EUSTON TOWER

Energy Statement

December 2023

British Land

ARUP

British Land Property Management Limited

Euston Tower

Energy Statement

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Contents

Appendices

1. Context

1.1 Regulatory changes

With the 2021 update to the Building Regulations Approved Document Part L – Conservation of fuel and power: Buildings other than dwellings, herafter abbreviated to Part L 2021, there have been significant improvements made to the notional building to which the Proposed Development is compared, and that forms the baseline comparison on which the GLA requirement of 35% reduction in on-site carbon emissions is to be demonstrated.

These improvements to the parameters of the notional building aim to drive proposed buildings to achieve a 27% reduction in carbon emissions compared to requirements in Part L 2013. However, this baseline improvement has not seen a change in the GLA requirements for a 35% reduction in on-site carbon emissions, meaning that this target is now very difficult to meet, especially on a scheme such as the Proposed Development that has a number of specific challenges, which are discussed further in paragraph 1.2 below.

The GLA acknowledge how these regulatory changes have made it more challenging to meet their targets in the document, 'Note to accompany GLA Energy Assessment Guidance 2022' which states that "*Initially, non-residential developments may find it more challenging to achieve significant on-site carbon reductions beyond Part L 2021 to meet both the energy efficiency target and the minimum 35 per cent improvement. This is because the new Part L baseline now includes low carbon heating for non-residential developments but not for residential developments. However, planning applicants will still be expected to follow the energy hierarchy to maximise carbon savings before offsetting is considered.*"

A summary of the main notional building changes between each version of the Building Regulations Part L is provided below to demonstrate the significant improvements made on the 2013 version.

		
	Building Regulations Approved Document Part L2a (2013)	**Building Regulations Approved Document Part L Volume 2 (2021)**
GLA requirement for on-site carbon reduction over Part L	35%	35%
Notional Building Fabric Parameters		
Roofs (W/m^2K)	0.18	0.15
Exposed walls (W/m^2K)	0.26	0.18
Exposed floors & ground floors (W/m^2K)	0.22	0.15
Windows (W/m^2K)	1.6	1.4
Air tightness ($m^3/hr/m^2$)	5.0	3
Notional Building System Parameters		
Space heating source	Gas boiler	Electric heat pump
Space heating source efficiency	81.9%	264%
Domestic hot water source	Gas heater	Electric heat pump
Domestic hot water source efficiency	86.4%	286%

Table 1: Comparison of the main notional building changes between each version of the Building Regulations Part L

The previous parameters of the Part L 2013 notional building meant that the GLA's required 35% on-site carbon reduction was considerably more achievable when this was used as the baseline comparison. For reference, during the pre-application meeting with the GLA held 20/09/23, initial results, relating to a slightly different building geometry, were shown to be exceeding the Part L 2013 baseline by around 36%. Based on the current geometry of the Proposed Development and correlating with the performance against the Part L 2021 baseline as is demonstrated in this document, it is identified that the performance against the Part L 2013 baseline would be even more than the 36% previously highlighted in those discussions.

1.2 Main challenges specific to the Proposed Development

1.2.1 Building form

As buildings rise in height, the exterior surface area increases disproportionately to the interior volume, leading to a higher proportion of exposed walls versus internal floor area. This larger surface area results in increased heat transfer, demanding more energy for heating or cooling systems to maintain acceptable internal conditions.

Whilst the notional building does also assume this form, it should be noted that this is a constraint, especially when the notional building façade thermal performance is considered as is explained below.

1.2.2 Curtain wall façade

The notional building as per Approved Document Part L 2021 assumes relatively high thermal performance of fabric constructions. The notional building assumes a wall area of 60% of the overall façade area and applies a U-value of 0.18 W/m^2K to these solid elements, it also assumes a window area of 40% of the overall façade area and applies a U-value of 1.4 W/m^2K to these glazed elements. This results in a notional building average façade U-value of 1.04 W/m^2K.

Analysis during the design of the Proposed Development has proven that a façade system implementing walls and windows, in the manner in which they are applied in the notional building, is not possible, owing to a range of constraints including constructability and increased structural loading on existing foundations. These factors are explained in more detail in Section 5.3.1. For these reasons a unitised curtain wall façade has been implemented within the Proposed Development.

Table 4.1 of Approvement Document Part L 2021 states a limiting U-value of 1.6 W/m^2K for curtain walling elements, and the U-value of the system implemented within the Proposed Development significantly improves on this, delivering an average façade U-value of 1.2 W/m^2K, which provides a balance between delivering high thermal performance to reduce operational energy demand and the increased embodied carbon arising from a higher performing façade. Sensitivity analysis has been undertaken which has found that the additional embodied carbon and complexity of the facade required to improve on this target does not correlate with significant energy and carbon reduction.

However, as the notional building baseline result is based on the better performing window and wall U-values previously detailed, demonstrating an improvement on this with the less well performing curtain wall system required for the Proposed Development is very difficult meaning demonstrable improvement in the Be Lean section of the GLA Energy Hierarchy is challenging to achieve.

1.2.3 Site constraints from the retention of existing structure

The Part L 2021 notional building also implements heat pumps with relatively high efficiencies, meaning that the demonstrable improvement of the Proposed Development over such a high performing baseline is reduced. Other solutions that could facilitate higher overall efficiencies, such as the integration of a ground source heat pump system, were investigated during the design process but were found to be unfeasible within the constraints of the site.

A system utilising boreholes through the new structural slab within the footprint of the basement, meaning the existing slab is not greatly disturbed, would only allow for approximately 30 boreholes, allowing an estimated system capacity of less than 175kW, which is not significant enough to make a material difference to the overall energy performance of the Proposed Development.

It is expected that a more significant GSHP installation with a higher capacity could be achieved if large parts of the existing structure within the basement were to be removed to allow the installation of a greater number of boreholes and connecting pipework. It is estimated that if around 60, 200m deep boreholes were installed, necessitating the removal of much of the existing basement structure, the overall peak capacity of the system could be increased to around 360kW. However, it is estimated that it would take over 1150 years for the carbon savings gained from the increased system efficiencies to pay back the embodied carbon associated with removing the existing structure

For these reasons, a GSHP installation has not been included within the Proposed Development. This reasoning is covered in more detail in Section 8.4.1.

2. Executive Summary

2.1 Purpose

This Energy Statement has been prepared in support of an application for planning permission in respect of the proposed redevelopment of Euston Tower, 286 Euston Road, London, NW1 3DP, submitted to the London Borough of Camden (LBC). This document has been compiled in accordance with the guidance provided by the Greater London Authority (GLA) for energy assessments within the planning process. The purpose of this statement is to provide an overview of the energy considerations and proposals for Euston Tower. It aims to demonstrate the Proposed Developments compliance with the GLA's and Camden Council's energy policies and objectives, the methods proposed to increase energy efficiency, and its contribution to sustainable development within the Greater London area.

2.2 Description of development

This Energy Statement has been prepared in support of an application for planning permission for the redevelopment of Euston Tower, 286 Euston Road, London, NW1 3DP.

Full planning permission is sought for the following development: -

"Redevelopment of Euston Tower, including the partial retention (retention of existing core, foundations and basement), disassembly, reuse and extension of the existing building, to provide a 32-storey building for use as offices and research and development floorspace (Class E(g)) and office, retail, café and restaurant space (Class E) and learning and community space (Class F) at ground, first and second floors, and associated external terraces. Provision of public realm enhancements, including new landscaping, and provision of new publicly accessible steps and ramp. Provision of short and long stay cycle storage, servicing, refuse storage, plant and other ancillary and associated works".

This is referred to throughout as the "Proposed Development".

2.3 The Applicant

The applicant for this application is British Land Property Management Limited (hereafter, British Land)

2.4 Description of Existing Site

Euston Tower is an existing 36-storey tall building standing on the northern edge of central London, situated in the south-west of the London Borough of Camden.

Located on the corner of Euston and Hampstead Road, at the top of Tottenham Court Road the tower shares a busy intersection with The UCL Hospital campus and is directly opposite Warren Street Station. The current tower has a prominent presence, given its status as the tallest building in the borough aside from the nearby BT Tower, and as such acts as a physical landmark for London Euston, Euston Square and Warren Street stations as well as wayfinding for the wider neighbourhood.

Completed in 1970, Euston Tower was designed in the 'International Style'. Above a two-storey extruded glazed podium, the tower has a pinwheel plan clad in aluminium curtain walling with green reflective tinted glazing. It was designed as an office building to provide cellular office accommodation typical of the period and formed part of a wider masterplan known as The Euston Centre. It now stands on the eastern edge of the pedestrianised Regent's Place Campus. Since its completion, it has undergone a minor refurbishment with the addition of secondary glazing in the 1990s, but beyond this its external form and façade remain as originally constructed. These elements of the building are in a generally poor condition, due to a combination of wear in use and the quality of the original detailing. Gradually the existing tower has been vacated, and since 2021, with the exception of the retail floorspace at grade level, the building is vacant.

2.5 Results summary

The Proposed Development embodies an ambitious energy and carbon emissions reduction strategy. Through a combination of innovative and best practice energy reduction measures, the proposed mixed-use development achieves an **overall reduction in regulated carbon dioxide emissions of 14%** over Part L 2021 .

2.5.1 Compliance with GLA requirements

- It is acknowledged that the current predicted on site reduction falls short of the GLA's 35% on-site carbon reduction over Part L 2021, which has been raised and highlighted in pre-application meetings with the GLA's energy officers. Feedback from these meetings stated the requirement for the limitations to be set out in detail, with clear reasons why compliance is not possible. These key points are detailed later in this section.

- The 'Note to accompany GLA Energy Assessment Guidance 2022' acknowledges that non-residential developments may find it more challenging to achieve significant on-site carbon reductions beyond Part L 2021 to meet both the energy efficiency target and the minimum 35% improvement. The note highlights that applicants are still expected to follow the energy hierarchy to maximise carbon savings.

- This Energy Statement for the Proposed Development is provided to demonstrate that the Energy Hierarchy has been followed in accordance with relevant planning requirements. Factors specific to the Proposed Development that prevent meeting this target are summarised in the following section.

2.5.2 Specific limitations of the Proposed Development:

Be Lean:

- Numerous façade options were explored as part of the design process, with detailed analysis of embodied carbon, constructability and thermal performance aspects. The curtain wall façade system chosen balances each of these factors and delivers a well-rounded solution. However, the achievable overall U-value of this system is higher than that of the notional building façade performance, which relates to solid wall and glazed elements, and forms the baseline to which the Proposed Development is compared. Other façade types that may have delivered marginally improved thermal performance were investigated but deemed to not be feasible. A precast panel façade with punched window openings was studied but was found to impose significantly increased and unacceptable structural loads on the existing building foundations, which are to be retained and reused. A façade system implementing Ultra High Performance Concrete (UHPC) panels was also investigated but was not taken forwards as the installation methodology, requiring the sealing of external joints from the outside, using scaffolding or abseiling, would have introduced installation health and safety risks that were deemed unacceptable. A detailed summary of the reasoning behind the façade strategy chosen is included in Section 5.3.1.

- Percentage glazing has been limited in many areas to be as low as feasibly possible whilst facilitating occupant satisfaction and connectivity through outward views. Overheating analysis and energy modelling has then informed the setting of g-value limits to minimise solar heat gain. However, there is also a balance to be made in providing glazing that allows sufficient natural light transmittance, reducing the operating hours of artificial lighting. The g-value targets for glazing within the Proposed Development aims to balance these factors.

Be Clean:

- Connections into local existing or planned heat networks were investigated but found to be unfeasible currently as there are no functioning heat networks or networks planned to be delivered within suitable timescales within the locality of the site.

Be Green:

- An assessment of different LZC technologies was undertaken but many were found to be unfeasible for application to the Proposed Development. In terms of power generating technologies, only PV was deemed suitable for inclusion within the scheme.

- System efficiencies have been maximised as far as possible. High efficiency simultaneous ASHPs have been implemented, using waste heat to produce domestic hot water through the use of WSHPs. However, as the Part L 2021 notional building also implements heat pumps with relatively high efficiencies, meaning that the demonstrable improvement of the Proposed Development over such a high performing baseline is reduced. Other solutions that could facilitate higher overall efficiencies, such as the integration of a ground source heat pump system, were investigated during the design process but were found to be unfeasible within the constraints of the site.

  A system utilising boreholes through the new structural slab within the footprint of the basement, meaning the existing slab is not greatly disturbed, would only allow for approximately 30 boreholes, allowing an estimated system capacity of less than 175kW, which is not deemed significant enough to make a material difference to the overall energy performance of the Proposed Development.

  A more significant GSHP installation could be achieved if significant parts of the existing structure within the basement were to be removed. It is estimated that if around 60, 200m deep boreholes were installed, necessitating the removal of much of the existing basement structure, the overall peak capacity of the system could be increased to around 360kW. However, it is estimated that it would take over 1150 years for the carbon savings gained from the increased system efficiencies to pay back the embodied carbon associated with removing the existing structure

  For these reasons, it has not been deemed possible to include a GSHP installation within the Proposed Development. This reasoning is covered in more detail in Section 8.4.1.

- The amount of usable area for PV is severely restricted, as a result of the buildings tower form and requirement for significant urban greening. The level 31 roof level accommodates ASHPs and air cooled chillers which cannot be situated anywhere else and require unobstructed free area above, making this space unusable for PV installation. As such, maximising the carbon offset from on-site electricity generation is challenging.

In line with the requirements of the London Plan, energy consumption and carbon dioxide emissions have been assessed at each stage of the energy hierarchy, with overall savings and resulting off-set payment calculated.

In line with the requirements of the London Plan and the Camden Local Plan, the shortfall in carbon emissions below net-zero on-site is proposed as a financial contribution, via off-set payment.

Results and calculated offset payments are shown in Figure 1 and listed in Table 2.

The energy performance data is calculated following the Approved Document Part L2 2021 compliance method and based on inputs and assumptions as outlined in this document. The predictive energy assessment is calculated following GLA ‘Be Seen’ guidance using CIBSE TM54 methodology.

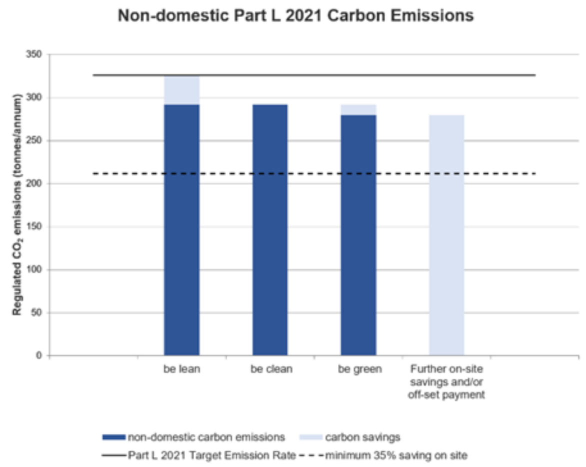


Figure 1: Regulated CO2 emissions savings from each stage of the Energy Hierarchy: non-domestic

	Total regulated emissions (Tonnes CO2 / year)	CO2 savings (Tonnes CO2 / year)	Percentage savings (%)
Baseline: Part L 2021	325.7		
Be lean: Savings from energy demand reduction	292.2	33.5	10%
Be clean: Savings from heat network	292.2	0.0	0%
Be green: Savings from renewable energy	279.2	13.0	4%
Cumulative on-site savings	-	**46.5**	**14%**
Annual savings from off-set payment	-	298.5	-
Cumulative savings for off-set payment (t CO2)		8,375	
Cash in-lieu contribution (£)		£795,581	

Table 2: Total Proposed Development regulated carbon emissions results, savings, off-set calculation and cash in-lieu contribution.

2.6 Energy strategy summary

This section sets out the key measures and CO_2 reductions identified for each stage of the energy hierarchy.

2.6.1 Be Lean

- Optimised glazing percentages to maximise daylight penetration but minimise overheating. g-value limits specified for glazing elements aims to limit excessive solar gain on to the floor plate.
- Façade elements that project horizontally and vertically adjacent to glazing are optimised to provide solar shading during peak scenarios but also allows for beneficial solar gain during winter months.
- An underfloor ventilation system avoids the need for active cooling for large periods of the year through free cooling provided by largely un-tempered fresh air supplied by the on-floor AHUs, with cooling done by the high efficiency heat exchanger. The underfloor system also avoids the need for additional high-level mechanical services, significantly reducing embodied carbon.
- A high-performance curtain wall façade has been specified to reduce space heating demand in winter and minimise the risk of summertime overheating. Embodied carbon has been considered in the analysis of the façade to provide a solution that reduces operational carbon but is also expected to be a lower embodied carbon solution when compared to other façade types, resulting in a better performance from a whole life carbon perspective.

2.6.2 Be Clean

- The development follows the GLA heating hierarchy first considering district systems followed by zero emissions or local heat sources. There are no proposed district heat networks in the local area for connection on day one, therefore on-site, low carbon generation of heat using ASHPs is proposed.
- The development is designed to avoid all on-site emissions, using an all-electric heating and cooling strategy, therefore no gas boilers or CHP are included in the scheme.
- Although not currently planned to connect, the scheme will be enabled for future connections into any local heat networks which can provide sufficient capacity to support the operation of the Proposed Development.

2.6.3 Be Green

- Heating and cooling will be provided to the development by central heating and cooling plant consisting of air-cooled chillers and simultaneous air source heat pumps (ASHPs) to maximise the ability to share heat between spaces within the building.
- Simultaneous heating and cooling heat pumps can utilise free cooling to maximise efficiency through mid-seasons.
- The installation of PV panels is included within the scheme to contribute to the reduction of operational carbon emissions. Approximately $100m^2$ is planned to be included spread across appropriate areas at Level 31 roof level.

2.6.4 Be Seen

- The GLA's 'Be Seen' spreadsheet with performance indicators including contextual data, building energy use and carbon emissions for the Proposed Development will be separately submitted.
- The energy performance of the Proposed Development has been assessed using a CIBSE TM54 compliant methodology to provide an assessment of regulated and non-regulated energy consumption.
- A comprehensive NABERS Design for Performance assessment will be carried out during RIBA Stage 3.

3. Planning Context

This Energy Statement has been prepared in response to the planning policies and guidance contained in the following documents:

- The National Planning Policy Framework (Ministry of Housing, Communities & Local Government, 2023)
- The London Plan (GLA, March 2021), Chapter 9: Sustainable Infrastructure
- GLA Energy Assessment Guidance (GLA, June 2022)
- Camden Local Plan (2017)
- Camden Planning Guidance Energy Efficiency and Adaptation (2021)
- Part L 2021 and the Energy Assessment Guidance 2022 – cover note

3.1 National planning policy framework (2023)

The National Planning Policy Framework sets out the Government's planning policies for England and how these should be applied. It provides a framework within which locally prepared plans for housing and other development can be produced.

This Energy Statement responds to the following paragraph:

Paragraph 157 states that in determining planning applications, local planning authorities should expect new development to:

a) comply with any development plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable; and

b) take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.

3.2 London Plan (2021)

The London Plan is an integrated policy framework that sets out an economic, environmental, transport and social framework for the development of Greater London from 2019 to 2041.

This Energy Statement responds to the following policies:

- SI 2 – Minimising greenhouse gas emissions
- SI 3 – Energy infrastructure
- SI 4 – Managing heat risk.

The overarching principle for new development is to develop a low carbon energy solution in accordance with the Mayor's energy hierarchy, which meets or exceeds the overall carbon emissions targets defined in Policy SI 2.

Policy SI 2 states that major developments should be net-zero carbon. By following the energy hierarchy, carbon must be reduced by a minimum of 35% beyond Building Regulations. Non-residential developments should aim to achieve 15% through energy efficiency measures alone.

The energy hierarchy is as follows:

- Be lean: use less energy
- Be clean: supply energy efficiently
- Be green: use renewable energy
- Be seen: monitor, verify and report on energy performance.

Where it is clearly demonstrated that the zero-carbon target cannot be fully achieved on site, any shortfall should be provided through a cash in lieu contribution to the relevant borough's carbon offset fund or off-site generation.

Policy SI 3 outlines the new heating hierarchy, which is considered in the development of the energy strategy.

The heating hierarchy is as follows:

1. Connect to local existing or planned heat networks
2. Use zero-emission or local secondary heat sources (in conjunction with heat pump, if required)
3. Use low-emission combined heat and power (CHP) (only where there is a case for CHP to enable the delivery of an area-wide heat network, meet the development's electricity demand and provide demand response to the local electricity network)
4. Use ultra-low NOx gas boilers.

Policy SI 4 outlines the cooling hierarchy, which requires major development proposals to demonstrate how they will reduce the potential for internal overheating and reliance on air conditioning systems in accordance with the following:

1. Reduce the amount of heat entering a building through orientation, shading, high albedo materials, fenestration, insulation and the provision of green infrastructure
2. Minimise internal heat generation through energy efficient design
3. Manage the heat within the building through exposed internal thermal mass and high ceilings
4. Provide passive ventilation
5. Provide mechanical ventilation
6. Provide active cooling systems.

3.3 Camden Local Plan (2017)

The Camden Local Plan was adopted on 3 July 2017, replacing the Core Strategy and Camden Development Policies as the basis for planning decisions and future development in Camden.

This Energy Statement responds to the following policies under 'Section 8: Sustainability and climate change':

- Policy CC1: 'Climate change mitigation'
- Policy CC2: 'Adapting to climate change'.

The energy strategy for the Proposed Development proposes a low carbon energy solution which has been developed in accordance with the energy hierarchy, cooling hierarchy and decentralised energy hierarchy referenced in CC1 and CC2. The strategy reduces on site carbon emissions as far as possible, with the remaining shortfall against the targets defined in CC1 to be secured as a financial cash-in-lieu contribution.

Policy CC1 requires all development to minimise the effects of climate change and encourage all developments to meet the highest feasible environmental standards that are financially viable during construction and occupation. This includes requiring all major development to demonstrate how London Plan targets for carbon dioxide emissions have been met. Policy CC1 also requires that major developments will be required to install appropriate monitoring equipment so that the Council can monitor the effectiveness of renewable and low carbon technologies.

Policy CC1: (Paragraph 8.8): All developments involving five or more dwellings and/or more than 500 sqm of (gross internal) any floorspace will be required to submit an energy statement demonstrating how the energy hierarchy (see London Plan Section 3.2) has been applied to make the fullest contribution to CO_2 reduction.

Policy CC1 (Section 8.11): The Council will expect developments of five or more dwellings and/or more than 500 sqm of any gross internal floorspace to achieve a 20% reduction in carbon dioxide emissions from on-site renewable energy generation (which can include sources of site related decentralised renewable energy), unless it can be demonstrated that such provision is not feasible. This is in line with stage three of the energy hierarchy 'Be green'. The 20% reduction should be calculated from the regulated CO2 emissions of the development after all proposed energy efficiency measures and any CO2 reduction from non-renewable decentralised energy (e.g. CHP) have been incorporated.

Policy CC1 (Section 8.12): All major developments will also be expected to demonstrate how relevant London Plan targets for CO2 reduction, including targets for renewable energy, have been met (see London Plan Section 3.2).

Where it is demonstrated that the required London Plan reductions in carbon dioxide emissions cannot be met on site, the Council will require a financial contribution to an agreed borough wide programme to provide for local low carbon projects.

Policy CC1 (Section 8.25): The Council will require all new developments to assess the feasibility of connecting to an existing decentralised energy network, or where this is not possible establishing a new network. Developments will be required to follow the steps below, in the order listed, to ensure that energy from an efficient source is used where possible:

- Connect immediately
- Connect in immediate future
- Provide a site wide low carbon network.

Policy CC2 (Section 8.41): All new developments will be expected to submit a statement demonstrating how the London Plan's 'cooling hierarchy' (see London Plan Section 3.2) has informed the building design.

Policy CC2 (Section 8.49): The council will expect the application of a BREEAM assessment to non-residential developments 500 sqm or more. We (the council) will expect these to achieve a BREEAM rating of excellent and will encourage zero carbon from 2019.

3.4 GLA Energy Assessment Guidance (June 2022)

This guidance document explains how to prepare an energy assessment to accompany strategic planning applications referred to the Mayor as set out in the London Plan Policy SI 2.

The purpose of an energy assessment is to demonstrate that the proposed climate change mitigation measures comply with London Plan energy policies, including the energy hierarchy. It also ensures energy remains an integral part of the development's design and evolution.

Section 1.7 identifies that each application is considered on its merits, taking into account the individual characteristics of the development. It further identifies that energy assessments should:

- be submitted at the planning application stage, not submitted post planning in response to a condition
- report estimated site-wide regulated CO2 emissions and reductions (broken down for the residential4 and non-residential elements of the development), expressed in tonnes per annum, after each stage of the energy hierarchy, using the GLA's carbon emissions reporting spreadsheet
- demonstrate how the net zero-carbon target for major residential and non-residential development will be met, with at least a 35 per cent on-site carbon reduction beyond Part L 2021 (to be met separately for residential and non-residential elements of the development), and provide the value of the offset payment which will be paid into the relevant borough's carbon offset fund to make up any shortfall to achieve net zero-carbon, where required
- commit that energy efficiency measures alone will reduce regulated CO2 emissions for residential uses by 10 per cent below those of a development compliant with Part L 2021 of the Building Regulations, and by 15 per cent for non-residential uses
- demonstrate that the cooling hierarchy has been followed and include information demonstrating that the risk of overheating has been mitigated through the incorporation of passive design measures
- demonstrate that connection to existing or planned district heating networks has been prioritised and provide correspondence to support this
- commit to a communal heat network to allow connection to existing or planned district heating networks identified in the area
- minimise the number of energy centres and provide a single point of connection to the District Heating Network (DHN)
- investigate and commit to suitable low carbon and/or renewable heating plant for installation within the energy centre if connection can't be made to an area wide network
- investigate and commit to maximising the installation of renewable technologies (including the potential for storage) on site
- report the Energy Use Intensity (EUI) and the space heating demand of the development using the GLA's carbon emissions reporting spreadsheet
- align with related documents and assessments that are submitted as part of the planning application, e.g. 'be seen' planning stage submissions, Whole Life-Cycle Carbon Assessments, Air Quality Assessments, Sustainability Statements.

