

Space Studios, Phase 3

Environmental Standards and Energy Statement

0048853

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Contents

1	Executive Summary	5
2	Introduction	6
2.1	Development Description	6
2.2	Planning context	6
3	Energy Strategy	8
3.1	Passive Design approach	8
3.2	LZC Technology appraisal	10
4	Energy Modelling	13
4.1	Part L modelling results	13
4.2	Criterion 3 – Limiting Solar Gains in Summer	17
5	Summary	18
	Appendix A Part L Modelling Assumptions	

Glossary

Term	Definition
AHU	Air Handling Unit
BER	Building Emission Rate
CHP	Combined Heat and Power
DPD	Development Plan Document
DX	Direct Expansion
EPC	Energy Performance Certificate
GIA	Gross Internal Area
GSHP	Ground Source Heat Pump
LZC	Low Zero Carbon
MCC	Manchester City Council
MVHR	Mechanical Ventilation Heat Recovery
NIA	Net Internal Area
O&M	Operation and Maintenance
PV	Photo Voltaic
TER	Target Emission Rate
VRF	Variable Refrigerant Flow

1 Executive Summary

This Environmental and Energy Statement has been written to support the full planning application for the new Space Studios Phase 3 Development situated on the existing Space Studios site in West Gorton, Manchester hereafter referred to as 'the Site'. The Site will be developed by Manchester City Council, hereafter referred to as 'the Applicant' and Manchester City Council are the local planning authority. The statement sets out the Energy and Sustainability strategy for the proposed development in line with planning policies EN4, EN6 and EN8:

- At least 10% improvement on Building Regulations Part L 2010.

In order to achieve the targets, the following MEAN and LEAN energy efficiency strategies are proposed in the design including:

- Improving the envelope thermal performance
- Optimise the façade form to reduce unwanted solar gain whilst maximising the potential for daylight
- Efficient heat recovery within the central ventilation system
- Utilisation of highly efficient integral heat pumps to temper air supply from Air Handling Units (AHUs)
- Utilisation of displacement ventilation methods
- Efficient heating and cooling distribution via VRF pipework
- Efficient lighting and lighting controls

The following GREEN energy generation strategy is proposed:

- Roof mounted PV to generate electricity for use in the building

The results from Building Regulations Part L calculations for the proposed building demonstrated that the above energy efficiency design strategy has the potential to reduce the regulated carbon emissions by at least 6% utilising Low and Zero Carbon (LZC) technologies and so are sufficient to meet the planning requirements.

The RIBA Stage 2 design strategies have been designed to conform to the Manchester City Council's (MCC) 'Low Carbon Build Standard'.

2 Introduction

This report details the route to compliance with the 2013 edition of the Building Regulations Part L for the proposed Space Studios, Phase 3 development. Compliance with Part L has been assessed using the Approved Document L2A for the proposed new building. Following the guidance within the Approved Document L2A the shell and core spaces on the building's ground floor have also been tested for compliance.

The aim of this assessment is to demonstrate that the proposed design solution achieves:

- Compliance with Building Regulations Part L (2013) to meet **MCC Core Planning Strategy**.

This report also sets out to demonstrate the client's and the design team's commitment to contributing to the achievement of the Greater Manchester Combine Authority's 5 year Environment Plan through the application of passive design and low-carbon solutions.

2.1 Development Description

The proposed development comprises of 2No ~2000m² stage areas, with central workshop areas at ground level and office areas at first floor level. A roof level plant enclosure shall be provided at lower roof level (above the office areas), to house the central ventilation, heating and cooling plant.

Level	Use	Area (GIA m ²)	Notes
Roof	Roof Plant	937	GIA inc. lift plant and lobby
Level 01	Offices	1356	GIA inc. toilets, plant rooms and core
Ground Floor	Stages and Workshops	5471	GIA inc. toilets, plant rooms and core
Total		7764	

2.2 Planning context

- It has been identified that to achieve planning consent the building is to comply with the guidelines set by the MCC described in the Manchester Core Strategy Development Plan Document (DPD). Energy performance requirements are stated under Policy EN6 *Target Framework for CO₂ reductions from low or zero carbon energy supplies*.

The policy stipulates applications for developments over 1,000m² will be expected as a minimum to meet the target shown in the table below, unless this can be shown not to be viable. The proposed Space Studios, Phase 3 building falls into Target area 3 – Micro generation area buildings. Note that the policy document was approved and adopted before the Part L 2013 came into force.

