

UNIVERSITY OF MANCHESTER – MUSIC PRACTICE ROOMS ENVIRONMENTAL STANDARDS STATEMENT

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BRUKL Report

INTRODUCTION

This report outlines the strategy for delivering Environmental Sustainability solutions at the new Manchester Music Practice Building.

This report summarises the analyses carried out to date and clarifies the proposals in relation to achieving the best energy solutions possible with low running costs.

The report also confirms the Design Stage Building Regulations Approved Document L2A calculation results and demonstrates the route to compliance.

The report demonstrates the approach towards RIBA 2030 climate challenge standards.

The site is located at the existing Martin Harris Music Building quad area which is currently being utilised as a small carpark. The site is accessed from Bridgeford Street and the Martin Harris Building entrance.

The surrounding land and properties are managed by the University of Manchester.

The proposed building will be a ground and first floor music practise facility for students at the University of Manchester with toilet facilities and will be fully accessible at ground floor level. The total gross internal floor area will be 203 m²



Picture 1 - Aerial View of Site Location

EXECUTIVE SUMMARY

Design to Date

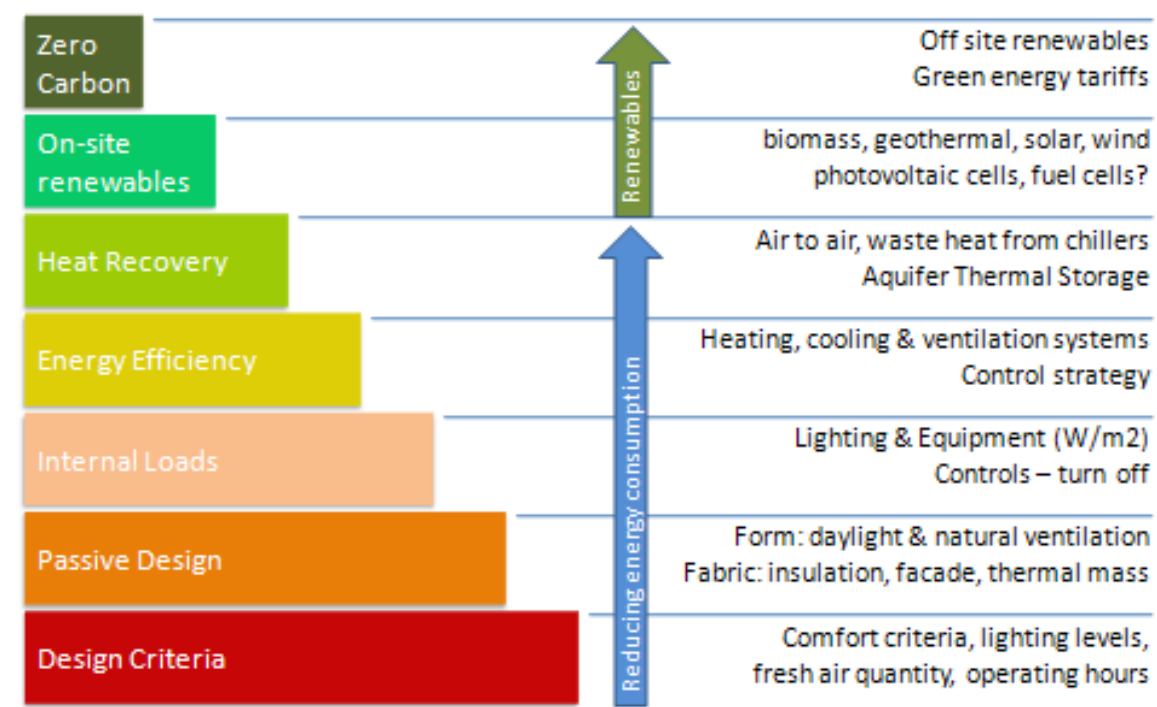
Within the design to date, we have developed strategies to optimise the environmental sustainability of the building whilst still striving for the RIBA 2030 climate challenge. We have carried out analysis of the building energy requirements to demonstrate the compliance with Building Regulations Part L (Conservation of Fuel and Power).