3.5 Camden Planning Guidance – Energy Efficiency and Adaptation (January 2021)

The document states that "all development in Camden is expected to reduce carbon emissions by following the energy hierarchy in accordance with Local Plan policy CC1."

Section 6 – Energy statements, states that:

- Energy statements are required for all developments involving 5 or more dwellings and/or more than 500sqm of any (gross internal) floorspace.
- Energy statements should demonstrate how a development has been designed following the steps in the energy hierarchy.

Section 7 of the document refers to the following key points related to energy reduction:

- All development in Camden is expected to reduce carbon dioxide emissions through the application of the energy hierarchy.
- All new build major development to demonstrate compliance with London Plan targets for carbon dioxide emissions.

3.6 Part L 2021 and the Energy Assessment Guidance 2022

This document describes how the update in Building Regulations Part L and Part O should be captured within energy assessments, as well as the impact on on-site carbon reduction targets against a significantly improved baseline. It includes the following guidance:

- Initially, non-residential developments may find it more challenging to achieve significant on-site carbon reductions beyond Part L 2021 to meet both the energy efficiency target and the minimum 35 per cent improvement. This is because the new Part L baseline now includes low carbon heating for non-residential developments but not for residential developments. However, planning applicants will still be expected to follow the energy hierarchy to maximise carbon savings before offsetting is considered.

4. Energy Assessment Methodology

4.1 The Energy Hierarchy

The performance of the Proposed Development has been assessed following the procedure as set out by *"Energy Assessment Guidance - Greater London Authority guidance on preparing energy assessments as part of planning applications (June 2022)",* against the policies and supporting information within the London Plan (March 2021). This process follows the Mayor's energy hierarchy as detailed in Section 3.2.

- Be lean: use less energy and manage demand during operation
- Be clean: exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly
- Be green: maximise opportunities for renewable energy by producing, storing and using renewable energy on-site
- Be seen: monitor, verify and report on energy performance.

This approach to assessment aligns with the requirements of Camden Local Plan, and its supporting planning guidance.

Each of these priorities is individually assessed to evaluate the performance of the design and the predicted carbon emissions relevant to each stage. A Predictive Energy Assessment using the TM54 methodology is also undertaken in fulfilment of the 'Be Seen' requirements.

4.2 Regulated energy and emissions

Regulated emissions are those from heating, cooling, lighting, hot water, fans, pumps and controls. These are fixed building services which are directly influenced by the building design and are the reported emissions used for assessment of the buildings' performance for policy compliance. These are determined based on generic building usage profiles to allow for like-for-like comparison, but these may not be realistic for any given building.

Building Regulations approved compliance software (IES Virtual Environment) has been used to establish the regulated CO_2 emissions after each stage of the energy reduction hierarchy as well as to determine the baseline emissions benchmark from which improvements are measured.

An energy model has been created for the below areas of the Proposed Development and screenshots of the model are included in Figure 2 and Figure 3..

The Proposed Development is assessed as a new building, under Approved Document L of the Building Regulations.

The Building Regulation UK Part L BRUKL report for the building model is appended to this document.

The carbon emissions reported in this Energy Statement use Part L 2021 emissions factors.

4.3 Unregulated energy and emissions

Unregulated emissions are defined as those resulting from non-regulated energy sources such as small power (computers, audio equipment and other electrical appliances). An allowance for unregulated emission is made using the standard National Calculation Methodology profiles and domestic benchmarks to capture their effect on regulated emissions but are not included in the emissions reduction targets.

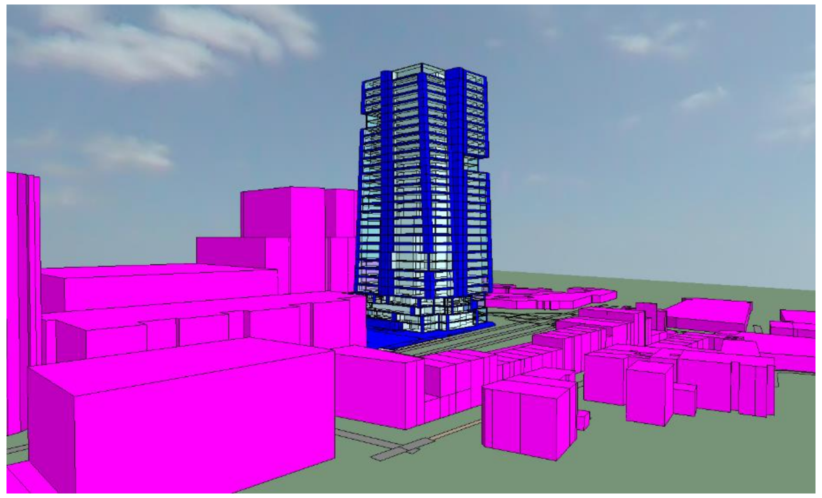


Figure 2: Image of the IES model of Euston Tower

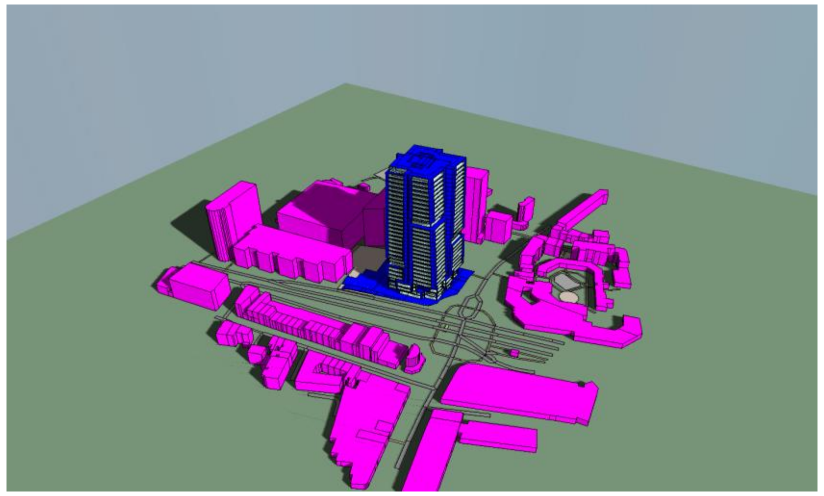


Figure 3: Image of the IES model of Euston Tower from above

4.4 Results

The baseline results for regulated and unregulated carbon dioxide emissions are included in Table 3 below. In accordance with GLA guidance, the baseline for this element is derived from a notional building generated by the Part L 2021 compliance software based on the proposed building geometry. These results are used throughout the energy hierarchy to establish the reductions achieved for each of the stages

Stage in energy hierarchy	Carbon dioxide emission (Tonnes CO_2 per annum)		Notes
	Regulated	Unregulated	
Baseline	325.7	48.7	Unregulated emissions assessed using Part L NCM profiles

Table 3: Baseline building carbon emissions

5. Demand Reduction (Be Lean)

The first stage of the Energy Hierarchy approach focuses on demand reduction through adopting energy efficiency principles. Energy and therefore, carbon emissions, can be reduced through architectural and building fabric interventions (passive design) and energy efficient services (active design).

5.1 Be Lean results

Stage in energy hierarchy	Regulated emissions (Tonnes CO_2 / year)	CO_2 savings (Tonnes CO_2 / year)	Percentage savings (%)
Baseline	325.7		
Be Lean	292.2	33.5	10%

Table 4: Carbon dioxide emissions from the Be Lean stage of the energy hierarchy

5.2 Passive design overview

Optimising passive design is the most effective means of ensuring the Proposed Development is inherently low in energy demand. There are a range of energy efficiency measures that have been investigated throughout the design process and are included for the design of the Proposed Development at this stage:

- A high-performance curtain wall façade has been specified to reduce space heating demand in winter and minimise the risk of summertime overheating. Factors such as embodied carbon, constructability and thermal performance have been considered in the analysis of the façade to provide a solution that balances all considerations.
- Optimised glazing percentages to maximise daylight penetration but minimising overheating. G-value limits specified for glazing elements aims to limit excessive solar gain on to the floor plate.
- Façade elements that project horizontally and vertically adjacent to glazing are optimised to provide solar shading during peak scenarios but also allows for beneficial solar gain during winter months.

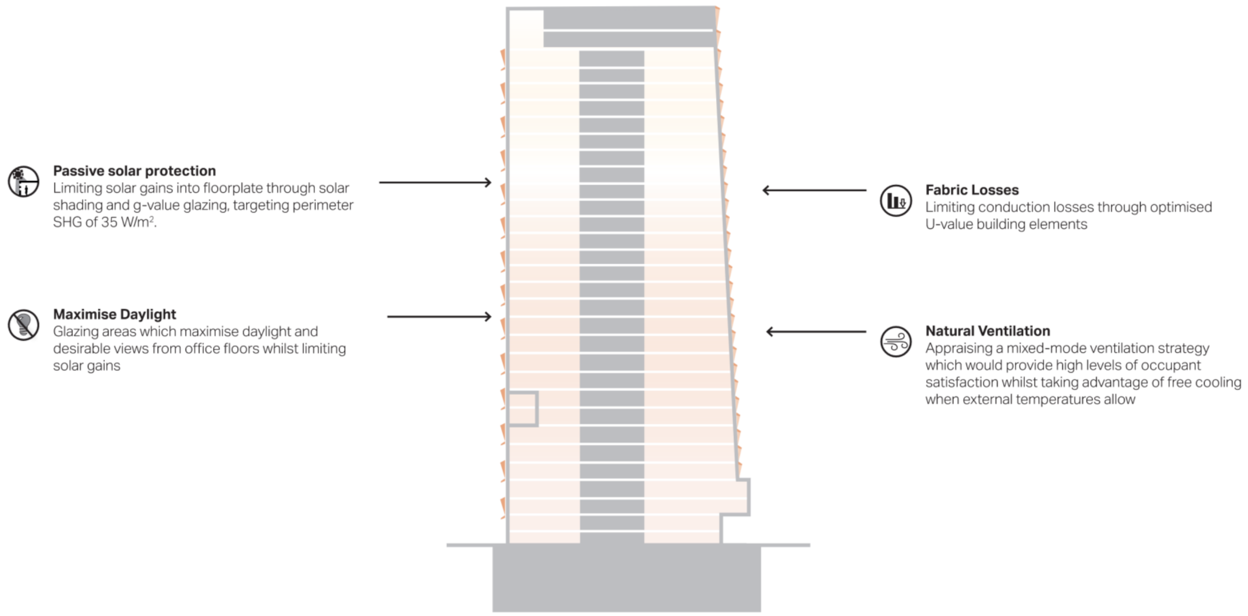


Figure 4: Overview of passive strategies employed within the Proposed Development

5.3 Passive design analysis

Following the London Plan and BREEAM guidance, the Proposed Development has been assessed early in the design process so that effective passive design measures can be successfully integrated into the overall design.

5.3.1 Approach to optimised envelope design

Thermal performance targets were set early in the design process to ensure the building envelope performs as well as possible. Working to a target average U-value of 1.2W/m^2.K across solid and glazed elements of the curtain wall, including thermal bridging, the design team developed a façade system that could deliver the required thermal performance. This target was based on other project experience and performance and aims to provide a balance between delivering high thermal performance to reduce operational energy demand and the increased embodied carbon arising from a higher performing façade. Sensitivity analysis has been undertaken which has found that the additional embodied carbon and complexity of the facade required to improve on this target does not correlate with significant energy and carbon reduction.

Other façade types that may have delivered marginally improved thermal performance were investigated but deemed to not be feasible for the Proposed Development. For example, a precast panel façade with punched window openings was studied but was found to impose significantly increased and unacceptable structural loads on the existing building foundations, which are to be retained and reused. A façade system implementing Ultra High Performance Concrete (UHPC) panels was also investigated, but was not taken forward, as the installation methodology, requiring the sealing of external joints from the outside, using scaffolding or abseiling, would have introduced installation health and safety risks that were deemed unacceptable.

The architectural intent, combined with various constructability considerations and an overall assessment of embodied carbon of different façade types meant that a unitised curtain wall system was deemed the most appropriate for the majority of the building façade.

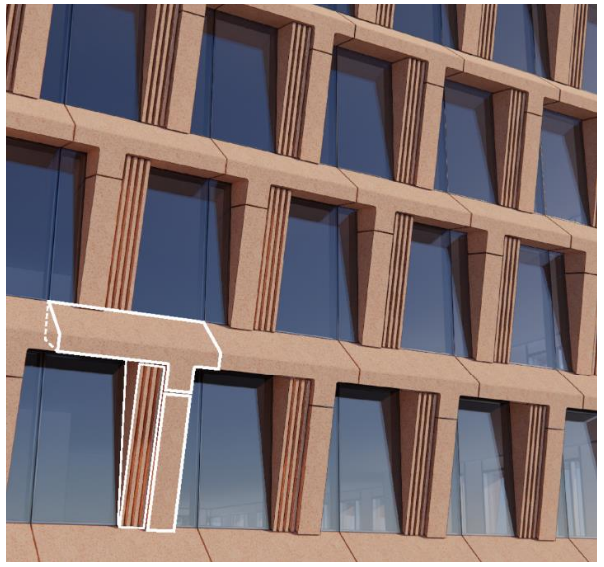


Figure 5: Example of curtain wall façade panels showing solid elements, louvred sections for ventilation and glazing

The façade was also designed to allow for openable panels, incorporated within the solid elements between glazing, that will form part of the mixed-mode strategy proposed for areas of the building. Figure 6 below shows how an openable panel in the open position may look from the floorplate.

Figure 6: How the openable panels may look from the floorplate

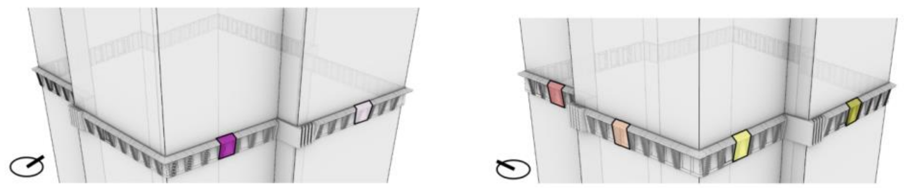
5.3.2 Approach to optimised solar gain targets

City offices are predominantly cooling-led buildings and optimising the façade to reduce solar gains as far as possible, whilst also providing good levels of daylight, is a key factor in reducing the overall operational energy performance of the building.

Industry net zero carbon energy targets from the UKGBC and supplementary guidance within the LETI Climate Emergency Design Guide have been used to establish targets for the Proposed Development. Based on limiting values suggested by LETI, and the peak incident solar gain on the façade, a peak solar gain limit of 35 W/m2 was set for the Office Building.

To investigate the effects of various solar control measures a number of investigations were undertaken to look at the effects of varying the g-value of the glazing and of varying the projection of the solid façade elements to quantify the benefit of the shading they provide.

The West and East façades were found to receive the worst solar gain and were used to test the various proposals. Figure 7 below shows the model used and results from the investigation into the shading elements.



East (Inclined façade / Vertical façade), 0.8m

		Inclined	Vertical
Peak solar gains	All year round	51	49
	During summer	51	49
Exceedance hours	All hours	167	142
	During occupancy*	84	61
Exceedance period		March to October	March to October

West (Inclined façade / Vertical façade), 0.8m

		Inclined	Vertical
Peak solar gains	All year round	52	50
	During summer	52	50
Exceedance hours	All hours	213	157
	Occupancy time*	213	157
Exceedance period		March to October	February to October

South (Inclined façade / Vertical façade), 0.8m

		Inclined	Vertical
Peak solar gains	All year round	58	55
	During summer	38	34
Exceedance hours	All hours	174	129
	Occupancy time*	174	129
Exceedance period		August to April	September to April

Figure 7: Solar gain modelling of shading elements

From this analysis it was apparent that the worst-case areas would require low g-value glazing to reduce the direct solar irradiation not mitigated by the shading elements. G-values of 0.27 for the East and West façades and 0.3 for the North & South were found to be appropriate in limiting peak solar gain to acceptable levels. As the shading elements include complex geometry, the effects of the shading elements were carefully correlated with reduced g-values in a detailed study comparing the solar heat gain onto the floorplate, with the resulting g-values then applied within the whole building energy model to reduce simulation run time whilst providing results that estimate the reduction in direct solar gain.

There are a number of amenity spaces throughout the Tower where the glazing is more extensive with limited framing, visually appearing double height. These areas are generally aligned with an external terrace, so that glazing is set back from the edge of the Tower and shaded by the projecting story above. Planting is proposed along each terrace which will provide additional shading, as will the structural columns and bracing that continues through the terrace, as indicated in Figure 8 below:

Figure 8: Example of amenity space glazing adjacent to a terrace area showing shading provided by the projecting storey above, planting and the structure.

Analysis of the modelling showed that with the shading elements in these amenity spaces, the solar heat gain was sometimes exceeding acceptable levels. As the architectural intent in these areas relies on the good daylighting and internal experience provided by the large, glazed areas, an external blind integrated into a Closed Cavity Façade (CCF) has been proposed in this area to limit the direct solar gain into amenity spaces.

5.3.3 Adaptation to climate change

By employing effective passive design measures, particularly those relating to solar control, the design is well placed to cope with anticipated increases in summertime temperatures. The building infrastructure is designed with future elevated summer temperatures in mind and predicted future weather data has been used in the modelling of the Proposed Development.

5.3.4 Envelope airtightness

Specific air-tightness targets have been set which are improvements on the Building Regulations Part L requirements. Best practice construction techniques will be employed, and airtightness tests will be made on completion to ensure that the finished construction achieves the design values.

5.3.5 Thermal mass

The intent within most spaces of the Proposed Development is that soffits remain exposed. This reduces the embodied carbon associated with ceiling installations and allows the thermal mass of the exposed soffits to be implemented as part of the strategy to reduce the maximum cooling demand by absorbing excess heat during peak periods, enhancing energy efficiency and increasing occupant comfort.

5.3.6 Summary of specified envelope thermal performance

Element		Proposed Performance
Curtain wall*		1.2 $W/m^2.K$ average
Roof		0.12
Floor		0.15
Solar gain target**		35 W/m^2 (averaged over a 4.5m perimeter area)
Glazing	Tower	44% - shaded by projecting façade elements
	Amenity Spaces	86% - extensively overshaded by floor above and structure, incl. external blinds
	Podium	62% - average figure across all facades
g-value	East & West	0.27 (inclined & vertical façade)
	North & South	0.30 (inclined & vertical façade)
Airtightness		3 $m^3/hr/m^2$ @ 50Pa

* Total thermal performance including glazing, opaque areas and all thermal bridging

**Target value, sometimes exceeded but outside of peak cooling season.

5.4 Active design overview

The building services systems have been carefully considered to ensure that they are as efficient as possible in operation. A summary of some of the active design measures employed on the Proposed Development are provided in Figure 9 below.

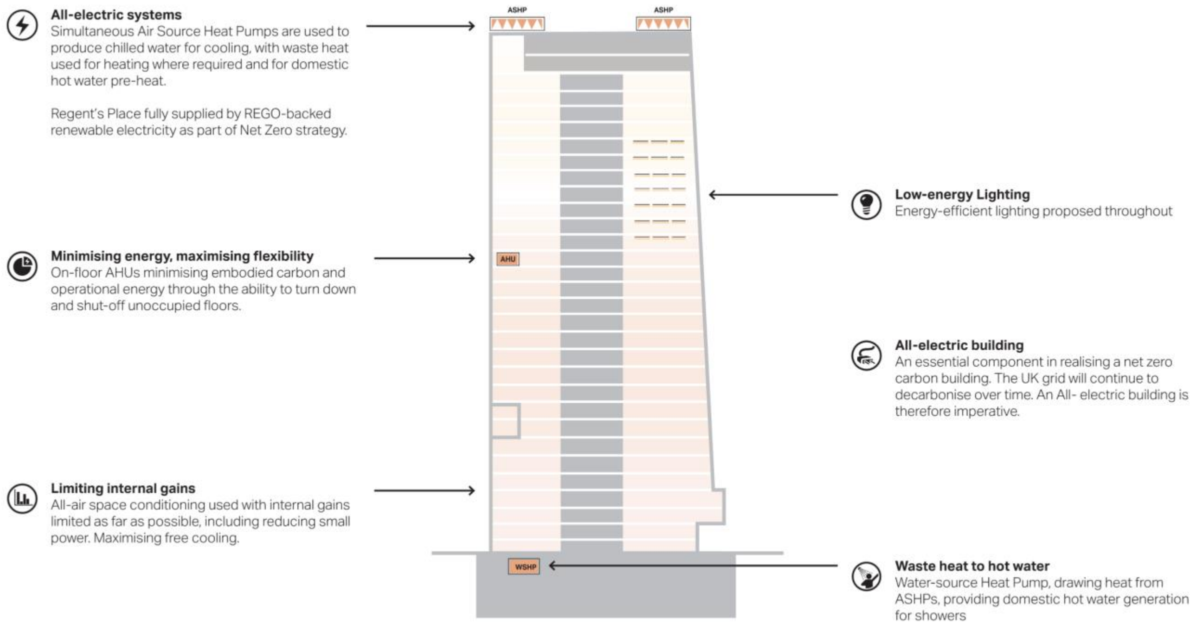


Figure 9: Overview of the proposed energy sharing strategy highlighting main cooling equipment.

5.4.1 Ventilation strategy

Decentralised ventilation systems are proposed in many areas of the Proposed Development to minimise fan energy and provide accurate demand control, ensuring that systems turn down to minimum levels of operation during periods of low use and off, when not required. The strategy in placing air handling equipment close to the areas they serve minimises long duct runs, which also presents an embodied carbon saving.

A 'full fresh air' underfloor air distribution (UFAD) system is proposed to satisfy the internal space conditioning requirements and provide excellent internal air quality. This strategy uses a pressurised floor plenum to provide supply air, negating the need for high level distribution ductwork within Office spaces, which presents a significant embodied carbon saving as well as improved visual perception across the floorplate.

The system facilitates the exploitation of free cooling, providing significant energy savings during the winter and mid-seasons. Air handling units will be fitted with high-efficiency heat recovery devices in all cases to ensure highly efficient operation.

To offset the minimised conduction heat gains and losses through the façade, active trench units are proposed in all office spaces and in certain areas of the podium. These incorporate low-energy fans to provide heating during winter and cooling during summer to ensure a comfortable internal environment across the whole extent of the floorplate.

During the detailed system modelling required as part of the NABERS process, to be undertaken in the next design stage, this will be further investigated and quantified.

5.4.2 Lighting

Low energy LED lighting will be used across the Proposed Development which will make a significant contribution to reducing the carbon emissions arising from the operation of the building. Internal lux levels will be specified to suit the expected tasks conducted in the various spaces of the building. The lowest possible lux levels will be used as the basis of design to reduce lighting energy consumption as far as possible. Lighting power densities of 6 W/m^2 and 10 W/m^2 have been allowed in office areas and lab-enabled areas, respectively, based on BCO guidance and client requirements.

5.4.3 Smart sensing and control

The Proposed Development will utilise sensing and control to effectively modulate building services systems to match the user demand, thereby improving user experience and satisfaction whilst minimising energy consumption. During future design stages, the following potential opportunities, among others, will be explored and implemented, subject to an assessment of feasibility and viability.

- Variable speed systems to ensure low energy consumption during periods of low load. Pump configurations and smart control systems will be explored using detailed energy modelling in the next design stages.
- The control methodologies of the natural ventilation openings in office areas will be further developed and refined. There are numerous project precedents for different types of system, and the project team will investigate possible options, to provide the best balance between occupant satisfaction and energy reduction.

5.4.4 Thermal storage, heat recovery and energy sharing

Simultaneous heating/cooling ASHPs form an integrated energy system that will serve the whole of the Proposed Development. These will recycle waste heat from the cooling system and use it to provide space and water heating. Peak cooling loads in the Office Building will be topped up by air-cooled chillers. These can provide higher efficiency cooling than ASHPs, especially when there is no simultaneous heating load. Thermal storage is a key part of maximising the operation of this system and allowing the equipment to work at optimal efficiency.

Detailed operational energy modelling during the Stage 3 design will develop the sizing of the thermal energy stores and inform the optimum capacity of the heating and cooling generation systems.

6. Cooling and Overheating

Avoiding operational energy consumption arising from active cooling has been a key driver of the design. As outlined in Section 5.2, a number of passive measures have been included within the Proposed Development to reduce the cooling requirements as much as is feasibly possible.

6.1 Cooling hierarchy

To minimise the operational carbon emissions of active cooling systems as well as reduce the embodied carbon impact of the system installations, the cooling hierarchy outlined in the London Plan has been implemented within the designs of the Proposed Development. The requirement for cooling, the extent fo the areas where it is applied and the overall system cooling capacity have all been minimised, as described below.

1. **Reduce the amount of heat entering a building through orientation, shading, high albedo materials, fenestration, insulation and the provision of green infrastructure**

   The passive design measures described in Section 5.2 substantially reduce solar gain, conduction and infiltration gains.

2. **Minimise internal heat generation through energy efficient design**

   Mechanical systems will be designed to minimise unwanted heat generation such as those from pipework, fans and pumps through proper insulation and specification of high efficiency equipment. Lighting systems will be highly efficient LED systems, controlled to minimise lighting energy during daylight hours.

3. **Manage the heat within the building through exposed internal thermal mass and high ceilings**

   Many spaces throughout the Proposed Development are enabled for an exposed soffit approach. This reduces the embodied carbon associated with suspended ceilings and allows the thermal mass of the exposed soffit to absorb excess heat and reduce peak cooling demand. This available thermal mass coupled with the openable panels may allow for night-purge ventilation to be investigated in the future, cooling the thermal mass during unoccupied hours, providing additional cooling to the floorplate if required during the day.

4. **Provide passive ventilation**

   To enhance occupant satisfaction and wellbeing, openable, solid panels are planned to be integrated within the façade design of the Office spaces of the Proposed Development. These panels will allow for additional natural ventilation to be supplied to perimeter zones of the floorplate. As there is still significant design development to undertake, no operational energy or carbon savings have been claimed from this addition. Further analysis in later design stages will confirm the expected ventilation levels delivered and the estimated energy savings achievable through reducing mechanical ventilation levels, if appropriate.