Table 2—1 Project's energy targets set by DPD

Target area	Target % minimum improvement	Applicable to the project
Target 1: Network development area	CHP/District heating anchor or connection Or where feasible, a 15% improvement on Part L 2010	NO

Target 2 Electricity intense buildings (applies to commercial uses with a high proportion of emissions from electricity use.	10% improvement on Part L 2010 (1% improvement on Part L 2013)	YES
Target 3 Micro generation area	15% improvement on Part L 2010	NO

A target improvement of achieving Part L 2013 compliance set as required by the DPD. The proposed building shall achieve the commitment to 10% improvement on Part L 2010, as required by 'Target 3' above. A 10% improvement over above the Part L 2010 is widely regarded as equivalent to achieving 6% compliance with Part L 2013 standard, based on the government impact assessment study for the wider sectors. In terms of Part L assessment methodology this translates into comparing Actual and Notional building carbon emissions represented by calculated Building Emission Rating (BER) and Target Emission Rating (TER). In order to achieve minimum compliance, BER figure has to be equal or lower than TER.

3 Energy Strategy

This section describes the steps taken for the proposed Space Studios, Phase 3 building design to achieve all set energy targets and contribute to the achievement of the Greater Manchester Combine Authority's '5 year Environment Plan' and MCC's 'Low Carbon Build Standard' in a meaningful way.

The following information describes the steps taken for the proposed design, based on three key principles:

1. A passive-first approach: Energy demand reduction has taken the highest priority.
2. Future-proofed development: An electric-led development with resilience to climate change
3. Maximising low and zero carbon technologies.

The following sections outline the detail of the energy strategy using the "Be Mean", "Be Lean", and "Be Green" philosophy: Where "Be Mean" incorporates demand reduction through passive measures and energy efficient systems; "Be Lean" is the integration and specification of low carbon technology; and "Be Green" utilises renewable technology. This framework has been adopted as it ensures that passive design is prioritised in order to reduce the demand for energy in the first instance.

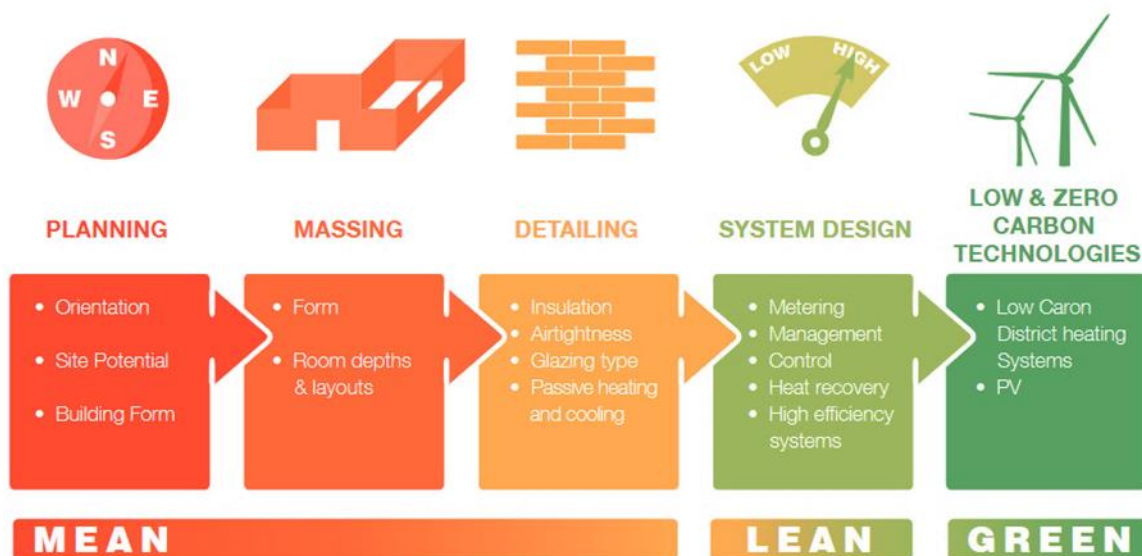


Figure 3—1 Passive design approach

3.1 Passive Design approach

The strategy approach can be generally summarised, as represented in the figure below.

