Energy Statement

151 Shaftesbury Avenue

Royal London Mutual Insurance Society Limited

3 May 2024

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H|M

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Contents

1. Introduction

Hilson Moran has been commissioned by Royal London Mutual Insurance Society Limited (RLMIS LTD) to provide an Energy Strategy for the proposed refurbishment and extension of 151 Shaftesbury Avenue in London.

The site is located in the London Borough of Camden, at the southwest corner of the junction of Shaftesbury Avenue and St Giles Passage. 151 Shaftesbury Avenue is a mixed-use building completed in 1999 and originally comprising offices, retail and residential elements. The building is arranged over two basement levels, ground and seven upper floors with an access to terrace on the roof.

The commercial offices within the building no longer meet the needs of the market and so RLMIS Ltd are considering an extensive refurbishment, and extension in order to bring the building up to current standards.

Sustainability is a central requirement, both in terms of embodied and operational carbon, to align with RLMIS Ltd's strategic objectives.

The building will need to satisfy future occupiers requirements, add high quality area, long term flexibility and be designed with future adaptability and re-use in mind. With the potential targeting of WELL Certification, the building will create a healthy and inspiring workplace for future tenants.

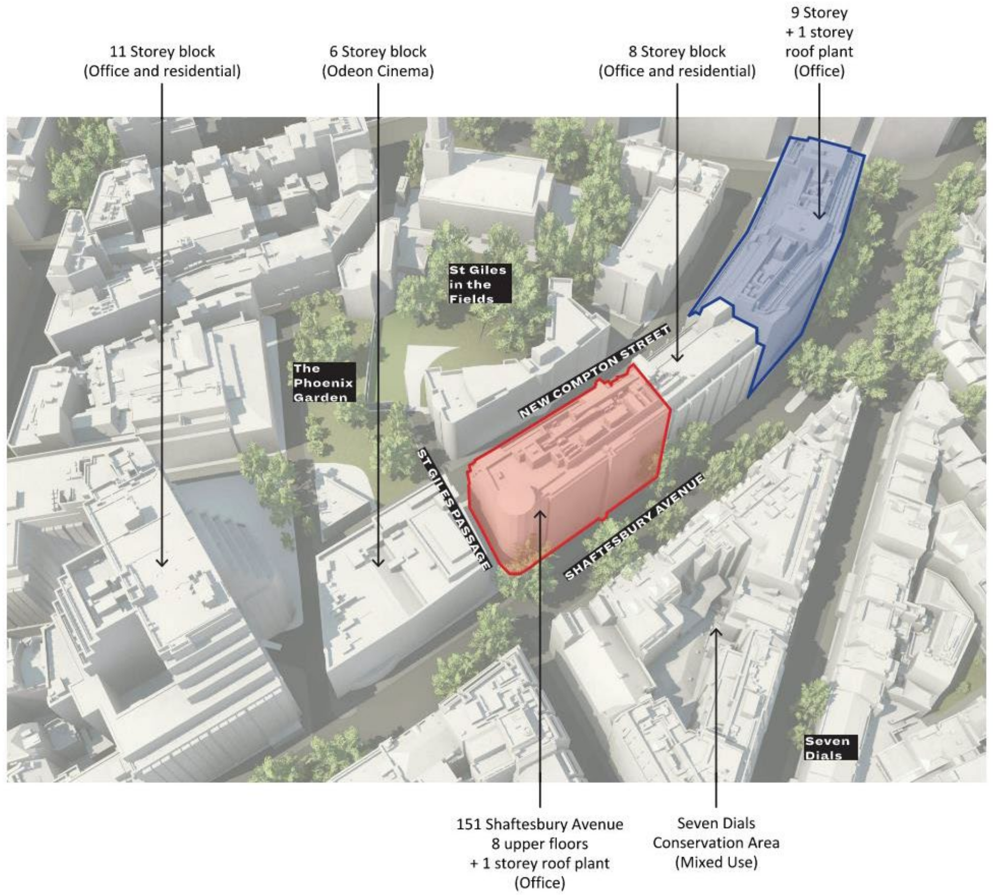


Figure 1-1: Site location aerial view

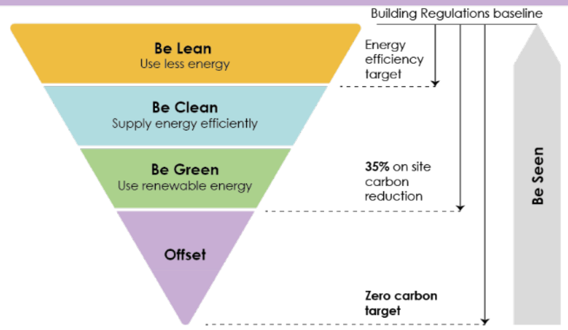
2. Planning Policy

The following tables summarises applicable national and local environmental sustainability policy and the status of the Proposed Development relative to each.

2.1. National Policy	
National Planning Policy Framework MHCLG, December 2023	Sets out the Government's Planning Policies for England and how these are expected to be applied, informing Local Councils and communities with regards to local plans and requirements. The document provides a revised and condensed approach to national planning and sustainability that includes economic, social and environmental roles.
Approved Document L, Conservation of fuel and power, Volume 2: Buildings other than dwellings DCLG, 2021 edition incorporating 2023 amendments	Sets out elemental minimum energy and CO_2 emissions performance standards for all elements of the built environment along with assessment methodologies necessary to confirm compliance. Sets out amendments to the current Part L documents, with regards to the requirements of the provision of an Energy Strategy document, to include the viability assessment of all Low and Zero Carbon technologies. The 2021 edition of the Building Regulations Approved Document Part L came into effect on **15th June 2022** for use in England.

2.2. Regional and Local Policy	
The London Plan Mayor of London, March 2021	The London Plan (March 2021) sets out the London Plan (2016) as the spatial development strategy for London. The London Plan (March 2021) provides a framework to address the key planning issued facing London, allowing boroughs to concentrate on those issues with a distinctly local dimension. **Policy GG6 'Increasing Efficiency and Resilience'** Help London become a more efficient and resilient city: • 'Improve energy efficiency and support move toward a low carbon circular economy' • Ensure buildings are designed to adapt to a changing climate while mitigating and avoiding contributing to the urban heat island effect **Policy D2 'Delivering good design'** **Policy SI2 'Minimising Greenhouse Gas Emissions'** The existing requirements have been strengthened, and some aspirations of the previous plan have been clarified:

2.2. Regional and Local Policy



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 onsite
Be Seen: Monitor, verify and report on energy performance

Policy SI3 'Energy Infrastructure'
Major development proposals within Heat Network Priority Areas should have a communal low-temperature heating system.
The heat source for the communal heating system should be selected in accordance with the following heating hierarchy:

- connect to local existing or planned heat networks
- use available zero-emission or local secondary heat sources (in conjunction with heat pump, if required
- 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).
- Use ultra-low NOx gas boilers.

Policy SI4 'Managing Heat Risk'
Show steps to minimise overheating and avoid active cooling:

- minimise internal heat generation
- reduce the amount of heat entering a building
- manage the heat within the building
- provide passive ventilation
- provide mechanical ventilation
- provide active cooling systems.

London Environment Strategy Mayor of London, 2018	This London Environment Strategy (LES) sets out an ambitious vision for improving London's environment for the benefit of all Londoners. The strategy provides a holistic plan for tackling the city's environmental challenges, including air quality, green infrastructure, climate change mitigation and energy, waste, adapting to climate change, ambient noise and low carbon economy.
Sustainable Design and Construction SPG Mayor of London, 2014	Providing sound sustainability principles, encompassing an integrated holistic approach as well as a high level of detail and best practice guidance.
Energy Planning Guidance Mayor of London, 2022	Provides detail on how to prepare energy assessments to accompany planning applications as set out in the London Plan. The purpose of an energy assessment is to demonstrate that climate change mitigation measures comply with London Plan energy policies, including the energy hierarchy.

2.2. Regional and Local Policy

Be Seen Energy Monitoring Guidance Mayor of London, September 2021	Guidance on the implementation of the London Plan post construction energy monitoring policy. To truly achieve net zero-carbon buildings we need to have a better understanding of their actual operational energy performance and work towards bridging the 'performance gap' between design theory and measured reality. In order to do so, the London Plan introduces a fourth stage to the energy hierarchy; the 'be seen' stage, which requires monitoring and reporting of the actual operational energy performance of major developments for at least five years.
London Borough of Camden Camden Local Plan (2017) Energy efficiency and adaptation CPG (2021)	**CC1 Climate change mitigation** The Council will require 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. **CC2 Adapting to climate change** All developments should adopt appropriate climate change adaptation measures. Non-domestic developments of 500 sqm of floorspace or above to achieve "excellent" in BREEAM assessments and encouraging zero carbon in new development from 2019. **Energy efficiency and adaptation CPG (2021)** • Developments are to target a 20% reduction in carbon dioxide emissions from on-site renewable energy technologies • Energy statements should demonstrate how a development has been designed following the steps in the energy hierarchy ○

Certification	
NABERS UK Design for Performance v2.0	NABERS UK is an adaptation of the highly successful rating programme that operates in Australia. Launched in 1999, NABERS is widely considered to be a world leading environmental performance rating tool for commercial buildings. Design for Performance (DfP) provides a framework by which projects can commit, preconstruction, to achieve a NABERS Energy for Offices rating in post-construction performance. It is done to show compliance with the 'Be Seen' category as the Mayor of London requires non-regulated energy (i.e., outside Building Regulations scope) to be assessed and reduced by major development. The NABERS strategies form a large part of the strategy to achieve NZC in Operation.

Certification	
	151 Shaftesbury Avenue is adopting a DfP approach for planning purposes.

3. London Plan Energy Hierarchy

3.1. London Plan Targets

The London Plan (March 2021) requires major developments to be net zero carbon. This means reducing greenhouse gas emissions in operation and minimising both annual and peak energy demand in accordance with the following energy hierarchy.

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

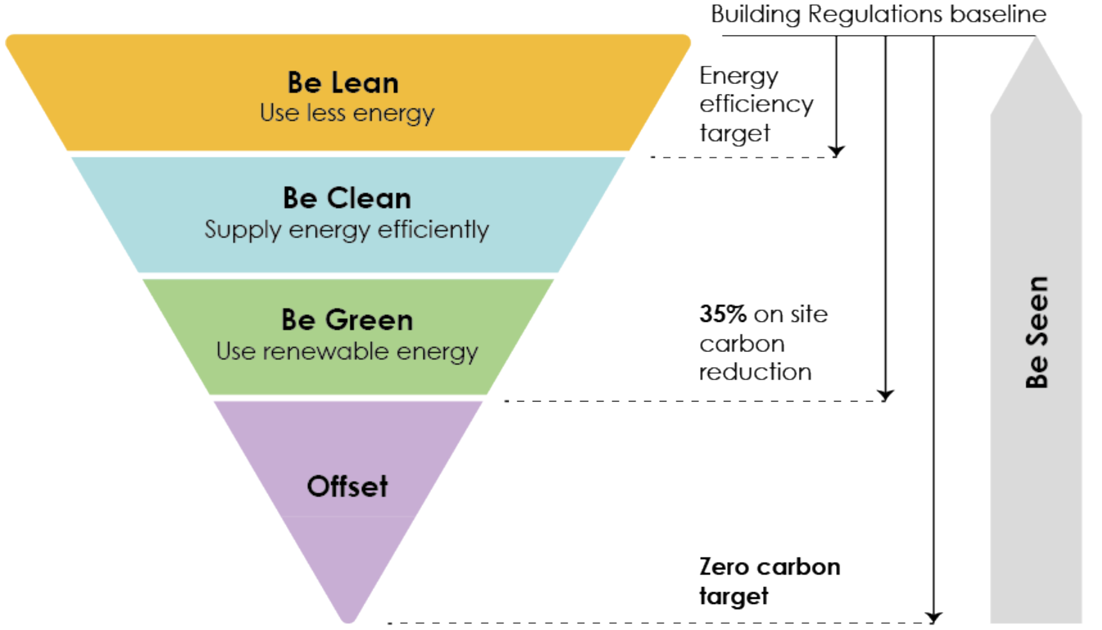


Figure 3-1: The London plan energy hierarchy and associated targets (Source: GLA)

An Energy Strategy Statement is required for every application that follows and shows compliance with the London Plan (March 2021), which indicates that all new major refurbishments shall achieve a net zero carbon performance with a minimum of 35% reduction with **respect to the existing building** of 15% reduction on CO_2 emissions in the “Be lean” stage. **Notional specification for existing buildings listed in Appendix 3 of the GLA Energy Assessment Guidance (July 2022) should be used to establish baseline emissions**. For non-referable applications, applicants should liaise with the respective borough on any local requirements for existing buildings in relation to demonstrating CO_2 emission performance.