5. **Provide mechanical ventilation**

   Mechanical ventilation provided to each space is covered in detail by the Ventilation Statement. In general, across the Lab-enabled and Office spaces, which occupy the majority of the floor area of the Proposed Development, an all-air underfloor displacement ventilation solution is proposed, using on-floor AHUs. This strategy optimises the potential for using free-cooling from outside fresh air, supplied into the spaces through the underfloor system, avoiding the need for active cooling. Avoiding the use of high-level ductwork also reduces the overall embodied carbon of the installation.

6. **Provide active cooling systems**

   The central mechanical cooling system will be highly efficient and will comprise simultaneous heating and cooling ASHPs and Air-Cooled Chillers. The simultaneous ASHP units will allow for waste heat rejected from spaces being cooled to be reused in heating other spaces and in the production of domestic hot water.

6.2 Overheating assessment

An overheating assessment has been completed to ensure that heat gains are minimised within the building and to ensure that adequate means of maintaining comfort conditions are provided.

The assessment has been undertaken in line with CIBSE TM52: The Limits of Thermal Comfort, which is applicable to non-domestic buildings.

Each space in the building is assessed against the following criteria:

1. Hours exceedance: The space must not exceed the threshold comfort temperature by >1°C for more than 3% of occupied hours
2. Daily Weighted Exceedance: A daily limit of temperature rise and duration, allowing longer periods of a low temperature rise and shorter periods of high temperature rise.
3. Upper Limit Temperature: Sets a maximum daily temperature for each space.

In accordance with GLA and BREEAM guidance, the overheating risk for these areas has been undertaken following CIBSE TM52 and tested against the following weather profiles to determine current and future climate resilience.

- Design Summer Year 1 for the 2020s: current design year
- Design Summer Year 2 for the 2020s: a year with a very intense single warm spell
- Design Summer Year 3 for the 2020s: a year with a prolonged period of sustained warmth

In accordance with CIBSE TM52, if more than 3% of a building’s occupied hours are above an operative temperature of 26°C, the building is determined to be at risk of overheating.

The GLA’s guidance does not expect the building to pass with the more onerous weather files, DSY2 and DSY3.

All areas analysed showed that less than 3% of a building’s occupied hours are above an operative temperature of 26°C, therefore the building is not considered to be at risk of overheating.

The building was also analysed under DSY2 and DSY3, and all areas analysed showed that less than 3% of a building’s occupied hours are above an operative temperature of 26°C.

Refer to Appendix A.4 Overheating Assessment for further information and results.

7. Heating Infrastructure (Be Clean)

7.1 District Heat Networks

The London Heat Map shows the planned Euston Road heat network within the vicinity of the Proposed Development with the indicative route marked in purple within Figure 10 below.

It is understood that although the planned network is indicated, there has not been any active progress in procuring this network in recent years. Camden's Borough Wide Heat Demand and Heat Source Mapping (2015) report does pick up on a focus area around the Euston station development, but it is understood that this network is not currently available for connection and there is no reasonable prospect of delivery within suitable timescales.

For this reason, the Proposed Development will be provided with high efficiency ASHPs to generate heat, rather than rely on a connection into a district heat network.

As the Proposed Development progresses there may be further clarity on planned heat networks within the area. As such, the requirements for a future network connection have been considered and provided for. Sleeves through the basement walls will be provided to allow pipework to pass through and connect into a future district heating network. Suitable space in the basement area will be allocated for the installation of heat exchangers as may be required in the future for heat network connection.

The indicative route shown on the London Heat Map shows the district heating main running along Euston Road and Hampstead Road, and it is proposed that the pipework sleeves be allowed in the East side of the basement for a connection into a future main along Hampstead Road. The final location and detailing of these connections will be decided in future design stages.

Figure 10: Image from the London Heat Map showing the proposed Euston Road heat network

7.2 Combined Heat and Power

The combined production of electricity and usable heat is known as Combined Heat and Power (CHP). In a CHP system, steam or hot water, which would otherwise be rejected when electricity alone is produced, is used for space or process heating. The London Plan and GLA Energy Assessment Guidance (2022) limits the use of CHP to 'only where there is a case for CHP to enable the delivery of an area-wide heat network'. As there are no area-wide heat networks planned within the vicinity of the Proposed Development, CHP is not proposed to be included as part of the energy strategy for the Proposed Development.

The Proposed Development adopts an all-electric heat-pump heating and cooling strategy with no on-site flue emissions in normal operation arising from heating and cooling equipment.

8. Renewable Energy (Be Green)

8.1 Be Green results

The table below shows the emissions reduction for the Be Green stage of the energy hierarchy.

Stage in energy hierarchy	Regulated emissions (Tonnes CO_2 / year)	CO_2 savings (Tonnes CO_2 / year)	Percentage savings (%)
Baseline	*325.7*		
Be Lean	*292.2*	*33.5*	*10%*
Be Clean	*292.2*	*0.0*	*0%*
Be Green	279.2	13.0	4%

Table 5: Carbon dioxide emissions savings from the Be Green stage of the energy hierarchy

8.2 LZC feasibility study

Following the GLA and BREEAM guidance, an initial review of potential Low and Zero Carbon technologies was undertaken at an early stage, the summary of which is included below:

Possible Technology	Assessment of feasibility	Notes
Heat generating technologies		
Solar thermal panels	Unfeasible	Roof space is insufficient for a significant installation that would be required to meet the domestic hot water demands of the building. Roof space is prioritised for ASHPs, Air Cooled Chillers and PV. Other roof / terrace areas are used for planting to improve the urban greening factor and sustainability targets.
Biomass boilers	Unfeasible	Fuel delivery would be disruptive to traffic and emissions arising from these deliveries and also the products of combustion would be detrimental to local air quality.
Air Source Heat Pumps	Feasible	The Proposed Development is well suited to the application of air source heat pump technology. Refer to Section 8.4.2 for further information.
Ground Source Heat Pumps	Unfeasible	Both open and closed loop ground source heat pump systems have been investigated but are not deemed feasible in the Proposed Development due to the disruption this would cause to the existing basement slab which is to be retained. The footprint of the development does also not allow sufficient separation between open loop abstraction and recharge boreholes. Refer to Section 8.4.1 for further information.
Hydrogen Boilers	Unfeasible	Immature technology with uncertainties around future hydrogen fuel supply. Heat pump technology is mature and available now and as such presents a more feasible approach.
Power generating technologies		
Wind turbines	Unfeasible	Limited performance in an urban setting with turbulent wind movement.
Photovoltaic panels	Feasible	The Level 31 roof level is suitable for PV installation, but with limited space available. Further areas for PV will be reassessed at each design stage if additional space is released. Refer to Section 8.3 for further information.
Hydrogen fuel cells	Unfeasible	Immature technology with uncertainties around future hydrogen fuel supply.

Table 6: Summary of LZC technology feasibility review

8.3 Photovoltaic panels used on the Site

The Level 31 roof level of the proposed development fulfils a number of functions, it:

- Provides plant areas for equipment that require high volumes of outside air for efficient operation, namely the ASHPs and Air-Cooled Chillers.
- Houses the Building Maintenance Unit (BMU) and the track it operates upon, to facilitate a safe access method for façade access and maintenance.
- Provides space for on-site electricity generation using photovoltaic panels.

An assessment of the available space has been undertaken and it is proposed that 58no. panels could be installed at Level 31 roof level as shown below at Figure 11.

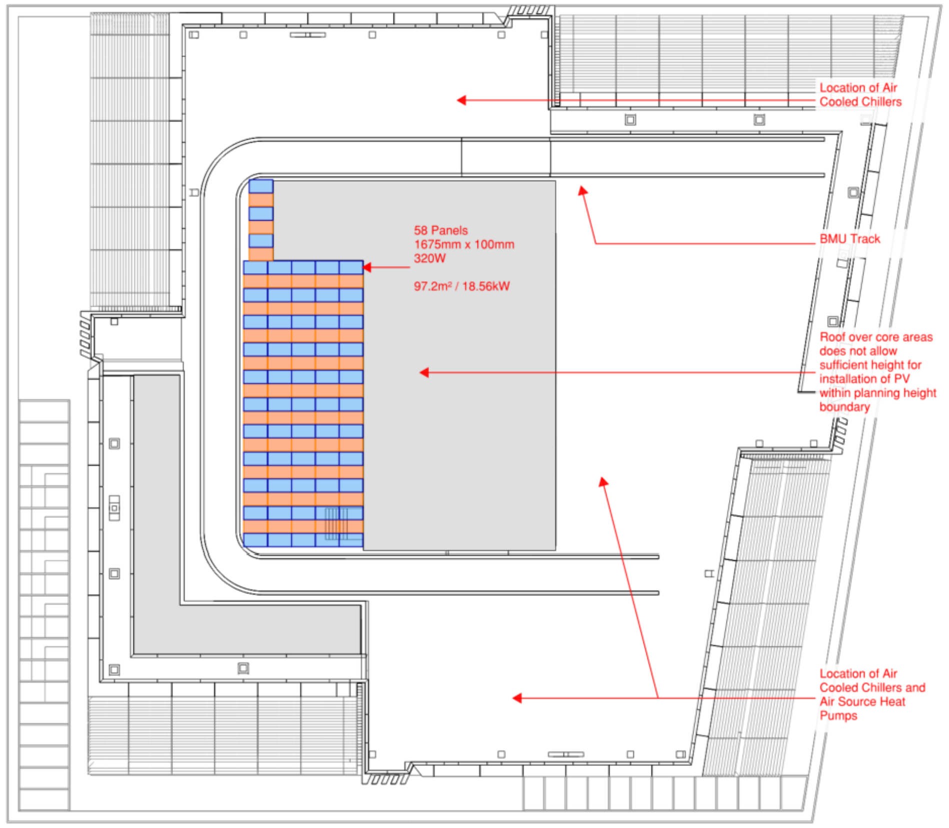


Figure 11: Areas available for installation of PV at Level 31 roof level

The table below outlines the parameters of the PV installation.

Item	Info
Total installed capacity (kWp)	18.56 kWp
Annual electricity generation (MWh/annum)	17.7 MWh/annum

Table 7: Summary of PV installation output

8.4 Heat pump systems

The use of electrically powered heat pumps within the Proposed Development will take advantage of the future decarbonisation of the national electricity grid. As the grid decarbonises, the Proposed Development will emit less operational carbon, feasibly becoming fully net zero carbon if the grid becomes sufficiently decarbonised.

8.4.1 Ground Source Heat Pumps

The use of a Ground Source Heat Pump (GSHP) system was evaluated as part of the LZC technology feasibility assessment. As domestic water heating loads are likely to be consistent through the year, it was proposed that a GSHP system could be used to provide this, whilst possibly allowing the discharge of excess heat from the buildings cooling systems to 'recharge' the ground heat source. During the study It was found that:

- Installing a pipe network within the new structural piles planned would not yield sufficient heat for it to be feasible.
- Allowing boreholes through the new structural slab within the footprint of the basement would allow for approximately 30 boreholes, allowing an estimated system capacity of less than 175kW, which again does not provide sufficient yield to be viable.
- An open loop system would require 2no. injection wells and 1no. abstraction well located approximately 100m apart. This separation distance would not be able to be accommodated within the redline boundary of the Proposed Development.
- The installation of boreholes (both open-loop and closed-loop) would require extensive excavation through the existing basement slab, which would have an impact on the structural capacity of the slab, likely requiring removal or reinforcement, carrying an embodied carbon penalty. The routing of distribution pipework connecting the boreholes to the GSHP equipment would also require extensive excavation of the existing slab which would also impact the structural capacity of the slab.
- It is expected that a more significant GSHP installation with a higher capacity could be achieved if large parts of the existing structure within the basement were to be removed to allow the installation of a greater number of boreholes and connecting pipework. It is estimated that if around 60, 200m deep boreholes were installed, necessitating the removal of much of the existing basement structure, the overall peak capacity of the system could be increased to around 360kW. However, it is estimated that it would take over 1150 years for the carbon savings gained from the increased system efficiencies to pay back the embodied carbon associated with removing the existing structure

In all cases, there is a recognition that the area surrounding and below Euston Tower is heavily congested with utilities and London Underground assets and this would require significant coordination and consenting from these stakeholders. For the possible yield of the system, the energy saving potential and the impact on the retained structural slab, it was not deemed feasible to include a GSHP installation within the Proposed Development.

Two different types of heat pump are included within the current strategy and are detailed in the following sections.

8.4.2 Air Source Heat Pumps

Simultaneous Air Source Heat Pumps (ASHP) will be installed at Level 31 roof level. The ASHPs are sized to meet the space heating and domestic hot water generation requirements of the Proposed Development.

Simultaneous heat pumps will recover heat from the cooling system and deliver it to the heating system, thereby providing heating and cooling at the same time. The simultaneous heat pumps will operate as air-source heat pumps/air-cooled chillers when the heating and cooling demand do not align.

Table 8 shows the rated performance of the simultaneous heat pump in its three modes of operation.

Since the performance of the system varies depending on the mode of operation and ambient temperature, annual demand profiles are required to calculate the overall system performance. Using the demand profiles and efficiencies stated in Table 8, the overall annual performance of the system can be calculated. This calculation is shown within Appendix A.4 and provides the heating and cooling SEER and SCOP assigned within the energy modelling.

8.4.3 Water Source Heat Pumps

The domestic hot water (DHW) required will be largely produced by Water Source Heat Pumps (WSHP), located in the basement level, recovering heat rejected by the ASHPs and providing DHW at acceptable temperatures. WSHP's are required to boost the temperature received from the ASHP's as these units alone cannot produce the temperatures required for domestic hot water. The main demand for DHW arises in the basement showers. For this reason, the WSHPs are located within the basement, to minimise distribution pipework and the heat losses caused by long pipe runs.

The expected performance of the Air Source and Water Source heat pumps proposed are shown in Table 8 below.

Table 8 Heat pump performance data

Parameter	Efficiency metric	Varies with ambient temperature
Cooling only, EER	2.98*	✓
Simultaneous heating & cooling, TER	7.47	×
Heating only, COP	2.54**	✓
DHW Heat Pump, COP	5.0	×

**at cooling design ambient, 35°C*
***at heating design ambient, -4°C*

9. Flexibility and peak energy demand

The operational carbon emissions from an all-electric building depend on the dynamic variation of the carbon intensity of the electrical grid. As the electrical grid continues to decarbonise, this variation of carbon intensity and power availability and cost will increase due to the fluctuations in supply from renewable energy sources.

The Proposed Development's heating and cooling strategy uses thermal energy storage linked to electric heat pumps. This is an efficient approach to load-shedding, maximising the use of infrastructure that is already in place within an all-electric heating strategy to further reduce the operational carbon footprint of the Proposed Development.

Thermal energy storage provides the following benefits:

- Reduces the peak electrical capacity required for the all-electric energy centre
- Acts as demand side energy storage, allowing the energy network to benefit from off-peak low carbon electrical energy and off-peak tariff, and then release it as thermal energy during peaks.

	Electrical	Heat	Details
Estimated peak demand	7600 kVA	2550 kW	Connected electrical load, and peak diversified thermal load
Available capacity	Mains supply -7600 kVA Backup supply – 3200 kVA	N/A	Local electrical capacity advised by utility consultant
Flexibility Potential	0 kW	640 kW	Thermal storage can provide approx. 25% of hourly peak load. On-site electrical storage or generation is not proposed
Revised peak demand	7600 kVA	2230 kW	Additional thermal capacity included for resilience and ability to be responsive when electrical grid incentivises use.
Percentage flexibility predicted (%)	0%	12.5%	Calculations from flexibility potential as a proportion of peak demand

Table 9: Summary of peak demand, capacity, and flexibility potential

Flexibility achieved through	Yes / No	Details
Electrical energy storage (kWh)	No	None planned within scheme
Heat energy storage (kWh) capacity	Yes	25,500 L thermal heat storage has been provided within the Proposed Development with the final size to be determined as the design progresses dependent on the eventual system volumes which are not yet known.
Renewable energy generation	Yes	PV installation is planned at Level 31 roof level
Gateway to enable automated demand response	Yes	To be provided to thermal energy system via Building Management System, and car park charging through dynamic load management system.
Smart systems integration	Yes	Landlord systems will be designed to be open-protocol where appropriate with gateways that gets useful data out, while providing appropriate level of data security.

Table 10: Summary of interventions for achieving flexibility

10. Monitoring and Reporting (Be Seen)

The effectiveness of the energy strategy for the Proposed Development will be assessed based on its real-world performance in operation. The London Plan requires the reporting of energy usage data within the 'Be Seen' requirements, which aims to reduce the energy performance gap often previously identified between the design and actual performance of the building in operation.

Building Management Systems (BMS) will be implemented within the Proposed Development. These systems will oversee and monitor the performance of building systems and services, offering insights into equipment and system efficiency as well as overall energy consumption. The BMS will be enabled to continuously monitor and analyse the actual energy performance post-construction.

10.1 Predictive energy assessment

To comply with the requirements described in the 'Be Seen' guidance for planning stage, the building energy consumption (kWh/m^2) has been estimated using the CIBSE TM54 analysis process to accompany the Building Regulations Part L compliant methodology. The CIBSE TM54 methodology provides an assessment of both regulated and unregulated energy consumption.

The TM54 modelling process uses a range of scenarios with different inputs, decided by the design team, including occupancy density and profiles, space uses, and equipment gains to model upper and lower energy consumption bounds for the Proposed Development. The process is summarised in further detail in Appendix A.1.

The carbon emissions reported in this assessment are used for the contribution of operational carbon performance for Module B6 of the separate Whole Life-Cycle Carbon Assessment

To further improve the estimations of operational energy demand and carbon emissions during operation a comprehensive NABERS Design for Performance (DfP) assessment will be carried out during the next design stage. This will be used to inform the refinement of the energy strategy and aid in ensuring that equipment and systems are appropriately sized, specified and controlled to optimise performance.

The GLA's 'Be Seen' reporting spreadsheet with performance indicators including contextual data, building energy use and carbon emissions for the Proposed Development with be submitted separately.

10.2 Be Seen results

Different low-end, high-end and mid-range scenarios were tested alongside the baseline cases, representing the design intent of the Proposed Development at this stage. Each was tested to give an indication of the range of variation in a building's performance due to various uncertainties.

- Baseline cases: these scenarios represent the current design intent most accurately. A scenario where the building is fully occupied by office tenants was chosen to compare against the current design intent where the building is also partially occupied by lab tenants on all lab enabled floors. These scenarios use the current design estimates and allowances.
- Medium Office/Lab: the best estimate of the energy use based on the occupancy estimates from the prospective occupants using less energy intensive assumptions for the building's power allowances.
- High-end and low-end scenarios: generated by considering the uncertainties on opposing ends from the baseline for key parameters.

Table 11 compares the absolute energy consumption and Energy Use Intensity (EUI) of the Proposed Development represented by the Baseline Office/Lab scenario with the alternative scenarios selected for CIBSE TM54 analysis.

TM54 Result	Building Energy Consumption (MWh/Year)	Building Energy Intensity (kWh/m2)
Baseline Office/ Lab	**15,454**	**244.01**
Baseline Office	8,594	135.70
Medium Office/ Lab	11,840	186.95
High End	18,462	291.50
Low End	7,553	119.26

Table 11 Summary of TM54 Results

For further information on the assumptions, methodology and results refer to Appendix A.1 Predictive Energy Assessment.

The results of the predictive energy assessments are presented in the graphs below.

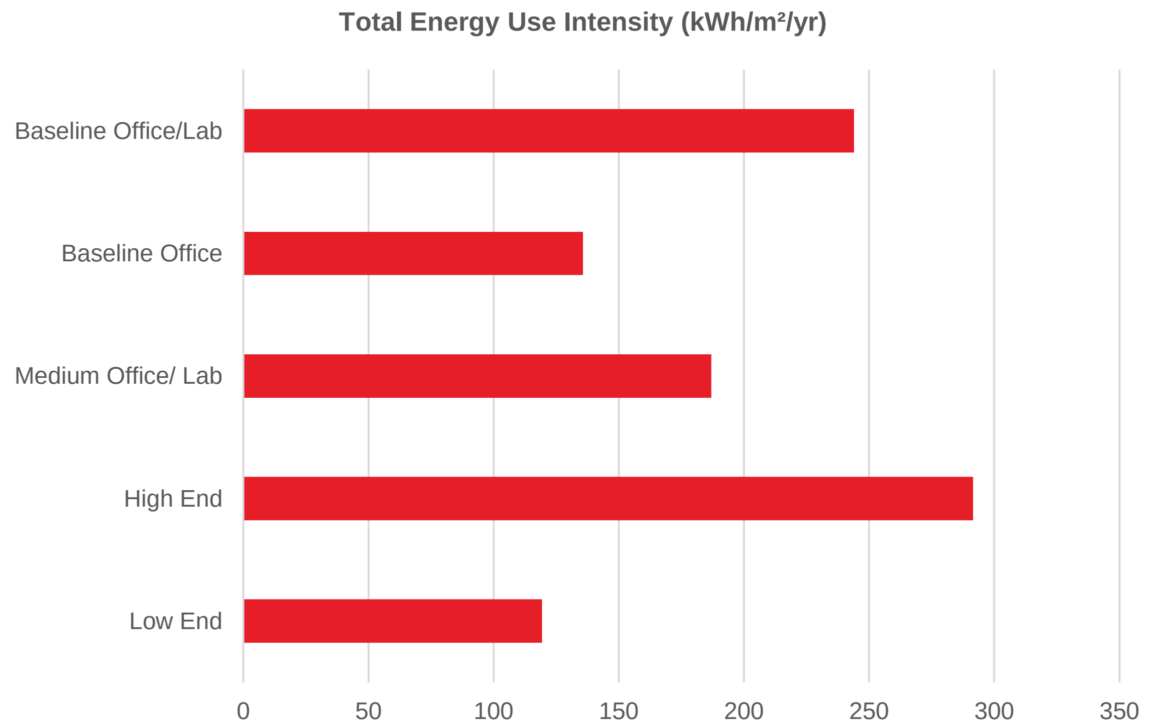


Figure 12: Energy Use Intensity per scenario for the Proposed Development

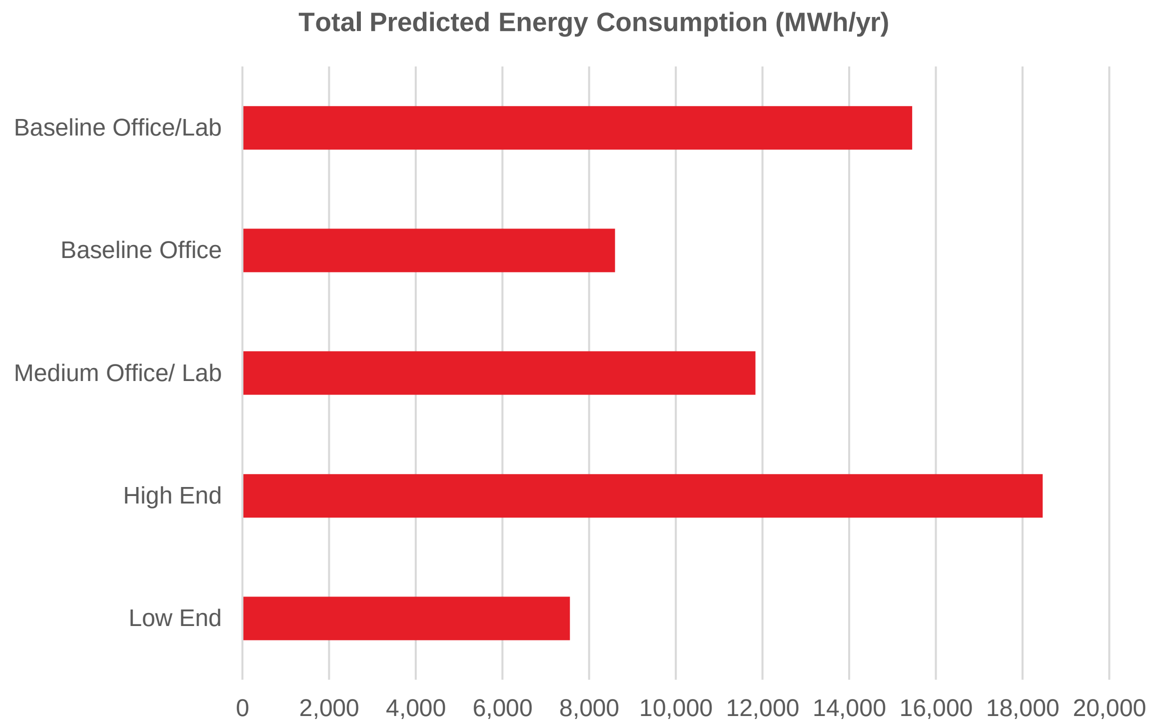


Figure 13 Predicted annual energy consumption per scenario for the Proposed Development

Building Type	EUI (kWh/m²/year) (excluding renewable energy)	Space heating demand (kWh/m²/year) (excluding renewable energy)	EUI value from Table 4 of the GLA Energy Assessment guidance (kWh/m²/year) (excluding renewable energy)	Space heating demand from Table 4 of the guidance (kWh/m²/year) (excluding renewable energy)	Operational energy use assessment	Notes (if expected performance differs from the Table 4 values in the guidance or other software used)
Office	199.54	6.82	55	15	CIBSE TM54	See appendix A.1

Table 12: Non-residential predicted energy use (as per GLA reporting spreadsheet)

Table 12 above presents the key information from the EUI & space heating demand tab of the GLA carbon emission reporting spreadsheet.

11. Conclusion

This Energy Strategy for the Proposed Development has followed the energy hierarchy principles set out in the London Plan (2021) and the Camden Local Plan (2017). The strategy is in line with Energy Hierarchy identified within the London Plan and the information provided to satisfy each requirement is summarised below.