Passive Design Solutions (Mean)

The design intention is to reduce the building demand for natural resources by utilising passive design measures. This design approach has been applied when developing the building's structure and façade constructions.

The energy demand of the building can be reduced through optimisation of the building's construction and fabrics, and through the implementation of passive design measures;

- **Building Fabrics** – all externally exposed fabrics will be insulated to achieve U-Values surpassing the mandatory standards required by Part L.
- **High Performance Glazing** – quality double glazing will be present across the constructions, again achieving U-Values surpassing the mandatory standards required by Part L. Additionally, low-emissivity film could be applied to provide a reduction in solar gains which will reduce risk of overheating during summer months.
- **Improved Air Tightness** - it is proposed that the building's envelope airtightness will be designed to high standards, minimising unintentional inward or outward leakage and therefore reducing potential for excess heat losses during the winter months.
- **Natural Ventilation** – natural ventilation methods are being used where possible in areas such as the workshops and ground floor tank room. This approach will mitigate the energy consumption that would be required of alternative mechanical systems.
- **Natural Daylight** – generous glazing areas have been applied to the building's occupied areas, in order to maximise available natural daylight and reduce the energy consumption of artificial light systems.
- **Zoning** - The control of the HVAC system will be thoughtfully zoned to allow different thermal and fresh air demands to be compartmentalised, permitting optimum flexibility and load balancing.

Active Design Solutions (Lean)

Energy and carbon demand can be further reduced through the use of energy efficient building services systems

- **Air Source Heat Pumps (ASHP)** – Specifically selected to meet project requirements, the plant generates heating and cooling at high efficiencies and ensures efficient delivery throughout the building distribution, minimising loss. This compliments the passive fabric strategy and further reducing building energy and fuel use.
- **Heat Recovery** - High efficiency heat recovery devices harness the energy within exhausted air and recirculate it back into the building to reduce heating and cooling loads.
- **Highly efficient Integral DX within AHUs** – AHU's will be fitted with integral DX units that make use of the controlled exhaust temperatures of the AHU to optimise performance when tempering air during peak summer and winter periods.
- **Free Cooling** – by utilising chilled air delivery strategies in the offices and stage areas, there is a significant opportunity for free cooling when the external temperature is below the design condition temperatures.
- **Demand Controlled Ventilation** - Methods of controlling ventilation air flow may be utilised in order to respond to occupancy and internal temperature. These controls will be linked to the building management system and CO₂ and temperature sensors will be provided to occupied zones.
- **Energy Efficient Lighting** - LED lighting can incorporate automatic controls that respond to daylight and human presence to minimise the buildings electrical lighting load.

Renewable Energy (Green)

Once all options for passive and active systems have been exhausted, low and zero carbon (LZC) technologies may be considered to supply energy to the building.

- **PV Technology** – a PV array shall be installed at roof level of both stage areas, allowing green onsite energy production for the new building.

3.2 LZC Technology appraisal

A preliminary Low-zero carbon technology feasibility study has been produced. The following table provides a comparison of LZC technologies within the context of the proposed building. To allow the comparison of technologies to include less quantifiable issues such as visual impact, a "traffic light" matrix has been developed to highlight the key benefits and disadvantages of each technology.

Table 3—1 LZC comparison matrix

Category	Solar thermal	Solar Photovoltaics (PV)	Ground Source Heat Pump (GSHP)	Biomass	Combined Heat & Power (CHP)
Capital cost value					
CO2 reduction potential					
LZC energy contribution					
Return on investment					
Spatial Requirements					
System integration					
Planning and regulatory risk					
Operation and maintenance					

The desktop analysis in the Low Zero Carbon Technology Feasibility Study shows that the provision of Solar PV would be the most applicable LZC technology for the proposed building. The other appraised LZC options have been ruled out for the following reasons:

- Biomass systems have characteristics which render the technologies unsuited for this project such as air quality concerns.
- Solar thermal systems come with high standing losses, which heavily offset the benefit of the systems.
- The use of CHP would prove unfeasible as the proposed building is predicted to have a low and intermittent hot water demand.

3.3 Policy EN8 Adaptation to Climate Change

The design team acknowledge that climate change presents one of the biggest global challenges of our time and welcome the leadership demonstrated by the Council by encouraging local solutions through Core Strategy Policy EN 8 Adaptation to Climate Change.

