Hydrock

Bicester Motion Innovation Quarter

Planning Issue - Part L Compliance Report

For *Bicester Motion Ltd*

Date	*30 November 2023*
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Bicester Motion Innovation Quarter

1. Introduction

1.1 Project & Report Scope

Hydrock Consultants has been appointed by Bicester Motion to design the M&E systems in relation to the Bicester Motion Innovation Quarter. This office and warehouse building is designed targeting Net Zero Carbon in regulated energy.

The purpose of this document is to inform the design team and client of the energy strategy for the project, and how this will address local and regional planning policy.

It should be noted that this document provides outline information for a shell and core fit out only. As such any commitment to internal plant, water usage and energy requirements cannot be confirmed. However this information shall all be provided prior to the occupation of any phase of the development.

Existing conditions 29 and 30 (Application 23/01941/F: This document has been produced to provide the required information to satisfy this condition. While specifications are provided within this document they are given as a method to demonstrate that compliance is possible, Final specifications may vary but shall achieve the same result overall.

The proposed new development will be required to comply with Building Regulations Approved Document L2 2021 (ADL2).

The proposed building has been modelled using Integrated Environmental Solutions Virtual Environment (IESVE) v2023.1.0.0 Compliance, an approved ADL2 2021 modelling package.

1.2 Development Details

The proposed site is located in Bicester. It comprises of a two-storey building including offices and workshop areas. The development is being undertaken as a shell fit out only.

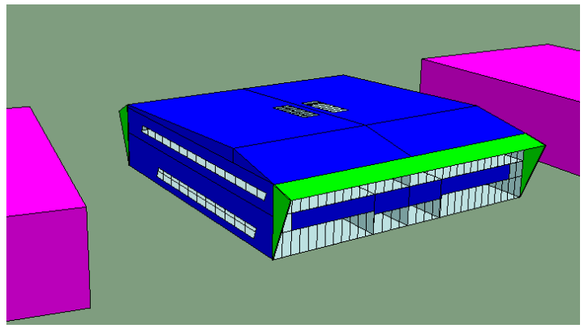

Figure 1: IESVE Compliance Software Model

2. Executive Summary

2.1 Energy Strategy Overview

Our energy strategy utilises a fabric first and passive design approach. With close collaborative working between Architects and Engineers the proposal is a building which is inherently energy efficient and gives a low regulated carbon emission rating due to the improved passive design options.

As a first step, the approach is to adopt a largely passive design which involves designing to reduce the energy consumption from the outset. This includes aspects such as increased levels of thermal insulation, use of high-performance glazing and very low fabric air permeability levels, all of which reduce the heating demand of the building.

The second step is to reduce the building's energy consumption associated with building services through the use of efficient systems. Mechanical ventilation is provided complete with high efficiency heat recovery to maximise energy efficiency and reduce energy costs by pre-heating cool fresh air in winter with the reclaimed heat from the exhaust air.

Low energy LED lighting will be used throughout, complete with lighting controls to further reduce lighting energy consumption.

Minimising the peak heat demand through efficient design means that heat for the building can be generated by air source heat pumps. As a result, the building is fully electric with no fossil fuels consumed on site and no associated on-site combustion emissions.

The final step is the provision of low or zero carbon technologies to generate renewable energy for the development as required to target net zero carbon in operation emissions for operational energy use. Photovoltaic panels (PV) will be utilised on the roof of the building to generate zero carbon energy for use by the building or to feed into the national grid when not utilised on site.

2.2 Building Regulations Act Reg. 26: Building Emission Rating and Primary Energy Rating

To demonstrate that compliance with regulations is possible a calculation has been undertaken which includes assumed performance specifications. These results are liable to change once the buildings are fit out.

The results of the Building Emission Rating calculation are shown in Table 1. As the BER and BPER is less than the TER and TPER, the proposed building complies with Criterion 1 of ADL2 2021 with PV array.

Definitions can be seen on the right.

2.3 Requirement L1(a) - Limiting Solar Gain

The use of blinds in some rooms to limit the effects of solar gain in summer. Please refer to BRUKL for the list of rooms.

2.4 Requirement L1(b)(i), (ii) and L2 – Minimum Standards for Building System Efficiency

The building's fixed services and systems have been designed and specified to improve on the minimum standards for compliance set by ADL2 2021. Please refer to Section 5 for system efficiencies used in the proposed buildings.

2.5 Regulation 23(2) and Requirement L1(a) – Minimum Standards for New Thermal Elements

All thermal elements in the proposed building meet the limiting standards in ADL2 2021.