Be lean: use less energy and manage demand during operation

The Proposed Development applies passive design principles including the specification of a high-performance building fabric and carefully considered glazing to reduce energy demand. Effective active systems are proposed to then meet this reduced demand as efficiently as possible. The reduction beyond Part L 2021 through energy efficiency measures is 10%.

Be clean: exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly

Connection into a district heat network has been considered and analysed with the future connection possibilities outlined. LZC technologies have also been appraised and assessed for feasibility.

Be green: maximise opportunities for renewable energy by producing, storing and using renewable energy on-site

The implementation of simultaneous ASHPs has been detailed and their integration with other building systems to share energy efficiently has been discussed. The inclusion of a PV installation at Level 31 roof level has been summarised. The reduction beyond Part L 2021 through renewable energy measures on-site is 4%.

Be seen: monitor, verify and report on energy performance.

Predictive energy assessments in accordance with CIBSE TM54 have been performed and submitted as part of this Energy Statement

The proposed energy strategy has been demonstrated to achieve an **14%** on-site reduction in regulated carbon dioxide emissions beyond Part L 2021. The results and carbon offset contributions can be seen in the tables below.

	Total regulated emissions (Tonnes CO2 / year)	CO2 savings (Tonnes CO2 / year)	Percentage savings (%)
Baseline: Part L 2021	325.7		
Be lean: Savings from energy demand reduction	292.2	33.5	10%
Be clean: Savings from heat network	292.2	0.0	0%
Be green: Savings from renewable energy	279.2	13.0	4%
Cumulative on-site savings		**46.5**	**14%**

Table 13: Total Proposed Development regulated carbon emissions results and savings

11.1.1 Compliance with GLA requirements

It is acknowledged that the current predicted on site reduction falls short of the GLA's 35% on-site carbon reduction over Part L 2021, which has been raised and highlighted in pre-application meetings with the GLA's energy officers. Feedback from these meetings stated the requirement for the limitations to be set out in detail, with clear reasons why compliance is not possible for the Proposed Development. The key points in this regard are detailed later in this section.

The 'Note to accompany GLA Energy Assessment Guidance 2022' acknowledges that non-residential developments may find it more challenging to achieve significant on-site carbon reductions beyond Part L 2021 to meet both the energy efficiency target and the minimum 35% improvement.

The note acknowledges that the non-residential baseline also now includes low-carbon, electrically powered heat generation, with a relatively high efficiency meaning the demonstrable improvement from the inclusion of these measures in the Proposed Development is greatly reduced.

The new Part L baseline is also based on building fabric with much better thermal performance than Patrt L 2013, making it very difficult to demonstrate significant improvements in energy demand reduction.

The note highlights that applicants are still expected to follow the energy hierarchy to maximise carbon savings.

This Energy Statement for the Proposed Development is provided to demonstrate that the Energy Hierarchy has been followed in accordance with relevant planning requirements. Factors specific to the Proposed Development that prevent meeting this target are summarised in the following section.

11.1.2 Specific limitations of the Proposed Development:

Be Lean:

- Numerous façade options were explored as part of the design process, with detailed analysis of embodied carbon, constructability and thermal performance aspects. The curtain wall façade system chosen balances each of these factors and delivers a well-rounded solution. However, the achievable overall U-value of this system is higher than that of the notional building façade performance, which relates to solid wall and glazed elements, and forms the baseline to which the Proposed Development is compared. Other façade types that may have delivered marginally improved thermal performance were investigated but deemed to not be feasible. A precast panel façade with punched window openings was studied but was found to impose significantly increased and unacceptable structural loads on the existing building foundations, which are to be retained and reused. A façade system implementing Ultra High Performance Concrete (UHPC) panels was also investigated but was not taken forwards as the installation methodology, requiring the sealing of external joints from the outside, using scaffolding or abseiling, would have introduced installation health and safety risks that were deemed unacceptable. A detailed summary of the reasoning behind the façade strategy chosen is included in Section 5.3.1.

- Percentage glazing has been limited in many areas to be as low as feasibly possible whilst facilitating occupant satisfaction and connectivity through outward views. Overheating analysis and energy modelling has then informed the setting of g-value limits to minimise solar heat gain. However, there is also a balance to be made in providing glazing that allows sufficient natural light transmittance, reducing the operating hours of artificial lighting. The g-value targets for glazing within the Proposed Development aims to balance these factors.

Be Clean:

- Connections into local existing or planned heat networks were investigated but found to be unfeasible currently as there are no functioning heat networks or networks planned to be delivered within suitable timescales within the locality of the site.

Be Green:

- An assessment of different LZC technologies was undertaken but many were found to be unfeasible for application to the Proposed Development. In terms of power generating technologies, only PV was deemed suitable for inclusion within the scheme.
- System efficiencies have been maximised as far as possible. High efficiency simultaneous ASHPs have been implemented, using waste heat to produce domestic hot water through the use of WSHPs. However, as the Part L 2021 notional building also implements heat pumps with relatively high efficiencies, the demonstrable improvement of the Proposed Development over such a high performing baseline is reduced. Other solutions that could facilitate higher overall efficiencies, such as the integration of a ground source heat pump system, were investigated during the design process but were found to be unfeasible within the constraints of the site.

  A system utilising boreholes through the new structural slab within the footprint of the basement, meaning the existing slab is not greatly disturbed, would only allow for approximately 30 boreholes, allowing an estimated system capacity of less than 175kW, which is not significant enough to make a material difference to the overall energy performance of the Proposed Development.

  A more significant GSHP installation with a higher capacity could be achieved if large parts of the existing structure within the basement were to be removed to allow the installation of a greater number of boreholes and connecting pipework. In all cases, there is a recognition that the area surrounding and below Euston Tower is heavily congested with utilities and London Underground assets and this would require significant coordination and consenting from these stakeholders.

  For the possible yield of the system, the energy saving potential and the impact on the retained structural slab, a GSHP installation has not been included within the Proposed Development. This reasoning is covered in more detail in Section 8.4.1.
- The amount of usable area for PV is severely restricted, as a result of the buildings tower form and requirement for significant urban greening. The level 31 roof level accommodates ASHPs and air cooled chillers which cannot be situated anywhere else and require unobstructed free area above, making this space unusable for PV installation. As such, maximising the carbon offset from on-site electricity generation is challenging.

11.2 Carbon off-setting

The carbon off-set has been calculated on the remaining regulated carbon emissions post Be Green stage. The carbon offsetting price of £95/tonne of CO2 has been used in line with recommendations from The London Plan. The resulting offset requirement and cash in-lieu contributions

Non-domestic building offset	
Cumulative shortfall in target CO_2 savings [tCO_2 over 30 years]	8,375
Cash in-lieu contribution [£]	795,581

A.1 Predictive Energy Assessment

Euston Tower

Predictive Energy Assessment

Contents

1. Executive Summary

This Predictive Energy Assessment is a supplemental report to the Energy Statement. This report describes the methodology used during the predicted energy assessment of the Proposed Development of Euston Tower, in line with the requirements of GLA ‘Be Seen’ guidance. For further details on policy and requirements, please refer to the main body of the Energy Statement.

The results from this assessment have formed the basis of the Whole Life Carbon Assessment submitted for planning, as well as the ‘Be Seen’ energy consumption that is reported in the main body of the Energy Statement.

2. Model Construction

2.1 Choice of modelling tool and approach

For this project, the DSM tool IES <Virtual Environment> was used to estimate the operational energy consumption of the building under expected conditions, using an hourly resolution over a year.

DSM tools provide a holistic estimate of energy use as they consider the variation of energy consumption over time by simulating the dynamic relationship between the building form, fabric, external weather, occupants, usage patterns. The HVAC plant can also be developed either as part of an existing dynamic simulation template (simple HVAC Modelling) or through separate HVAC modules specified at a component level (Detailed HVAC Modelling).

Since this project is at RIBA Stage 2, an initial operational energy model has been set up using the simple HVAC modelling approach. As the design progresses to stages 3 and onwards, a more detailed HVAC modelling methodology will be developed to inform the design process.

Dynamic simulation models require a range of different input parameters to be able to provide detailed outputs and accurate insights into building performance. Further information about the input data can be found in following sections.

2.2 Weather File

The Proposed Development is located on Euston Road, in the London Borough of Camden, therefore the London Test Reference Year (TRY05) weather data was used as a reference for the external ambient conditions the building will experience.

In this development cooling is anticipated to be the dominant load, therefore the overall energy use will be highly dependent on external conditions. The impact of the weather is included in the sensitivity analysis.

2.3 Model geometry

The building geometry and the context of the Proposed Development was modelled within IES using Stage 2 design drawings – snapshots of the 3D model geometry are shown in Figure 1

The entire Office Building was modelled to allow detailed energy analysis throughout the building. The Part L modelling described within the main body of the Energy Statement was based on a full building model.

Internal layouts were generated for different areas of the buildings according to their function as well as their different loads, solar gains, and usage patterns. The main office floor plate is divided into four perimeter zones (North East, North West, South East and South West) and two internal zones (North and South).

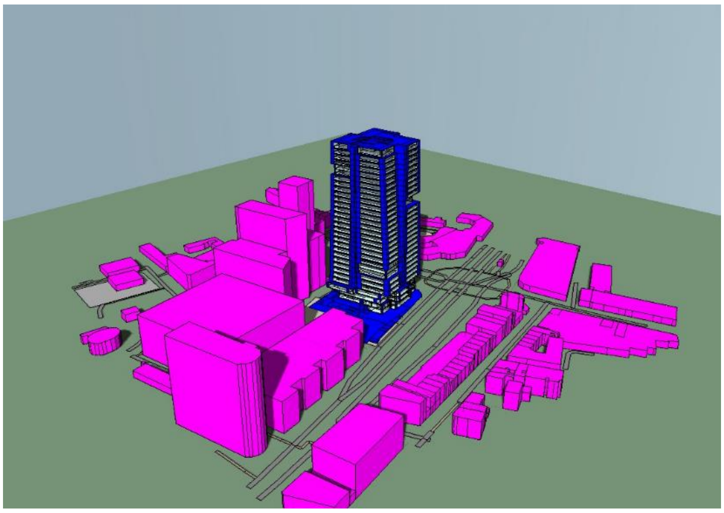


Figure 1 – Snapshots from 3D energy model

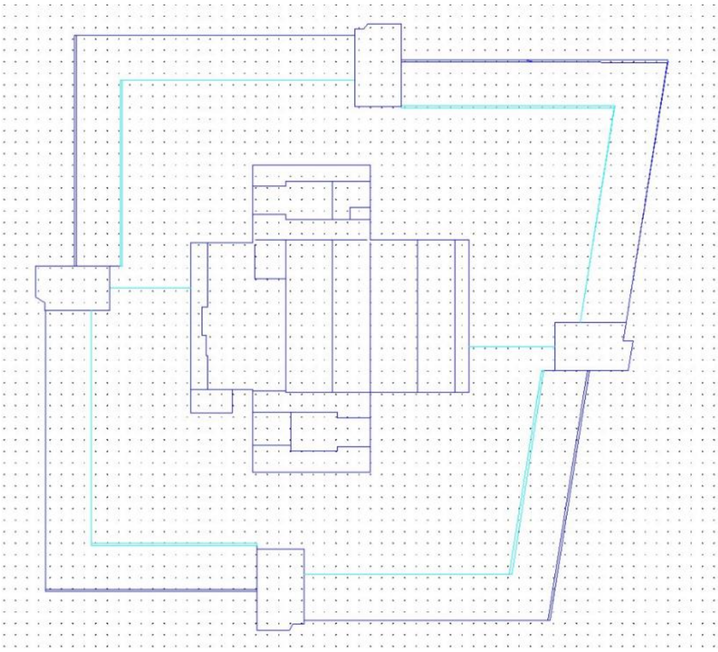


Figure 2 – Internal zones on a typical upper level in the office tower

2.4 Façade thermal performance

Façade performance is as described within the Be Lean chapter of the Energy Statement.

3. Scenario Methodology

3.1 Scenario testing: low-end, mid-range and high-end

Different low-end, high-end and mid-range scenarios were tested alongside the baseline cases, representing the design intent of the Proposed Development at this stage. Each was tested to give an indication of the range of variation in a building's performance due to various uncertainties.

- Baseline cases: these scenarios represent the current design intent most accurately. A scenario where the building is fully occupied by office tenants was chosen to compare against the current design intent where the building is also partially occupied by lab tenants. These scenarios use the current design estimates and allowances.
- Medium Office/Lab: the best estimate of the energy use based on the occupancy estimates from the prospective occupants using more less energy intensive assumptions for the building's power allowances.
- High-end and low-end scenarios: generated by considering the uncertainties on opposing ends from the baseline for key parameters.

The scenarios in Table 1 were to represent ranges in the variables that are least certain or have a have a high influence on performance.

Table 1 – Summary of test scenario inputs

	Low-end	Medium Office/Lab	Baseline Office	Baseline Office/Lab	High-end
Tenancy	All office	Office + Lab	All office	Office + Lab	Office + Lab
Office occupancy density (m^2 per person)	1: 10	1:8	1:8	1:8	1:8
Lab occupancy density (m^2 per person)	-	1:20	-	1:12	1:12
Plant operation hours	Refer to Table 3 *Low*	Refer to Table 3 *Medium (Baseline)*	Refer to Table 3 *Medium (Baseline)*	Refer to Table 3 *Medium (Baseline)*	Refer to Table 3 *High*
Office small power*	13.5 W/m^2 (BCO 2023)	13.5 W/m^2 (BCO 2023)	20 W/m^2 (BCO 2019)	20 W/m^2 (BCO 2019)	27.5 W/m^2
Lab small power	-	80 W/m^2	-	130 W/m^2	145 W/m^2
Lift energy controls	Incorporating ECO controls and regenerative braking	Standard	Standard	Standard	Maximum usage assumption
Weather file	London_TRY	London_TRY	London_TRY	London_TRY	London_TRY

*Includes tenant tea point allowances

4. Model Assumptions

4.1 Internal gains and associated energy uses

Internal heat gains are generated by the activity of occupants as metabolic heat, by electrical devices, or by thermal emission of artificial lighting.

The internal heat gains from occupants, equipment and processes within the building were included in the model to accurately calculate the energy use associated with heating, cooling and distribution systems.

4.1.1 Occupancy Factors

The occupancy density and pattern can have a significant impact on the building's energy use. Future occupiers are not known at this design stage, therefore different occupancy scenarios where defined and tested.

In different tested scenarios the design occupant densities were combined with the workstation density and real diversity or utilisation factors (the average proportion of staff that are in the office at any one time) as shown in Table 2.

Table 2 – Modelled occupancy factors

Parameters	Low	Medium (Baseline)	High
Design Occupant Density	10 m^2/person	8 m^2/person	8 m^2/person
Workstation Diversity	70%*	70%*	80%
Occupant Diversity	70%* 30% at weekend	70%* 30% at weekend	80% 30% at weekend

*Based on NABERS DfP as referenced within CIBSE TM54 Guidance

4.1.2 Operating Hours

The building's operating profile is defined both by its operating hours and by the extent of the out-of-hours activity. The intended hours of operation of the plant and equipment are also needed to accurately calculate the energy performance of the building. Table 3 shows the operating hours assumptions that were tested.

Table 3 – Modelled operating hours

	Low	Medium (Baseline)	High
Occupancy, small power & lighting	**Mon – Fri:** 8am to 6pm **Sat: 9**am to 11am **Sun:** None	**Mon – Fri:** 8am to 6pm **Sat:** 9am to 11am **Sun:** None	**Mon-Fri:** 7am to 7pm **Sat:** 8am to 6pm **Sun:** None
Reception Plant, Basement Plant and Servers	**Mon-Fri:** 24/7 **Sat:** 24/7 **Sun:** 24/7	**Mon-Fri:** 24/7 **Sat:** 24/7 **Sun:** 24/7	**Mon-Fri:** 24/7 **Sat:** 24/7 **Sun:** 24/7
Plant Operating Hours	**Mon – Fri:** 7am to 7pm **Sat:** 11am to 1pm **Sun:** None	**Mon – Fri:** 7am to 7pm **Sat:** 9am to 1pm **Sun:** None	**Mon-Fri:** 5am to 10pm **Sat:** 8am to 6pm **Sun:** None

4.2 Internal lighting gains and controls

The internal lighting and their control strategies have been modelled for all spaces within the building to estimate an accurate lighting energy use. Table (9) shows the lighting power breakdown that was implemented in each of the different building zones. For landlord areas, it has been assumed that the lighting operates on a time switch profile from 08.00 to 20.00.

Table 4 – Modelled lighting power

Building Zones	Lighting Power Density (W/m²)	Control Type
Office	5.5	PIR Sensor
Lab enabled	5.5	PIR Sensor
Accelerator Space	5.5	PIR Sensor
Public Facing	6	PIR Sensor
Circulation	6	PIR Sensor
Retail	6	PIR Sensor
Showers/ Changing	6	PIR Sensor
Cycle Store	6	PIR Sensor
Plantrooms	6	PIR Sensor
WC	6	PIR Sensor

4.3 Lifts and escalators

Estimation of the annual lift energy consumption is shown in Table 5 and has been based on the *BS EN ISO 25745-2:2015: Energy Performance of lifts, escalators and moving walks. Energy Calculations and classifications for lifts (elevators).*

Table 5 – Calculated lift energy consumption

Type	Number	Annual Energy Consumption (kWh)
General Lifts	13	282,985
Goods Lifts	5	147,117
Other Lifts -	4	53,405
Escalators	5	105,040

4.4 Catering

Estimation of catering consumption is shown in Table 5 and has been based on the *Restaurants, Clubs and Bars: Planning, Design and Investment for Food Service Facilities (Lawson 1995)* as references within *CIBSE TM50: Energy efficiency in commercial kitchens (2021)*

Table 6 – Calculated catering energy consumption

Catering Type	Meals Per Year	Annual Energy Consumption (kWh)
Coffee Shop/ Restaurant	180,562	155,283

4.5 Small power gains and profiles

Benchmarks from the British Council for Offices (BCO) guide to specification, key design criteria (BCO, 2023) and NABERS UK guidance (2020) among others were used to extract a range of small power loads.

The energy use from other equipment such as communal small power (e.g., printers), small catering equipment (e.g., fridges), local kitchen areas and tea points (e.g., microwaves) were also considered in the calculations and are accounted for within the values stated in Table 7. Lab enabled equipment loads have been derived from industry best practice guidance (BCO Science Guide 202 /BL Guide 2022).

It should be noted that out of hours consumption was allowed for, with equipment operating at 25% out of main office hours.

Table 7 – Modelled small power load

Small Power Load (W/m²)	Low-end	Medium Office/Lab	Baseline Office	Baseline Office/Lab	High-end
Office Equipment Load	12.5	13.5	23	23	27.5
Lab Enabled Equipment Load	-	80	-	130	145

4.6 Server rooms

The building includes 2no. main Server rooms each containing servers with a rated power of **26.4kW**. In addition, there are10no. satellite equipment rooms containing servers with a rated power of **5.4kW** on upper levels of the building. These rooms are equipped with local cooling, therefore their energy consumption was considered in the energy model.

IT and server rooms were assumed to run **24/7.**

4.7 Domestic hot water usage

The domestic hot water (DHW) demand and profile was established using benchmarks from CIBSE Guide G (2014) as shown in Table 8.

Table 8 – Modelled domestic hot water consumption

Building Zone	Daily demand (l/person)	Storage per 24-hour demand (l)	Recovery Period (hour)
Office (Open Plan)	4	4.5	2.0
Lab Enabled	4	4.5	2.0
Changing/Showers	3	3	2.0
Retail	Considered within general power allowance to retail spaces		

4.8 Mechanical ventilation

The majority of the building zones will be mechanically ventilated with a mechanical ventilation system providing the required fresh air to maintain adequate indoor air quality and thermal comfort. The following air-flow rates were used, in line with the proposed building specification.

Table 9 –Modelled ventilation rates

Building Zone	Air Supply Rate (L/s/person)

Office	3.01 (l/s/m²)
Lab enabled	6 ACH
Accelerator Space	16
Public Facing	12
Circulation	0
Retail	12
Showers/ Changing	10 ACH
Cycle Store	0
Plantrooms	1 ACH
WC	5 ACH

4.9 Space heating: Setpoints, controls, generation, and distribution

The setpoint and setback temperatures for space heating shown in Table 10 are set consistently across the building zones with a sufficient dead band to avoid simultaneous heating and cooling. Figure 3 shows the annual heating load profile

Table 10 – Modelled internal temperatures (winter)

Building Zone	Setpoint Temperature	Setback Temperature
Office (Open Plan)	20 ºC ± 2 ºC	16 ºC ± 2 ºC
Lab enabled	20 ºC ± 2 ºC	16 ºC ± 2 ºC
Circulation	18 ºC ± 2 ºC	N/A

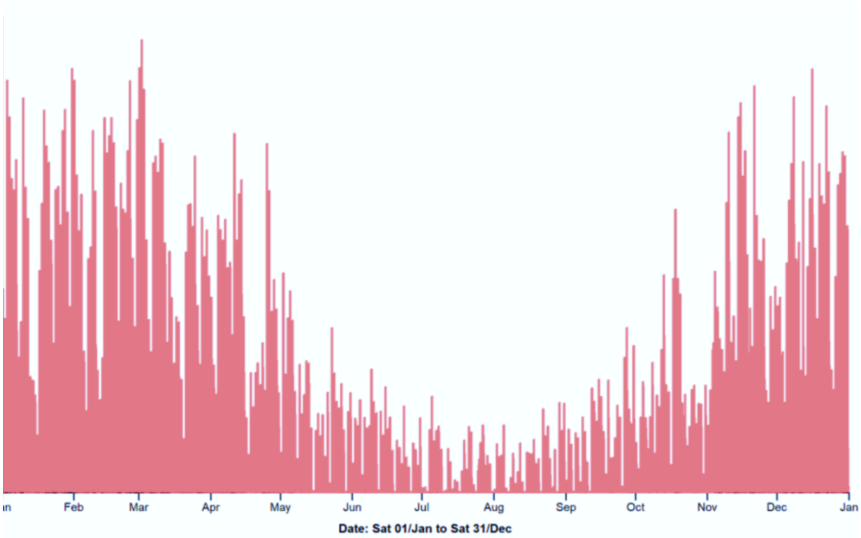


Figure 3 – Heating demand across the year

4.10 Space cooling: Setpoints, controls, generation, and distribution

The setpoint and setback temperatures for space cooling shown in Table 11 are set consistently across the building zones with a sufficient dead band to avoid simultaneous heating and cooling. Figure 4 shows the annual cooling load profile.

Table 11 – Modelled internal temperatures (summer)

Building Zone	Setpoint Temperature	Setback Temperature
Office (Open Plan)	24ºC ± 2 ºC	26ºC ± 2 ºC
Lab enabled	24 ºC ± 2 ºC	26ºC ± 2 ºC
Circulation	26 ºC ± 2 ºC	N/A

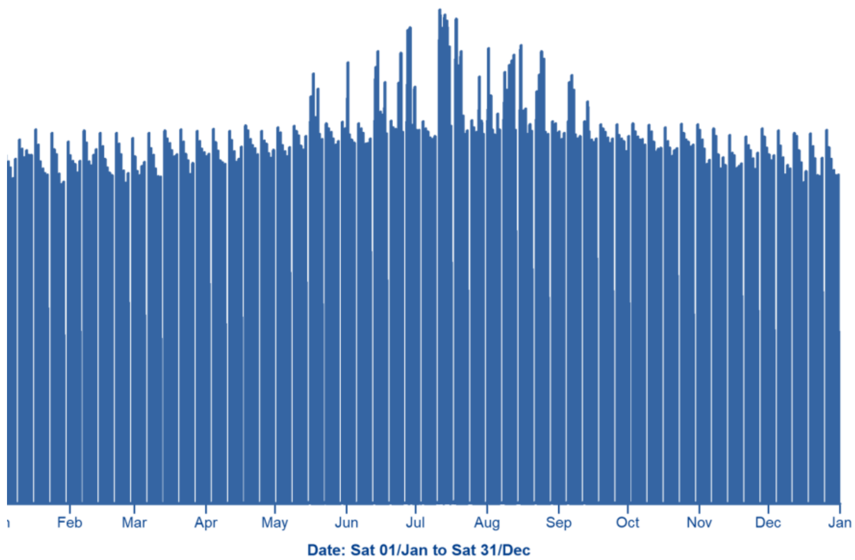


Figure 4 – Cooling profile across the year

5. Results and Conclusion

5.1 Baseline results

The results show that the most energy consumption is associated with 'unregulated loads' of equipment/ small power and therefore cooling, along with lifts and escalators (other). In this case, the equipment energy consumption is particularly high due to the requirement of the lab enabled spaces.