The priority has been to minimise the need for energy through the use of robust energy conservation measures and utilising energy management/efficiency solutions. Within the Music Practice Building project, this is primarily facilitated by:

- Optimising the fabric of the building to reduce heat losses.
- Increased air tightness to reduce heat losses.
- Use of low energy artificial lighting solutions (including LED).
- Metering to aid Energy Monitoring when the building is in use.

Low & Zero Carbon Technologies

Detailed calculations have taken place to assess how the use of Low & Zero Carbon (LZC) Technologies could reduce the carbon emissions on-site, while providing financial benefit. Many aspects beyond the carbon and cost factors have been considered, including maintainability, aesthetics, benefit towards statutory energy conservation requirements etc. This process is set out in the “Steps to Low Carbon” methodology.



Picture 2 - Steps to Low Carbon Methodology

PROPOSED ENVIRONMENTAL MEASURES

The building envelope aims to achieve a high level of performance by the selection and specification of individual materials, and by strategic use of double and triple glazed elements. The building has limited glazing to suit the acoustic requirements within the building. This has led to an architecturally coherent building design, with its own character, and has been developed with performance efficiency in mind.

The following table provides the thermal performance of the building fabric including U-values and air tightness standards. The design has been developed in line with these standards which are to be met (or improved upon) to ensure the project’s comfort and energy requirements are achieved.

Fabric Element	Part L U-Value (W/m2.K)	Achieved U-Value (W/m2.K)
Walls	0.26	0.11
Floors	0.18	0.16
Flat Roof	0.18	0.15
Double Glazed Windows	1.6	1.5
Triple Glazed Windows	1.6	0.92
Rooflights	2.2	1.6
High Usage Door	3.0	3.11
Air Permeability m3/(h.m2) at 50Pa	8	5

Table 1 - U-Values

ESTIMATED ENERGY CONSUMPTION AND APPROVED DOCUMENT PART L

The energy strategy has followed the well proven principles of the energy hierarchy, and in doing so has made significant improvements over and above the requirements as set out in the Building Regulation Part L2 2021 regulations.

This has been demonstrated by modelling the building within IES Virtual Environment using the Apache app, following the methodology of Part L 2021.

The BRUKL report in Appendix A demonstrates a Building Emission Rate (BER) of 7.49 kgCO₂/m².annum against a Target Emission Rate (TER) of 7.69 kgCO₂/m².annum.

The TER is calculated based on the regulated energy use, weighted to reflect the emissions factors for different fuels and energy sources. The improvement is achieved through effectively focusing on the key drivers of energy usage and associated carbon emissions.

The analysis carried out predicts the annual energy usage for the new Music Practice Building. The analysis has been developed in line with the current architectural design proposals and our assessment of predicted hours of usage.

A BRUKL output document has been produced that indicates the Building Primary Energy Rate (BPER) of 77.92 kWh/m² per annum against a Target Primary Energy Rate of 80.27 kWh/m² per annum.

The BRUKL report shows an improvement on ADL2 2021.