Steps taken to increase climate resilience of this development include:

- The drainage strategy has been designed for a 1 in 100 year storm with 40% increase for climate change (Refer to Flood Risk Assessment and Drainage Strategy Statement Integra Consulting).

- The office air handling units (AHUs) contain integral heat pumps, meaning that the performance of these is largely driven by the internal return air temperature, rather than the external air temperature. This means that the effects of more extreme external conditions will be lessened by using this strategy.
- The selected external air source heat pumps are capable of efficient operation within the following external temperatures ranges:

This will ensure effective heat pump operation within the below temperature ranges:

- Cooling mode: -5°C Min to 43°C Max
- Heating mode: -20°C Min to 15.5°C Max

The above conditions shall allow for continued effective building cooling systems in the event of the predicted average temperature increases within the UK.

For further information please refer to:

- Flood Risk Assessment and Drainage Strategy Statement (Integra Consulting)

Flood Risk Analysis

A Flood Risk Assessment (FRA) has been undertaken as part of the planning application in line with national and local policy. This concludes the proposed development is at low risk of flooding from all sources and represents no risk of flooding to adjacent areas. Notably:

- The site is located entirely within Flood Zone 1, according to the national flood map produced by the Environment Agency (EA), which relates to an annual probability of river flooding of less than 1 in 1000.
- The risk from surface water flooding is classified as low to very low.

For further information please refer to: Flood Risk Assessment and Drainage Strategy Statement (Integra Consulting)

Urban Heat Island Effect

The proposed development in West Gorton, is located outside of the 'urban centre' of Manchester, where the local area is not densely concentrated with concrete and other heat retaining structures. There is green infrastructure proposed in the form of a tree lined boundary at the rear of the stages.

For the above reasons, we do not consider 'urban heat island effect' relevant to the determination of this application.

Controlling Overheating

Due to the proposed nature of the building, it is anticipated that there will be a high amount of internal heat gains, and for this reason high efficiency air source heat pumps are being provided for mechanical cooling provision. The feasibility of natural ventilation has been appraised, however was deemed unsuitable to this building application due to the high acoustic sensitivity of the recording areas.

It should be noted that the selected mechanical ventilation strategies offer great potential for 'free cooling', which will alleviate the cooling systems power consumption greatly, when the external conditions are lower than the required room air temperature in cooling mode.

Enhanced Natural Habitats

Core Policy EN15 Biodiversity and Geological Conservation requires the protection and enhancement of sites of biodiversity value in line with Manchester's Biodiversity Strategy.

The Ecological Appraisal undertaken by Urban Green highlighted a number of existing major habitat types, including:

- Scattered trees
- Amenity grassland
- Introduced shrub
- Bare ground
- Hardstanding
- Buildings

The existing site is largely deemed to be of low ecological value. With the scattered trees offering the highest value, these are to be retained and protected during the construction, through methods explained in Urban Green's report. In addition, the landscape proposal intends to enhance these tree habitats by providing a treelined edge to the site at the rear of the studio block along Wenlock Way.

For more information, please refer to the 'Preliminary Ecological Appraisal', produced by Urban Green.

4 Energy Modelling

Following the identification of targets and the best system solutions a Part L model has been created using approved software package IES VE 2018 by an experienced energy assessor. The assumptions for system and fabric performances used in the simulations model can be found in Appendix A. To demonstrate the impact of improvements made to the building modelling was conducted for three cases:

Baseline – Highly efficient systems and controls utilised within a building model that has minimum fabric performance requirements (as per previous Space Studio phases).

Fabric Improvement – Highly efficient systems and controls utilised within a building model that has improved fabric standards.

Proposed - Highly efficient systems and controls utilised within a building model that has improved fabric standards and a 1350m² PV array situated at roof level, sized to provide 20% of the building's predicted energy usage in line with MCC 'Low Carbon Standard'. In line with MCC's 'Low Carbon Standard' solar PV should be specified for all new build projects together with a target for 20% of the developments energy to come from on-site renewable sources. Based on an operational energy target of < 110 kWh/m²/y, this equates to an annual consumption of 750,970 kWh, 20% of which equates to 150,194 kWh. This figure shall be used to size the PV array requirement at this stage in the design.

4.1 Part L modelling results

Following Approved Part L methodology and the design philosophy as detailed in the previous section the main occupied space of the proposed building has been modelled.