The GLA states in the June 2022 cover note that accompanied the Energy Assessment Guidance 2022 update, following the adoption of Part L 2021:

“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.” [1]

Unregulated emissions should also be calculated, and commercial developments >5,000m^2 are encouraged to undergo a NABERS UK Design for Performance assessment to estimate total energy in use and equip the building with detailed energy monitoring infrastructure.

A comprehensive energy and carbon dioxide (CO_2) emissions assessment has been carried out for the development in order to establish the performance of the proposed building against the GLA Energy guidance. This analysis has included:

- A hierarchal design approach to develop an Energy Strategy in line with industry best practice and SI2 of the London Plan (March 2021).
- Baseline model is set up to estimate the CO_2 emissions baseline performance of the existing building, in accordance Appendix 3 of the GLA Energy Assessment Guidance (July 2022) using Building Regulations approved compliance software. The baseline model consists of the existing building with the additional proposed top floor and extension areas on the existing floors.
- The existing building’s building fabric and system efficiencies are modelled in compliance with notional specifications for existing non-residential buildings (Appendix 3 of GLA Energy Assessment Guidance). The baseline model is set up in reference to the GLA Energy Assessment Guidance guidelines below, extracted from the GLA document:
  - *Applicants are required to generate baseline CO_2 emissions assuming the notional specification for existing buildings and which is based on Approved Documents L1 and L2.*
  - *In change of use applications, it is possible that the existing building does not include certain building elements that should be included in the baseline. In this case it is expected that the estimate of the performance of the building element would meet the notional specification for existing buildings.*
- The proposed extensions floors are modelled against Part L 2021 criteria to assess the notional energy performance. Merging the lower existing floors with the proposed top floors and extension areas forms the baseline performance of CO_2 emissions of the existing building.

[1] https://www.london.gov.uk/sites/default/files/energy_assessment_guidance_cover_note_june_2022_july_update.pdf

- A feasibility review of all low and zero carbon technologies, in relation to the 'Be Clean' and 'Be Green' elements of the London Plan Energy Hierarchy.

3.2. London Borough of Camden Targets

The Camden Local Plan sets out the Council's planning policies for the period of 2016-2031. It ensures that Camden continues to have robust, effective, and up to-date planning policies that respond to changing circumstances and the borough's unique characteristics and contribute to delivering the Camden Plan and other local priorities.

The Local Plan is set out to help deliver the objectives of creating the conditions for harnessing the benefits of economic growth, reducing inequality, and securing sustainable neighbourhoods in the local council.

Relevant local policies to this report:

- **CC1 Climate change mitigation:** The Council will require 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. All developments to optimise resource efficiency by enabling low energy and water demands once the building is in use.
- **CC2 Adapting to climate change:** All developments should adopt appropriate climate change adaptation measures including the application of the cooling hierarchy and demonstrate how it has informed the building design.

The council has developed other supporting documents that provide advice and guidance on how the planning policies will be applied for certain topics, areas or sites known as Supplementary Planning Guidance (SPG). The most relevant Camden Planning Guidance (CPG) for this energy statement is the 'Energy Efficiency and Adaptation' guidance developed to support the policies in the Camden Local Plan.

Key targets of the guidance:

- Natural 'passive' measures should be prioritised over active measures to reduce energy.
- All new major developments in Camden are expected to assess the feasibility of decentralised energy network growth if the property is listed in a conservation area.
- Consider the feasibility of renewable energy technologies that can be installed to supplement a development's energy needs.
- All medium and major developments are to target a 20% reduction in carbon dioxide emissions from on-site renewable energy technologies.
- Energy statements are required for all developments with more than 500sqm of any (gross internal) floorspace demonstrating how sustainable design principles have been considered and incorporated in the design.
- All development in Camden is expected to reduce carbon dioxide emissions through the application of the energy hierarchy through the compliance with London Plan targets for carbon dioxide emissions.
- Deep refurbishments (i.e. refurbishments assessed under Building Regulations Part L1A/L2A) should also meet the London Plan carbon reduction targets for new buildings, which requires all major new development to be net zero-carbon by achieving at least a 35% on-site reduction beyond Part L of Building Regulations and to offset any remaining emissions. (not applicable to the Proposed Development, see paragraph below)
- All developments should comply with Local Plan policy CC2, where active cooling is only permitted where needed as per the cooling hierarchy and the risk of overheating is reduced.
- All developments considered as major refurbishments (> 1000m^2) and medium new build (500m^2 and < 1000m^2) are required to achieve the greatest possible overall carbon reduction, meeting Part L for retained thermal elements.
- Only major new build developments (> 1000m^2) are required to achieve the minimum 35% on-site reduction beyond Part L criteria and 15% reduction through on-site energy efficiency measures.

As the Proposed Development increases the floor area of the existing building by 763sqm (GIA), it represents a minor development for planning purposes, but is considered a major refurbishment under Camden Planning Guidance. The 35% on-site carbon reduction beyond Part L for deep refurbishments is not applicable to this development (since it is a major refurbishment but not a deep refurbishment). As per the below building regulations criteria, the extension of this development is not regarded as a new building based on the paragraph below:

'An extension should be regarded as a new building if the proposed extension has a total useful floor area that is both greater than 100m^2 AND greater than 25% of the total useful floor area of the existing building.' – Part L Volume 2, 2021.

Therefore, the Proposed Development is not assessed under Part L 2 new building criteria, sections 1 to 9.

3.3. Targets applicable to the development

The applicable targets covered in this report include achieving 15% reduction through on-site energy efficient measures (as per the GLA Be Lean criteria) and achieving 20% reduction in carbon dioxide emissions from on-site renewable energy technologies (as per the energy reduction targets of the Camden local policy).

3.4. Operational Carbon Emissions

The regulated operational carbon performance in relation to the London Plan 2021 energy hierarchy and policy targets is as follows:

Table 3-1 - Regulated carbon dioxide emission reduction for the Proposed Development compared to the GLA Baseline for the existing building.

	CO_2 Emissions (Tonnes CO_2 per annum)	Policy Minimum targets (Regulated CO_2 emissions)	Performance of the scheme (Regulated CO_2 emissions)
Baseline	**80.2**	**-**	**-**
Be lean	**32.1**	**15%**	**60%**
Be clean	**32.1**	**-**	**-**
Be green	**29.4**	**35%**	**63%**

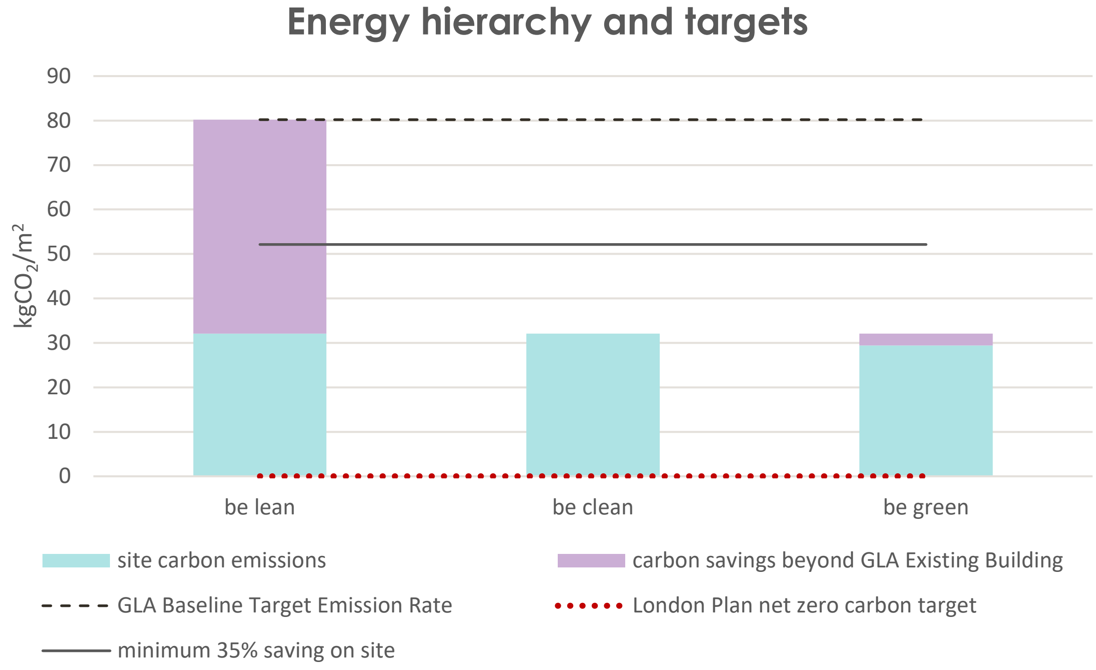


Figure 3-2 - Energy hierarchy and targets for the Proposed Development compared to GLA baseline for the existing building.

The Proposed Development complies with the 2021 London Plan, achieving a carbon emissions reduction of 63% (beyond the 35% target) compared to the existing baseline modelled in accordance with Appendix 3 of the GLA Energy Planning Guidance.

Mitigation measures have been investigated in line with the energy hierarchy to optimise its energy performance. Local energy sources have been explored as part of the be clean measures but deemed unfeasible due to the site's location far from existing and future district heating networks.

PV panels are installed to comply with renewable technology measures, but the limited roof space and the overshadowing dense urban context restrict the energy production output of the on-site renewables. Therefore, the reduction in carbon dioxide emissions from on-site renewable energy technologies is less than the 20% target stated in the Energy efficiency and adaptation CPG (2021) of Camden local policy.

However, with these constraints, the development is able to achieve satisfactory reduction in regulated emissions beyond the notional building of 63% reduction beyond the baseline performance which is greater than the minimum policy targets of 35%.

Also, when compared with compared with the Part L2021 baseline, the proposed development achieves satisfactory levels of compliance.

Table 3-2 – Primary energy reduction for the Proposed Development compared to Baseline Part L2021 of the Building Regulations Compliant Development

	Primary energy (kWh/m²)	CO_2 Emissions (Tonnes CO_2 per annum)	Policy Minimum targets (Regulated CO_2 emissions)	Performance of the scheme (Regulated CO_2 emissions)
Baseline	**54.7**	**39.4**		
Be lean	**44.5**	**32.1**	**15%**	**19%**
Be clean	**44.5**	**32.1**		
Be green	**40.7**	**29.4**	**35%**	**25%**

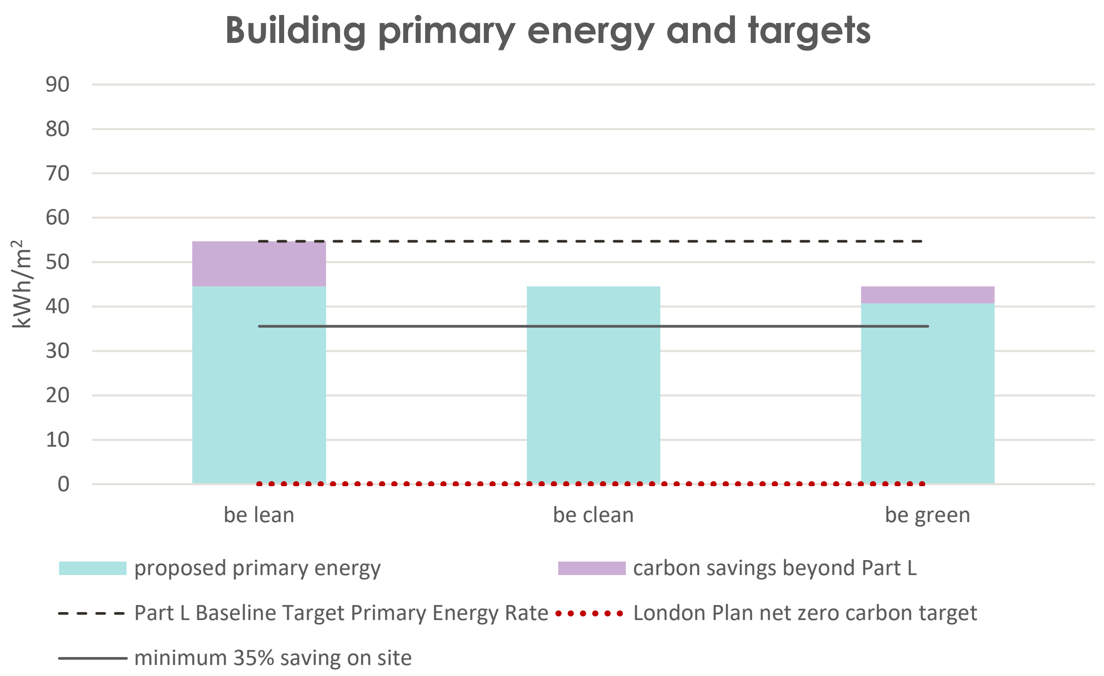
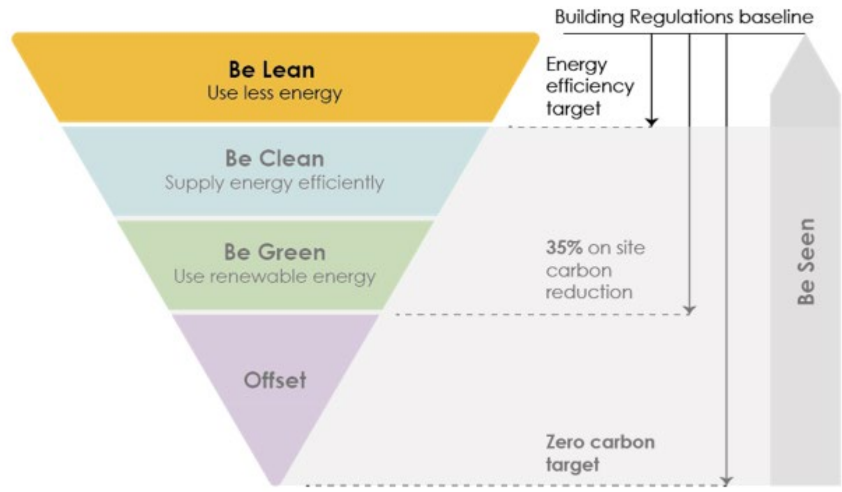


Figure 3-3 – Primary energy and targets for the Proposed Development compared to Baseline Part L2021 of the Building Regulations Compliant Development

4. Demand Reduction (Be Lean)



Within the first stage of the energy hierarchy, it was proposed to incorporate high levels of passive and energy efficient design measures in order to reduce the development's energy consumption and associated CO_2 emissions. Design recommendations were provided to the project architect and preliminary tests carried out enabling the development of a strategy from an early stage.