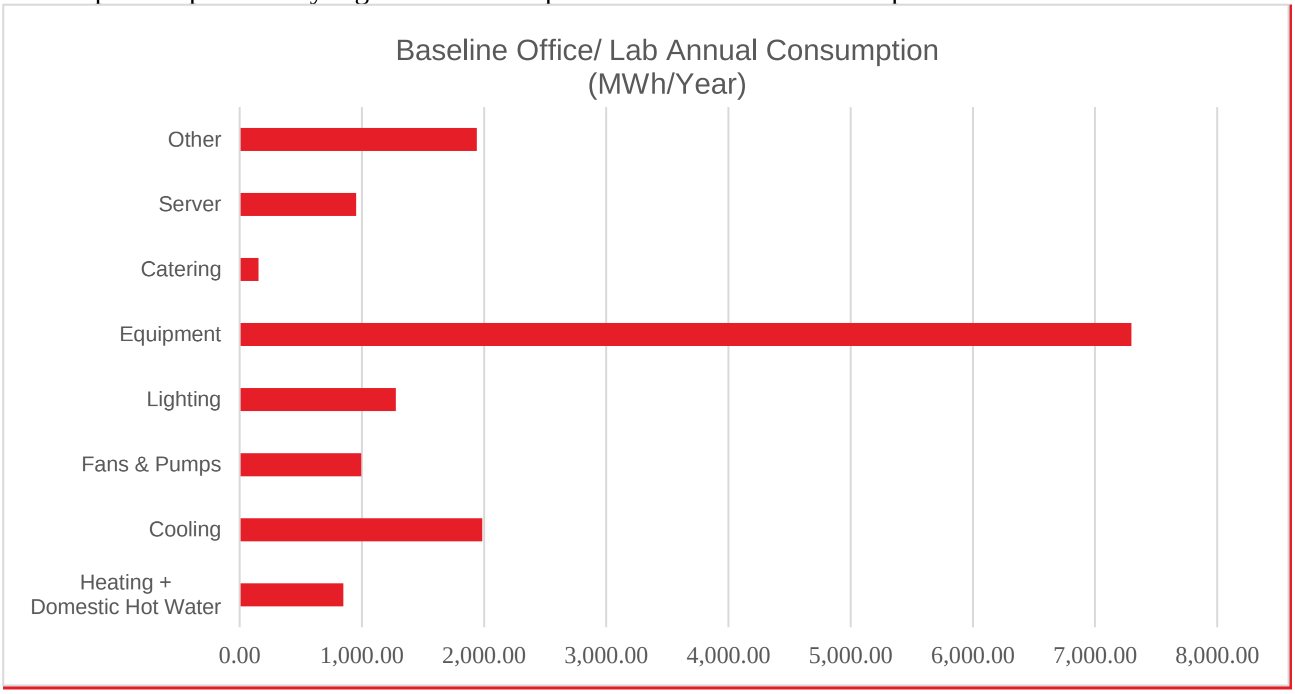


Figure 5 - Baseline energy consumption

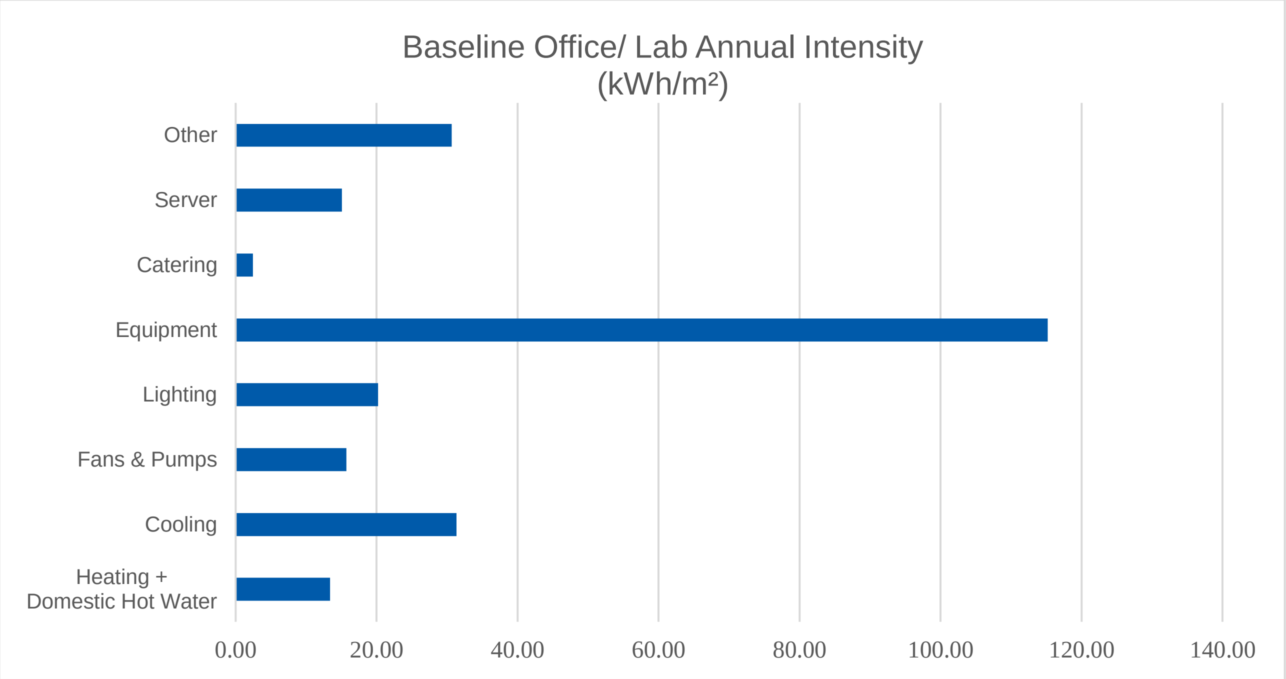


Figure 6 - Baseline energy intensity

Table 12 provides the split of regulated and unregulated energy use inline with the GLA requirement to provide consumption separately, which has been provided as an input into the Whole Life Carbon Assessment.

Table 12 - Regulated and Unregulated Energy Use

Baseline Office/Lab	Predicted Energy Consumption (MWh/yr)		
	Base Build	Tenant	Total
	7139.67	8313.96	15453.63

5.2 Scenario testing results

The change from a lab enabled spaces to all office scenario has the greatest reduction in energy consumption, mainly due to the decrease in equipment and therefore cooling consumption. The medium scenario, which includes lab enabled spaces, also shows a significant reduction in energy consumption from equipment and cooling, due to reduced small power allowances. The changes in occupancy rates resulted in changes in lift energy. It is clear that the equipment is the leading energy consumer and therefore has the greatest impact on these scenarios.

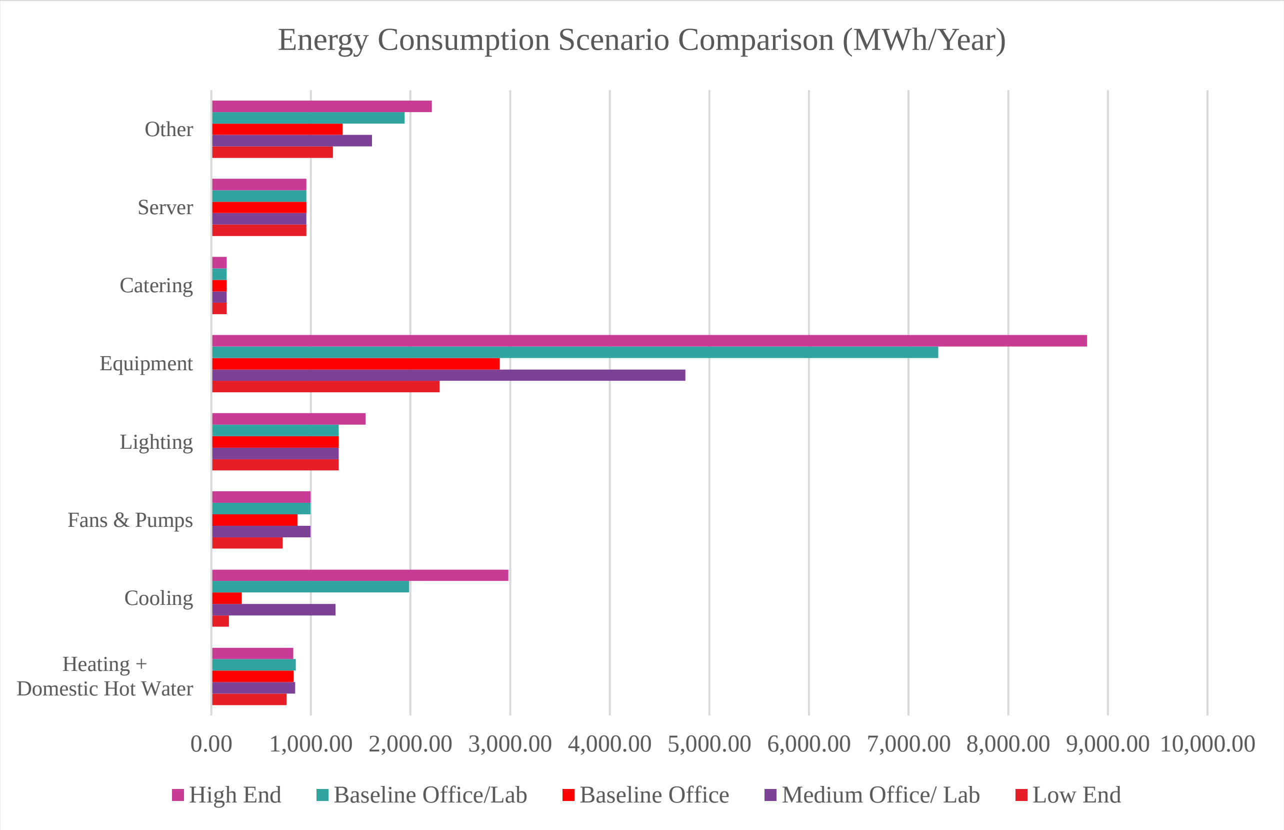


Figure 7 Total energy consumption by scenario

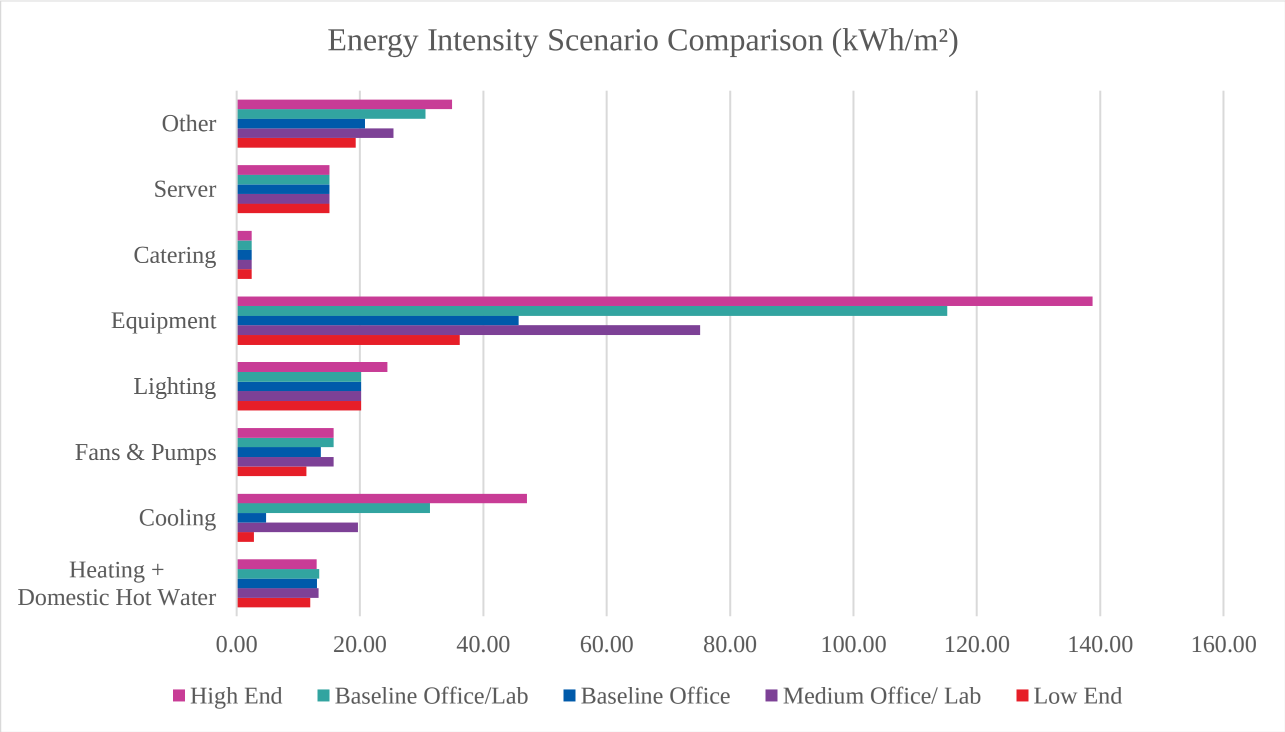


Figure 8 Total energy intensity by scenario

5.3 Be Seen results

The below figures show the absolute energy consumption of each building in the Proposed Development as well as the relative energy use intensity. These results include the residential buildings energy, as assessed separately to this report, using SAP methodology.

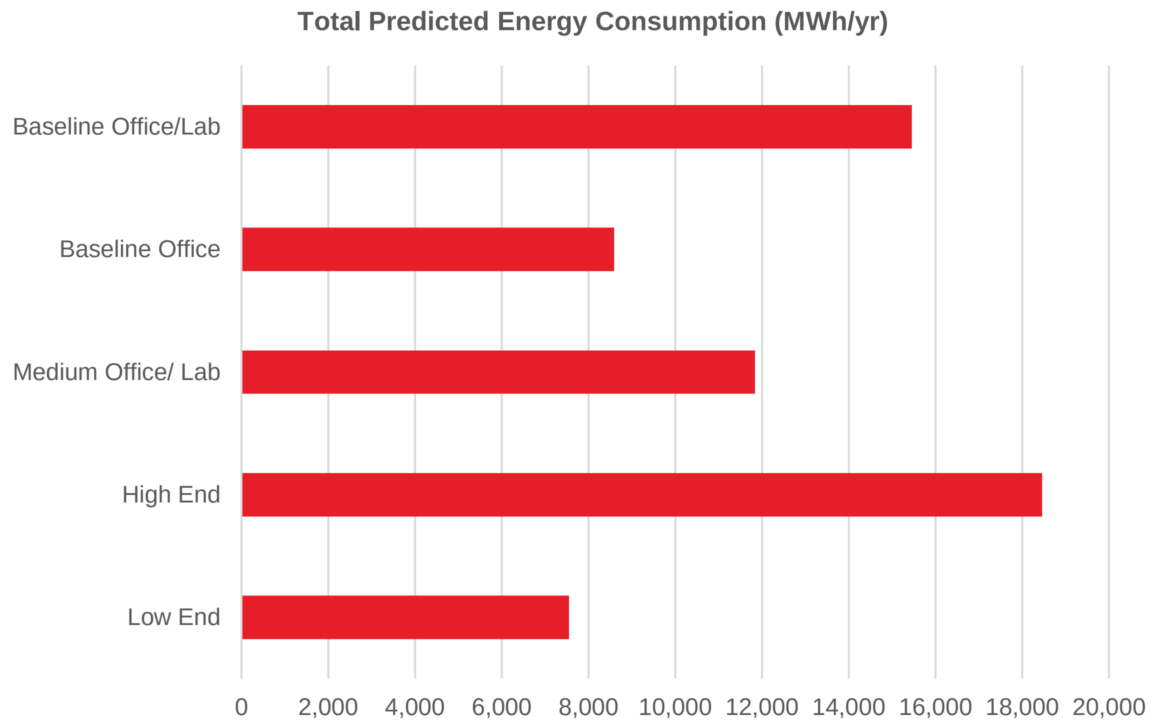


Figure 9 Predicted annual energy consumption per scenario for the Proposed Development

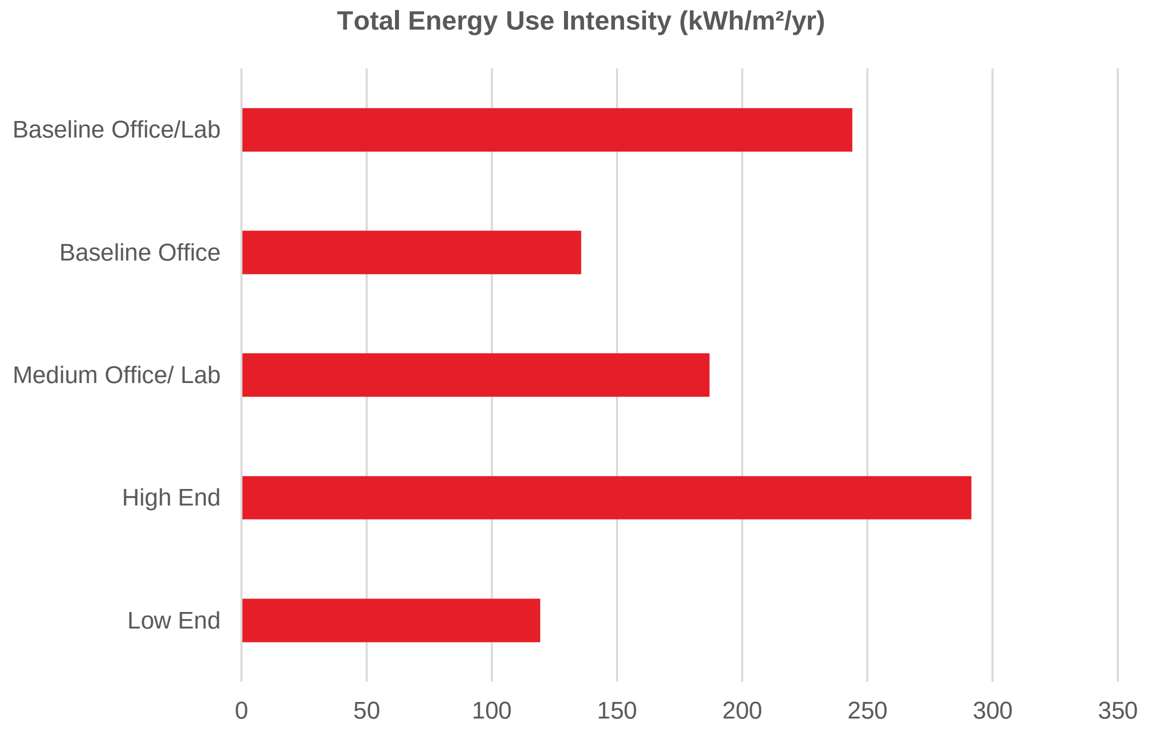


Figure 10 Energy Use Intensity per scenario for the Proposed Development

5.4 Next steps

5.4.1 Sensitivity analysis

Sensitivity analysis will be undertaken during Stage 3 design using the NABERS methodology. Several optioneering studies have been pre-selected to inform the design development.

- Simultaneous vs. reversable ASHP to determine greatest level of efficiency for the overall system.
- Water-cooled chillers v air-cooled chillers (and adiabatic coolers v cooling towers)
- Assessment of 24 hour cooling circuit serving server rooms
- Analysis into the benefits of free cooling through natural ventilation and AHUs.

This list will be supplemented with additional sensitivity studies where appropriate, based on initial modelling results.

A.2 Be Lean BRUKL Report

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

ET_WholeBuilding_Part5

As built

Date: Fri Nov 24 10:17:14 2023

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.23

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.23

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

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Foundation area [m²]: 2139.24

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

Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	4.2	
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	3.84	
Target primary energy rate (TPER), $kWh_{PE}/m^2.annum$	46.54	
Building primary energy rate (BPER), $kWh_{PE}/m^2.annum$	41.88	
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	-	-	UNKNOWN
Floors	0.18	0.15	0.22	02000006:Surf[19]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.12	0.12	00000009:Surf[4]
Windows** and roof windows	1.6	1.12	1.45	00000002:Surf[0]
Rooflights***	2.2	-	-	No roof lights in building
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

$U_{a-Limit}$ = 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

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
m³/(h.m²) at 50 Pa	8	3

A.3 Be Green BRUKL Report

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

ET_WholeBuilding_Part5

As built

Date: Fri Nov 24 12:07:47 2023

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.23

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.23

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

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Foundation area [m²]: 2139.24

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	4.2	
Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	3.62	
Target primary energy rate (TPER), kWh_{PE}/m^2.annum	46.54	
Building primary energy rate (BPER), kWh_{PE}/m^2.annum	39.51	
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	-	-	UNKNOWN
Floors	0.18	0.15	0.22	02000006:Surf[19]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.12	0.12	00000009:Surf[4]
Windows** and roof windows	1.6	1.12	1.45	00000002:Surf[0]
Rooflights***	2.2	-	-	No roof lights in building
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

$U_{a-Limit}$ = 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	3

A.4 SEER & SCoP Calculation

Euston Tower

Arup

SEER & SCOP Calculation

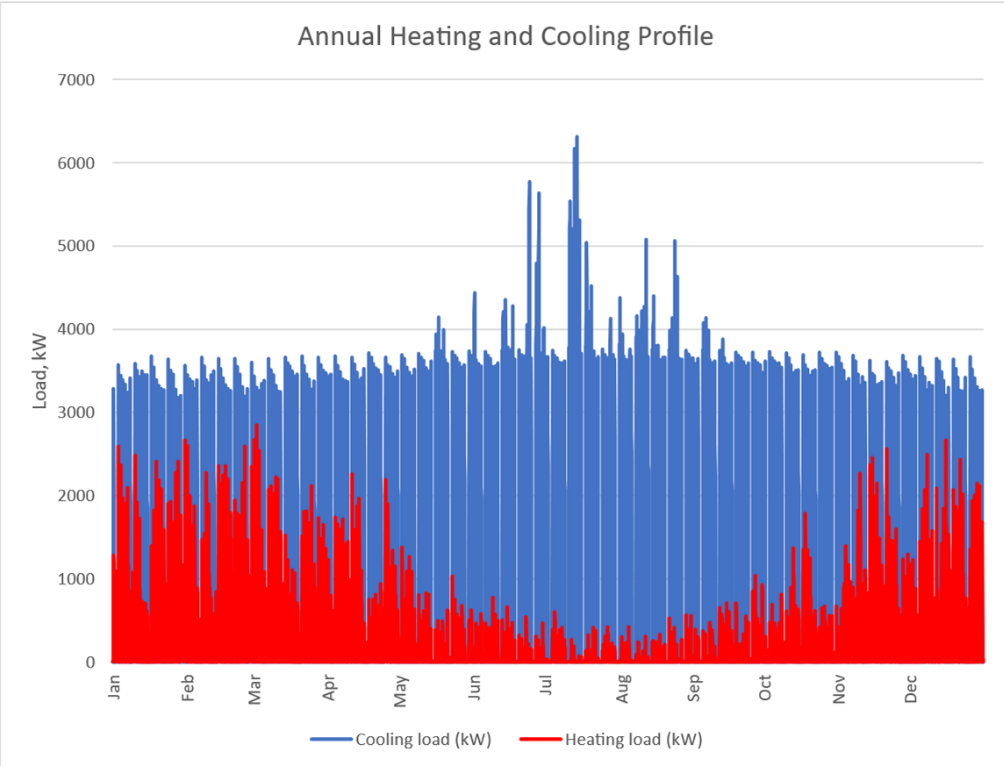
20/10/2023

This calculation determines the seasonal Energy Efficiency Ratio (SEER) and Seasonal Coefficient of Performance (SCOP) for the heat pumps on Euston Tower. The performance of the heat pump varies depending on whether they are in 'simultaneous' mode (generating heating and cooling simultaneously), or they are generating only cooling or only heating.

Annual Cooling Load	**546,800**	**kWh**	**4.69**	SEER	Calculated Seasonal Performance when in heat recovery mode @ 35°C External Ambient
Simultaneous Cooling	**207,784**	kWh	7.47	EER	
Air Cooling	339,016	kWh	2.98	EER	

Annual Heating load	**96,400**	**kWh**	**3.5256**	SCOP	Calculated Seasonal Performance when in heat recovery mode @ -4°C External Ambient
Simultaneous Heating	19,280	kWh	7.47	COP	
Air Heating	77,120	kWh	2.54	COP	

Dynamic simulations were undertaken to determine the demand profiles, which can be seen withing the graph below. Implementing this heat pump arrangement significantly decrease the carbon emissions associated with the building, primarily due to its high efficiency in generating heat.



A.5 Overheating Assessment

ARUP

British Land Property Management Limited

Euston Tower

Overheating Assessment

| 10 November 2023

This report takes into account the particular instructions and requirements of our client. It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 281835

Ove Arup & Partners Limited
Central Square
Forth Street
Newcastle upon Tyne
NE1 3PL
United Kingdom
arup.com

1. Non-residential Overheating Assessment

This Overheating Assessment is a supplemental report to the Euston Tower Energy Statement (EST-ARP-XX-XX-RP-M-00002). The purpose of this assessment is to demonstrate the resilience of the proposed building against the risk of overheating. The assessment specifically responds to the requirements of London Plan (2021) planning policy SI 4: Managing Heat Risk, as set-out below.

Major development proposals should demonstrate through an energy strategy how they will reduce the potential for internal overheating and reliance on air conditioning systems in accordance with the following cooling hierarchy:

- reduce the amount of heat entering a building through orientation, shading, high albedo materials, fenestration, insulation and the provision of green infrastructure
- minimise internal heat generation through energy efficient design
- manage the heat within the building through exposed internal thermal mass and high ceilings
- provide passive ventilation
- provide mechanical ventilation
- provide active cooling systems.

The Overheating Assessment has been carried out in accordance with the methodology set out in:

- CIBSE TM52 "The limits of thermal comfort" (CIBSE, 2013)
- GLA Energy Assessment Guidance (June 2022)

Methodology

The following areas were identified as those with the highest risk and appropriate for this assessment:

- Level 00 - Public Entrance
- Level 28 – 'Typical' High Level Office
- Amenity Spaces (Various levels)

In accordance with GLA and BREEAM guidance, the overheating risk for these areas has been undertaken following CIBSE TM52 and tested against the following weather profiles to determine current and future climate resilience.

- Design Summer Year 1 for the 2020s: current design year
- Design Summer Year 2 for the 2020s: a year with a very intense single warm spell
- Design Summer Year 3 for the 2020s: a year with a prolonged period of sustained warmth

In accordance with CIBSE TM52, if more than 3% of a building's occupied hours are above an operative temperature of 26°C, the building is determined to be at risk of `.

The GLA's guidance does not expect the building to pass with the more onerous weather files, DSY2 and DSY3.

Overheating Study Results Summary

All areas analysed showed that less than 3% of a building's occupied hours are above an operative temperature of 26°C, therefore the building is not considered to be at risk of overheating.

The building was also analysed under DSY2 and DSY3, and all areas analysed showed that less than 3% of a building's occupied hours are above an operative temperature of 26°C.

The results do not include the benefit of natural ventilation through façade openings.

The passive and active design measures adopted, successfully limit the overheating risk and in a manner that is resilient to climate change.

Results: Level 00 – Public Entrance

The public entrance on Level 00 is prone to overheating due to the significant amount of glazed façade. To effectively limit internal operative temperatures, the terrace at level 02 provides shading, in combination with high performance glazing, with low G-value. Although these measures are effective in reducing solar gains, they do not prevent overheating in the space, therefore active cooling is proposed. This can be seen from the results in Table 1.