Definitions

Target Emission Rate (TER)

The Target Emission Rate (expressed as $kgCO_2/m^2$·annum) is the maximum permissible CO_2 emission rate of the ***notional equivalent*** of the proposed building (same geometry, standard properties). The ***proposed*** building needs to perform better than this value.

Building Emission Rate (BER)

The building CO_2 emission rate (also expressed as $kgCO_2/m^2$·annum) is a measure of how much CO_2 the ***proposed*** building produces each year from regulated energy.

Target Primary Energy Rate (TPER)

The Target Primary Energy Rate (expressed as kWh_{PE}/m^2·annum) is the maximum primary energy use for the ***notional equivalent*** of the proposed building. The "primary" refers to the proportion of energy contained within the raw materials (e.g. coal, crude oil, radioactive materials). The ***proposed*** building needs to perform better than this baseline value.

Building Primary Energy Rate (BPER)

The Building Primary Energy Rate (also expressed as kWh_{PE}/m^2·annum) is the calculated amount of primary energy that the ***proposed*** building uses each year.

Table 1: Part L Results

Target Emission Rating (TER) kgCO2/m2·annum	Building Emission Rating (BER) with fabric improvement kgCO2/m2·annum	Building Emission Rating (BER) with fabric improvement and PV kgCO2/m2·annum	Compliance Margins BER vs TER (%)	Target Primary Energy Rate (TPER) kWh/m2·annum	Building Primary Energy Rate (BPER) with fabric improvement kWh/m2·annum	Building Primary Energy Rate (BPER) with fabric improvement and PV kWh/m2·annum	Compliance Margins BPER vs TPER (%)
2.75	1.86	-2.87	206	29.75	20.15	-34.43	216

3. Planning Policy

3.1 National Planning Policy Framework

The National Planning Policy Framework (NPPF) sets out the government's planning policies for England and how they are expected to be applied. There is a presumption in favour of sustainable development.

The NPPF supersedes all previous planning policy statements, which have now been withdrawn.

3.2 Building Regulations Approved Document Part L

The development will need to meet the standards set by Building Regulations Approved Document 'Part L, Conservation of Fuel and Power - Volume 2: Buildings other than Dwellings (ADL2 2021)'.

3.3 Local Planning Policy - Cherwell District Council Local Plan 2011-2031

The following policies of the Cherwell District Council Core Strategy are of relevance as referenced in Condition 30 of the planning conditions:

3.3.1 Policy ESD 1: Mitigating and Adapting to Climate Change

Measures will be taken to mitigate the impact of development within the district on climate change. At a strategic level, this will include:

- Delivering development that seeks to reduce the need to travel and which encourages sustainable travel options including walking, cycling and public transport to reduce dependence on private cars.
- Designing developments to reduce carbon emissions and use resources more efficiently, including water.
- Promoting the use of decentralised and renewable or low carbon energy where appropriate.

3.3.2 ESD 3: Sustainable Construction

Cherwell District is in an area of water stress and as such the Council will seek a higher level of water efficiency than required in the Building Regulations, with developments achieving a limit of 110 litres/person/day.

All new non-residential development will be expected to meet at least BREEAM 'Very Good' with immediate effect, subject to review over the plan period to ensure the target remains relevant.

All development proposals will be encouraged to reflect high quality design and high environmental standards, demonstrating sustainable construction methods including but not limited to:

- Minimising both energy demands and energy loss.
- Maximising passive solar lighting and natural ventilation.
- Maximising resource efficiency.
- Incorporating the use of recycled and energy efficient materials.
- Incorporating the use of locally sourced building materials
- Reducing waste and pollution and making adequate provision for the recycling of waste.
- Making use of sustainable drainage methods.
- Reducing the impact on the external environment and maximising opportunities for cooling and shading (by the provision of open space and water, planting, and green roofs, for example); and
- Making use of the embodied energy within buildings wherever possible and re-using materials where proposals involve demolition or redevelopment.

3.4 BREEAM

Condition 29 of the Planning Conditions requires the buildings to achieve a BREEAM rating of Very Good for a shell only development. Using the below Part L calculations and in collaboration with the BREEAM assessor it has been demonstrated that a BREEAM score of Very Good can be achieved. A revised BREEAM assessment and energy calculation will need to be completed once the internal layouts and systems are defined.

4. Methodology

To demonstrate compliance with both condition 29 and 30 of the planning conditions (23/01941/F) a Part L calculation has been undertaken. These u-values and plant specifications may alter slightly upon the final submittal but overall, the performance will be as below. These calculations have been done to satisfy the above conditions and clauses ESD1 and ESD3 of the local plan.