This design approach has identified the following viable design measures and an overall design route. The table below summarises some of the viable 'Be lean' measures identified in order to reduce energy demand and as part of the design approach.

Table 4-1 - Energy efficient 'Be Lean' measures.

Efficiency measures	Design Approach
Site orientation	The proposal includes the extensive refurbishment of the installed systems on site with an office floor extension and a pavilion at the roof top level. The orientation is therefore determined by the existing building and urban massing. The location and height of existing surrounding buildings overshadow the lower floors of the building; therefore, there is no possibility of further reducing the overall solar gains on the building based on orientation.
Site layout optimisation	The building layout has been informed by existing slabs. Key office occupied spaces are located around the perimeter of the building to make best use of higher daylight levels.
Enhanced U-value	Enhanced U-values relative to Part L limiting and notional values are proposed for both opaque and transparent elements. The external wall of the extension has a U-value of 0.18 W/m²K which is better performing than the GLA specifications.
High performance glass	A g-value of 0.3 has been considered in this study for replaced windows of the facades.

Fabric Performance U values (W/m²K)	Part L2:2021 limiting factors	Proposed performance of new elements	Performance
New Windows	1.60	1.30	✓
New External Wall	0.26	0.18	✓
Roof	0.18	0.15	✓

**External wall refers to any exposed wall or wall to an unheated space; Roof refers to the top roof of the building and any terrace/exposed ceiling;*

Efficiency measures	Design Approach
	A thermal comfort analysis was undertaken using a g-value of 0.3. The results show it is insufficient to achieve thermal comfort and determined that a g-value of 0.28 from Ground Floor to the top level is appropriate for replaced windows. The lower g-values deemed appropriate for the replaced windows from the thermal comfort study will result in less energy consumption and carbon emission levels, and ultimately an improvement in the energy performance.
Glazing percentage of the building*	The glazing percentage of the building is assessed to minimise energy demand and carbon emissions. Optimum glazing ratios were calculated for every orientation of the facades. A maximum of 40% window to wall ratio has been proposed for the extension and the new build façade to make sure solar gains are controlled.
Air-tightness improvement	Given that the existing windows are being replaced, the anticipated improvement in air tightness will likely exceed the standard expectations for a building of its age. This upgrade is anticipated to significantly enhance the overall air tightness performance and a 3 $m^3/(h.m^2)$ is assumed
Thermal mass	The existing development has mainly steel structure thus, low thermal mass. For top floors of new construction, minimum opportunities arise for the increase of thermal mass.
Solar shading	External shading is provided by structural elements of façade design and set back of windows. The building is situated within the dense urban landscape of central London, surrounded by buildings of similar height to the assessed building, which limits the impact of reducing direct sunlight exposure and provides limited shading.
Natural ventilation	Natural ventilation is adopted currently in the design. When outdoor conditions are acceptable, windows in the office spaces could be opened to allow for natural ventilation in the space during the day.
Lighting	The sensitivity of natural light to glazing ratios and glass light transmittance properties has been explored during RIBA Stage 2. The overall priority is to reduce carbon emissions from cooling and artificial lighting. Light fittings will be designed and specified to a high energy efficiency and quality standard.
Lighting control	Lighting energy efficiency and controls are detailed in the following table:

Use	Power Density (W/m^2)	NCM Illuminance (lux)	Auto Presence Detection	Daylight Control	Constance Illuminance Control
Office (perimeter)	4	400	*Auto On/Auto Off*	*Photocell Control Dimming*	*Yes*
Office (internal)	4	400	*Auto On/Auto Off*	*Photocell Control Dimming*	*Yes*
WCs	5	200	*Auto On/Auto Off*	*None*	*No*
Plant Rooms	5	200	*Auto On/Auto Off*	*None*	*No*
Lift Lobbies	5	100	*Auto On/Auto Off*	*None*	*No*
Reception/ Ground Floor Entrance	5	300	*Auto On/Auto Off*	*None*	*No*
Cyclist Facilities/ Changing room	5	100	*Auto On/Auto Off*	*None*	*No*
Bike store/ Charging room	5	100	*Auto On/Auto Off*	*None*	*No*
Stairs/ Circulation	5	100	*Auto On/Auto Off*	*None*	*No*

Efficiency measures	Design Approach
Mechanical ventilation heat recovery and efficiency	Heat recovery units are integrated with the mechanical ventilation system. Air Handling Units and terminals are proposed to be specified with very efficient Specific Fan Power. The following ventilation energy performance values targeted by the Proposed Development are listed in the table below:

Use	System	Heat Recovery efficiency	Ventilation Plant SFP (W/(l/s))		
			SP	EX	TR
Offices	4 pipe perimeter FCUs with decentralised AHU	89.9%	0.60	0.60	0.15
Pavilion at roof level	Mechanical Ventilation	-	0.54	0.5	
WCs	Centralised Ventilation with Heat Recovery	88.4%	0.60	0.50	-
Plant Rooms	Mechanical Ventilation	-	0.76	0.70	-
Lift Lobbies / Reception/ Ground Floor Entrance / Club Lounge (GF Office amenity)	Mechanical ventilation and FCUs	89.9%	0.60	0.60	0.15
Cyclist Facilities/ Changing room	Centralised Ventilation with Heat Recovery	88.4%	0.74	0.68	-
Bike store	Extract only (remote fan)	-	-	0.30	-

Efficiency measures	Design Approach
Cooling / Heating	The following cooling and heating system energy efficiencies are targeted by the Proposed Development:

Use	System	Heating	Cooling Source	Domestic Hot Water
Offices	4 pipe perimeter FCUs with decentralised AHU	Heat Pump Air Source SCOP 398% (60% capacity) & 312% (40% capacity)	Heat Pump Chiller SEER 4.79 (60% capacity) & 4.25 (40% capacity)	-
Pavilion at roof level	Mechanical Ventilation	Heat Pump Air Source SCOP 398% (60% capacity) & 312% (40% capacity)	Heat Pump Chiller SEER 4.79 (60% capacity) & 4.25 (40% capacity)	-
WCs	Centralised Ventilation with Heat Recovery	Heat Pump Air Source SCOP 398% (60% capacity) & 312% (40% capacity)	-	-
Plant Rooms	Mechanical Ventilation	-	-	-
Lift Lobbies / Reception/ Ground Floor Entrance	Mechanical ventilation and FCUs	Heat Pump Air Source SCOP 398% (60% capacity) & 312% (40% capacity)	Heat Pump Chiller SEER 4.79 (60% capacity) & 4.25 (40% capacity)	-
Club Lounge (GF Office amenity)	Mechanical ventilation and FCUs	Heat Pump Air Source SCOP 398% (60% capacity) & 312% (40% capacity)	Heat Pump Chiller SEER 4.79 (60% capacity) & 4.25 (40% capacity)	High Temp Heat Pump SCOP 345%
Cyclist Facilities/ Changing room	Centralised Ventilation with Heat Recovery	Heat Pump Air Source SCOP 398% (60% capacity) & 312% (40% capacity)	-	High Temp Heat Pump SCOP 345%
Bike store	Extract only (remote fan)	-	-	-

In addition, the following measures will also be adopted:

- A **power factor** correction (> 0.95) will be included to improve the electric stability and efficiency of the transmission network.
- **Smart meters** are planned for the development to enable a demand-led response, which makes it possible to save energy by turning off non-essential equipment or running equipment at lower capacities at times of peak demand.
- **Fan controls**: Zones with supply and extract ventilation will benefit from demand control as a function of the occupancy density.
- In addition, a **Building User Guide** will be handed over to tenants and will contain recommendations on how to reduce unregulated energy consumption through the procurement of energy efficient equipment.

4.1. Cooling and Overheating

The design was developed in line with the GLA's recommended 'Cooling Hierarchy' approach which applies a similar principle to the thorough decision-making process of the 'Energy Hierarchy' applied specifically with the aim of reducing CO_2 emissions from cooling:

Action	Measure
Minimising internal heat generation through energy efficient design	Heat gain from lighting will be minimised through energy efficient lighting design and controls. Daylight dimming along the perimeter of workspace will help reduce the use of artificial lighting. Light transmittance of glazing will be optimised to maximise natural daylight
Reduction of the amount of heat entering the building in summer	During Stage 2, a façade analysis was conducted for the existing and new parts of the building. A suggestion of an average percentage of 40%, allowing for greater areas with limited access to daylight and no solar access issues, was advised. A thermal comfort analysis of the office spaces was undertaken using a g-value of 0.3. The results show it is insufficient to achieve thermal comfort and determined that a g-value of 0.28 from Ground Floor to the top level is appropriate for replaced windows. The glazing specifications have been derived after thermal comfort analysis considering solar gains targets, orientation, and exposure per floor.
Management of the heat within the building through exposed thermal mass and high ceilings	BGY Architects confirmed that thermal mass for passive cooling is not part of the cooling strategy due to the lightweight structure (metal deck).
Mechanical ventilation	A mixed-mode ventilation strategy is proposed, with openable windows. Mechanical ventilation will be on floor decentralised and specified with energy efficient Specific Fan Power.
Active cooling	Cooling is delivered to the building by highly efficient air source heat pumps with an overall SEER of 4.57 (4.79 at 60% capacity & 4.25 at 40% capacity).

The cooling requirement/ demand of the different elements of the proposed development are reported in the following table:

Table 4-2: Cooling requirement/ demand of the Proposed development with mixed mode

Cooling demand ($kWh/m^2/yr$)	Part L2:2021 Notional	Actual	% Change
Current design	28.55	24.38	-14.6%

The cooling demand of the actual building is less compared to the notional, therefore the development has maximised benefit from passive design measures.

4.2. Thermal Comfort Analysis

The overheating risk analysis has been undertaken for the Proposed Redevelopment in line with the assumptions made in the energy assessment since the early design stage.

Office spaces were assessed using the CIBSE TM 52: 2014 'The Limits of Thermal Comfort: Avoiding Overheating in European buildings. A thermal comfort analysis was carried out using a g-value of 0.3 and the results determined that the g-value should not exceed 0.28 for all façades on all levels. Reducing the g-value can improve the energy performance of the development reducing the energy consumption.

The following table summarises the main assumptions used in the overheating analysis:

Table 4-3: Overheating risk main analysis assumptions

	Proposed Development
Design Stage	2
GLA referrable	no
Assessment methodology	Dynamic thermal modelling in line with CIBSE TM 52: 2014 and CIBSE TM 49 (future weather)
Dynamic overheating analysis software	EDSL TAS v9.5.6
CIBSE current Weather file	DSY1 for 2020s, (50th percentile) with a High (A1F1) emissions scenario.
CIBSE future Weather files	DSY2 – 2003, (50th percentile) with a High (A1F1) emissions scenario

	Proposed Development
	DSY3 – 1976 (50th percentile) with a High (A1F1) emissions scenario
Internal gains	Design criteria (Occupancy latent, occupancy sensible, lighting, equipment latent, equipment sensible)
Thermal mass	BGY confirmed that thermal mass for passive cooling is not part of the cooling strategy due to the lightweight structure and unknown architectural finishes in the office area.
Occupancy profiles	8am-6pm
Ventilation strategy (for thermal comfort study)	Mechanical ventilation
Reference Document	32099-HML-XX-XX-RP-V-790001

4.3. Be Lean Results

The Proposed Development is targeting at least 15% improvement beyond the baseline, from 'Be lean' (energy efficiency) measures only, to comply with the energy efficiency targets set in the London Plan. The 'Be lean' stage includes all passive design and energy efficiency measures but excludes heat pumps, low carbon, and renewable energy.