Figure 1 - Public Entrance

Table 1 - Public Entrance Operative Temperatures

Weather File	Operative Temperature (°C) -% hours in range	
	Passive Measures	Active Cooling
	> 26	> 26
DSY1	20.8	0.0
DSY2	20.4	0.0
DSY3	19.8	0.0

Results: Level 28 – Typical Office Southeast Perimeter

The ‘typical’ office levels have dual aspect glazing, meaning they are susceptible to overheating. To reduce the risk of overheating, the façade design provides shading though a combination of projecting panels and overhangs, reducing solar gain. A number of investigations were undertaken to look at the effects of varying the g-value of the glazing and of varying the projection of the solid façade elements to quantify the benefit of the shading they provide. Although these measures are effective in reducing solar gains, they do not prevent overheating in the space, therefore active cooling is proposed. This can be seen from the results in Table 2.

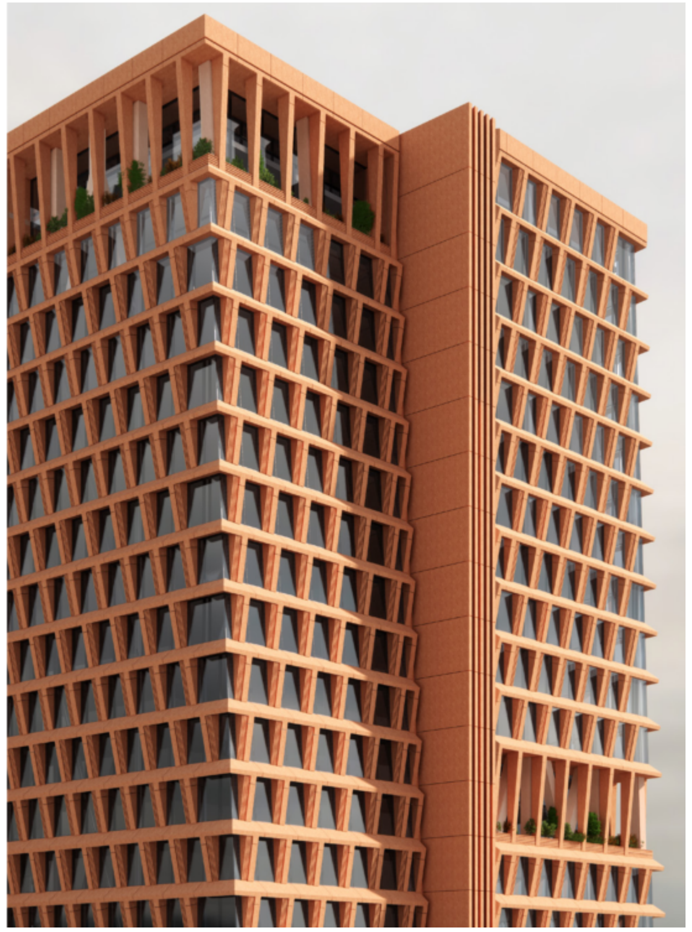


Figure 2 - Tower Shading

Table 2 - Level 28 Operative Temperatures

Weather File	Operative Temperature (°C) -% hours in range	
	Passive Measures	Active Cooling
	> 26	> 26
DSY1	42.1	0.0
DSY2	42.5	0.0
DSY3	38.8	0.0

Results: Level 07 Amenity Space – SW Perimeter

Amenity Spaces with significant dual aspect glazing are proposed for across multiple levels of the building. Analysis shows that the highest level of solar gain is present for the amenity space on Level 07 and therefore this space will be used for analysis within this assessment as an example of this space type. To provide shading in this area, the glazed façade is set back, creating a terrace, allowing for considerable shading from the resulting overhang. To further reduce solar gains, external blinds are proposed. All of these measures significantly reduce solar gains, however they do not eliminate the need for active cooling as shown in Table 3.

Figure 3 - Amenity Space

Table 3 - Amenity Space Operative Temperatures

Weather File	Operative Temperature (°C) -% hours in range	
	Passive Measures	Active Cooling
	> 26	> 26
DSY1	50.0	0.0
DSY2	51.7	0.0
DSY3	47.5	0.0

Results: Occupied Spaces Breakdown

Table 4 shows an overheating breakdown of all spaces, which highlights the need for active cooling.

Table 4 - Space Operative Temperatures

Room Name	Peak Internal Temperature at DSY 365 days, 24hrs a day		Thermal comfort Occupied hours > 26°C		Thermal comfort Occupied hours > 28°C		Thermal comfort Occupied hours > 30°C		Mech Vent	Active Cooling
	Time / Date	(°C)	Total	%	Total	%	Total	%	% Hours over 3%	% Hours over 3%
00_Circulation	21:30,24/Jul	28.72	0	0	0	0	0	0	Pass	-
00_Circulation	22:30,22/Jul	29.58	0	0	0	0	0	0	Pass	-
00_Circulation	17:30,25/Jul	23.36	0	0	0	0	0	0	Pass	-
00_Circulation	19:30,25/Jul	27.18	0	0	0	0	0	0	Pass	-
00_Circulation	23:30,25/Jul	24.08	0	0	0	0	0	0	Pass	-
00_Circulation	21:30,23/Jul	25.8	0	0	0	0	0	0	Pass	-
00_Circulation	00:30,26/Jul	24.53	0	0	0	0	0	0	Pass	-
00_Circulation	21:30,22/Jul	31.52	0	0	0	0	0	0	Pass	-
00_Circulation	20:30,24/Jul	24.42	0	0	0	0	0	0	Pass	-
00_Circulation	00:30,26/Jul	24.15	0	0	0	0	0	0	Pass	-
00_Circulation	22:30,24/Jul	27.42	0	0	0	0	0	0	Pass	-
00_Circulation	17:30,24/Jul	28.03	0	0	0	0	0	0	Pass	-
00_FDC	16:30,22/Jul	32.16	1750	38.2	654	14.3	166	3.6	Fail	Pass
00_Public	19:30,20/Jun	36.38	962	21	531	11.6	265	5.8	Fail	Pass
00_Lobby	18:30,23/Jul	33.16	1335	29.1	230	5	39	0.9	Fail	Pass
00_Lobby	17:30,23/Jul	34.07	1412	30.8	354	7.7	64	1.4	Fail	Pass
00_Lobby	20:30,22/Jul	30.73	1925	42	119	2.6	5	0.1	Fail	Pass
00_Plant	19:30,23/Jul	27.33	0	0	0	0	0	0	Pass	-
00_Public	16:30,23/Jul	29.86	311	6.8	40	0.9	0	0	Fail	Pass
00_Public	19:30,22/Jul	29.03	259	5.6	15	0.3	0	0	Fail	Pass
00_Public	16:30,23/Jul	29.79	315	6.9	39	0.9	0	0	Fail	Pass
00_Public Prem	16:30,23/Jul	31.13	553	12.1	123	2.7	12	0.3	Fail	Pass
00_Security	16:30,22/Jul	32.2	1757	38.3	667	14.5	169	3.7	Fail	Pass
00_Stair	20:30,25/Jul	27.51	0	0	0	0	0	0	Pass	-
00_Stair	20:30,25/Jul	25.65	0	0	0	0	0	0	Pass	-
00_WC	19:30,23/Jul	26.99	0	0	0	0	0	0	Pass	-
00_WC	20:30,24/Jul	30.05	0	0	0	0	0	0	Pass	-
01_Cafe	18:30,20/Jun	40.91	2490	54.3	1633	35.6	1019	22.2	Fail	Pass
01_Cafe	18:30,20/Jun	41.83	2380	51.9	1590	34.7	1038	22.6	Fail	Pass
01_Circulation	21:30,24/Jul	25.48	0	0	0	0	0	0	Pass	-
01_Circulation	22:30,24/Jul	27.83	0	0	0	0	0	0	Pass	-
01_Circulation	00:30,26/Jul	24.1	0	0	0	0	0	0	Pass	-
01_Lobby	21:30,24/Jul	28.24	0	0	0	0	0	0	Pass	-
01_Lobby	18:30,24/Jul	30.91	0	0	0	0	0	0	Pass	-
01_Plant	21:30,24/Jul	28.5	0	0	0	0	0	0	Pass	-
01_Plant	20:30,23/Jul	32.06	0	0	0	0	0	0	Pass	-
01_Plant	18:30,24/Jul	31.47	0	0	0	0	0	0	Pass	-

Room Name	Peak Internal Temperature at DSY 365 days, 24hrs a day		Thermal comfort Occupied hours > 26°C		Thermal comfort Occupied hours > 28°C		Thermal comfort Occupied hours > 30°C		Mech Vent	Active Cooling
	Time / Date	(°C)	Total	%	Total	%	Total	%	% Hours over 3%	% Hours over 3%
01_Public	20:30,22/Jul	33	597	13	290	6.3	70	1.5	Fail	Pass
01_WC	21:30,25/Jul	29.63	0	0	0	0	0	0	Pass	-
02_Circulation	19:30,24/Jul	30.23	0	0	0	0	0	0	Pass	-
02_Circulation	20:30,24/Jul	28.4	0	0	0	0	0	0	Pass	-
02_Circulation	20:30,24/Jul	30.86	0	0	0	0	0	0	Pass	-
02_Circulation	20:30,24/Jul	29.16	0	0	0	0	0	0	Pass	-
02_Circulation	22:30,24/Jul	26.29	0	0	0	0	0	0	Pass	-
02_Lobby	20:30,24/Jul	29.19	0	0	0	0	0	0	Pass	-
02_Lobby	19:30,23/Jul	32.51	0	0	0	0	0	0	Pass	-
02_Lobby Prem	18:30,23/Jul	33.01	1383	30.2	453	9.9	116	2.5	Fail	Pass
02_Lobby Prem	18:30,23/Jul	32.88	1320	28.8	430	9.4	102	2.2	Fail	Pass
02_Open Void	18:30,20/Jun	38.54	0	0	0	0	0	0	Pass	-
02_Open Void	18:30,24/Jul	30.7	0	0	0	0	0	0	Pass	-
02_Plant	19:30,24/Jul	31.56	0	0	0	0	0	0	Pass	-
02_Plant	20:30,24/Jul	27.87	0	0	0	0	0	0	Pass	-
02_Public	19:30,22/Jul	34.14	992	21.6	464	10.1	186	4.1	Fail	Pass
02_Public	20:30,22/Jul	33.44	859	18.7	406	8.9	134	2.9	Fail	Pass
02_Public Prem	16:30,24/Jul	33.62	921	20.1	455	9.9	150	3.3	Fail	Pass
02_Public Prem	16:30,24/Jul	33.51	850	18.5	432	9.4	138	3	Fail	Pass
02_Riser	20:30,24/Jul	30.06	0	0	0	0	0	0	Pass	-
02_Riser	04:30,25/Jul	26.94	0	0	0	0	0	0	Pass	-
02_Stair	20:30,25/Jul	26.46	0	0	0	0	0	0	Pass	-
02_WC	18:30,24/Jul	32.09	0	0	0	0	0	0	Pass	-
03_Accelerator Lab Space Int	20:30,22/Jul	35.3	1943	42.4	1141	24.9	561	12.2	Fail	Pass
03_Accelerator Lab Space Prem	17:30,23/Jul	35.93	1811	39.5	1121	24.4	579	12.6	Fail	Pass
03_Accelerator Lab Space Prem	16:30,22/Jul	35.32	1824	39.8	1102	24	559	12.2	Fail	Pass
03_Accelerator Lab Space Prem	19:30,22/Jul	36.5	2386	52	1523	33.2	832	18.1	Fail	Pass
03_Accelerator Office Space Int	19:30,22/Jul	34.97	1883	41.1	1091	23.8	534	11.6	Fail	Pass
03_Accelerator Office Space Int	16:30,22/Jul	35.17	1896	41.4	1084	23.6	532	11.6	Fail	Pass
03_Accelerator Office Space Int	16:30,22/Jul	35.29	1841	40.2	1073	23.4	533	11.6	Fail	Pass
03_Accelerator Office Space Prem	16:30,22/Jul	35.29	1862	40.6	1159	25.3	580	12.6	Fail	Pass
03_Accelerator Office Space Prem	16:30,22/Jul	35.94	1757	38.3	1069	23.3	562	12.3	Fail	Pass
03_Accelerator Office Space Prem	16:30,22/Jul	35.35	1804	39.3	1054	23	536	11.7	Fail	Pass
03_Circulation	21:30,24/Jul	26.85	0	0	0	0	0	0	Pass	-
03_Circulation	21:30,24/Jul	27.75	0	0	0	0	0	0	Pass	-
03_Circulation	20:30,24/Jul	30.02	0	0	0	0	0	0	Pass	-
03_Circulation	20:30,25/Jul	30.88	0	0	0	0	0	0	Pass	-
03_Plant	18:30,24/Jul	32.69	0	0	0	0	0	0	Pass	-
03_Plant	21:30,22/Jul	33.6	0	0	0	0	0	0	Pass	-
03_Plant	18:30,24/Jul	34.03	0	0	0	0	0	0	Pass	-
03_Plant	18:30,24/Jul	34.07	0	0	0	0	0	0	Pass	-
03_Riser	19:30,24/Jul	31.66	0	0	0	0	0	0	Pass	-
03_Riser	22:30,24/Jul	28	0	0	0	0	0	0	Pass	-

Room Name	Peak Internal Temperature at DSY 365 days, 24hrs a day		Thermal comfort Occupied hours > 26°C		Thermal comfort Occupied hours > 28°C		Thermal comfort Occupied hours > 30°C		Mech Vent	Active Cooling
	Time / Date	(°C)	Total	%	Total	%	Total	%	% Hours over 3%	% Hours over 3%
03_Stair	19:30,24/Jul	26.82	0	0	0	0	0	0	Pass	-
03_WC	19:30,24/Jul	29.74	0	0	0	0	0	0	Pass	-
04_ Prem Lab Enabled Floorplate Class E	16:30,22/Jul	35.12	1858	40.5	1147	25	568	12.4	Fail	Pass
04_ Prem Lab Enabled Floorplate Class E	16:30,22/Jul	35.2	1804	39.3	1094	23.9	538	11.7	Fail	Pass
04_ Prem Office Floorplate Class E	15:30,22/Jul	35.07	1792	39.1	1130	24.6	557	12.1	Fail	Pass
04_ Prem Office Floorplate Class E	16:30,22/Jul	35.28	1801	39.3	1109	24.2	562	12.3	Fail	Pass
04_AHU	19:30,23/Jul	33.51	0	0	0	0	0	0	Pass	-
04_AHU	17:30,22/Jul	33.09	0	0	0	0	0	0	Pass	-
04_AHU	17:30,22/Jul	32.81	0	0	0	0	0	0	Pass	-
04_AHU	20:30,23/Jul	32.29	0	0	0	0	0	0	Pass	-
04_Circulation	22:30,24/Jul	29.01	0	0	0	0	0	0	Pass	-
04_Circulation	22:30,24/Jul	26.54	0	0	0	0	0	0	Pass	-
04_Circulation	20:30,25/Jul	30.24	0	0	0	0	0	0	Pass	-
04_Circulation	22:30,24/Jul	27.26	0	0	0	0	0	0	Pass	-
04_Circulation	22:30,24/Jul	28.16	0	0	0	0	0	0	Pass	-
04_Internal Lab Enabled Floorplate Class E	16:30,22/Jul	34.87	1957	42.7	1165	25.4	569	12.4	Fail	Pass
04_Internal Office Floorplate Class E	16:30,22/Jul	34.83	1916	41.8	1137	24.8	556	12.1	Fail	Pass
04_Stair	20:30,25/Jul	26.51	0	0	0	0	0	0	Pass	-
04_WC	20:30,24/Jul	28.42	0	0	0	0	0	0	Pass	-
04_WC	20:30,24/Jul	29.35	0	0	0	0	0	0	Pass	-
04_WC	20:30,24/Jul	29.25	0	0	0	0	0	0	Pass	-
05_ Prem Lab Enabled Floorplate Class E	15:30,22/Jul	35.67	2225	48.5	1476	32.2	831	18.1	Fail	Pass
05_ Prem Lab Enabled Floorplate Class E	16:30,22/Jul	35.84	2200	48	1446	31.5	808	17.6	Fail	Pass
05_ Prem Office Floorplate Class E	14:30,22/Jul	36.05	2238	48.8	1497	32.6	859	18.7	Fail	Pass
05_ Prem Office Floorplate Class E	15:30,22/Jul	36.06	2245	49	1499	32.7	863	18.8	Fail	Pass
05_AHU	17:30,25/Jul	30.32	0	0	0	0	0	0	Pass	-
05_AHU	17:30,25/Jul	30.07	0	0	0	0	0	0	Pass	-
05_AHU	19:30,23/Jul	30.78	0	0	0	0	0	0	Pass	-
05_AHU	19:30,25/Jul	29.05	0	0	0	0	0	0	Pass	-
05_Circulation	20:30,24/Jul	25.43	0	0	0	0	0	0	Pass	-
05_Circulation	21:30,24/Jul	26.38	0	0	0	0	0	0	Pass	-
05_Circulation	20:30,28/Jul	29.52	0	0	0	0	0	0	Pass	-
05_Circulation	21:30,24/Jul	26.13	0	0	0	0	0	0	Pass	-
05_Circulation	20:30,24/Jul	25.28	0	0	0	0	0	0	Pass	-
05_Internal Lab Enabled Floorplate Class E	16:30,22/Jul	35.51	2476	54	1563	34.1	857	18.7	Fail	Pass
05_Internal Office Floorplate Class E	15:30,22/Jul	35.6	2474	54	1575	34.4	868	18.9	Fail	Pass
05_Server Room	22:30,27/Jul	33.04	0	0	0	0	0	0	Pass	-
05_Stair	20:30,25/Jul	26	0	0	0	0	0	0	Pass	-

Room Name	Peak Internal Temperature at DSY 365 days, 24hrs a day		Thermal comfort Occupied hours > 26°C		Thermal comfort Occupied hours > 28°C		Thermal comfort Occupied hours > 30°C		Mech Vent	Active Cooling
	Time / Date	(°C)	Total	%	Total	%	Total	%	% Hours over 3%	% Hours over 3%
05_WC	20:30,24/Jul	27.64	0	0	0	0	0	0	Pass	-
05_WC	19:30,24/Jul	27.23	0	0	0	0	0	0	Pass	-
05_WC	20:30,25/Jul	25.72	0	0	0	0	0	0	Pass	-
06_ Prem Lab Enabled Floorplate Class E	15:30,24/Jul	51.67	2231	48.7	1503	32.8	864	18.8	Fail	Pass
06_ Prem Lab Enabled Floorplate Class E	16:30,24/Jul	51.65	2205	48.1	1474	32.1	846	18.5	Fail	Pass
06_ Prem Office Floorplate Class E	13:30,24/Jul	46.74	2346	51.2	1640	35.8	1053	23	Fail	Pass
06_ Prem Office Floorplate Class E	15:30,24/Jul	46.96	2258	49.2	1545	33.7	953	20.8	Fail	Pass
06_AHU	18:30,24/Jul	31.38	0	0	0	0	0	0	Pass	-
06_AHU	16:30,25/Jul	31.74	0	0	0	0	0	0	Pass	-
06_AHU	17:30,24/Jul	31.95	0	0	0	0	0	0	Pass	-
06_AHU	19:30,23/Jul	32.54	0	0	0	0	0	0	Pass	-
06_Circulation	22:30,24/Jul	28.38	0	0	0	0	0	0	Pass	-
06_Circulation	21:30,24/Jul	26.6	0	0	0	0	0	0	Pass	-
06_Circulation	22:30,24/Jul	27.9	0	0	0	0	0	0	Pass	-
06_Circulation	20:30,25/Jul	30.41	0	0	0	0	0	0	Pass	-
06_Circulation	21:30,24/Jul	26.27	0	0	0	0	0	0	Pass	-
06_Internal Lab Enabled Floorplate Class E	16:30,24/Jul	50.38	4585	100	4585	100	4479	97.7	Fail	Pass
06_Internal Office Floorplate Class E	16:30,24/Jul	47.5	4585	100	4512	98.4	3959	86.3	Fail	Pass
06_Stair	20:30,25/Jul	25.98	0	0	0	0	0	0	Pass	-
06_WC	21:30,24/Jul	30.83	0	0	0	0	0	0	Pass	-
06_WC	16:30,24/Jul	25.86	0	0	0	0	0	0	Pass	-
06_WC	20:30,24/Jul	29.3	0	0	0	0	0	0	Pass	-
07_ Prem Lab Enabled Floorplate Class E	15:30,22/Jul	35.89	2231	48.7	1503	32.8	864	18.8	Fail	Pass
07_ Prem Lab Enabled Floorplate Class E	16:30,22/Jul	36.06	2205	48.1	1474	32.1	846	18.5	Fail	Pass
07_ Prem Office Floorplate Class E	16:30,20/Jun	37.25	2346	51.2	1640	35.8	1053	23	Fail	Pass
07_ Prem Office Floorplate Class E	14:30,22/Jul	36.49	2258	49.2	1545	33.7	953	20.8	Fail	Pass
07_AHU	20:30,23/Jul	28.65	0	0	0	0	0	0	Pass	-
07_AHU	18:30,23/Jul	30.7	0	0	0	0	0	0	Pass	-
07_AHU	19:30,23/Jul	30.69	0	0	0	0	0	0	Pass	-
07_AHU	17:30,25/Jul	29.94	0	0	0	0	0	0	Pass	-
07_Circulation	21:30,24/Jul	26.05	0	0	0	0	0	0	Pass	-
07_Circulation	20:30,24/Jul	25.12	0	0	0	0	0	0	Pass	-
07_Circulation	20:30,24/Jul	26.09	0	0	0	0	0	0	Pass	-
07_Circulation	20:30,24/Jul	25.13	0	0	0	0	0	0	Pass	-
07_Circulation	20:30,25/Jul	29.3	0	0	0	0	0	0	Pass	-
07_Internal Lab Enabled Floorplate Class E	16:30,22/Jul	35.74	2474	54	1594	34.8	914	19.9	Fail	Pass
07_Internal Office Floorplate Class E	15:30,22/Jul	36.1	2498	54.5	1639	35.7	981	21.4	Fail	Pass
07_Stair	20:30,25/Jul	25.85	0	0	0	0	0	0	Pass	-

Room Name	Peak Internal Temperature at DSY 365 days, 24hrs a day		Thermal comfort Occupied hours > 26°C		Thermal comfort Occupied hours > 28°C		Thermal comfort Occupied hours > 30°C		Mech Vent	Active Cooling
	Time / Date	(°C)	Total	%	Total	%	Total	%	% Hours over 3%	% Hours over 3%
07_WC	20:30,25/Jul	25.45	0	0	0	0	0	0	Pass	-
07_WC	17:30,24/Jul	27.15	0	0	0	0	0	0	Pass	-
07_WC	19:30,24/Jul	27.55	0	0	0	0	0	0	Pass	-
08_ Prem Lab Enabled Floorplate Class E	16:30,22/Jul	35.31	1851	40.4	1181	25.8	612	13.3	Fail	Pass
08_ Prem Lab Enabled Floorplate Class E	16:30,22/Jul	35.11	1885	41.1	1205	26.3	627	13.7	Fail	Pass
08_ Prem Office Floorplate Class E	14:30,22/Jul	35.56	1962	42.8	1284	28	701	15.3	Fail	Pass
08_ Void	06:30,10/Aug	25.48	0	0	0	0	0	0	Pass	-
08_AHU	19:30,23/Jul	30.11	0	0	0	0	0	0	Pass	-
08_AHU	17:30,25/Jul	29.52	0	0	0	0	0	0	Pass	-
08_AHU	18:30,23/Jul	30.07	0	0	0	0	0	0	Pass	-
08_AHU	20:30,23/Jul	28.11	0	0	0	0	0	0	Pass	-
08_Circulation	20:30,24/Jul	25.49	0	0	0	0	0	0	Pass	-
08_Circulation	20:30,24/Jul	24.78	0	0	0	0	0	0	Pass	-
08_Circulation	20:30,24/Jul	24.72	0	0	0	0	0	0	Pass	-
08_Circulation	20:30,28/Jul	28.82	0	0	0	0	0	0	Pass	-
08_Circulation	20:30,24/Jul	25.41	0	0	0	0	0	0	Pass	-
08_Internal Lab Enabled Floorplate Class E	16:30,22/Jul	34.95	2004	43.7	1263	27.5	650	14.2	Fail	Pass
08_Internal Office Floorplate Class E	16:30,22/Jul	35.21	2079	45.3	1335	29.1	702	15.3	Fail	Pass
08_Prem Office Floorplate Class E	16:30,22/Jul	35.89	2018	44	1339	29.2	745	16.2	Fail	Pass
08_Server Room	22:30,28/Jul	31.21	0	0	0	0	0	0	Pass	-
08_Stair	20:30,25/Jul	25.78	0	0	0	0	0	0	Pass	-
08_WC	20:30,25/Jul	25.34	0	0	0	0	0	0	Pass	-
08_WC	19:30,24/Jul	26.99	0	0	0	0	0	0	Pass	-
08_WC	17:30,24/Jul	26.7	0	0	0	0	0	0	Pass	-
09_ Prem Lab Enabled Floorplate Class E	16:30,22/Jul	34.95	1857	40.5	1165	25.4	581	12.7	Fail	Pass
09_ Prem Lab Enabled Floorplate Class E	16:30,22/Jul	35.16	1810	39.5	1134	24.7	561	12.2	Fail	Pass
09_ Prem Office Floorplate Class E	14:30,22/Jul	35.35	1902	41.5	1214	26.5	632	13.8	Fail	Pass
09_ Prem Office Floorplate Class E	15:30,22/Jul	35.25	1850	40.3	1188	25.9	616	13.4	Fail	Pass
09_AHU	17:30,25/Jul	29.39	0	0	0	0	0	0	Pass	-
09_AHU	19:30,23/Jul	28.03	0	0	0	0	0	0	Pass	-
09_AHU	17:30,25/Jul	29.46	0	0	0	0	0	0	Pass	-
09_AHU	20:30,23/Jul	29.94	0	0	0	0	0	0	Pass	-
09_Circulation	20:30,28/Jul	28.66	0	0	0	0	0	0	Pass	-
09_Circulation	20:30,24/Jul	25.22	0	0	0	0	0	0	Pass	-
09_Circulation	20:30,24/Jul	24.66	0	0	0	0	0	0	Pass	-
09_Circulation	20:30,24/Jul	25.37	0	0	0	0	0	0	Pass	-
09_Circulation	20:30,24/Jul	24.62	0	0	0	0	0	0	Pass	-
09_Internal Lab Enabled Floorplate Class E	16:30,22/Jul	34.78	1947	42.5	1210	26.4	605	13.2	Fail	Pass