Guidance in Part L2 for new building is as follows:

- Regulation 26 – The predicted rate of carbon dioxide emissions (BER) from the proposed building is not greater than the existing building.
- Requirement L1(a) – The building has appropriate passive control measures to limit solar gains and limit or eliminate the need for air conditioning.
- Requirement L1(b)(i),(ii) and L2 – A replacement fixed building service should be at least as efficient as the minimum system efficiencies in ADL2 and should comply with either of the following:
  - Use the same fuel as the service being replaced and have an efficiency that is not worse than that of the service being replaced.
  - Use a different fuel than the service being replaced. The system should both:
    - not produce more CO_2 emissions per kWh of heat than the appliance being replaced
    - not have a higher primary energy demand per kWh of heat than the appliance being replaced
- Regulation 23(2) and Requirement L1(a) – The new thermal elements in an existing building and the thermal elements constructed to replace existing thermal elements should met the limiting standards in ADL2 2021.
- Regulation 28 - Additional work is required to improve the overall energy efficiency of the building. Consequential improvements should be carried out to ensure that the entire building complies with Part L of the Building Regulations to the extent that they are technically, functionally and economically feasible.

4.1 Calculation Methodology

The proposed building has been modelled using Integrated Environmental Solutions Virtual Environment (IESVE) 2023.1.0.0 Compliance, an approved ADL2 2021 modelling package. IESVE uses Dynamic Simulation Modelling to simulate the performance of the building at hourly intervals for a full test year.

The model geometry has been constructed based on the most up to date architectural layouts and elevations.

As required by ADL2 2021 building occupancies, room heating set-points, ventilation rates and illumination levels have been modelled according to the National Calculation Method (NCM) as defined by the Department for Communities and Local Government. The NCM enables calculation of the energy consumption required to deliver a defined level of comfort and service provision, based on standardised occupancy conditions.

All system efficiencies have been set to the minimum values or above in the non-domestic building services compliance guide, unless stated otherwise.

CIBSE approved 'Test Reference Year' weather data for Swindon, Swindon Brize Norton TRY, the nearest available to the proposed site, has been used in the simulation.

4.1.1 Regulation 26 – Building Emission Rating and Primary Energy Rating

The IESVE Compliance software calculates the carbon emissions for a notional building of the same shape and size as the proposed building, constructed to a concurrent specification.

The Target Emission Rate (TER) is set equal to the CO_2 emissions from this notional building. The software package then uses the true building configuration and systems to calculate the Building Emission Rating (BER).

In order to demonstrate compliance, the BER needs to be equal to, or lower than, the TER.

The Target Primary Energy Rate (TPER) is set equal to the primary energy usage from this notional building. The software package then uses the true building configuration and systems to calculate the Building Emission Rating (BPER).

In order to demonstrate compliance, the BPER needs to be equal to, or lower than, the TPER.

4.1.2 Requirement L1(a) – Limiting Solar Gain

A key method of reducing carbon emissions (in relation to local plan clause ESD1 and ESD3) is to reduce the requirements for cooling within a space by limiting heat gains from the sun, The below methodology has been utilised to confirm compliance.

The proposed building currently complies with Criterion 3 of ADL2 2021, with the maximum solar gain to all rooms less than the maximum permitted benchmark limit. For each space in the building that is occupied or mechanically cooled, the solar gains through the glazing - aggregated from April to September inclusive - should be no greater than would occur through the relevant reference glazing systems with a defined total solar energy transmittance (g-value) calculated according to BS EN 410.

- For every space that is defined in the National Calculation (NCM) database as being side lit, the reference case is an east-facing façade with full-width glazing to a height of 1.0m having a framing factor of 10 percent and a normal solar energy transmittance (g-value) of 0.48.
- For every space that is defined in the NCM database as being top-lit, and whose average zone height is not greater than 6m, the reference case is a horizontal roof of the same total area that is 10 percent glazed as viewed from the inside out and having roof-lights that
- For every space that is defined in the NCM database as brief top lit and whose average zone height is greater than 6m, the reference case is a horizontal roof of the same total area that is 20 percent glazed as viewed from the inside out and having roof-lights that have a framing factor of 15 percent and a normal solar energy transmittance (g-value) of 0.42.

Blinds have been applied to some of the rooms to limit the effects of solar gains in occupied rooms. Please refer to BRUKL for the list of rooms.

4.1.3 Regulation 23(2), 6, 22 and Requirement L1(a)– Minimum Standards for the Building Envelope

For reference, the building envelope refers to all of the building components that separate the indoors from the outdoors: foundations, exterior walls, roof, windows, and doors.