In Part L 2021 the Notional Building no longer uses gas boilers; it uses heat pumps for heating and hot water with COPs of 2.64 and 2.86 respectively. Therefore, heat pumps were used for the 'Be Lean' calculation. The following table summarises the results from the application of the 'Be lean' measures only, without the application of any viable 'Be clean' and 'Be green' measures at this stage:

Table 4-4: Building emissions performance under 'Be Lean' measures only (Potential Future Approach)

	GLA Baseline Emission Rate (Tonnes CO_2/annum)	Building Emission Rate (Tonnes CO_2/annum)	Existing baseline improvement (%) - 'Be lean' only
151 Shaftesbury Avenue	80.2	32.1	**60%**

5. Heating Infrastructure (Be Clean)

This section describes 'be clean' measures adopted by the proposed refurbishment, namely, to exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly.

The Camden Local Plan (2017) identifies all major developments should incorporate communal heat distribution systems to facilitate a single point of connection to decentralised energy networks unless it can be clearly demonstrated that it is not applicable due to local circumstances. As identified in the *'Borough Wide Heat Demand and Heat Source Mapping'* report for London Borough of Camden, the borough consists of 5 existing heat networks: Euston Road corridor (Euston Area Plan and Somers Town Energy proposals), King's Cross, Bloomsbury, Gower Street, and Gospel Oak. In addition to the five existing heat network clusters, six cluster areas have been identified as potential network areas for further assessment. The potential future networks are identified as Kilburn, Kentish Town, South Camden, Camley Street, Russell Square, and Great Ormond Street.

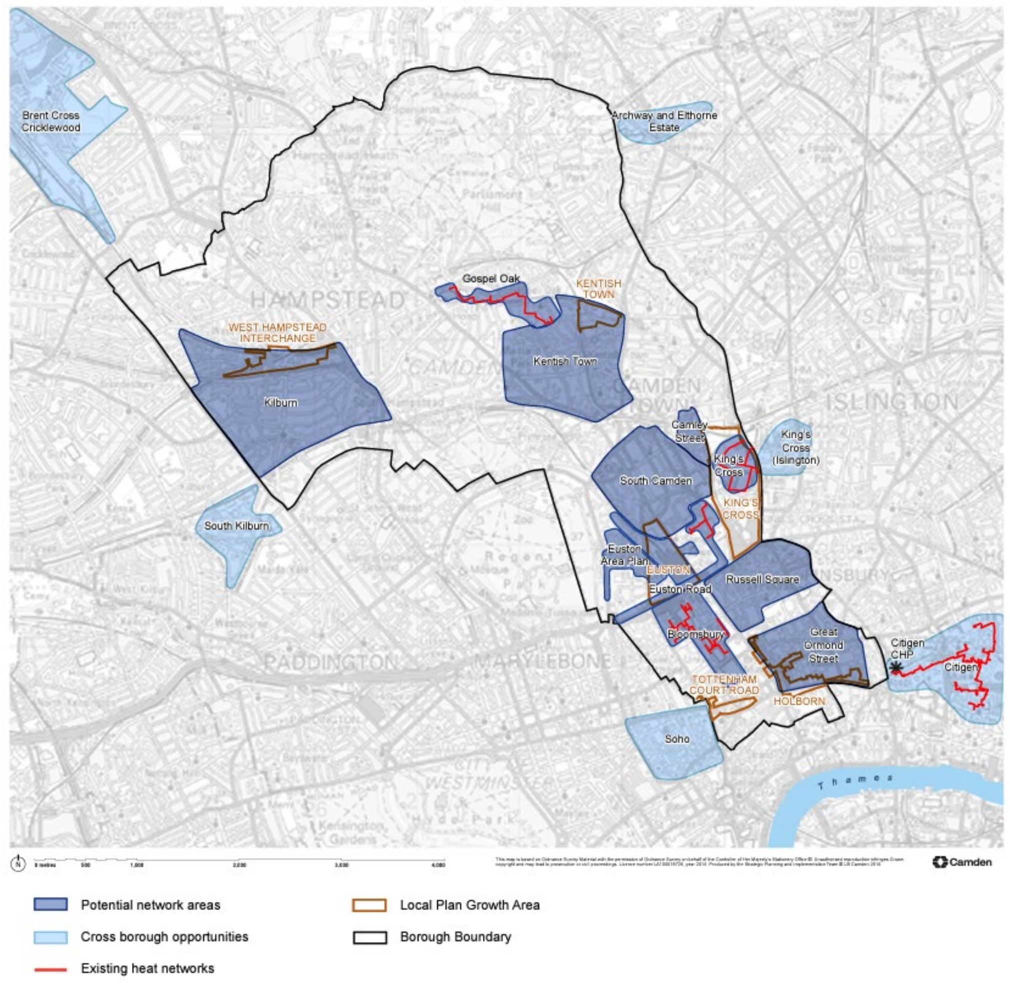


Figure 5-1: Energy networks map from Camden Local Plan (2017)

5.1. Heating Hierarchy

The Proposed Development is not located within a Heat Network Priority Area (HNPA) and there are no nearby existing or potential future district heating networks. The building's energy demands are predominantly dictated by the need for cooling, significantly surpassing the requirement for heating throughout the year. Given the pronounced emphasis on cooling requirements, the feasibility, and potential advantages of integrating the building into a district heat network appear limited. The relatively lower demand for heating, particularly when contrasted with the substantial need for cooling, does not justify the investments and complexities associated with connecting to a district heat network.

According to Camden Local Plan (2017), within the context of the energy hierarchy, gas fired networks are considered to sit within stage two, 'Be clean'. However, it is important to note that there are serious air quality implications for the use of CHP plants and biomass boilers therefore are not considered feasible for this development.

Table 5-1: Hierarchy for low temperature heating systems

Low temperature system	Proposed Redevelopment	Feasibility	Carbon emissions savings (%)
Connect to local existing or planned heat networks	Explore feasibility of connecting to existing or proposed network. Currently proposed development is designed for future connection	×	-
Use available zero-emission or local secondary heat sources (in conjunction with heat pump, if required)	High efficiency heat pump system proposed to provide low temperature heating, enabling net zero carbon emissions.	✓	-
Use low-emission combined heat and power (CHP), where feasible	CHP not considered feasible for the Proposed Redevelopment due to relatively low heat demand.	×	-
Use ultra-low NOx gas boilers	No boilers specified in Proposed Redevelopment	×	-
Where a heat network is planned but not yet in existence the development should be designed for connection at a later date	No evidence of plans for future heat network to be developed in the area	×	-

5.2. Existing and Planned District Heating Networks

The proposed development is not located within a Heat Network Priority area of any of the existing heat networks within the borough, where the nearest existing network 'Citigen' (in red) is approximately 1.65km away.

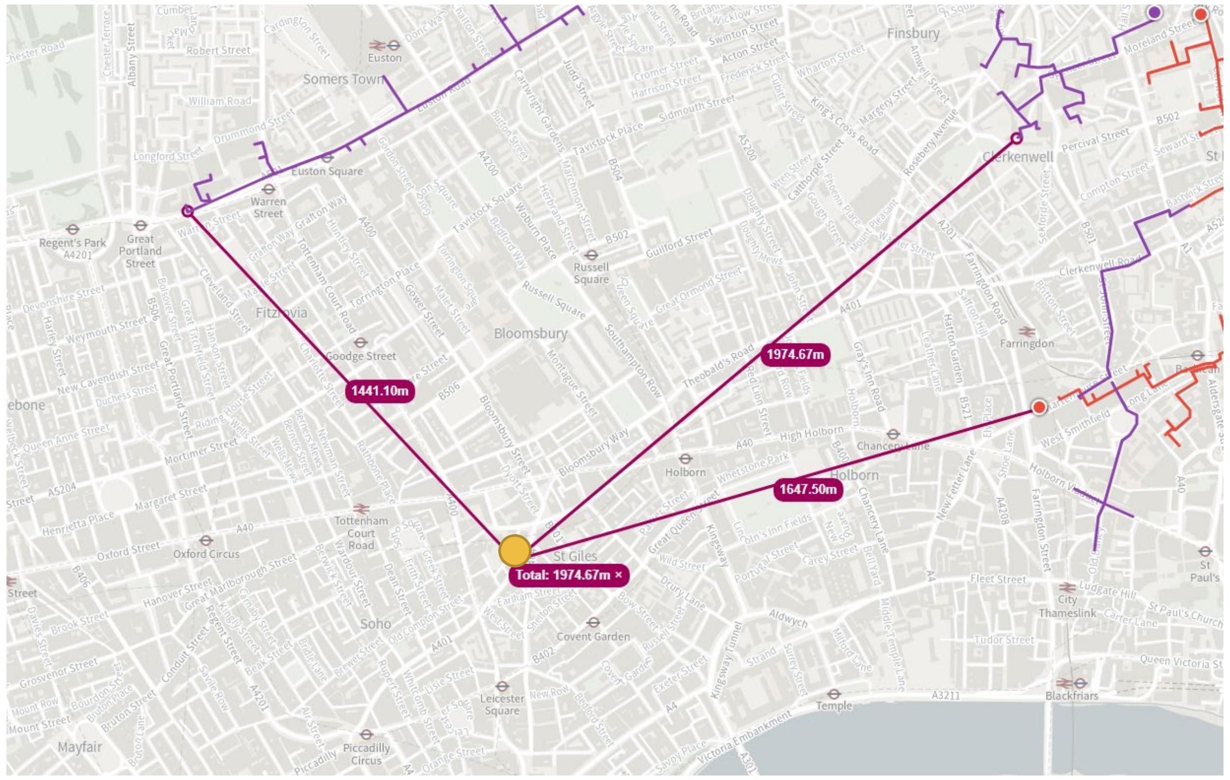


Figure 5-2: London Heat Map showing existing and planned district heat networks in the area. Red lines indicate existing energy networks and purple lines indicate proposed energy networks.

151 Shaftesbury Avenue is located approximately 1.44km from the nearest proposed network 'Euston Road' (in purple) which makes the potential to connect to the heat networks at a future date difficult. Due to uncertainty of programme for delivery of both planned networks, the building is currently continuing to make provisions to include its own central plant systems, as described in this report.

6. Utilise Renewables (Be Green)

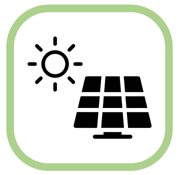
The following summary table sets out the complete list of potential renewable technologies along with their concluding viability at this design stage of the development. Further details of each technology and their associated assessment in relation to the development are provided on the subsequent sections.

6.1. 'Low and Zero Carbon' Strategy

Table 6-1: Summary Review of Be Green Measures

Technology	Viable	Notes	Tonnes/ year CO_2 Reduction	% Regulated CO_2 Reduction
Photovoltaics	Yes	Available space on roof will be utilised. Total PV active area of 81 sqm is available for 54 panels. Monocrystalline type with rated output of 211W/m^2 are recommended by HM.	1.8	2%
Solar Thermal	No	Not viable due to low domestic hot water demand and internalised and/or overshadowed plant areas	N/A	N/A
Bio-fuelled heating	No	Unviable due to local air quality requirements, fuel delivery and storage (Air Quality Positive target, zero onsite combustion).	N/A	N/A
Ground/Water source heat pump	No	Unviable in this location due to constraints to excavation and majority re-use of existing below ground sub-structure	N/A	N/A
Aerothermal energy for heating	Yes	Air Source Heat Pumps with thermal stores proposed for heating (and cooling)	0.9	1%
Wind Power	No	There is considerable evidence of urban wind turbines failing to perform to manufacturer's output estimates. Significant planning and integration issues also exist and consequently wind turbines are not viable.	N/A	N/A
Hydro/ocean energy	No	Not possible in this location	N/A	N/A

6.1.1. Photovoltaics (PV)



Photovoltaic cells directly convert sunlight into electrical current using semi-conductors. The output of a cell is directly proportional to the intensity of the light received by the active surface of the cell. Exposure to sunlight causes electricity to flow through the cells. Direct sunlight produces the greatest output, but power is produced even when overcast.

- Photovoltaic modules are based on silicon cells of various types, with corresponding cost and performance benefits: Mono silicon panels are moderately cheaper with corresponding lower performance; poly-silicon panels are more expensive with higher performance.
- Electrical integration – electricity from the PV array is fed via inverters into the distribution network of the building where it is anticipated most of the electricity will be consumed. A further connection will enable unconsumed electricity to be sold back to the electricity grid.
- Optimum electrical output is obtained from PV panels facing +/- 45 degrees of south and should be ideally inclined at 10˚ to 30˚ from the horizontal, thereby optimising electricity generation and allowing the self-cleaning by the action of rain.
- Shading – it is important to avoid locating PV on surfaces that are permanently shaded, even transient shadows should be avoided where possible.
- Ventilation of the panel can enable the PV panel to remain cool, improving its performance.
- Panels are typically warranted for 20 years.