Room Name	Peak Internal Temperature at DSY 365 days, 24hrs a day		Thermal comfort Occupied hours > 26°C		Thermal comfort Occupied hours > 28°C		Thermal comfort Occupied hours > 30°C		Mech Vent	Active Cooling
	Time / Date	(°C)	Total	%	Total	%	Total	%	% Hours over 3%	% Hours over 3%
09_Internal Office Floorplate Class E	15:30,22/Jul	34.85	1982	43.2	1239	27	630	13.7	Fail	Pass
09_Stair	20:30,25/Jul	25.76	0	0	0	0	0	0	Pass	-
09_WC	19:30,24/Jul	26.87	0	0	0	0	0	0	Pass	-
09_WC	17:30,24/Jul	26.59	0	0	0	0	0	0	Pass	-
09_WC	20:30,25/Jul	25.37	0	0	0	0	0	0	Pass	-
10_ Prem Lab Enabled Floorplate Class E	16:30,22/Jul	35.18	1796	39.2	1134	24.7	562	12.3	Fail	Pass
10_ Prem Lab Enabled Floorplate Class E	16:30,22/Jul	34.95	1835	40	1151	25.1	564	12.3	Fail	Pass
10_ Prem Office Floorplate Class E	14:30,22/Jul	35.4	1903	41.5	1213	26.5	638	13.9	Fail	Pass
10_ Prem Office Floorplate Class E	15:30,22/Jul	35.42	1883	41.1	1210	26.4	636	13.9	Fail	Pass
10_AHU	20:30,23/Jul	29.97	0	0	0	0	0	0	Pass	-
10_AHU	17:30,25/Jul	29.38	0	0	0	0	0	0	Pass	-
10_AHU	19:30,23/Jul	28.02	0	0	0	0	0	0	Pass	-
10_AHU	17:30,25/Jul	29.47	0	0	0	0	0	0	Pass	-
10_Circulation	20:30,24/Jul	25.19	0	0	0	0	0	0	Pass	-
10_Circulation	20:30,24/Jul	24.64	0	0	0	0	0	0	Pass	-
10_Circulation	20:30,24/Jul	24.6	0	0	0	0	0	0	Pass	-
10_Circulation	20:30,28/Jul	28.63	0	0	0	0	0	0	Pass	-
10_Circulation	20:30,24/Jul	25.34	0	0	0	0	0	0	Pass	-
10_Internal Lab Enabled Floorplate Class E	16:30,22/Jul	34.79	1928	42.1	1198	26.1	599	13.1	Fail	Pass
10_Internal Office Floorplate Class E	15:30,22/Jul	34.92	1992	43.4	1242	27.1	635	13.8	Fail	Pass
10_Stair	20:30,25/Jul	25.78	0	0	0	0	0	0	Pass	-
10_WC	20:30,25/Jul	25.56	0	0	0	0	0	0	Pass	-
10_WC	19:30,24/Jul	27.28	0	0	0	0	0	0	Pass	-
10_WC	17:30,24/Jul	26.98	0	0	0	0	0	0	Pass	-
11_ Prem Lab Enabled Floorplate Class E	16:30,22/Jul	35.49	1827	39.8	1200	26.2	640	14	Fail	Pass
11_ Prem Lab Enabled Floorplate Class E	15:30,22/Jul	35.58	1945	42.4	1293	28.2	730	15.9	Fail	Pass
11_ Prem Office Floorplate Class E	15:30,22/Jul	35.57	1887	41.2	1227	26.8	669	14.6	Fail	Pass
11_ Prem Office Floorplate Class E	14:30,22/Jul	35.55	1882	41	1230	26.8	672	14.7	Fail	Pass
11_AHU	18:30,23/Jul	29.54	0	0	0	0	0	0	Pass	-
11_AHU	20:30,23/Jul	30.01	0	0	0	0	0	0	Pass	-
11_AHU	19:30,23/Jul	28.46	0	0	0	0	0	0	Pass	-
11_AHU	18:30,23/Jul	29.43	0	0	0	0	0	0	Pass	-
11_Circulation	20:30,24/Jul	24.37	0	0	0	0	0	0	Pass	-
11_Circulation	16:30,22/Jul	34.16	0	0	0	0	0	0	Pass	-
11_Circulation	20:30,24/Jul	24.34	0	0	0	0	0	0	Pass	-
11_Circulation	20:30,25/Jul	28.75	0	0	0	0	0	0	Pass	-
11_Circulation	20:30,24/Jul	25.24	0	0	0	0	0	0	Pass	-
11_Circulation	20:30,25/Jul	27.9	0	0	0	0	0	0	Pass	-
11_Circulation	20:30,24/Jul	25.34	0	0	0	0	0	0	Pass	-

Room Name	Peak Internal Temperature at DSY 365 days, 24hrs a day		Thermal comfort Occupied hours > 26°C		Thermal comfort Occupied hours > 28°C		Thermal comfort Occupied hours > 30°C		Mech Vent	Active Cooling
	Time / Date	(°C)	Total	%	Total	%	Total	%	% Hours over 3%	% Hours over 3%
11_Circulation	20:30,24/Jul	27.5	0	0	0	0	0	0	Pass	-
11_Cleaners	07:30,29/Jul	26.94	0	0	0	0	0	0	Pass	-
11_Internal Lab Enabled Floorplate Class E	16:30,22/Jul	35.14	1954	42.6	1256	27.4	669	14.6	Fail	Pass
11_Internal Office Floorplate Class E	15:30,22/Jul	35.08	1979	43.2	1261	27.5	666	14.5	Fail	Pass
11_Server Room	22:30,29/Jul	28.96	0	0	0	0	0	0	Pass	-
11_Stair	20:30,25/Jul	25.87	0	0	0	0	0	0	Pass	-
11_WC	19:30,24/Jul	27.55	0	0	0	0	0	0	Pass	-
11_WC	20:30,24/Jul	28.05	0	0	0	0	0	0	Pass	-
11_WC	17:30,24/Jul	27.47	0	0	0	0	0	0	Pass	-
12_AHU	19:30,23/Jul	28.16	0	0	0	0	0	0	Pass	-
12_AHU	19:30,23/Jul	29.28	0	0	0	0	0	0	Pass	-
12_AHU	18:30,23/Jul	29.75	0	0	0	0	0	0	Pass	-
12_AHU	20:30,23/Jul	29.74	0	0	0	0	0	0	Pass	-
12_Circulation	20:30,24/Jul	25.24	0	0	0	0	0	0	Pass	-
12_Circulation	20:30,24/Jul	25.16	0	0	0	0	0	0	Pass	-
12_Circulation	20:30,24/Jul	24.55	0	0	0	0	0	0	Pass	-
12_Circulation	16:30,22/Jul	33.89	0	0	0	0	0	0	Pass	-
12_Circulation	16:30,22/Jul	34.05	0	0	0	0	0	0	Pass	-
12_Circulation	20:30,28/Jul	28.7	0	0	0	0	0	0	Pass	-
12_Circulation	20:30,24/Jul	24.68	0	0	0	0	0	0	Pass	-
12_Cleaners	07:30,29/Jul	27.43	0	0	0	0	0	0	Pass	-
12_Internal Office Floorplate Class E	15:30,22/Jul	34.88	2008	43.8	1264	27.6	650	14.2	Fail	Pass
12_Internal Office Floorplate Class E	16:30,22/Jul	34.74	1929	42.1	1203	26.2	606	13.2	Fail	Pass
12_Prem Office Floorplate Class E	15:30,22/Jul	35.06	1867	40.7	1182	25.8	607	13.2	Fail	Pass
12_Prem Office Floorplate Class E	16:30,22/Jul	35.09	1793	39.1	1142	24.9	565	12.3	Fail	Pass
12_Prem Office Floorplate Class E	15:30,22/Jul	35.41	1918	41.8	1240	27	658	14.4	Fail	Pass
12_Prem Office Floorplate Class E	14:30,22/Jul	35.41	1933	42.2	1252	27.3	664	14.5	Fail	Pass
12_Server Room	23:30,28/Jul	30.07	0	0	0	0	0	0	Pass	-
12_Server Room	22:30,29/Jul	29.76	0	0	0	0	0	0	Pass	-
12_Stair	20:30,25/Jul	26.05	0	0	0	0	0	0	Pass	-
12_WC	16:30,24/Jul	27.47	0	0	0	0	0	0	Pass	-
12_WC	17:30,24/Jul	27.45	0	0	0	0	0	0	Pass	-
12_WC	20:30,24/Jul	28.04	0	0	0	0	0	0	Pass	-
13_AHU	20:30,23/Jul	27.89	0	0	0	0	0	0	Pass	-
13_AHU	20:30,23/Jul	29.74	0	0	0	0	0	0	Pass	-
13_AHU	17:30,25/Jul	29.29	0	0	0	0	0	0	Pass	-
13_AHU	18:30,23/Jul	29.82	0	0	0	0	0	0	Pass	-
13_Circulation	20:30,24/Jul	24.62	0	0	0	0	0	0	Pass	-
13_Circulation	20:30,28/Jul	28.83	0	0	0	0	0	0	Pass	-
13_Circulation	20:30,24/Jul	24.71	0	0	0	0	0	0	Pass	-
13_Circulation	20:30,24/Jul	25.29	0	0	0	0	0	0	Pass	-
13_Circulation	20:30,24/Jul	25.17	0	0	0	0	0	0	Pass	-

Room Name	Peak Internal Temperature at DSY 365 days, 24hrs a day		Thermal comfort Occupied hours > 26°C		Thermal comfort Occupied hours > 28°C		Thermal comfort Occupied hours > 30°C		Mech Vent	Active Cooling
	Time / Date	(°C)	Total	%	Total	%	Total	%	% Hours over 3%	% Hours over 3%
13_Internal Office Floorplate Class E	15:30,22/Jul	34.87	2136	46.6	1330	29	678	14.8	Fail	Pass
13_Internal Office Floorplate Class E	16:30,22/Jul	34.64	2007	43.8	1234	26.9	621	13.5	Fail	Pass
13_Prem Office Floorplate Class E	15:30,22/Jul	34.62	1856	40.5	1157	25.2	561	12.2	Fail	Pass
13_Prem Office Floorplate Class E	16:30,22/Jul	35	1846	40.3	1159	25.3	575	12.5	Fail	Pass
13_Prem Office Floorplate Class E	14:30,22/Jul	35.4	2006	43.8	1296	28.3	689	15	Fail	Pass
13_Prem Office Floorplate Class E	15:30,22/Jul	35.4	2003	43.7	1283	28	682	14.9	Fail	Pass
13_Stair	20:30,25/Jul	25.97	0	0	0	0	0	0	Pass	-
13_WC	20:30,25/Jul	26.04	0	0	0	0	0	0	Pass	-
14_AHU	20:30,23/Jul	28.04	0	0	0	0	0	0	Pass	-
14_AHU	17:30,25/Jul	29.35	0	0	0	0	0	0	Pass	-
14_AHU	20:30,23/Jul	29.76	0	0	0	0	0	0	Pass	-
14_AHU	18:30,23/Jul	29.89	0	0	0	0	0	0	Pass	-
14_Circulation	20:30,24/Jul	25.28	0	0	0	0	0	0	Pass	-
14_Circulation	20:30,24/Jul	25.17	0	0	0	0	0	0	Pass	-
14_Circulation	20:30,24/Jul	24.62	0	0	0	0	0	0	Pass	-
14_Circulation	20:30,28/Jul	28.88	0	0	0	0	0	0	Pass	-
14_Circulation	20:30,24/Jul	24.72	0	0	0	0	0	0	Pass	-
14_Internal Office Floorplate Class E	16:30,22/Jul	34.76	2059	44.9	1276	27.8	637	13.9	Fail	Pass
14_Internal Office Floorplate Class E	15:30,22/Jul	34.95	2164	47.2	1351	29.5	693	15.1	Fail	Pass
14_Prem Office Floorplate Class E	16:30,22/Jul	35.11	1875	40.9	1186	25.9	596	13	Fail	Pass
14_Prem Office Floorplate Class E	15:30,22/Jul	35.47	2016	44	1308	28.5	696	15.2	Fail	Pass
14_Prem Office Floorplate Class E	15:30,22/Jul	34.88	1912	41.7	1200	26.2	610	13.3	Fail	Pass
14_Prem Office Floorplate Class E	14:30,22/Jul	35.47	2025	44.2	1309	28.5	705	15.4	Fail	Pass
14_Stair	20:30,25/Jul	25.94	0	0	0	0	0	0	Pass	-
14_WC	20:30,25/Jul	25.71	0	0	0	0	0	0	Pass	-
15_AHU	20:30,23/Jul	29.77	0	0	0	0	0	0	Pass	-
15_AHU	17:30,25/Jul	29.38	0	0	0	0	0	0	Pass	-
15_AHU	18:30,23/Jul	29.94	0	0	0	0	0	0	Pass	-
15_AHU	20:30,23/Jul	28.11	0	0	0	0	0	0	Pass	-
15_Circulation	20:30,24/Jul	25.17	0	0	0	0	0	0	Pass	-
15_Circulation	20:30,24/Jul	24.62	0	0	0	0	0	0	Pass	-
15_Circulation	20:30,24/Jul	25.28	0	0	0	0	0	0	Pass	-
15_Circulation	20:30,24/Jul	24.72	0	0	0	0	0	0	Pass	-
15_Circulation	20:30,28/Jul	28.89	0	0	0	0	0	0	Pass	-
15_Internal Office Floorplate Class E	16:30,22/Jul	34.77	2063	45	1277	27.9	639	13.9	Fail	Pass
15_Internal Office Floorplate Class E	15:30,22/Jul	34.95	2167	47.3	1353	29.5	695	15.2	Fail	Pass
15_Prem Office Floorplate Class E	15:30,22/Jul	35.47	2018	44	1307	28.5	698	15.2	Fail	Pass
15_Prem Office Floorplate Class E	15:30,22/Jul	34.89	1914	41.7	1202	26.2	612	13.3	Fail	Pass
15_Prem Office Floorplate Class E	16:30,22/Jul	35.12	1881	41	1189	25.9	599	13.1	Fail	Pass
15_Prem Office Floorplate Class E	14:30,22/Jul	35.47	2025	44.2	1313	28.6	706	15.4	Fail	Pass
15_Stair	20:30,25/Jul	25.94	0	0	0	0	0	0	Pass	-
15_WC	20:30,25/Jul	25.71	0	0	0	0	0	0	Pass	-
16_AHU	17:30,25/Jul	29.41	0	0	0	0	0	0	Pass	-

Room Name	Peak Internal Temperature at DSY 365 days, 24hrs a day		Thermal comfort Occupied hours > 26°C		Thermal comfort Occupied hours > 28°C		Thermal comfort Occupied hours > 30°C		Mech Vent	Active Cooling
	Time / Date	(°C)	Total	%	Total	%	Total	%	% Hours over 3%	% Hours over 3%
16_AHU	20:30,23/Jul	28.17	0	0	0	0	0	0	Pass	-
16_AHU	20:30,23/Jul	29.78	0	0	0	0	0	0	Pass	-
16_AHU	18:30,23/Jul	30	0	0	0	0	0	0	Pass	-
16_Circulation	20:30,24/Jul	24.61	0	0	0	0	0	0	Pass	-
16_Circulation	20:30,24/Jul	25.19	0	0	0	0	0	0	Pass	-
16_Circulation	20:30,24/Jul	25.28	0	0	0	0	0	0	Pass	-
16_Circulation	20:30,24/Jul	24.72	0	0	0	0	0	0	Pass	-
16_Internal Office Floorplate Class E	16:30,22/Jul	34.78	2064	45	1275	27.8	642	14	Fail	Pass
16_Internal Office Floorplate Class E	15:30,22/Jul	34.96	2165	47.2	1350	29.4	695	15.2	Fail	Pass
16_Lift Lobby	20:30,28/Jul	28.92	0	0	0	0	0	0	Fail	Pass
16_Prem Office Floorplate Class E	16:30,22/Jul	35.14	1880	41	1189	25.9	605	13.2	Fail	Pass
16_Prem Office Floorplate Class E	15:30,22/Jul	35.48	2016	44	1306	28.5	699	15.2	Fail	Pass
16_Prem Office Floorplate Class E	15:30,22/Jul	34.9	1913	41.7	1205	26.3	614	13.4	Fail	Pass
16_Prem Office Floorplate Class E	14:30,22/Jul	35.47	2025	44.2	1310	28.6	706	15.4	Fail	Pass
16_Stair	20:30,25/Jul	25.93	0	0	0	0	0	0	Pass	-
16_WC	20:30,25/Jul	25.71	0	0	0	0	0	0	Pass	-
17_AHU	20:30,23/Jul	29.79	0	0	0	0	0	0	Pass	-
17_AHU	17:30,25/Jul	29.44	0	0	0	0	0	0	Pass	-
17_AHU	20:30,23/Jul	28.2	0	0	0	0	0	0	Pass	-
17_AHU	18:30,23/Jul	30.05	0	0	0	0	0	0	Pass	-
17_Circulation	20:30,24/Jul	25.28	0	0	0	0	0	0	Pass	-
17_Circulation	20:30,24/Jul	25.18	0	0	0	0	0	0	Pass	-
17_Circulation	20:30,24/Jul	24.61	0	0	0	0	0	0	Pass	-
17_Circulation	20:30,24/Jul	24.71	0	0	0	0	0	0	Pass	-
17_Circulation	20:30,28/Jul	28.87	0	0	0	0	0	0	Pass	-
17_Internal Office Floorplate Class E	16:30,22/Jul	34.79	2053	44.8	1271	27.7	645	14.1	Fail	Pass
17_Internal Office Floorplate Class E	15:30,22/Jul	34.96	2153	47	1344	29.3	694	15.1	Fail	Pass
17_Prem Office Floorplate Class E	15:30,22/Jul	34.91	1912	41.7	1204	26.3	615	13.4	Fail	Pass
17_Prem Office Floorplate Class E	15:30,22/Jul	35.48	2010	43.8	1302	28.4	696	15.2	Fail	Pass
17_Prem Office Floorplate Class E	14:30,22/Jul	35.47	2020	44.1	1306	28.5	704	15.4	Fail	Pass
17_Prem Office Floorplate Class E	16:30,22/Jul	35.15	1877	40.9	1188	25.9	605	13.2	Fail	Pass
17_Server Room	22:30,28/Jul	30.16	0	0	0	0	0	0	Pass	-
17_Stair	20:30,25/Jul	25.92	0	0	0	0	0	0	Pass	-
17_WC	20:30,25/Jul	25.68	0	0	0	0	0	0	Pass	-
18_AHU	18:30,23/Jul	30.09	0	0	0	0	0	0	Pass	-
18_AHU	20:30,23/Jul	28.23	0	0	0	0	0	0	Pass	-
18_AHU	20:30,23/Jul	29.81	0	0	0	0	0	0	Pass	-
18_AHU	17:30,25/Jul	29.45	0	0	0	0	0	0	Pass	-
18_Circulation	20:30,28/Jul	28.81	0	0	0	0	0	0	Pass	-
18_Circulation	20:30,24/Jul	24.67	0	0	0	0	0	0	Pass	-
18_Circulation	20:30,24/Jul	25.3	0	0	0	0	0	0	Pass	-
18_Circulation	20:30,24/Jul	24.57	0	0	0	0	0	0	Pass	-
18_Circulation	20:30,24/Jul	25.18	0	0	0	0	0	0	Pass	-

Room Name	Peak Internal Temperature at DSY 365 days, 24hrs a day		Thermal comfort Occupied hours > 26°C		Thermal comfort Occupied hours > 28°C		Thermal comfort Occupied hours > 30°C		Mech Vent	Active Cooling
	Time / Date	(°C)	Total	%	Total	%	Total	%	% Hours over 3%	% Hours over 3%
18_Internal Office Floorplate Class E	15:30,22/Jul	34.93	2103	45.9	1317	28.7	679	14.8	Fail	Pass
18_Internal Office Floorplate Class E	16:30,22/Jul	34.77	2029	44.3	1255	27.4	634	13.8	Fail	Pass
18_Prem Office Floorplate Class E	15:30,22/Jul	34.9	1896	41.4	1194	26	605	13.2	Fail	Pass
18_Prem Office Floorplate Class E	14:30,22/Jul	35.39	1958	42.7	1268	27.7	671	14.6	Fail	Pass
18_Prem Office Floorplate Class E	16:30,22/Jul	35.14	1861	40.6	1180	25.7	600	13.1	Fail	Pass
18_Prem Office Floorplate Class E	15:30,22/Jul	35.45	1982	43.2	1274	27.8	687	15	Fail	Pass
18_Stair	20:30,25/Jul	25.9	0	0	0	0	0	0	Pass	-
18_WC	20:30,25/Jul	25.7	0	0	0	0	0	0	Pass	-
19_AHU	16:30,22/Jul	30.02	0	0	0	0	0	0	Pass	-
19_AHU	18:30,23/Jul	30.65	0	0	0	0	0	0	Pass	-
19_AHU	20:30,23/Jul	29.82	0	0	0	0	0	0	Pass	-
19_AHU	20:30,23/Jul	28.26	0	0	0	0	0	0	Pass	-
19_Circulation	20:30,28/Jul	28.68	0	0	0	0	0	0	Pass	-
19_Circulation	20:30,24/Jul	24.67	0	0	0	0	0	0	Pass	-
19_Circulation	20:30,24/Jul	24.57	0	0	0	0	0	0	Pass	-
19_Circulation	20:30,24/Jul	25.16	0	0	0	0	0	0	Pass	-
19_Circulation	20:30,24/Jul	25.28	0	0	0	0	0	0	Pass	-
19_Internal Office Floorplate Class E	16:30,22/Jul	34.82	2031	44.3	1278	27.9	656	14.3	Fail	Pass
19_Internal Office Floorplate Class E	16:30,22/Jul	35.05	2118	46.2	1360	29.7	721	15.7	Fail	Pass
19_Prem Office Floorplate Class E	15:30,22/Jul	35.54	2004	43.7	1310	28.6	722	15.7	Fail	Pass
19_Prem Office Floorplate Class E	16:30,22/Jul	35.17	1871	40.8	1192	26	611	13.3	Fail	Pass
19_Prem Office Floorplate Class E	15:30,22/Jul	35.55	2136	46.6	1428	31.1	815	17.8	Fail	Pass
19_Prem Office Floorplate Class E	15:30,22/Jul	34.92	1897	41.4	1208	26.3	619	13.5	Fail	Pass
19_Stair	20:30,25/Jul	25.95	0	0	0	0	0	0	Pass	-
19_WC	20:30,25/Jul	25.71	0	0	0	0	0	0	Pass	-
20_AHU	16:30,22/Jul	29.84	0	0	0	0	0	0	Pass	-
20_AHU	20:30,23/Jul	29.81	0	0	0	0	0	0	Pass	-
20_AHU	18:30,23/Jul	30.49	0	0	0	0	0	0	Pass	-
20_AHU	20:30,23/Jul	28.27	0	0	0	0	0	0	Pass	-
20_Circulation	20:30,23/Jul	26.27	0	0	0	0	0	0	Pass	-
20_Circulation	20:30,25/Jul	28.45	0	0	0	0	0	0	Pass	-
20_Circulation	21:30,24/Jul	27.2	0	0	0	0	0	0	Pass	-
20_Circulation	20:30,23/Jul	26.25	0	0	0	0	0	0	Pass	-
20_Circulation	20:30,24/Jul	25.29	0	0	0	0	0	0	Pass	-
20_Circulation	20:30,24/Jul	25.17	0	0	0	0	0	0	Pass	-
20_Internal Office Floorplate Class E	16:30,22/Jul	35.05	2011	43.9	1236	27	623	13.6	Fail	Pass
20_Internal Office Floorplate Class E	16:30,22/Jul	34.78	1951	42.6	1191	26	597	13	Fail	Pass
20_Plant	20:30,24/Jul	27.53	0	0	0	0	0	0	Fail	Pass
20_Prem Office Floorplate Class E	16:30,22/Jul	34.87	1836	40	1150	25.1	563	12.3	Fail	Pass
20_Prem Office Floorplate Class E	16:30,22/Jul	35.13	1800	39.3	1130	24.6	567	12.4	Fail	Pass
20_Prem Office Floorplate Class E	15:30,22/Jul	35.65	1989	43.4	1232	26.9	626	13.7	Fail	Pass
20_Prem Office Floorplate Class E	16:30,22/Jul	35.51	1904	41.5	1210	26.4	639	13.9	Fail	Pass
20_WC	18:30,23/Jul	26.47	0	0	0	0	0	0	Pass	-