The following table shows the U-values proposed by the architects and are used for the calculations.

Table 2: Building Element Thermal Properties

Proposed Building Element	U-Value (W/m2K)
External Wall	0.15
External Floor	0.12
Roof	0.12

Table 3: Glazing Thermal Properties

Glazing Type	U-Value (W/m²K)	g-Value
Windows	1.10	0.40

ADL2 2021 specifies a maximum building fabric air permeability of 8 m3/h/m2 @ 50Pa. The proposed building will target 3 m3/h/m2 @ 50Pa. Architectural details will be required to meet these standards. Post construction air leakage testing will be required to demonstrate that this figure has been achieved.

The good levels of insulation and air tightness follow the fabric first energy strategy, designed to minimise the energy required to maintain an acceptable internal environment. This will be complemented by highly efficient building services to result in energy performance better than the minimum requirements.

5. IES Inputs

5.1 MEP Systems

These units are developed as being shell only so the below inputs are estimates based on good practice. We have also assessed the unit as a whole. If the unit is split tenancy, then these results will change.

5.2 Heating System

A VRF system has been proposed with the below performance specification.

Table 4: ASHP Specification

ASHP System Element / Property	Value/Type
Heating COP	5.5
Cooling COP	5.05
Control	Central Time
	Local Temp.
Metering	Yes
Out-Of-Range	No

5.3 Ventilation

5.3.1 MVHR Units

Table 5: MVHR Specification

AHU System Element / Property	Value/Type
Specific Fan Power	1.2
Heat Recovery Type	Plate Heat Exchanger
Heat Recovery Efficiency	75%
Control	Speed Controlled

5.4 Lighting

Lighting controls vary across the building depending on use type and access to daylight. They have been listed by feature and location in the following Table:

The lighting gains have been based on the following specification:

Table 6: Other Lighting System Parameters

Specification	Value/Type
Design Illuminance	NCM Template
Light Output Ratio	1.0
Lighting Efficacy	95 lm/W

5.5 Power Factor Correction (PFC)

No provision has been made for Power Factor Correction.

5.6 Solar Photovoltaics (PV)

To achieve the Part L requirement, the annual predicted yield of the array is 110,874.658kWh.

6. Planning Application 23/01941/F Compliance

The scheme currently complies with the Local Plan requirements and the Planning Application requirements however this information is based on assumed specifications for a Shell fit out. A final energy assessment will need to be provided once the fit-out specification is known.

6.1 Condition 29

Under the Shell only assessment based on the previously listed specifications the units each achieve a BREEAM score of Very Good. A final BREEAM assessment will need to be provided once the fit-out details are defined.

6.2 Condition 30

6.2.1 ESD 1

This development has been designed with accessibility in mind, there are nearby public transport links (please see transport plan for further information). A substantial amount of bicycle storage is provided to each unit to encourage cycling. The site will also be fully pedestrian accessible.

As the above methodology demonstrates, the design has been carried out from the inception to reduce carbon emissions and provide a comfortable sustainable environment for the users. Fabric has been the first consideration with low u-values specified for all building fabric elements alongside low air permeability. This allows heat/coolth to be retained within the building avoiding wastage.

The units have been designed to allow the possibility of district heating if required. In addition to this the electricity distribution system has been designed to allow for a microgrid. An IDNO has been appointed to provide a private HV ring. This will facilitate on site renewables being used to provide the energy demands of the units through renewable technology (likely photovoltaic).

6.2.2 ESD 3

Water usage will be reduced to achieve the BREEAM credits with a target of less than 110/litres/day/person

Based on the listed inputs within this document a BREEAM score of Very Good is currently being achieved (please see BREEAM Assessor's Report for more detail).

As has been detailed the fabric and air permeability have been designed to be as efficient as feasibly possible. A careful balance has been struck between utilising glazing to provide natural light but also minimising the risk of overheating to avoid the need for excess cooling.

Please see the drainage strategy report for further information on the drainage solution proposed.

7. Part L Results

The Part L simulation with fabric improvements and Solar PV implementation are shown in the Table below. As the BER and BPER are less than the TER and TPER, the proposed building complies with Regulation 26 of ADL2 2021.