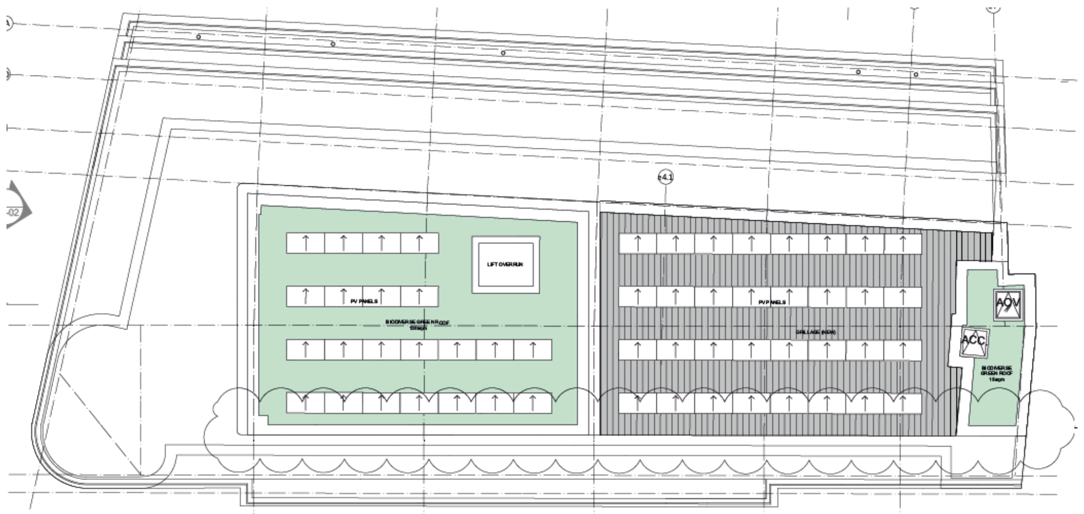


Figure 6-1: Proposed PV location on the roof's plant area

Position of the PV panels on the roof has been determined above the plant area on roof and the following performance has been assumed at this stage:

Table 6-2: PV system proposed performance

PV module type	Rated output (W)	Efficiency	Tilt angle	PV module size (m)	PV panel active area (m^2)	Number of PVs	Total PV active area (m^2)
Monocrystalline	211	22%	0°	1.67x0.91	1.5	**54**	**81**

The reduction in carbon dioxide emissions from on-site renewable energy technologies is less than the 20% target stated in the Energy efficiency and adaptation CPG (2021) of Camden local policy. This is due to the limited roof area for PV panels installation. Also, the overshadowing dense site location also restricts direct sunlight exposure thus reducing the energy production output.

6.1.2. Aerothermal Energy for heating (Heat Pumps)

Using ambient air as a thermal resource for a heat pump can provide lower emission heating, although typically the highest heating loads occur when the outside ambient air temperature, and subsequent heat pump efficiency, is at their lowest. Rejected heat from typical non-domestic buildings are traditionally used for pre-heating of incoming air within a simpler heat recovery system.

Additionally, recovered heat cannot be truly classed as ‘renewable’ by relevant guidance including BSRIA Guidance BG 1/2008 and EU Directive 2009/28/EC. However, the GLA’s Energy Planning guidance classifies heat pumps are under the third and final element of the energy strategy, hence ASHP are included in the ‘Be Green’ section.

It is envisaged that ASHPs will be incorporated into the Proposed Development.

The office space will be ventilated by on floor decentralised mechanical ventilation system.

The office floors include openable windows to allow the office space (or part thereof) to be naturally ventilated when the ambient conditions are suitable.

If openable windows are provided the windows will be monitored by the Building Management System (BMS) and linked to the mechanical ventilation and air conditioning systems. Upon opening a window the local ventilation and air conditioning to the window will be isolated / shut down to reduce the building’s energy use.

The heating and cooling requirements for the building will be met by an Air to Water 4-Pipe Heat Pump Unit and an Air to Water Reversible Heat Pump Unit, both located at roof level. These units will be selected to match both the peak summer and the peak winter building loads. The system utilises the 4-pipe unit as lead plant which would operate simultaneously in heating and cooling mode and the reversible heat pump would operate in either heating or cooling mode depending on the building demand, providing the energy requirement of the building to a number of thermal store vessels.

To achieve the required heating water temperatures for the purposes of domestic hot water generation, a high lift compressor water-to-water heat pump (WSHP) will be installed in the basement. The WSHP will be connected to the primary LTHW circuit. The heating and cooling distribution will be provided by 4 pipe fan coil units (FCU) located in the ceiling void space and the FCU will distribute heated or cooled air to the space via secondary ductwork and air supply diffusers.

The FCU cooling load will be derived from the peak output within the zone they serve. In case of a perimeter unit this will include the solar gain, infiltration and user related loads driven by the workplace density. For internal FCU’s the solar gain is significantly reduced.

Additional information for operation:

- End-users will be supplied with information to control and operate the heating system.
- The system will utilise a low temperature supply. The supply temperature is to be confirmed during detailed design. The aim will be to minimise the supply temperature to increase the system efficiency.
- The performance of the system will be monitored post-construction to ensure the predicted performance.

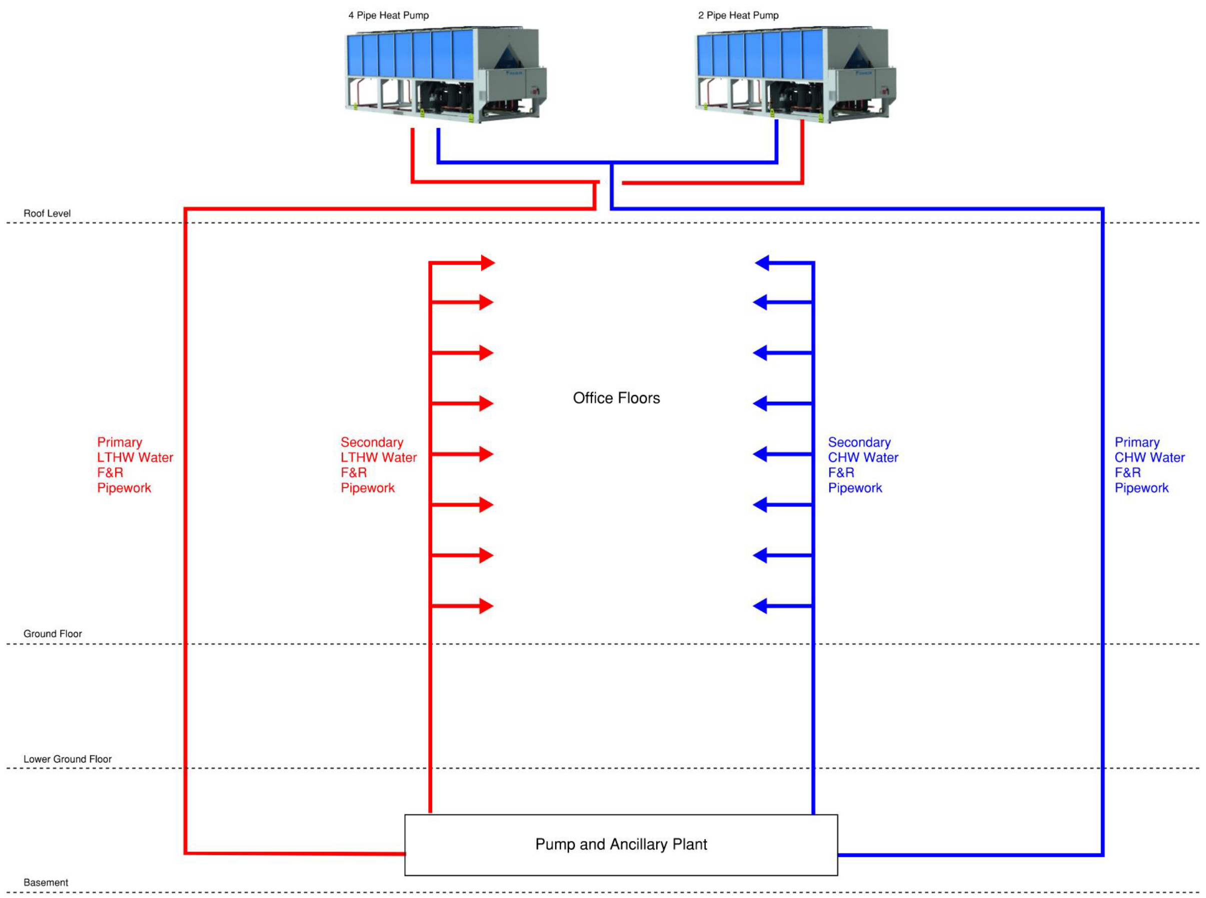


Figure 6-2: Heating and Cooling system schematic

The Proposed Development is targeting at least 35% improvement beyond the GLA baseline, from 'Be Green' measures, to comply with the energy efficiency targets set in the London Plan. The 'Be Green' stage includes all passive design and energy efficiency measures and includes heat pumps, low carbon, and renewable energy.

The following table summarises the results from the application of the 'Be Green' measures at this stage:

Table 6-3: Building emissions performance under 'Be 'Green' measures.

	GLA Baseline Emission Rate (Tonnes CO_2/annum)	Building Emission Rate (Tonnes CO_2/annum)	Existing baseline improvement (%)
151 Shaftesbury Avenue	80.2	29.4	**63%**

7. Be Seen Strategy

The Mayor of London requires non-regulated energy (i.e., outside Building Regulations scope) to be assessed and reduced by major development and encourages the application of a NABERS UK Design for Performance (DfP) process for commercial developments >5,000m^2. NABERS UK DfP provides a framework by which projects can commit pre-construction to achieve a NABERS Energy for Offices target rating in post-construction performance.

The targets required for compliance with the 'Be seen' category refer to the base built energy intensity of the development. The project is adopting a design for performance approach and is achieving 56.4 kWh$_e$/m^{2}NLA at RIBA Stage 2. The NABERS UK approach includes measures for sub-metering, monitoring, extended aftercare and commissioning, and public disclosure of annual energy performance.

7.1. NABERS UK DfP Assessment

An early-stage baseline energy model following the Design for Performance (the NABERS UK) approach (DfP Guide V2.0) has been prepared for Stage 2, showing that 151 Shaftesbury Avenue has a potential of achieving a high rating if a NABERS certification is targeted. Steps will be taken to achieve the targeted rating during upcoming RIBA Stages including the ongoing optimisation of design and corresponding control strategy. Significant further detail will be incorporated into the model in parallel with the evolving design to ensure the modelling and its outputs can be leveraged to assist and add value to this process.

Measures will be in place to influence fit-out energy performance and demand-side control, and to facilitate and support facilities managers and future occupants on reducing energy consumption. The metering strategy will be further developed during Stage 4 to support operational energy and carbon reporting and benchmarking throughout the lifetime of the building. Tenants will require a 'green' lease setting out performance parameters to achieve the higher Star ratings.

7.2. Predicted Performance – Baseline

Design for Performance (DfP) provides a framework by which projects can commit, pre- construction, to achieve a NABERS UK Energy for Offices target rating in post-construction performance. Projects subject to a Design for Performance Agreement process are required to undertake Advanced Simulation Modelling in line with the Guide to Design for Performance and produce a Simulation Report that forms a part of the Independent Design Review.

The current design stage Landlord consumption split for the baseline model is **56.4 kWh$_e$/m^2/annum.** Floor area used for the EUI calculations is 5,133m^2 of office NIA**.** It is currently believed this is a conservative, and viable estimate of the building's capability. As stipulated further detail will be incorporated into the modelling to enhance accuracy and granularity of outputs, leading to enhanced corresponding recommendations. Several measures will be recommended to mitigate against risk to this performance in further stages, and into operation, thereby helping ensure this is achievable.

Table 7-1: Summary of initial results

Component	kWh_e/m^2
Heating	0.36
Cooling	6.14
Domestic hot water	9.42
Landlord auxiliary	4.26
Landlord equipment	12.87
Landlord lighting	6.08
Server Loads	-
Manual calc + distribution loss	17.30
PV Generation	2.54
Energy Intensity (kWh_e/sqm)	**56.4**

The lighting and equipment gain from the tenant office spaces were included in the modelling but are excluded from the NABERS base build rating.