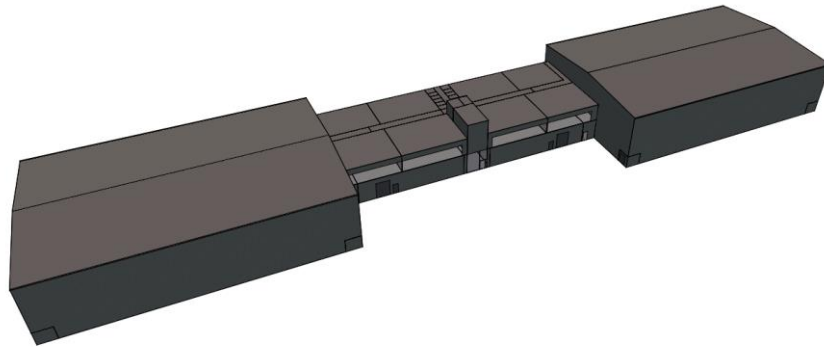


Figure 4—1 Part L model 3D views

The results of Part L energy modelling can be found in the table and figure below. As can be seen, the proposed design solution far exceeds the mandatory targets.

		Baseline	Fabric Improvement	Proposed
Target CO2 emission rate (TER)	kGCO ₂ /m ² .annum	30.8	30.8	30.8
Building CO2 emission rate (BER)	kGCO ₂ /m ² .annum	28.8	25.6	19.7
BER < TER?	✓/ X	✓	✓	✓
Improvement on Part L 2013	%	6.5%	16.9%*	36.0%*

***Note:** The compliance margin may be subject to change following design development i.e., changes in equipment efficiencies or if the proposed building geometry and fabric gets revised.

Table 4—1 Part L modelling results

Figure 4—2 Part L BRUKL Report

Extracts from the 'Proposed' Part L BRUKL report are shown below.

BRUKL Output Document

Compliance with England Building Regulations Part L 2013

Project name

Space Studios - Phase 3

As designed

Date: Fri Nov 05 12:36:30 2021

Administrative information**Building Details**

Address: Vaughan St, Manchester, M12 5FQ

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.13

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.13

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Criterion 1: The calculated CO₂ emission rate for the building must not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	30.8
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	30.8
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	19.7
Are emissions from the building less than or equal to the target?	BER ≤ TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.18	0.18	L0000009:Surf[1]
Floor	0.25	0.15	0.15	L0000009:Surf[0]
Roof	0.25	0.16	0.18	L1000002:Surf[0]
Windows***, roof windows, and rooflights	2.2	1.44	1.44	L1000003:Surf[1]
Personnel doors	2.2	1.88	2.2	L0000029:Surf[1]
Vehicle access & similar large doors	1.5	0.6	0.6	L0000001:Surf[1]
High usage entrance doors	3.5	-	-	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)] * There might be more than one surface where the maximum U-value occurs. ** 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. 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	Worst acceptable standard	This building
m ³ /(h.m ²) at 50 Pa	10	3

Figure 4—3 BRUKL Document extract

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters			Building Use	
	Actual	Notional	% Area	Building Type
Area [m ²]	7516.8	7524.4		A1/A2 Retail/Financial and Professional services
External area [m ²]	18235.9	18278.8		A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
Weather	MAN	MAN		B1 Offices and Workshop businesses
Infiltration [m ³ /hm ² @ 50Pa]	3	3		B2 to B7 General Industrial and Special Industrial Groups
Average conductance [W/K]	3504.59	4479.72	17	B8 Storage or Distribution
Average U-value [W/m ² K]	0.19	0.25		C1 Hotels
Alpha value* [%]	10	10		C2 Residential Institutions: Hospitals and Care Homes
				C2 Residential Institutions: Residential schools
				C2 Residential Institutions: Universities and colleges
				C2A Secure Residential Institutions
				Residential spaces
				D1 Non-residential Institutions: Community/Day Centre
				D1 Non-residential Institutions: Libraries, Museums, and Galleries
				D1 Non-residential Institutions: Education
				D1 Non-residential Institutions: Primary Health Care Building
				D1 Non-residential Institutions: Crown and County Courts
			83	D2 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

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

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	11.69	12.27
Cooling	0.3	0.4
Auxiliary	10.77	7.16
Lighting	22.93	41
Hot water	1.49	1.56
Equipment*	21.16	21.17
TOTAL**	47.17	62.38

* 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	8.07	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	101.04	99.75
Primary energy* [kWh/m ²]	141.2	178.36
Total emissions [kg/m ²]	19.7	30.8

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

4.2 Criterion 3 – Limiting Solar Gains in Summer

For each room that is either occupied or comfort cooled the solar gain through glazing should not exceed limits set by a reference room of the same shape. All occupied and comfort cooled rooms have achieved these requirements with an acceptable margin as indicated in the design stage BRUKL.