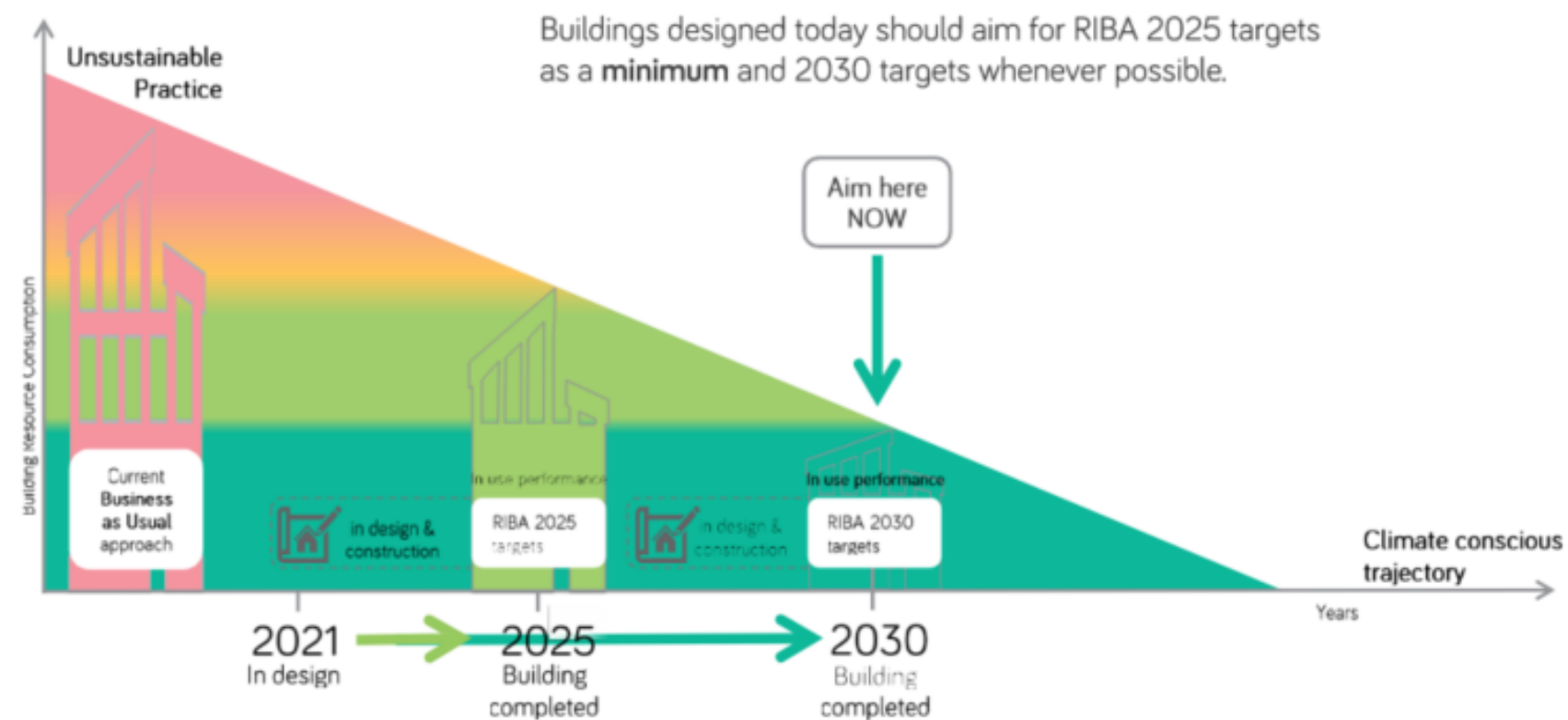
The building regulations uplift from 2013 to 2021 regs for non-domestic buildings is around 27%.

The building regulations uplift from 2010 to 2013 regs for non-domestic buildings is around 6%.

The building regulations uplift from 2010 for non-domestic buildings for this project is around 41%.

The design has been driven towards achieving the RIBA 2030 Climate Challenge in which the document outlines three key areas to focus on to reduce the buildings energy rating. The design has focused on these three areas which has assisted in reducing the energy rating and are listed below:

- Use a 'Fabric First' approach.
- Minimise energy demand. Use efficient services and low carbon heat.
- Maximise onsite renewables.



Picture 3 - RIBA 2030 Climate Challenge Trajectory

PROPOSALS FOR BUILDING OPERATION & ASSOCIATED BUILDING SERVICES SYSTEMS

After assessing the contribution of the passive elements to the overall energy balance, the aim is to further reduce CO₂ emissions by selecting efficient mechanical and electrical systems to manage the energy use during operation.

Renewable Energy

Air source heat pumps (ASHP) are used to supply heating to the building. The proposed heat pumps provide space heating in conjunction with the ventilation systems. The efficiency of these systems is inherently linked to the ambient air temperatures. Heat pumps supply more energy than they consume, by extracting heat from their surroundings.

Each system is connected to an outdoor condensing unit which has a Coefficient of Performance (COP) of 4.72 which is calculated and complies to EN14511-3:2018.

The refrigerant flow rate is varied accurately to match the required heating loads, thereby saving energy, and providing more accurate control of temperatures and energy consumption.

Ventilation

Ventilation is provided to each music pod with the systems incorporating heat recovery units with plate heat exchangers which meet the high efficiencies as required with the Energy related Product Directive (ErPD) to further reduce energy usage yet still provide high indoor air quality.

Low Energy Lighting

Efficient low energy light fittings internally and externally can significantly reduce a building's overall lighting load hence lowering its annual CO₂ emissions. The development will reduce the energy consumption by the inclusion of low energy LED luminaires to all spaces. Efficiencies will be further enhanced with the use of a comprehensive automated lighting controls incorporating presence detection.