Table 7-2: Summary of initial results not included in NABERS Rating

Component	kWh_e/m^2
Tenant Equipment	49.03
Tenant Lighting	11.12

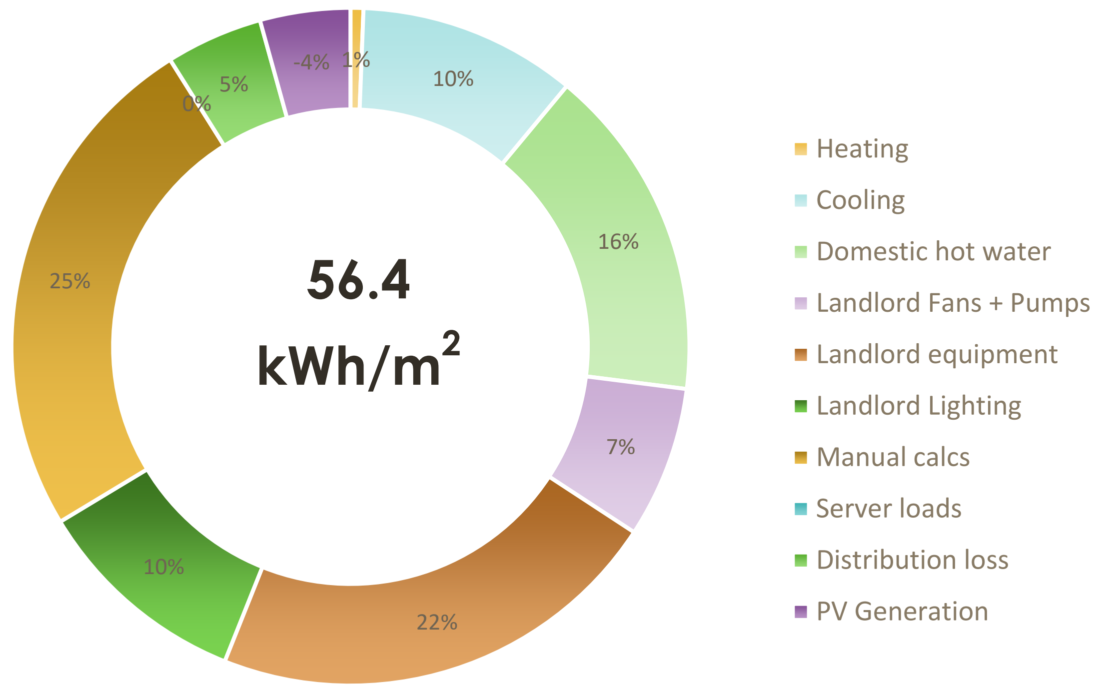


Figure 7-1: Break down of Energy Use Intensity for Stage 2 baseline model.

8. Further energy improvements

The following opportunities are proposed to reduce operational energy and carbon emissions during RIBA Stage 3. It distinguishes between recommendations that are included in the RIBA Stage 2 results and others to be explored during RIBA Stage 3.

Ref	Opportunity	Currently	Improvements
1	Reduce Cooling Demand	Current cooling set point is 24ºC	Set point could be increased to 25ºC or 26ºC
2	Improve ventilation efficiency and control in offices	No air temperature control	Fan-coil supply air temperature should be measured for each fan-coil to allow fault diagnosis
3	Improve air tightness in fabric	Openable windows included	High air tightness windows specified
4	Domestic hot water	Water temperature is 70ºC	Reduce distribution temperature to 55ºC
5	Heating setback setpoint	Heating setback setpoint at 17ºC	Explore reduced setpoints ex. 10ºC
6	Window operation	Windows are operable between 22.5ºC and 23.5 ºC	Explore lower temperatures for window operation to reduce cooling demand ex. openable windows at 21ºC
7	Extract fans ventilation rates	Some areas have high extract air changes operating full time such as changing rooms, toilets and bin storage	Controls can be proposed to regulate operation based on humidity levels or temperatures.

Reduction of operation hours for HVAC systems can reduce the operational energy. Landlord could look to agree with the tenant's core 'occupancy hours' reducing servicing hours from typical UK operation times to those more appropriate for core building occupation i.e. 8am to 6pm, during which central plant operates automatically to maintain conditions. Ensuring additional warm up or cool down required to achieve comfort conditions during those hours is met using optimised start/stop.

Outside the occupancy hours, a more stringent control specification could ensure plant will not run unless necessary. Should the tenant require central services a request system could be used to request central plant to operate automatically outside hours to meet this requirement and charges levied accordingly.

Granularity in metering will be necessary to effectively measure and monitor the building's performance and trajectory relative to UKGBC and NABERS UK targets. Specifically, HVAC on tenant floor plates will be metered separately to Small Power and Lighting. Aside from being necessary to provide appropriate energy delineation for annual NABERS UK Assessments, this will allow performance of landlord HVAC, and tenant operation to be monitored and improved upon. Provision of this data to tenants, and continual engagement with them, will aim to drive continual improvement for Landlord and whole-building efficiency in operation.

9. Conclusions

Hilson Moran has carried out an energy assessment of the Proposed Development at 151 Shaftesbury Avenue prepared in accordance with the GLA Energy Planning Guidance and Camden Planning Policy and Guidance. The study is undertaken to verify compliance with the carbon emissions reduction targets of the national and local planning policies of the London Plan and London Borough of Camden.

The Proposed Development complies with the 2021 London Plan, achieving a carbon emissions reduction of 63% compared to the existing baseline modelled in accordance with Appendix 3 of the GLA Energy Planning Guidance.

Mitigation measures have been investigated in line with the energy hierarchy to optimise its energy performance. Local energy sources have been explored as part of the be clean measures but deemed unfeasible due to the site's location far from existing and future district heating networks.

PV panels are installed to comply with renewable technology measures, but the limited roof space and the overshadowing dense urban context restrict the energy production output of the on-site renewables. Therefore, the reduction in carbon dioxide emissions from on-site renewable energy technologies is less than the 20% target stated in the Energy efficiency and adaptation CPG (2021) of Camden local policy.

However, with these constraints, the development is able to achieve satisfactory reduction in regulated emissions beyond the notional building of 63% reduction beyond the baseline performance which is greater than the minimum policy targets of 35%. As part of the 'Be Seen' compliance, the project is adopting a design for performance approach.

Appendix 1: Energy Model Outputs (BRUKL)

Proposed- Be Green

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

151 Shaftsbury As designed

Date: Fri Feb 09 16:41:06 2024

Administrative information

Building Details

Address: xx, xxx, xxxxxx

Certifier details

Name:

Telephone number:

Address: , ,

Certification tool

Calculation engine: TAS

Calculation engine version: "v9.5.6"

Interface to calculation engine: TAS

Interface to calculation engine version: v9.5.6

BRUKL compliance module version: v6.1.e.0

Foundation area [m²]: 612.14

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

Target CO_2 emission rate (TER), $kgCO_2/m^2annum$	5.24	
Building CO_2 emission rate (BER), $kgCO_2/m^2annum$	3.91	
Target primary energy rate (TPER), kWh_{PE}/m^2annum	57.63	
Building primary energy rate (BPER), kWh_{PE}/m^2annum	42.87	
Do the building's emission and primary energy rates exceed the targets?	BER =< TER	BPER =< TPER

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

Fabric element	$U_{a-Limit}$	U_{a-Calc}	U_{i-Calc}	First surface with maximum value
Walls*	0.26	0.22	0.35	BW_0.35
Floors	0.18	0.16	0.57	Ground Floor/CL_0.9
Pitched roofs	0.16	-	-	No pitched roofs in project
Flat roofs	0.18	0.15	0.15	RF_0.98
Windows** and roof windows	1.6	1.27	1.32	GL_S_3_GF
Rooflights***	2.2	-	-	No rooflights in project
Personnel doors^	1.6	1.24	1.3	DR_E/W_5_RF
Vehicle access & similar large doors	1.3	-	-	No vehicle access or similar large doors in project
High usage entrance doors	3	-	-	No high usage entrance doors in project

$U_{a-Limit}$ = 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	3.08

Page 1 of 19

Building services

For details on the standard values listed below, system-specific guidance, and additional regulatory requirements, refer to the Approved Documents.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	>0.95

1- Cycle Storage_Extract only (2 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	-	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system	YES				

2- Bin Store_Extract only (SR_GF_ 1)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	-	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system	YES				

3- Natural Ventilation

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system	YES				

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

4- Changing_Mech Vent (7 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.58	-	-	1.42	0.88
Standard value	2.5*	N/A	N/A	1.9^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system	YES				

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

5- Plant_Mech Vent (3 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0	-	-	1.46	-
Standard value	N/A	N/A	N/A	1.5^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system	YES				

^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

6- Core Corridors_Mech Vent (30 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.58	-	-	1.2	0.9
Standard value	2.5*	N/A	N/A	1.9^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system	YES				

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

Page 2 of 19

7- WC_Mech vent (21 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.58	-	-	1.1	0.9
Standard value	2.5*	N/A	N/A	1.9^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

8- Storage GF/RF_Extract only (2 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	-	-	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

9- HC WC_Extract only (SH_LG_ 1)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

10- SH in FM office_Mech Vent (SH_LG_ 2)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.58	-	-	1.42	0.9
Standard value	2.5*	N/A	N/A	1.9^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

11- ED RF_Extract only (ED_RF_ 1)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

12- Office/Rec_FCU (95 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.58	4.77	-	1.2	0.9
Standard value	2.5*	N/A	N/A	2^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

13- Pavilion_Mech Vent (OF_RF_ 1)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.58	-	-	1.04	-
Standard value	2.5*	N/A	N/A	2^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

14- OF_LG/ RE/ RC (12 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.58	4.77	-	1.2	0.9
Standard value	2.5*	N/A	N/A	2^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

1- Electric 100%

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	0
Standard value	1	N/A

2- Heat pump

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	3.45	0
Standard value	2*	N/A

* Standard shown is for all types except absorption and gas engine heat pumps.

Zone-level mechanical ventilation, exhaust, and terminal units

ID	System type in the Approved Documents
A	Local supply or extract ventilation units
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal balanced supply and extract ventilation system
E	Local balanced supply and extract ventilation units
F	Other local ventilation units
G	Fan assisted terminal variable air volume units
H	Fan coil units
I	Kitchen extract with the fan remote from the zone and a grease filter

