Meeting room		50	-	-
Office 3		50	-	-
Office 4		50	-	-
Acc WC		50	-	-
Lift		50	-	-
Acc WC		50	-	-
Office 5		50	-	-
Office 6		50	-	-
Acc WC		50	-	-
Lift		50	-	-
Acc WC		50	-	-
Corridor		50	-	-
Stair		50	-	-

General lighting and display lighting		General luminaire	Display light source	
Zone name		Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m ²]
	Standard value	95	80	0.3
Corridor		50	-	-
Stair		50	-	-

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?
Office Lobby	YES (+215.3%)	NO
Cafe/ office space	NO (-22.7%)	NO
Acc WC	N/A	N/A
Lift	N/A	N/A
Stairs	N/A	N/A
Office 2	YES (+38.1%)	NO
Office 1	YES (+15%)	NO
Corridor	N/A	N/A
Cupboard	N/A	N/A
Acc WC	N/A	N/A
Corridor	N/A	N/A
Meeting room	YES (+77.9%)	NO
Office 3	YES (+14.6%)	NO
Office 4	YES (+12.7%)	NO
Acc WC	N/A	N/A
Lift	N/A	N/A
Acc WC	N/A	N/A
Office 5	YES (+14.6%)	NO
Office 6	YES (+12.7%)	NO
Acc WC	N/A	N/A
Lift	N/A	N/A
Acc WC	N/A	N/A
Corridor	N/A	N/A
Stair	N/A	N/A
Corridor	N/A	N/A
Stair	N/A	N/A

Regulation 25A: Consideration of high efficiency alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m ²]	699.5	699.5
External area [m ²]	1572.9	1572.9
Weather	MAN	MAN
Infiltration [m ³ /hm ² @ 50Pa]	10	3
Average conductance [W/K]	1935.2	580.78
Average U-value [W/m ² K]	1.23	0.37
Alpha value* [%]	9.4	28.3

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	Retail/Financial and Professional Services
	Restaurants and Cafes/Drinking Establishments/Takeaways
100	Offices and Workshop Businesses
	General Industrial and Special Industrial Groups
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	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	158.44	43.08
Cooling	0	0
Auxiliary	2.13	1.01
Lighting	18.3	9.3
Hot water	5.29	2.89
Equipment*	42.19	42.19
TOTAL **	184.16	56.28

* 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	0.05
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
<i>Displaced electricity</i>	<i>0</i>	<i>0.05</i>

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	493.2	202.18
Primary energy [kWh/m ²]	215.46	67.98
Total emissions [kg/m ²]	37.27	10.84

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] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	427.8	65.4	158.4	0	2.1	0.75	0	0.84	0
Notional	133.4	68.8	43.1	0	1	0.86	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