LANDSCAPING & BIODIVERSITY

Located adjacent to Bridgeford Street, currently the site is used as a forecourt and approach to the Existing Martin Harris Music Building. The existing surface is tarmac with two existing Pyrus chanticleer trees planted in 2008, offering some shade and cover for birds. Other than the trees, there is little landscape amenity.

Landscape Design

The proposed landscaping works will enhance the amenity, seasonal and ecological value of the area.

The trees are to be retained in their current position, and existing metal tree grilles removed and replaced with new amenity planting beds.

New ornamental trees and planting is proposed. The trees will provide seasonal interest, with spring flowers and autumn colour.

The planting consists of low semi-formal lines of evergreen shrubs to provide structure. These frame a varied palette of seasonal herbaceous flowering plants. Plants are selected to provide attractive flowers, colour, scent and nectar to benefit pollinating insects.

The University of Manchester operates a maintenance programme with selective pruning to maintain good health of plants, removal of dead or failing plants and replacement of any dead or failing plants; and implementation of wildlife friendly gardening practices by the management agent such as minimising the use of herbicides and insecticides.

The University have agreed to include the maintenance of the new landscaping proposed in these works.

Periodical clearance of weeds and pervasive species to limit ground coverage.

Biodiversity

The proposed works include the provision of 2No. bat boxes and 4No. bird box.

Each bat and bird box shall be installed in locations with due consideration to limit interference from light pollution from the external lighting and to limit interference from the movement of students and university staff.

Sustainable Drainage

The proposed works include modifications to the existing rain water drainage infrastructure.

The development includes the provision of a below ground rain water attenuation tank to reduce the risk of storm water overloading the existing and proposed rain water drainage infrastructure.

POLICY EN4 STATEMENT

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, 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.

Picture 4 – EN4 Statement

The building benefits from natural lighting through the use of windows and skylights. An element of passive heating is provided from solar gain through the windows. Free cooling is available from the mechanical ventilation system. Building fabric U values exceed the current building regulations reducing the need for energy. Some of the windows used are triple glazed to provide enhanced levels of thermal insulation.

Fabric Element	Part L U-Value (W/m2.K)	Achieved U-Value (W/m2.K)
Walls	0.26	0.11
Floors	0.18	0.16
Flat Roof	0.18	0.15
Double Glazed Windows	1.6	1.5
Triple Glazed Windows	1.6	0.92
Rooflights	2.2	1.6
High Usage Door	3.0	3.11
Air Permeability m3/(h.m2) at 50Pa	8	5

Table 1 - U-Values

The mechanical heating of the PODs is through the use of air source heat pumps using low refrigerant gas R32 with a global warming potential of 675 (68% lower global warming potential compared to R410a) and a Coefficient of Performance of greater than 4.7.

POLICY EN6 STATEMENT

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, submitted as part of the Design and Access Statement. Such a statement will be expected to set out the projected regulated energy demand and associated CO₂emissions for all phases of the development.

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.

Domestic CO₂emissions reduction targets

Table 12.1

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	+15% increase on Part L 2010
Target 3: Micro generation area	+15%increase on Part L 2010

Non-domestic CO₂emissions reduction targets

Table 12.2

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 CO2/m2))	+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.

Guidance on what the energy statement should contain and how to decide which target applies to a development proposal is given in Appendix A.

Picture 5 – EN6 Statement

The long-term plan for the University of Manchester is to replace the gas fired steam district heating system with all electric solutions and therefore our building is Target 2 from table 12.2. All the U values and air permeability offer a significant improvement on Part L 2010 as shown in the following table.