NB: Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard
PL_B_ 1	-	-	-	1.5	-	-	-	-	-	-	N/A
CO_B_ 1	-	-	-	1.2	-	-	-	-	-	-	N/A
CO_B_ 2	-	-	-	1.2	-	-	-	-	-	-	N/A
CO_B_ 3	-	-	-	1.2	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard
PL_LG_ 1	-	-	-	1.5	-	-	-	-	-	-	N/A
Cycle Storage_LG_ 1	-	-	0.3	-	-	-	-	-	-	-	N/A
CH_LG_ 1	-	-	-	-	1.4	-	-	-	-	-	N/A
CO_LG_ 1	-	-	-	1.2	-	-	-	-	-	-	N/A
WC_LG_ 1	-	-	-	1.1	-	-	-	-	-	-	N/A
RE_LG_ 1	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_LG_ 1	-	-	-	1.2	-	-	-	0.2	-	-	N/A
CH_LG_ 2	-	-	-	-	1.4	-	-	-	-	-	N/A
OF_LG_ 2	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_LG_ 3	-	-	-	1.2	-	-	-	0.2	-	-	N/A
SH_LG_ 1	-	-	0.5	-	-	-	-	-	-	-	N/A
SH_LG_ 2	-	-	-	-	1.4	-	-	-	-	-	N/A
WC_LG_ 2	-	-	-	1.1	-	-	-	-	-	-	N/A
OF_LG_ 7	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_LG_ 8	-	-	-	1.2	-	-	-	0.2	-	-	N/A
CO_LG_ 2	-	-	-	1.2	-	-	-	-	-	-	N/A
CO_LG_ 3	-	-	-	1.2	-	-	-	-	-	-	N/A
CO_LG_ 6	-	-	-	1.2	-	-	-	-	-	-	N/A
SR_GF_ 1	-	-	0.4	-	-	-	-	-	-	-	N/A
WC_GF_ 1	-	-	-	1.1	-	-	-	-	-	-	N/A
RC_GF_ 1	-	-	-	1.2	-	-	-	0.2	-	-	N/A
RC_GF_ 2	-	-	-	1.2	-	-	-	0.2	-	-	N/A
SR_GF_ 2	-	-	0.5	-	-	-	-	-	-	-	N/A
LL_GF_ 1	-	-	-	1.2	-	-	-	0.2	-	-	N/A
CO_GF_ 2	-	-	-	1.2	-	-	-	-	-	-	N/A
CO_GF_ 3	-	-	-	1.2	-	-	-	-	-	-	N/A
CO_GF_ 4	-	-	-	1.2	-	-	-	-	-	-	N/A
RC_GF_ 3	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_P_1_ 1	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_I_1_ 1	-	-	-	1.2	-	-	-	0.2	-	-	N/A
LL_1_ 1	-	-	-	1.2	-	-	-	0.2	-	-	N/A
WC_1_ 1	-	-	-	1.1	-	-	-	-	-	-	N/A
CO_1_ 1	-	-	-	1.2	-	-	-	-	-	-	N/A
OF_P_1_ 2	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_P_1_ 3	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_P_1_ 4	-	-	-	1.2	-	-	-	0.2	-	-	N/A
WC_1_ 2	-	-	-	1.1	-	-	-	-	-	-	N/A
CO_1_ 2	-	-	-	1.2	-	-	-	-	-	-	N/A
OF_P_2_ 1	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_I_2_ 1	-	-	-	1.2	-	-	-	0.2	-	-	N/A
LL_2_ 1	-	-	-	1.2	-	-	-	0.2	-	-	N/A
WC_2_ 1	-	-	-	1.1	-	-	-	-	-	-	N/A
CO_2_ 1	-	-	-	1.2	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard
CO_2_ 2	-	-	-	1.2	-	-	-	-	-	-	N/A
OF_P_2_ 2	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_P_2_ 3	-	-	-	1.2	-	-	-	0.2	-	-	N/A
WC_2_ 2	-	-	-	1.1	-	-	-	-	-	-	N/A
OF_P_3_ 1	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_I_3_ 1	-	-	-	1.2	-	-	-	0.2	-	-	N/A
LL_3_ 1	-	-	-	1.2	-	-	-	0.2	-	-	N/A
WC_3_ 1	-	-	-	1.1	-	-	-	-	-	-	N/A
CO_3_ 1	-	-	-	1.2	-	-	-	-	-	-	N/A
WC_3_ 2	-	-	-	1.1	-	-	-	-	-	-	N/A
OF_P_3_ 2	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_P_3_ 3	-	-	-	1.2	-	-	-	0.2	-	-	N/A
CO_3_ 2	-	-	-	1.2	-	-	-	-	-	-	N/A
OF_P_4_ 1	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_I_4_ 1	-	-	-	1.2	-	-	-	0.2	-	-	N/A
LL_4_ 1	-	-	-	1.2	-	-	-	0.2	-	-	N/A
WC_4_ 1	-	-	-	1.1	-	-	-	-	-	-	N/A
CO_4_ 1	-	-	-	1.2	-	-	-	-	-	-	N/A
WC_4_ 2	-	-	-	1.1	-	-	-	-	-	-	N/A
OF_P_4_ 2	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_P_4_ 3	-	-	-	1.2	-	-	-	0.2	-	-	N/A
CO_4_ 2	-	-	-	1.2	-	-	-	-	-	-	N/A
OF_P_5_ 1	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_I_5_ 1	-	-	-	1.2	-	-	-	0.2	-	-	N/A
LL_5_ 1	-	-	-	1.2	-	-	-	0.2	-	-	N/A
WC_5_ 1	-	-	-	1.1	-	-	-	-	-	-	N/A
CO_5_ 1	-	-	-	1.2	-	-	-	-	-	-	N/A
OF_P_5_ 2	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_P_5_ 3	-	-	-	1.2	-	-	-	0.2	-	-	N/A
WC_5_ 2	-	-	-	1.1	-	-	-	-	-	-	N/A
OF_P_6_ 1	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_I_6_ 1	-	-	-	1.2	-	-	-	0.2	-	-	N/A
LL_6_ 1	-	-	-	1.2	-	-	-	0.2	-	-	N/A
WC_6_ 1	-	-	-	1.1	-	-	-	-	-	-	N/A
CO_6_ 1	-	-	-	1.2	-	-	-	-	-	-	N/A
WC_6_ 2	-	-	-	1.1	-	-	-	-	-	-	N/A
OF_P_6_ 2	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_P_6_ 3	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_P_7_ 1	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_I_7_ 1	-	-	-	1.2	-	-	-	0.2	-	-	N/A
WC_7_ 1	-	-	-	1.1	-	-	-	-	-	-	N/A
CO_7_ 1	-	-	-	1.2	-	-	-	-	-	-	N/A
LL_7_ 1	-	-	-	1.2	-	-	-	0.2	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard
OF_P_7_ 2	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_P_7_ 3	-	-	-	1.2	-	-	-	0.2	-	-	N/A
WC_7_ 2	-	-	-	1.1	-	-	-	-	-	-	N/A
OF_P_8_ 1	-	-	-	1.2	-	-	-	0.2	-	-	N/A
LL_8_ 1	-	-	-	1.2	-	-	-	0.2	-	-	N/A
CO_8_ 1	-	-	-	1.2	-	-	-	-	-	-	N/A
WC_8_ 1	-	-	-	1.1	-	-	-	-	-	-	N/A
WC_8_ 2	-	-	-	1.1	-	-	-	-	-	-	N/A
PL_RF_ 1	-	-	-	1.5	-	-	-	-	-	-	N/A
OF_RF_ 1	-	-	-	1	-	-	-	-	-	-	N/A
OF_P_8_ 2	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_P_8_ 3	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_I_1_ 2	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_I_2_ 2	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_I_3_ 2	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_I_4_ 2	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_I_5_ 2	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_I_6_ 2	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_I_7_ 2	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_I_8_ 1	-	-	-	1.2	-	-	-	0.2	-	-	N/A
Vanity_LG_ 1	-	-	-	-	1.4	-	-	-	-	-	N/A
Charging_LG_ 1	-	-	0.3	-	-	-	-	-	-	-	N/A
Drying_LG_ 1	-	-	-	1.1	-	-	-	-	-	-	N/A
CH_LG_ 4	-	-	-	-	1.4	-	-	-	-	-	N/A
RE_GF_ 1	-	-	-	1.2	-	-	-	0.2	-	-	N/A
RE_GF_ 2	-	-	-	1.2	-	-	-	0.2	-	-	N/A
CO_3_ 3	-	-	-	1.2	-	-	-	-	-	-	N/A
OF_I_3_ 3	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_P_3_ 4	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_P_3_ 5	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_P_3_ 6	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_I_4_ 3	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_P_4_ 4	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_P_4_ 5	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_P_4_ 6	-	-	-	1.2	-	-	-	0.2	-	-	N/A
CO_4_ 3	-	-	-	1.2	-	-	-	-	-	-	N/A
CO_5_ 2	-	-	-	1.2	-	-	-	-	-	-	N/A
CO_5_ 3	-	-	-	1.2	-	-	-	-	-	-	N/A
OF_I_5_ 3	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_P_5_ 4	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_P_5_ 5	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_P_5_ 6	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_P_6_ 4	-	-	-	1.2	-	-	-	0.2	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard
OF_P_6_ 5	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_P_6_ 6	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_I_6_ 3	-	-	-	1.2	-	-	-	0.2	-	-	N/A
CO_6_ 2	-	-	-	1.2	-	-	-	-	-	-	N/A
CO_6_ 3	-	-	-	1.2	-	-	-	-	-	-	N/A
CO_7_ 2	-	-	-	1.2	-	-	-	-	-	-	N/A
CO_7_ 3	-	-	-	1.2	-	-	-	-	-	-	N/A
OF_P_7_ 4	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_P_7_ 5	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_P_7_ 6	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_P_8_ 4	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_P_8_ 5	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_P_8_ 6	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_P_8_ 7	-	-	-	1.2	-	-	-	0.2	-	-	N/A
SR_RF_ 2	-	-	0.5	-	-	-	-	-	-	-	N/A
WC_LG_ 3	-	-	-	1.1	-	-	-	-	-	-	N/A
CH_LG_ 5	-	-	-	-	1.4	-	-	-	-	-	N/A
CH_LG_ 6	-	-	-	-	1.4	-	-	-	-	-	N/A
CH_LG_ 7	-	-	-	-	1.4	-	-	-	-	-	N/A
ED_RF_ 1	-	-	0.5	-	-	-	-	-	-	-	N/A
OF_P_2_ 4	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_P_2_ 5	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_I_1_ 3	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_I_2_ 3	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_I_2_ 4	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_P_1_ 5	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_P_1_ 6	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_I_1_ 4	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_I_1_ 5	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_P_1_ 7	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_P_1_ 8	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_P_7_ 7	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_P_6_ 7	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_P_6_ 8	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_P_5_ 7	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_P_5_ 8	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_P_4_ 7	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_P_4_ 8	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_P_3_ 7	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_P_3_ 8	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_P_2_ 6	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_P_2_ 7	-	-	-	1.2	-	-	-	0.2	-	-	N/A
OF_P_8_ 8	-	-	-	1.2	-	-	-	0.2	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1	Zone	Standard
OF_P_8_9	-	-	-	1.2	-	-	-	0.2	-	-	N/A

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
PL_B_1	-	-	-
ST_B_1	-	-	-
CO_B_1	-	-	-
CO_B_2	-	-	-
CO_B_3	-	-	-
PL_LG_1	-	-	-
ST_LG_1	-	-	-
Cycle Storage_LG_1	-	-	-
CH_LG_1	-	-	-
CO_LG_1	-	-	-
WC_LG_1	-	-	-
RE_LG_1	-	-	-
OF_LG_1	-	-	-
CH_LG_2	-	-	-
IT_LG_1	-	-	-
IT_LG_2	-	-	-
OF_LG_2	-	-	-
OF_LG_3	-	-	-
ST_LG_2	-	-	-
IT_LG_3	-	-	-
SH_LG_1	-	-	-
SH_LG_2	-	-	-
WC_LG_2	-	-	-
OF_LG_7	-	-	-
OF_LG_8	-	-	-
CO_LG_2	-	-	-
CO_LG_3	-	-	-
CO_LG_5	-	-	-
CO_LG_6	-	-	-
ST_GF_1	-	-	-
SR_GF_1	-	-	-
WC_GF_1	-	-	-
CO_GF_1	-	-	-
RC_GF_1	-	95	-
RC_GF_2	-	95	-
SR_GF_2	-	-	-
LL_GF_1	-	-	-
ST_GF_2	-	-	-

Page 9 of 19

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
ST_GF_3	-	-	-
CO_GF_2	-	-	-
CO_GF_3	-	-	-
CO_GF_4	-	-	-
CO_GF_6	-	-	-
RC_GF_3	-	95	-
OF_P_1_1	-	-	-
OF_I_1_1	-	-	-
ST_1_1	-	-	-
LL_1_1	-	-	-
WC_1_1	-	-	-
CO_1_1	-	-	-
OF_P_1_2	-	-	-
OF_P_1_3	-	-	-
OF_P_1_4	-	-	-
WC_1_2	-	-	-
CO_1_2	-	-	-
OF_P_2_1	-	-	-
OF_I_2_1	-	-	-
ST_2_1	-	-	-
LL_2_1	-	-	-
WC_2_1	-	-	-
CO_2_1	-	-	-
CO_2_2	-	-	-
OF_P_2_2	-	-	-
OF_P_2_3	-	-	-
WC_2_2	-	-	-
OF_P_3_1	-	-	-
OF_I_3_1	-	-	-
LL_3_1	-	-	-
WC_3_1	-	-	-
CO_3_1	-	-	-
WC_3_2	-	-	-
ST_3_3	-	-	-
OF_P_3_2	-	-	-
OF_P_3_3	-	-	-
CO_3_2	-	-	-
OF_P_4_1	-	-	-
OF_I_4_1	-	-	-
LL_4_1	-	-	-
WC_4_1	-	-	-
CO_4_1	-	-	-
WC_4_2	-	-	-

Page 10 of 19

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
ST_4_ 3	-	-	-
OF_P_4_ 2	-	-	-
OF_P_4_ 3	-	-	-
CO_4_ 2	-	-	-
OF_P_5_ 1	-	-	-
OF_I_5_ 1	-	-	-
LL_5_ 1	-	-	-
ST_5_ 1	-	-	-
WC_5_ 1	-	-	-
CO_5_ 1	-	-	-
OF_P_5_ 2	-	-	-
OF_P_5_ 3	-	-	-
ST_5_ 2	-	-	-
WC_5_ 2	-	-	-
OF_P_6_ 1	-	-	-
OF_I_6_ 1	-	-	-
ST_6_ 1	-	-	-
LL_6_ 1	-	-	-
WC_6_ 1	-	-	-
CO_6_ 1	-	-	-
WC_6_ 2	-	-	-
ST_6_ 2	-	-	-
OF_P_6_ 2	-	-	-
OF_P_6_ 3	-	-	-
OF_P_7_ 1	-	-	-
OF_I_7_ 1	-	-	-
ST_7_ 1	-	-	-
WC_7_ 1	-	-	-
CO_7_ 1	-	-	-
LL_7_ 1	-	-	-
OF_P_7_ 2	-	-	-
OF_P_7_ 3	-	-	-
ST_7_ 2	-	-	-
WC_7_ 2	-	-	-
OF_P_8_ 1	-	-	-
LL_8_ 1	-	-	-
ST_8_ 1	-	-	-
CO_8_ 1	-	-	-
WC_8_ 1	-	-	-
ST_8_ 2	-	-	-
WC_8_ 2	-	-	-
ST_RF_ 1	-	-	-
PL_RF_ 1	-	-	-