Table 7: Part L Result

Target Emission Rating (TER) kgCO2/m2·annum	Building Emission Rating (BER) with fabric improvement kgCO2/m2·annum	Building Emission Rating (BER) with fabric improvement and PV kgCO2/m2·annum	Compliance Margins BER vs TER (%)	Target Primary Energy Rate (TPER) kWh/m2·annum	Building Primary Energy Rate (BPER) with fabric improvement kWh/m2·annum	Building Primary Energy Rate (BPER) with fabric improvement and PV kWh/m2·annum	Compliance Margins BPER vs TPER (%)
2.75	1.86	-2.87	206	29.75	20.15	-34.43	216

Appendix A *BRUKL Output Document*

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

Bicester

As designed

Date: Wed Sep 27 10:59:49 2023

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.22

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.22

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

Certifier details

Name: Chris Alsop

Telephone number: Phone

Address: Street Address, City, Postcode

Foundation area [m^2]: 1474.17

The CO_2 emission and primary energy rates of the building must not exceed the targets

Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	2.75	
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	-2.87	
Target primary energy rate (TPER), $kWh_{PE}/m^2.annum$	29.75	
Building primary energy rate (BPER), $kWh_{PE}/m^2.annum$	-34.43	
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	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	First surface with maximum value
Walls*	0.26	0.15	0.15	B3000003:Surf[1]
Floors	0.18	0.12	0.12	B300000D:Surf[0]
Pitched roofs	0.16	0.12	0.12	B3000003:Surf[0]
Flat roofs	0.18	0.12	0.12	B3000002:Surf[8]
Windows** and roof windows	1.6	1.1	1.1	B300000D:Surf[1]
Rooflights***	2.2	1.1	1.1	B3000002:Surf[0]
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

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$] $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$]

* 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^2K

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	<0.9

1- Room

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	5.23	5.05	0.2	-	0.75
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.					

2- Natural Vent

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	5.23	-	0.2	-	-
Standard value	2.5*	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 all types >12 kW output, except absorption and gas engine heat pumps.					

"No HWS in project, or hot water is provided by HVAC system"

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**		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	**Zone**	**Standard**
B3	-	-	-	1.2	-	-	-	-	-	-	N/A
B3	-	-	-	1.2	-	-	-	-	-	-	N/A
B3	-	-	-	1.2	-	-	-	-	-	-	N/A
B3	-	-	-	1.2	-	-	-	-	-	-	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
B3 - Roof	95	-	-

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
B3 - Roof	95	-	-
B3 - Roof	95	-	-
B3 - Roof	95	-	-
B3 - Stairs	95	-	-
B3 - Stairs	95	-	-
B3 Stairs	95	-	-
B3 Stairs	95	-	-
B3 Stairs	95	-	-
B3	95	-	-
B3	95	-	-
B3 Stairs	95	-	-
B3	95	-	-
B3 - Stairs	95	-	-
B3 - Stairs	95	-	-
B3	95	-	-

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?
B3 - Roof	NO (-76.8%)	NO
B3 - Roof	NO (-76.8%)	NO
B3 - Roof	NO (-70.1%)	NO
B3 - Roof	NO (-70.4%)	NO
B3 - Stairs	NO (-11%)	NO
B3 - Stairs	NO (-9.4%)	NO
B3 Stairs	NO (-92.4%)	NO
B3 Stairs	NO (-69.5%)	NO
B3 Stairs	YES (+7.2%)	NO
B3	NO (-30%)	NO
B3	NO (-32.7%)	NO
B3 Stairs	YES (+18.6%)	NO
B3	NO (-25.6%)	NO
B3 - Stairs	N/A	N/A
B3 - Stairs	N/A	N/A
B3	NO (-29.9%)	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?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m^2]	2978.9	2994.9
External area [m^2]	4421.9	4421.9
Weather	SWI	SWI
Infiltration [m^3/hm^2@ 50Pa]	3	5
Average conductance [W/K]	978.17	1314.36
Average U-value [W/m^2K]	0.22	0.3
Alpha value* [%]	25	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
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/m^2]

	Actual	Notional
Heating	1.39	2.99
Cooling	1.77	1.16
Auxiliary	2.1	0.61
Lighting	6.29	13.67
Hot water	1.74	1.57
Equipment*	17.75	17.75
TOTAL**	**13.29**	**19.99**

* 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/m^2]

	Actual	Notional
Photovoltaic systems	37.22	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*37.22*	*0*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	47.03	49.23
Primary energy [kWh_{PE}/m^2]	-34.43	29.59
Total emissions [kg/m^2]	-2.87	2.73

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 SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	23.5	25.2	1.3	2	2.1	4.87	3.59	5.23	5.05
	Notional	29.2	21.4	2.9	1.3	0.6	2.78	4.63	----	----
[ST] Central heating using water: radiators, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	30.6	0	1.8	0	2.1	4.67	0	5.23	0
	Notional	36.4	0	3.6	0	1	2.78	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