It should be noted that satisfying this criterion is NOT evidence that the internal climate of the building will be comfortable since factors such as internal gains and ventilation provision that will influence comfort are not tested by this criterion.

5 Summary

On the basis of the measures and modelling results detailed in this report, it is anticipated that the development, as proposed, will achieve energy performance requirements as stated under Policy EN6 within the Core Strategy.

In order to achieve Manchester City Council's planning energy targets, the strategies below are proposed to be implemented:

- Good thermal insulation standards.
- Solar control of glazed façades.
- Improved air tightness provisions for the facade.
- Maximising daylight inside perimeter spaces.
- Energy efficient lighting fittings and daylight/occupancy controls.
- Energy efficient fans and pumps.
- Metering and monitoring provisions for all systems.
- Heat recovery devices installed within primary mechanical ventilation systems.
- Using available roof space for Solar PV generation.

As the detailed design is developed the elements in the above strategy will be fine-tuned such that the final as-constructed building achieved the targets set.

Risks to compliance

Achieving the identified energy targets will be subject to carefully implementing design parameters and considerations detailed in Appendix A of this report. This design achieves a good compliance margin so meeting Building regulation targets is not deemed to be a risk at this stage in the design. The following features have been identified as having a large impact on building energy performance so compromising any of them may result in lower Part L compliance margin.

- Compromising achieving cooling and heating seasonal efficiencies.
- Compromised ventilation controls.
- Compromised water pumping type.
- Compromised DHW design.
- Compromising achieving the efficient lighting design, daylight, and occupancy sensing controls.
- Poor building air permeability performance.
- Failure to provide effective internal shading for office spaces.
- Compromised fabric or glazing U-values.

- Compromised specific fan power and ventilation controls.

Risk Mitigation

In order to prevent further design development affecting the proposed energy targets and operational performance of the completed building, the following measures are proposed;

- Rational and intelligent approach to finance and building element procurement. Identified performance and efficiency targets should drive system and fabric selection.
- Careful monitoring of on-construction works to ensure highest quality craftsmanship and compliance with all relevant standards and regulations. Special care should be taken when installing external openings as a poorly sealed façade will have a detrimental effect on system operation and occupant wellbeing.
- Mechanical Electrical and Plumbing system commissioning undertaken before handover. Testing and adjusting is undertaken to ensure that the whole system uses no more fuel and power than is reasonable in the circumstances and demonstrate all performance and regulation requirements are met.

A detailed Operation & Maintenance (O&M) Manual should be handed over to the Client on building completion. The O&M Manual should include a detailed description of works; Details of each system such as its location, model number, all relevant manufacturers' operation and maintenance information. The O&M should lay down a maintenance schedule for all installed systems throughout the building, with references to the manufacturers' information where appropriate.

Appendix A Part L Modelling Assumptions

A.1 Part L Modelling Assumptions

Building fabric standards

The tables below summarise the minimum building fabric standards that has resulted in a building regulations part L compliant building.

Figure 5—1 Building fabric U-values

Building Fabric	Units	Proposed building	Notes
U-values			
External wall	W/m²K	0.18	Applies to all opaque wall constructions
Ground floor	W/m²K	0.15	
Stage Roof	W/m²K	0.18	
Office Roof	W/m²K	0.18	
External glazing including glazed doors	W/m²K	1.44	Clear low-e and Solar Control
Glazing properties			
Glazing	g value	0.4	
	Light T	0.71	
Shading device properties (applied to all office spaces)			
Shading coefficient	N/A	0.40	Light-coloured roller blinds
Short wave radiant fraction	N/A	0.45	
Air permeability and cold bridging			
Air permeability	m³/hr/m² @ 50pa	3.0	
Thermal bridging coefficient	W/m²K	Varied	'Default' thermal bridging coefficients have been applied to all construction and opening types.
Light T = Light transmittance, g value = solar transmittance			

Room activity definition

Room activities have been set based on the planning class D2 General Assembly and Leisure, Night Clubs, and Theatres

HVAC standards

HVAC systems have been applied to the building and are detailed in the following tables.