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
CO_RF_ 1	-	-	-
LL_RF_ 1	-	-	-
OF_RF_ 1	-	-	-
ST_RF_ 2	-	-	-
OF_P_8_ 2	-	-	-
OF_P_8_ 3	-	-	-
OF_I_1_ 2	-	-	-
OF_I_2_ 2	-	-	-
OF_I_3_ 2	-	-	-
OF_I_4_ 2	-	-	-
OF_I_5_ 2	-	-	-
OF_I_6_ 2	-	-	-
OF_I_7_ 2	-	-	-
OF_I_8_ 1	-	-	-
ST_1_ 2	-	-	-
ST_2_ 2	-	-	-
ST_3_ 2	-	-	-
ST_4_ 2	-	-	-
Vanity_LG_ 1	-	-	-
CO_LG_ 9	-	-	-
CO_LG_ 10	-	-	-
Charging_LG_ 1	-	-	-
Drying_LG_ 1	-	-	-
CH_LG_ 4	-	-	-
RE_GF_ 1	-	95	-
RE_GF_ 2	-	95	-
CO_3_ 3	-	-	-
OF_I_3_ 3	-	-	-
OF_P_3_ 4	-	-	-
OF_P_3_ 5	-	-	-
OF_P_3_ 6	-	-	-
OF_I_4_ 3	-	-	-
OF_P_4_ 4	-	-	-
OF_P_4_ 5	-	-	-
OF_P_4_ 6	-	-	-
CO_4_ 3	-	-	-
CO_5_ 2	-	-	-
CO_5_ 3	-	-	-
OF_I_5_ 3	-	-	-
OF_P_5_ 4	-	-	-
OF_P_5_ 5	-	-	-
OF_P_5_ 6	-	-	-
OF_P_6_ 4	-	-	-

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
OF_P_6_ 5	-	-	-
OF_P_6_ 6	-	-	-
OF_I_6_ 3	-	-	-
CO_6_ 2	-	-	-
CO_6_ 3	-	-	-
CO_7_ 2	-	-	-
CO_7_ 3	-	-	-
OF_P_7_ 4	-	-	-
OF_P_7_ 5	-	-	-
OF_P_7_ 6	-	-	-
OF_P_8_ 4	-	-	-
OF_P_8_ 5	-	-	-
OF_P_8_ 6	-	-	-
OF_P_8_ 7	-	-	-
SR_RF_ 2	-	-	-
WC_LG_ 3	-	-	-
CH_LG_ 5	-	-	-
CH_LG_ 6	-	-	-
CH_LG_ 7	-	-	-
ED_RF_ 1	-	-	-
OF_P_2_ 4	-	-	-
OF_P_2_ 5	-	-	-
OF_I_1_ 3	-	-	-
OF_I_2_ 3	-	-	-
OF_I_2_ 4	-	-	-
OF_P_1_ 5	-	-	-
OF_P_1_ 6	-	-	-
OF_I_1_ 4	-	-	-
OF_I_1_ 5	-	-	-
OF_P_1_ 7	-	-	-
OF_P_1_ 8	-	-	-
OF_P_7_ 7	-	-	-
OF_P_6_ 7	-	-	-
OF_P_6_ 8	-	-	-
OF_P_5_ 7	-	-	-
OF_P_5_ 8	-	-	-
OF_P_4_ 7	-	-	-
OF_P_4_ 8	-	-	-
OF_P_3_ 7	-	-	-
OF_P_3_ 8	-	-	-
OF_P_2_ 6	-	-	-
OF_P_2_ 7	-	-	-
OF_P_8_ 8	-	-	-

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
OF_P_8_ 9	-	-	-
CO_9_ 1	-	-	-

The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
RE_LG_ 1	N/A	N/A
OF_LG_ 1	N/A	N/A
OF_LG_ 2	N/A	N/A
OF_LG_ 3	N/A	N/A
OF_LG_ 7	N/A	N/A
OF_LG_ 8	N/A	N/A
RC_GF_ 1	YES (+16%)	NO
RC_GF_ 2	YES (+91%)	NO
LL_GF_ 1	NO (-23%)	NO
RC_GF_ 3	NO (0%)	NO
OF_P_1_ 1	NO (-52%)	NO
OF_I_1_ 1	NO (-63%)	NO
LL_1_ 1	NO (-62%)	NO
OF_P_1_ 2	NO (-52%)	NO
OF_P_1_ 3	NO (-23%)	NO
OF_P_1_ 4	NO (-49%)	NO
OF_P_2_ 1	NO (-49%)	NO
OF_I_2_ 1	NO (-69%)	NO
LL_2_ 1	N/A	N/A
OF_P_2_ 2	NO (-46%)	NO
OF_P_2_ 3	NO (-18%)	NO
OF_P_3_ 1	NO (-49%)	NO
OF_I_3_ 1	NO (-93%)	NO
LL_3_ 1	N/A	N/A
OF_P_3_ 2	NO (-41%)	NO
OF_P_3_ 3	NO (-28%)	NO
OF_P_4_ 1	NO (-50%)	NO
OF_I_4_ 1	NO (-93%)	NO
LL_4_ 1	N/A	N/A
OF_P_4_ 2	NO (-40%)	NO
OF_P_4_ 3	NO (-26%)	NO
OF_P_5_ 1	NO (-59%)	NO
OF_I_5_ 1	NO (-17%)	NO
LL_5_ 1	N/A	N/A
OF_P_5_ 2	NO (-39%)	NO
OF_P_5_ 3	NO (-24%)	NO
OF_P_6_ 1	NO (-58%)	NO
OF_I_6_ 1	NO (-17%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
LL_6_ 1	N/A	N/A
OF_P_6_ 2	NO (-41%)	NO
OF_P_6_ 3	NO (-24%)	NO
OF_P_7_ 1	NO (-53%)	NO
OF_I_7_ 1	YES (+121%)	NO
LL_7_ 1	N/A	N/A
OF_P_7_ 2	NO (-56%)	NO
OF_P_7_ 3	NO (-25%)	NO
OF_P_8_ 1	NO (-57%)	NO
LL_8_ 1	N/A	N/A
OF_RF_ 1	NO (-14%)	NO
OF_P_8_ 2	NO (-43%)	NO
OF_P_8_ 3	YES (+8%)	NO
OF_I_1_ 2	NO (-65%)	NO
OF_I_2_ 2	NO (-65%)	NO
OF_I_3_ 2	NO (-68%)	NO
OF_I_4_ 2	NO (-68%)	NO
OF_I_5_ 2	NO (-67%)	NO
OF_I_6_ 2	NO (-45%)	NO
OF_I_7_ 2	NO (-63%)	NO
OF_I_8_ 1	NO (-57%)	NO
Vanity_LG_ 1	N/A	N/A
RE_GF_ 1	NO (-30%)	NO
RE_GF_ 2	NO (-38%)	NO
OF_I_3_ 3	NO (-61%)	NO
OF_P_3_ 4	NO (-13%)	NO
OF_P_3_ 5	NO (-34%)	NO
OF_P_3_ 6	NO (-28%)	NO
OF_I_4_ 3	NO (-62%)	NO
OF_P_4_ 4	NO (-13%)	NO
OF_P_4_ 5	NO (-36%)	NO
OF_P_4_ 6	NO (-29%)	NO
OF_I_5_ 3	NO (-61%)	NO
OF_P_5_ 4	NO (-11%)	NO
OF_P_5_ 5	NO (-34%)	NO
OF_P_5_ 6	NO (-28%)	NO
OF_P_6_ 4	NO (-11%)	NO
OF_P_6_ 5	NO (-34%)	NO
OF_P_6_ 6	NO (-28%)	NO
OF_I_6_ 3	NO (-60%)	NO
OF_P_7_ 4	NO (-11%)	NO
OF_P_7_ 5	NO (-33%)	NO
OF_P_7_ 6	NO (-28%)	NO
OF_P_8_ 4	NO (-26%)	NO
OF_P_8_ 5	NO (-28%)	NO
OF_P_8_ 6	NO (-16%)	NO
OF_P_8_ 7	NO (-31%)	NO
ED_RF_ 1	N/A	N/A
OF_P_2_ 4	NO (-39%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
OF_P_2_ 5	NO (-27%)	NO
OF_I_1_ 3	NO (-73%)	NO
OF_I_2_ 3	NO (-70%)	NO
OF_I_2_ 4	NO (-84%)	NO
OF_P_1_ 5	NO (-46%)	NO
OF_P_1_ 6	NO (-32%)	NO
OF_I_1_ 4	NO (-76%)	NO
OF_I_1_ 5	NO (-84%)	NO
OF_P_1_ 7	NO (-54%)	NO
OF_P_1_ 8	NO (-60%)	NO
OF_P_7_ 7	NO (-47%)	NO
OF_P_6_ 7	NO (-60%)	NO
OF_P_6_ 8	NO (-58%)	NO
OF_P_5_ 7	NO (-53%)	NO
OF_P_5_ 8	NO (-55%)	NO
OF_P_4_ 7	NO (-56%)	NO
OF_P_4_ 8	NO (-54%)	NO
OF_P_3_ 7	NO (-55%)	NO
OF_P_3_ 8	NO (-54%)	NO
OF_P_2_ 6	NO (-55%)	NO
OF_P_2_ 7	NO (-56%)	NO
OF_P_8_ 8	NO (-65%)	NO
OF_P_8_ 9	NO (-44%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m²]	7134	7134
External area [m²]	5571	5571
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	3	3
Average conductance [W/K]	2525	2245
Average U-value [W/m²K]	0.45	0.4
Alpha value* [%]	49.09	34.09

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

Building Use

% Area	Building Type
4	**Retail/Financial and Professional Services**
	Restaurants and Cafes/Drinking Establishments/Takeaways
95	**Offices and Workshop Businesses**
	General Industrial and Special Industrial Groups
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
	General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger Terminals
	Others: Emergency Services
1	**Others: Miscellaneous 24hr Activities**
	Others: Car Parks 24 hrs
	Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	0.47	0.14
Cooling	5.11	9.09
Auxiliary	5.83	7.6
Lighting	7.86	10.2
Hot water	11.73	12.37
Equipment*	51.31	51.31
TOTAL**	31	39.4

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	1.83	0.15
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*1.83*	*0.15*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	93.17	104
Primary energy [kWh_{PE}/m^2]	42.87	57.63
Total emissions [kg/m²]	3.91	5.24

Page 17 of 19

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] No Heating or Cooling										
	Actual	0.2	0	0	0	1.2	1	0	1	0
	Notional	0.2	0	0.1	0	1.6	1.34	0	----	----
[ST] No Heating or Cooling										
	Actual	1.6	0	0.5	0	8.6	1	0	1	0
	Notional	0.2	0	0.1	0	8.6	1.34	0	----	----
[ST] Central heating using water: radiators, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	26.7	0	7.4	0	2.2	1	0	1	0
	Notional	10.9	0	2.3	0	2.3	1.34	0	----	----
[ST] Central heating using water: radiators, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	0	0	0	0	7.3	3.41	0	3.58	0
	Notional	0	0	0	0	5.7	2.64	0	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	0	0	0	----	----
[ST] Central heating using water: radiators, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	3.2	0	0.3	0	3	3.41	0	3.58	0
	Notional	4.1	0	0.4	0	4.8	2.64	0	----	----
[ST] Central heating using water: radiators, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	0.8	0	0.1	0	6.5	3.41	0	3.58	0
	Notional	0.1	0	0	0	4.5	2.64	0	----	----
[ST] No Heating or Cooling										
	Actual	17	0	4.7	0	2.7	1	0	1	0
	Notional	0.2	0	0.1	0	2.1	1.34	0	----	----
[ST] Central heating using water: radiators, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	0.4	0	0.1	0	14.1	1	0	1	0
	Notional	0.4	0	0.1	0	12.6	1.34	0	----	----
[ST] Central heating using water: radiators, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	2.5	0	0.2	0	7.4	3.41	0	3.58	0
	Notional	0	0	0	0	6.4	2.64	0	----	----
[ST] Central heating using water: radiators, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	36.7	0	10.2	0	6.9	1	0	1	0
	Notional	37.5	0	7.8	0	6.2	1.34	0	----	----
[ST] Fan coil systems, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	6	101.9	0.5	6.3	7.6	3.41	4.53	3.58	4.77
	Notional	1.2	121.5	0.1	12.5	10	2.64	2.7	----	----
[ST] Central heating using water: radiators, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	88	0	7.2	0	5.2	3.41	0	3.58	0
	Notional	15.8	0	1.7	0	6	2.64	0	----	----
[ST] Fan coil systems, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	1.2	220.2	0.1	13.5	7.6	3.41	4.53	3.58	4.77
	Notional	0	244	0	15.4	9.5	2.64	4.4	----	----

Page 18 of 19

Key to terms	
Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

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