Fabric Element	2010 Part L U-Value (W/m2.K)	2021 Part L U-Value (W/m2.K)	Achieved U-Value (W/m2.K)	Percentage Improvement on 2010
Walls	0.28	0.26	0.11	61%
Floors	0.22	0.18	0.16	27%
Flat Roof	0.18	0.18	0.15	17%
Double Glazed Windows	1.8	1.6	1.5	17%
Triple Glazed Windows	1.8	1.6	0.92	49%
Rooflights	1.8	2.2	1.6	11%
High Usage Door	3.5	3.0	3.11	11%
Air Permeability m3/(h.m2) at 50Pa		8	5	38% on 2021

BRUKL Output Document



Compliance with England Building Regulations Part L 2021

Project name

MUSIC

As designed

Date: Wed Jun 21 10:58:14 2023

Administrative information

Building Details

Address: Address 1, City, Postcode

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.20

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.20

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

Foundation area [m²]: 98.36

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	7.69
Building CO ₂ emission rate (BER), kgCO ₂ /m ² :annum	7.49
Target primary energy rate (TPER), kWh _{PE} /m ² :annum	80.27
Building primary energy rate (BPER), kWh _{PE} /m ² :annum	77.92
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	0.11	0.11	G0000013:Surf[2]
Floors	0.18	0.16	0.16	G0000000:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.15	0.15	G0000013:Surf[1]
Windows** and roof windows	1.6	1.76	3.11	G0000003:Surf[2]
Rooflights***	2.2	1.51	1.51	G0000013:Surf[0]
Personnel doors^	1.6	2.2	2.2	G0000008:Surf[1]
Vehicle access & similar large doors	1.3	-	-	No vehicle access doors in building
High usage entrance doors	3	3.11	3.11	G0000003:Surf[2]

U_a-Limit = Limiting area-weighted average U-values [W/(m²K)]

U_a-Calc = Calculated area-weighted average U-values [W/(m²K)]

U_i-Calc = Calculated maximum individual element 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.

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

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- Resistive Element Elec Rads

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.2	0	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

2- VRF System

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.75	5.5	0	-	0.85
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					NO
* 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	1	0.003
Standard value	1	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
F1. Circulation		128	-	-
F1.Circulation		128	-	-
F1.Practice Pod		100	-	-
F1.Practice Pod		100	-	-
F1.Practice Pod		100	-	-
F1.Practice Pod		100	-	-
F1.Practice Pod		100	-	-
F1.Practice Pod		100	-	-
F1.Practice Pod		100	-	-
F1.WC		150	-	-
G0.Acc WC		150	-	-
G0.Circulation		128	-	-
G0.Circulation		128	-	-
G0.Practice Pod 1		100	-	-
G0.Practice Pod 2		100	-	-
G0.Practice Pod 3		100	-	-
G0.Practice Pod 4		100	-	-
G0.Practice Pod 5		100	-	-
G0.Practice Pod 6		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?
F1.Practice Pod	N/A	N/A
F1.Practice Pod	N/A	N/A
F1.Practice Pod	N/A	N/A
F1.Practice Pod	N/A	N/A
F1.Practice Pod	N/A	N/A
F1.Practice Pod	N/A	N/A
F1.Practice Pod	N/A	N/A
F1.WC	NO (-93.3%)	NO
G0.Practice Pod 1	N/A	N/A
G0.Practice Pod 2	N/A	N/A
G0.Practice Pod 3	N/A	N/A
G0.Practice Pod 4	N/A	N/A
G0.Practice Pod 5	N/A	N/A
G0.Practice Pod 6	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]	196.7	196.7
External area [m ²]	496.4	496.4
Weather	MAN	MAN
Infiltration [m ³ /hm ² @ 50Pa]	5	3
Average conductance [W/K]	140.71	225.81
Average U-value [W/m ² K]	0.28	0.45
Alpha value* [%]	24.37	10

* 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
 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
100 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	31.22	30.64
Cooling	0.32	0.62
Auxiliary	0	6.71
Lighting	7.8	7.76
Hot water	10.87	10.96
Equipment*	11.22	11.22
TOTAL **	50.21	56.7

* 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	3.48
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
<i>Displaced electricity</i>	<i>0</i>	<i>3.48</i>

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	298.93	277.3
Primary energy [kWh _{PE} /m ²]	77.92	80.27
Total emissions [kg/m ²]	7.49	7.69

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] Electricity, [CFT] Electricity									
Actual	484	9.5	30.4	0.7	0	4.43	3.91	4.75	5.5
Notional	475.8	21.9	47.6	1.3	0	2.78	4.63	----	----
[ST] Central heating using air distribution, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity									
Actual	122.8	0	32	0	0	1.07	0	1	0
Notional	77.8	0	15.3	0	5.7	1.41	0	----	----
[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