Room Name	Peak Internal Temperature at DSY 365 days, 24hrs a day		Thermal comfort Occupied hours > 26°C		Thermal comfort Occupied hours > 28°C		Thermal comfort Occupied hours > 30°C		Mech Vent	Active Cooling
	Time / Date	(°C)	Total	%	Total	%	Total	%	% Hours over 3%	% Hours over 3%
21_AHU	18:30,23/Jul	30.21	0	0	0	0	0	0	Pass	-
21_AHU	20:30,23/Jul	28.31	0	0	0	0	0	0	Pass	-
21_AHU	19:30,23/Jul	29.33	0	0	0	0	0	0	Pass	-
21_AHU	20:30,23/Jul	29.83	0	0	0	0	0	0	Pass	-
21_Circulation	20:30,28/Jul	28.22	0	0	0	0	0	0	Pass	-
21_Circulation	20:30,24/Jul	25.19	0	0	0	0	0	0	Pass	-
21_Circulation	20:30,24/Jul	24.59	0	0	0	0	0	0	Pass	-
21_Circulation	20:30,24/Jul	25.09	0	0	0	0	0	0	Pass	-
21_Circulation	00:30,26/Jul	24.51	0	0	0	0	0	0	Pass	-
21_Internal Office Floorplate Class E	16:30,22/Jul	34.68	1943	42.4	1200	26.2	602	13.1	Fail	Pass
21_Internal Office Floorplate Class E	16:30,22/Jul	34.81	1989	43.4	1242	27.1	629	13.7	Fail	Pass
21_Plant	19:30,24/Jul	26.19	0	0	0	0	0	0	Fail	Pass
21_Prem Office Floorplate Class E	15:30,22/Jul	35.32	1901	41.5	1215	26.5	635	13.8	Fail	Pass
21_Prem Office Floorplate Class E	14:30,22/Jul	34.98	1840	40.1	1175	25.6	587	12.8	Fail	Pass
21_Prem Office Floorplate Class E	15:30,22/Jul	34.8	1844	40.2	1150	25.1	567	12.4	Fail	Pass
21_Prem Office Floorplate Class E	16:30,22/Jul	35.05	1798	39.2	1133	24.7	567	12.4	Fail	Pass
21_Stair	20:30,25/Jul	25.39	0	0	0	0	0	0	Pass	-
21_WC	20:30,25/Jul	25.68	0	0	0	0	0	0	Pass	-
22_AHU	16:30,22/Jul	29.66	0	0	0	0	0	0	Pass	-
22_AHU	20:30,23/Jul	29.86	0	0	0	0	0	0	Pass	-
22_AHU	20:30,23/Jul	28.35	0	0	0	0	0	0	Pass	-
22_AHU	18:30,23/Jul	30.32	0	0	0	0	0	0	Pass	-
22_Circulation	20:30,24/Jul	25.23	0	0	0	0	0	0	Pass	-
22_Circulation	20:30,24/Jul	24.54	0	0	0	0	0	0	Pass	-
22_Circulation	20:30,28/Jul	28.37	0	0	0	0	0	0	Pass	-
22_Circulation	20:30,24/Jul	25.15	0	0	0	0	0	0	Pass	-
22_Circulation	20:30,24/Jul	24.65	0	0	0	0	0	0	Pass	-
22_Internal Office Floorplate Class E	15:30,22/Jul	34.95	2078	45.3	1306	28.5	671	14.6	Fail	Pass
22_Internal Office Floorplate Class E	16:30,22/Jul	34.75	1967	42.9	1218	26.6	618	13.5	Fail	Pass
22_Plant	20:30,24/Jul	26.6	0	0	0	0	0	0	Fail	Pass
22_Prem Office Floorplate Class E	15:30,22/Jul	35.46	1963	42.8	1262	27.5	675	14.7	Fail	Pass
22_Prem Office Floorplate Class E	14:30,22/Jul	35.44	1964	42.8	1275	27.8	676	14.7	Fail	Pass
22_Prem Office Floorplate Class E	16:30,22/Jul	35.12	1814	39.6	1154	25.2	582	12.7	Fail	Pass
22_Prem Office Floorplate Class E	15:30,22/Jul	34.87	1859	40.5	1165	25.4	584	12.7	Fail	Pass
22_Stair	20:30,25/Jul	25.84	0	0	0	0	0	0	Pass	-
22_WC	20:30,25/Jul	25.69	0	0	0	0	0	0	Pass	-
23_AHU	20:30,23/Jul	29.88	0	0	0	0	0	0	Pass	-
23_AHU	20:30,23/Jul	28.38	0	0	0	0	0	0	Pass	-
23_AHU	18:30,23/Jul	30.39	0	0	0	0	0	0	Pass	-
23_AHU	16:30,22/Jul	29.72	0	0	0	0	0	0	Pass	-
23_Circulation	20:30,24/Jul	24.6	0	0	0	0	0	0	Pass	-
23_Circulation	20:30,24/Jul	25.26	0	0	0	0	0	0	Pass	-
23_Circulation	20:30,28/Jul	28.81	0	0	0	0	0	0	Pass	-

Room Name	Peak Internal Temperature at DSY 365 days, 24hrs a day		Thermal comfort Occupied hours > 26°C		Thermal comfort Occupied hours > 28°C		Thermal comfort Occupied hours > 30°C		Mech Vent	Active Cooling
	Time / Date	(°C)	Total	%	Total	%	Total	%	% Hours over 3%	% Hours over 3%
23_Circulation	20:30,24/Jul	24.7	0	0	0	0	0	0	Pass	-
23_Circulation	20:30,24/Jul	25.2	0	0	0	0	0	0	Pass	-
23_Internal Office Floorplate Class E	16:30,22/Jul	34.77	2043	44.6	1262	27.5	636	13.9	Fail	Pass
23_Internal Office Floorplate Class E	15:30,22/Jul	34.92	2126	46.4	1326	28.9	680	14.8	Fail	Pass
23_Prem Office Floorplate Class E	16:30,22/Jul	35.13	1871	40.8	1185	25.8	601	13.1	Fail	Pass
23_Prem Office Floorplate Class E	15:30,22/Jul	34.89	1901	41.5	1192	26	604	13.2	Fail	Pass
23_Prem Office Floorplate Class E	15:30,22/Jul	35.43	1998	43.6	1277	27.9	685	14.9	Fail	Pass
23_Prem Office Floorplate Class E	14:30,22/Jul	35.41	1994	43.5	1295	28.2	690	15	Fail	Pass
23_Server	22:30,28/Jul	30.11	0	0	0	0	0	0	Pass	-
23_Stair	20:30,25/Jul	25.92	0	0	0	0	0	0	Pass	-
23_WC	20:30,25/Jul	25.67	0	0	0	0	0	0	Pass	-
24_AHU	20:30,23/Jul	29.89	0	0	0	0	0	0	Pass	-
24_AHU	16:30,22/Jul	29.8	0	0	0	0	0	0	Pass	-
24_AHU	20:30,23/Jul	28.43	0	0	0	0	0	0	Pass	-
24_AHU	18:30,23/Jul	30.46	0	0	0	0	0	0	Pass	-
24_Circulation	20:30,24/Jul	24.72	0	0	0	0	0	0	Pass	-
24_Circulation	20:30,24/Jul	25.29	0	0	0	0	0	0	Pass	-
24_Circulation	20:30,24/Jul	25.32	0	0	0	0	0	0	Pass	-
24_Circulation	20:30,28/Jul	28.96	0	0	0	0	0	0	Pass	-
24_Circulation	20:30,24/Jul	24.7	0	0	0	0	0	0	Pass	-
24_Internal Office Floorplate Class E	16:30,22/Jul	34.8	2028	44.2	1258	27.4	640	14	Fail	Pass
24_Internal Office Floorplate Class E	15:30,22/Jul	34.95	2126	46.4	1326	28.9	685	14.9	Fail	Pass
24_Prem Office Floorplate Class E	16:30,22/Jul	35.14	1858	40.5	1178	25.7	597	13	Fail	Pass
24_Prem Office Floorplate Class E	15:30,22/Jul	35.46	2001	43.6	1283	28	691	15.1	Fail	Pass
24_Prem Office Floorplate Class E	14:30,22/Jul	35.44	1999	43.6	1298	28.3	694	15.1	Fail	Pass
24_Prem Office Floorplate Class E	15:30,22/Jul	34.93	1900	41.4	1196	26.1	606	13.2	Fail	Pass
24_Stair	20:30,25/Jul	25.95	0	0	0	0	0	0	Pass	-
24_WC	20:30,25/Jul	25.72	0	0	0	0	0	0	Pass	-
25_AHU	16:30,22/Jul	30.05	0	0	0	0	0	0	Pass	-
25_AHU	20:30,23/Jul	29.05	0	0	0	0	0	0	Pass	-
25_AHU	20:30,23/Jul	30.12	0	0	0	0	0	0	Pass	-
25_AHU	18:30,23/Jul	30.55	0	0	0	0	0	0	Pass	-
25_Circulation	21:30,24/Jul	25.9	0	0	0	0	0	0	Pass	-
25_Circulation	20:30,24/Jul	24.79	0	0	0	0	0	0	Pass	-
25_Circulation	20:30,24/Jul	25.2	0	0	0	0	0	0	Pass	-
25_Circulation	20:30,24/Jul	25.4	0	0	0	0	0	0	Pass	-
25_Circulation	20:30,28/Jul	29.22	0	0	0	0	0	0	Pass	-
25_Internal Office Floorplate Class E	16:30,22/Jul	35.57	2162	47.2	1353	29.5	733	16	Fail	Pass
25_Internal Office Floorplate Class E	16:30,22/Jul	36.16	2321	50.6	1409	30.7	775	16.9	Fail	Pass
25_Prem Office Floorplate Class E	16:30,22/Jul	36.6	2034	44.4	1340	29.2	775	16.9	Fail	Pass
25_Prem Office Floorplate Class E	16:30,22/Jul	35.91	1992	43.4	1288	28.1	706	15.4	Fail	Pass
25_Prem Office Floorplate Class E	16:30,22/Jul	35.97	2001	43.6	1307	28.5	734	16	Fail	Pass
25_Prem Office Floorplate Class E	14:30,22/Jul	35.84	2016	44	1318	28.7	744	16.2	Fail	Pass

Room Name	Peak Internal Temperature at DSY 365 days, 24hrs a day		Thermal comfort Occupied hours > 26°C		Thermal comfort Occupied hours > 28°C		Thermal comfort Occupied hours > 30°C		Mech Vent	Active Cooling
	Time / Date	(°C)	Total	%	Total	%	Total	%	% Hours over 3%	% Hours over 3%
25_Stair	20:30,25/Jul	26.02	0	0	0	0	0	0	Pass	-
25_WC	20:30,25/Jul	25.85	0	0	0	0	0	0	Pass	-
26_AHU	18:30,23/Jul	30.59	0	0	0	0	0	0	Pass	-
26_AHU	20:30,23/Jul	30.09	0	0	0	0	0	0	Pass	-
26_AHU	20:30,23/Jul	30.67	0	0	0	0	0	0	Pass	-
26_AHU	16:30,22/Jul	31.86	0	0	0	0	0	0	Pass	-
26_Circulation	19:30,24/Jul	30	0	0	0	0	0	0	Pass	-
26_Circulation	19:30,24/Jul	29.01	0	0	0	0	0	0	Pass	-
26_Circulation	20:30,24/Jul	25.35	0	0	0	0	0	0	Pass	-
26_Circulation	20:30,25/Jul	30.49	0	0	0	0	0	0	Pass	-
26_Circulation	20:30,24/Jul	24.89	0	0	0	0	0	0	Pass	-
26_Internal Office Floorplate Class E	16:30,22/Jul	35.4	2112	46.1	1319	28.8	691	15.1	Fail	Pass
26_Internal Office Floorplate Class E	16:30,22/Jul	35.84	2214	48.3	1309	28.5	695	15.2	Fail	Pass
26_Prem Office Floorplate Class E	16:30,22/Jul	35.66	1938	42.3	1238	27	653	14.2	Fail	Pass
26_Prem Office Floorplate Class E	16:30,22/Jul	35.82	1959	42.7	1265	27.6	700	15.3	Fail	Pass
26_Prem Office Floorplate Class E	14:30,22/Jul	35.71	1976	43.1	1281	27.9	704	15.4	Fail	Pass
26_Prem Office Floorplate Class E	16:30,22/Jul	36.34	2011	43.9	1281	27.9	723	15.8	Fail	Pass
26_Server	23:30,28/Jul	30.7	0	0	0	0	0	0	Pass	-
26_Stair	20:30,25/Jul	26.21	0	0	0	0	0	0	Pass	-
26_WC	16:30,24/Jul	27.07	0	0	0	0	0	0	Pass	-
27_AHU	20:30,23/Jul	28.69	0	0	0	0	0	0	Pass	-
27_AHU	16:30,22/Jul	30.22	0	0	0	0	0	0	Pass	-
27_AHU	18:30,23/Jul	30.65	0	0	0	0	0	0	Pass	-
27_AHU	20:30,23/Jul	29.95	0	0	0	0	0	0	Pass	-
27_Circulation	20:30,28/Jul	29.24	0	0	0	0	0	0	Pass	-
27_Circulation	20:30,24/Jul	25.14	0	0	0	0	0	0	Pass	-
27_Circulation	20:30,24/Jul	25.31	0	0	0	0	0	0	Pass	-
27_Circulation	21:30,24/Jul	25.82	0	0	0	0	0	0	Pass	-
27_Circulation	20:30,24/Jul	24.78	0	0	0	0	0	0	Pass	-
27_Internal Office Floorplate Class E	16:30,22/Jul	35.03	2084	45.5	1298	28.3	671	14.6	Fail	Pass
27_Internal Office Floorplate Class E	16:30,22/Jul	35.08	2015	43.9	1249	27.2	634	13.8	Fail	Pass
27_Prem Office Floorplate Class E	16:30,22/Jul	35.09	1861	40.6	1172	25.6	605	13.2	Fail	Pass
27_Prem Office Floorplate Class E	15:30,22/Jul	35.52	1962	42.8	1263	27.5	678	14.8	Fail	Pass
27_Prem Office Floorplate Class E	16:30,22/Jul	35.31	1818	39.7	1135	24.8	584	12.7	Fail	Pass
27_Prem Office Floorplate Class E	14:30,22/Jul	35.48	1966	42.9	1271	27.7	679	14.8	Fail	Pass
27_WC	20:30,25/Jul	25.83	0	0	0	0	0	0	Pass	-
28_AHU	16:30,22/Jul	30.21	0	0	0	0	0	0	Pass	-
28_AHU	18:30,23/Jul	30.89	0	0	0	0	0	0	Pass	-
28_AHU	20:30,23/Jul	29.97	0	0	0	0	0	0	Pass	-
28_AHU	20:30,23/Jul	28.64	0	0	0	0	0	0	Pass	-
28_Circulation	20:30,24/Jul	24.78	0	0	0	0	0	0	Pass	-
28_Circulation	20:30,24/Jul	24.7	0	0	0	0	0	0	Pass	-
28_Circulation	20:30,24/Jul	25.37	0	0	0	0	0	0	Pass	-

Room Name	Peak Internal Temperature at DSY 365 days, 24hrs a day		Thermal comfort Occupied hours > 26°C		Thermal comfort Occupied hours > 28°C		Thermal comfort Occupied hours > 30°C		Mech Vent	Active Cooling
	Time / Date	(°C)	Total	%	Total	%	Total	%	% Hours over 3%	% Hours over 3%
28_Circulation	20:30,24/Jul	25.25	0	0	0	0	0	0	Pass	-
28_Circulation	20:30,28/Jul	29.35	0	0	0	0	0	0	Pass	-
28_Internal Office Floorplate Class E	15:30,22/Jul	34.94	2086	45.5	1300	28.4	671	14.6	Fail	Pass
28_Internal Office Floorplate Class E	16:30,22/Jul	34.8	2009	43.8	1246	27.2	630	13.7	Fail	Pass
28_Prem Office Floorplate Class E	15:30,22/Jul	34.93	1881	41	1183	25.8	595	13	Fail	Pass
28_Prem Office Floorplate Class E	16:30,22/Jul	35.17	1847	40.3	1172	25.6	596	13	Fail	Pass
28_Prem Office Floorplate Class E	14:30,22/Jul	35.43	1971	43	1281	27.9	677	14.8	Fail	Pass
28_Prem Office Floorplate Class E	15:30,22/Jul	35.45	1964	42.8	1263	27.5	676	14.7	Fail	Pass
28_Stair	20:30,25/Jul	26	0	0	0	0	0	0	Pass	-
28_WC	20:30,25/Jul	25.73	0	0	0	0	0	0	Pass	-
29_AHU	20:30,23/Jul	30.11	0	0	0	0	0	0	Pass	-
29_AHU	19:30,23/Jul	33.47	0	0	0	0	0	0	Pass	-
29_AHU	20:30,23/Jul	28.86	0	0	0	0	0	0	Pass	-
29_AHU	16:30,22/Jul	30.48	0	0	0	0	0	0	Pass	-
29_Circulation	21:30,24/Jul	25.24	0	0	0	0	0	0	Pass	-
29_Circulation	20:30,24/Jul	25.83	0	0	0	0	0	0	Pass	-
29_Circulation	20:30,22/Jul	32.8	0	0	0	0	0	0	Pass	-
29_Circulation	20:30,24/Jul	24.71	0	0	0	0	0	0	Pass	-
29_Circulation	20:30,24/Jul	30.61	0	0	0	0	0	0	Pass	-
29_Circulation	20:30,24/Jul	25.11	0	0	0	0	0	0	Pass	-
29_Internal Office Floorplate Class E	16:30,22/Jul	35.49	1979	43.2	1189	25.9	623	13.6	Fail	Pass
29_Internal Office Floorplate Class E	16:30,22/Jul	35.13	1885	41.1	1135	24.8	572	12.5	Fail	Pass
29_Prem Office Floorplate Class E	16:30,22/Jul	35.11	1753	38.2	1080	23.6	541	11.8	Fail	Pass
29_Prem Office Floorplate Class E	14:30,22/Jul	35.66	1846	40.3	1174	25.6	625	13.6	Fail	Pass
29_Prem Office Floorplate Class E	16:30,22/Jul	35.8	1836	40	1163	25.4	628	13.7	Fail	Pass
29_Prem Office Floorplate Class E	16:30,22/Jul	35.42	1735	37.8	1071	23.4	551	12	Fail	Pass
29_Stair	20:30,25/Jul	26.16	0	0	0	0	0	0	Pass	-
29_WC	20:30,25/Jul	25.86	0	0	0	0	0	0	Pass	-
30_AHU	20:30,23/Jul	32.26	0	0	0	0	0	0	Pass	-
30_AHU	16:30,22/Jul	32.62	0	0	0	0	0	0	Pass	-
30_AHU	20:30,23/Jul	29.9	0	0	0	0	0	0	Pass	-
30_AHU	20:30,23/Jul	32.72	0	0	0	0	0	0	Pass	-
30_Circulation	20:30,24/Jul	29.66	0	0	0	0	0	0	Pass	-
30_Circulation	19:30,24/Jul	29.57	0	0	0	0	0	0	Pass	-
30_Circulation	21:30,24/Jul	25.67	0	0	0	0	0	0	Pass	-
30_Circulation	21:30,24/Jul	25.7	0	0	0	0	0	0	Pass	-
30_Circulation	18:30,24/Jul	30.49	0	0	0	0	0	0	Pass	-
30_Circulation	18:30,24/Jul	31.39	0	0	0	0	0	0	Pass	-
30_Circulation	16:30,22/Jul	34.33	0	0	0	0	0	0	Pass	-
30_Internal Office Floorplate Class E	16:30,22/Jul	34.42	1539	33.6	886	19.3	408	8.9	Fail	Pass
30_Plant	17:30,23/Jul	33.81	0	0	0	0	0	0	Fail	Pass
30_Plant	17:30,23/Jul	33.8	772	16.8	363	7.9	91	2	Fail	Pass
30_Plant	17:30,23/Jul	34.88	845	18.4	435	9.5	163	3.6	Fail	Pass

Room Name	Peak Internal Temperature at DSY 365 days, 24hrs a day		Thermal comfort Occupied hours > 26°C		Thermal comfort Occupied hours > 28°C		Thermal comfort Occupied hours > 30°C		Mech Vent	Active Cooling
	Time / Date	(°C)	Total	%	Total	%	Total	%	% Hours over 3%	% Hours over 3%
30_Prem Office Floorplate Class E	16:30,22/Jul	34.82	1491	32.5	869	19	427	9.3	Fail	Pass
30_Prem Office Floorplate Class E	16:30,22/Jul	34.96	1524	33.2	903	19.7	468	10.2	Fail	Pass
30_Prem Office Floorplate Class E	15:30,22/Jul	34.81	1537	33.5	918	20	453	9.9	Fail	Pass
30_Stair	20:30,24/Jul	26.98	0	0	0	0	0	0	Pass	-
30_WC	17:30,24/Jul	27.82	0	0	0	0	0	0	Pass	-
B01_Bike Store	20:30,25/Jul	26.52	0	0	0	0	0	0	Pass	-
B01_Circulation	17:30,24/Jul	26.61	0	0	0	0	0	0	Pass	-
B01_Circulation	23:30,09/Aug	21.9	0	0	0	0	0	0	Pass	-
B01_Circulation	00:30,10/Aug	22.05	0	0	0	0	0	0	Pass	-
B01_Circulation	21:30,28/Jul	23.44	0	0	0	0	0	0	Pass	-
B01_Circulation	21:30,28/Jul	23.76	0	0	0	0	0	0	Pass	-
B01_Circulation	07:30,30/Jul	22.77	0	0	0	0	0	0	Pass	-
B01_Circulation	21:30,27/Jul	23.55	0	0	0	0	0	0	Pass	-
B01_Circulation	23:30,09/Aug	21.72	0	0	0	0	0	0	Pass	-
B01_Circulation	03:30,30/Jul	20.33	0	0	0	0	0	0	Pass	-
B01_Open Store	00:30,30/Jul	19.55	0	0	0	0	0	0	Pass	-
B01_Plant	17:30,25/Jul	22.62	0	0	0	0	0	0	Pass	-
B01_Plant	17:30,25/Jul	23.37	0	0	0	0	0	0	Pass	-
B01_Plant	17:30,25/Jul	23.04	0	0	0	0	0	0	Pass	-
B01_Plant	17:30,25/Jul	22.96	0	0	0	0	0	0	Pass	-
B01_Plant	17:30,25/Jul	22.62	0	0	0	0	0	0	Pass	-
B01_Plant	17:30,25/Jul	22.65	0	0	0	0	0	0	Pass	-
B01_Plant	17:30,25/Jul	23.04	0	0	0	0	0	0	Pass	-
B01_Plant	17:30,25/Jul	23.43	0	0	0	0	0	0	Pass	-
B01_Plant	17:30,24/Jul	26.31	0	0	0	0	0	0	Pass	-
B01_Plant	18:30,24/Jul	25.12	0	0	0	0	0	0	Pass	-
B01_Plant	17:30,25/Jul	23.71	0	0	0	0	0	0	Pass	-
B01_Plant	20:30,24/Jul	24.08	0	0	0	0	0	0	Pass	-
B01_Plant	17:30,25/Jul	23.25	0	0	0	0	0	0	Pass	-
B01_Plant	19:30,24/Jul	25.43	0	0	0	0	0	0	Pass	-
B01_Plant	17:30,25/Jul	22.77	0	0	0	0	0	0	Pass	-
B01_Plant	17:30,25/Jul	23.53	0	0	0	0	0	0	Pass	-
B01_Plant	17:30,25/Jul	23.73	0	0	0	0	0	0	Pass	-
B01_Plant	17:30,24/Jul	27.18	0	0	0	0	0	0	Pass	-
B01_Plant	17:30,25/Jul	23.11	0	0	0	0	0	0	Pass	-
B01_Plant	17:30,25/Jul	22.76	0	0	0	0	0	0	Pass	-
B01_Plant	17:30,25/Jul	23.66	0	0	0	0	0	0	Pass	-
B01_Plant	17:30,25/Jul	23.29	0	0	0	0	0	0	Pass	-
B01_Plant	17:30,25/Jul	22.85	0	0	0	0	0	0	Pass	-
B01_Plant	17:30,24/Jul	24.39	0	0	0	0	0	0	Pass	-
B01_Plant	17:30,24/Jul	27.52	0	0	0	0	0	0	Pass	-
B01_Plant	17:30,25/Jul	23.31	0	0	0	0	0	0	Pass	-
B01_Plant	17:30,25/Jul	23.85	0	0	0	0	0	0	Pass	-

Room Name	Peak Internal Temperature at DSY 365 days, 24hrs a day		Thermal comfort Occupied hours > 26°C		Thermal comfort Occupied hours > 28°C		Thermal comfort Occupied hours > 30°C		Mech Vent	Active Cooling
	Time / Date	(°C)	Total	%	Total	%	Total	%	% Hours over 3%	% Hours over 3%
B01_Plant	17:30,25/Jul	22.73	0	0	0	0	0	0	Pass	-
B01_Plant	17:30,25/Jul	22.76	0	0	0	0	0	0	Pass	-
B01_Plant	17:30,25/Jul	22.85	0	0	0	0	0	0	Pass	-
B01_Plant	17:30,25/Jul	22.44	0	0	0	0	0	0	Pass	-
B01_Plant	17:30,25/Jul	23.6	0	0	0	0	0	0	Pass	-
B01_Plant	17:30,25/Jul	22.7	0	0	0	0	0	0	Pass	-
B01_Plant	17:30,25/Jul	23.23	0	0	0	0	0	0	Pass	-
B01_Plant	17:30,25/Jul	23.25	0	0	0	0	0	0	Pass	-
B01_Room	04:30,30/Jul	20.67	0	0	0	0	0	0	Pass	-
B01_Showers/ Lockers	16:30,25/Jul	24.92	0	0	0	0	0	0	Pass	-
B01_Stair	19:30,25/Jul	24.89	0	0	0	0	0	0	Pass	-
B01_Stair	16:30,25/Jul	23.57	0	0	0	0	0	0	Pass	-
B01_Stair	16:30,25/Jul	24.38	0	0	0	0	0	0	Pass	-
B02_Circulation	22:30,09/Aug	19.55	0	0	0	0	0	0	Pass	-
B02_Plant	17:30,25/Jul	21.76	0	0	0	0	0	0	Pass	-
B02_Plant	17:30,25/Jul	22.45	0	0	0	0	0	0	Pass	-
B02_Plant	17:30,25/Jul	22.51	0	0	0	0	0	0	Pass	-
B02_Stair	17:30,22/Jul	23.1	0	0	0	0	0	0	Pass	-