Figure 5—2 Heating and cooling system standards

Heating and cooling	Unit	1. Displacement Ventilation	2. VAV	3. VRF	4. Electric Heaters	5. Electric Heaters
NCM system		Chilled ceilings or passive chilled beams and displacement ventilation	Single-duct VAV	Split or multi-split system	Other local room heater - fanned	Other local room heater - unfanned
Rooms		Stages	Offices	Switch & Dimmer Room	Workshops	WCs, Showers, circulation
Heating						
Fuel		Electricity				
Generator		Heat pump (electric): Air source			Direct Electric	
Emitter		Diffusers	Diffusers	Local fan coils	Fan heater	Radiant Panel
Seasonal Efficiency	SCOP	2.5	23.0	3.45	N/A	N/A
Cooling						
Fuel		Electricity				
Generator		Heat pump (electric): Air source			N/A	
Emitter		Diffusers	Diffusers	Local fan coils	N/A	N/A
Seasonal Efficiency	SEER	2.5	9.0	5.0	N/A	N/A
Pumping type		Variable speed, multiple pressure sensors			N/A	N/A

Figure 5—3 DHW system standards

DHW	Unit	Instantaneous hot water
Serving		Building
Fuel		Electric
Generator		Instantaneous Local Heater
Delivery Efficiency	%	~90
Total Cylinder Volume (calorifiers)	Litres	N/A
Cylinder Loss	kWh/l/day	N/A

Figure 5—4 Ventilation system standards

Ventilation	Units	Local extract	Displacement Ventilation	Variable Air Volume (VAV)
Room activity		Toilets, Showers, Storage	Stages	Offices
Extract air volume	Air change per hour	6 (Toilets/Shower) 3 (Storage)	N.A.	N.A.
AHU total SFP	W/l/s	N.A.	1.9	1.9
Terminal unit SFP	W/l/s	0.6	N.A.	N.A.
AHU leakage classification	-	N.A.	N.A.	N.A.
Duct leakage classification	-	N.A.	N.A.	N.A.
Heat recovery efficiency	%	N.A.	75%	75%
Ventilation volume control	N.A.	N.A.	Fan speed control based on Temperature Sensors	Fan speed control based on CO ₂ and Temperature Sensors

Electrical services

The following tables summarise electrical system standards assumed for the compliance calculations.

Figure 5—5 Lighting standards

Zone	NCM Lighting lux level	Lighting efficacy (lm/W)	Lighting control	Lighting control parasitic power (W/m ²)
Office	400	100	Absence detection / Daylight dimming	0.1
Stages	300	100	Absence detection / Daylight dimming	0.1
Workshop	500	100	Absence detection / Daylight dimming	0.1
Dimmer Room	200	100	Presence detection	0.1
Circulation	100	100	Presence detection	0.1
Showers	200	100	Presence detection	0.1
WCs	200	100	Presence detection	0.1
Storage	200	100	Presence detection	0.1
M&E Plant	200	100	Manual	-
1W connected load per occupancy sensor/ daylight dimming control gear as parasitic power				

Where rooms are specified as having daylight lighting control all luminaires within 6m of an external window were controlled.

Table 5—6 Renewable system standards

LZC Technology	Units	Requirement
PV collector area	m ²	1350
Panel efficiency	%	20%
Shading factor		0.860
		Installed at a 15 degree pitch facing 163 degrees clockwise from north
		Inverter efficiency 95%

Figure 5—7 Metering, emission factor, and power factor correction

Sub-meter	Provision	Comments
Sub-metering	Automatic monitoring and targeting software with alarms for out-of-range values to include a complete installation that measures, records, transmits, analyses, reports, and communicates meaningful energy management information from all building energy meters and sub-meters to enable the building operator to manage the energy the building uses.	Building Energy Monitoring and Targeting Software must be installed
Heating	Meter electric supply to primary plant	
HVAC	Meter all MCC Panels	
Cooling	Meter electrical supply to primary plant	
Lighting	Metering on a distribution board by distribution board basis	
Small Power	Metering on a distribution board by distribution board basis	
Power Factor Correction	Above 0.95	Power factor monitoring equipment must be installed. Should the stated power factor not be achieved power factor equipment must be installed.

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