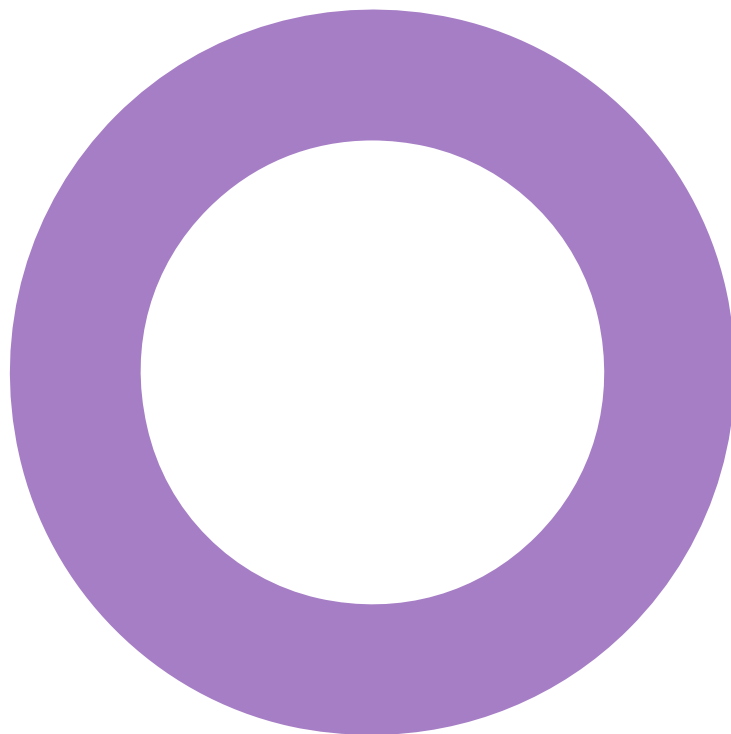


Broad Street Mall. Reading.

McLaren (Broad Street Mall) Ltd and UREF III LP.

SUSTAINABILITY
ENERGY STRATEGY

REVISION 03 – 09 JANUARY 2024



Audit sheet.

Rev.	Date	Description of change / purpose of issue	Prepared	Reviewed	Authorised
01	20/11/2023	Stage 2 Draft Issue	H. Brown	R. Collins	T. Spurrier
02	07/12/2023	Stage 2 Issue	H. Brown	A. Lane	T. Spurrier
03	09/01/2024	Final Issue for Planning	H. Brown	A. Lane	T. Spurrier

This document has been prepared for McLaren (Broad Street Mall) Ltd and UREF III LP only and solely for the purposes expressly defined herein. We owe no duty of care to any third parties in respect of its content. Therefore, unless expressly agreed by us in signed writing, we hereby exclude all liability to third parties, including liability for negligence, save only for liabilities that cannot be so excluded by operation of applicable law. The consequences of climate change and the effects of future changes in climatic conditions cannot be accurately predicted. This report has been based solely on the specific design assumptions and criteria stated herein.

Project number: 23/25089
Document reference: REP-2325089-5A-HB-20230109-Energy Strategy-Rev03.docx

Contents.

Audit sheet.	2
Executive summary.	4
The proposed development.	4
Applicable policy and regulations.	4
Results	4
SAP/EPC Ratings	4
1. Introduction.	5
1.1 The proposed development	5
1.2 Building Regulations Part L1 2021.	5
1.3 Unregulated Energy and Carbon.	5
1.4 Calculation Tool.	5
2. Overview of policy drivers.	6
2.3 Local Policy	6
3. Cooling and overheating.	7
3.1 Cooling hierarchy.	7
3.2 Commercial Mitigation Strategy	7
3.3 Part O: Residential Assessment methodology.	7
3.4 Overheating results.	8
4. Energy Strategy approach and modelling parameters.	9
4.1 Passive design and energy efficiency features	9
4.2 Fabric Permeability.	9
4.1 Active measures.	10
5. Supply energy efficiently.	11
5.1 Network and technologies.	11
6. Use renewable or low carbon (LZC) energy sources.	11
6.1 Low and zero carbon (LZC) technology assessment.	11
6.2 Proposed heating infrastructure.	12
7. Energy strategy results.	13
7.1 Results	13
Proposed site-wide energy strategy.	13
7.2 Carbon Offsetting.	13
Appendix A: Part L1 Results.	15

Appendix B: Part L2 BRUKL.	16
Appendix C: Part O Results.	19
Part O-Building Regulations 2021	19

Executive summary.

This energy strategy has been prepared by Hoare Lea on behalf of McLaren (Broad Street Mall) Ltd and UREF III LP. (Hereafter referred to as ‘the applicant’) in support of the planning application for the Broad Street Mall development (hereafter ‘the Proposed Development’) in Reading.

The proposed development.

The development consists of three interconnected tower blocks and an adjacent smaller residential block. The buildings are comprised of apartments and residential amenity and servicing space. The ground floor of the development also consists of a mix of non-domestic units, which include retail spaces, residential amenity and a gym.

Table 1: Area schedule.

Space type	Space use	Floor area (GIA)
Domestic	Apartments	49,920 m²
Non-domestic	Retail units, Gym & Residential Amenity space	5,348 m²
Total		55,268 m²

Applicable policy and regulations.

With respect to energy and carbon performance, this project must comply with the following policies and regulations:

Reading Local Plan (2019) CC4 – Main focus of the Energy Strategy Report.

- Any development of more than 20 dwellings and/ or non-residential development of over 1,000 sq. m shall consider the inclusion of decentralised energy provision, within the site, unless it can be demonstrated that the scheme is not suitable, feasible or viable for this form of energy provision.
- New build housing should be built to the following standards, unless it can be clearly demonstrated that this would render a development unviable: All major new-build residential development should be designed to achieve zero carbon homes.
- Other relevant policies such as CC2 – BREEAM; CC3 Climate change as well as H5 with specific reference to paragraph 4.4.46 stating minimum carbon requirements and carbon offset levy.

Building Regulations Part L 2021

- The development will be required to achieve compliance with Building Regulations Part L 2021

Results

Figure 1 provides a summary of the results of the ADL1 & L2 calculations and area weighted emission rate for the residential units and non-residential spaces associated with the Broad Street Mall development.

The calculations are based on the performance parameters detailed within this document.

The SAP Ratings of the sample are split 60% B and 40% C however looking more closely at the sample the C Rated apartments are limited to Ground Floor and Roof Level apartments. This would equate to potentially 46 Apartments out of 644 in total.

The design team could look to improve U-values for the roof and ground floor and review the thermal bridging of key junctions associated with ground and roof level apartments, to ensure all units are to achieve EPC B during Stage 3 design development

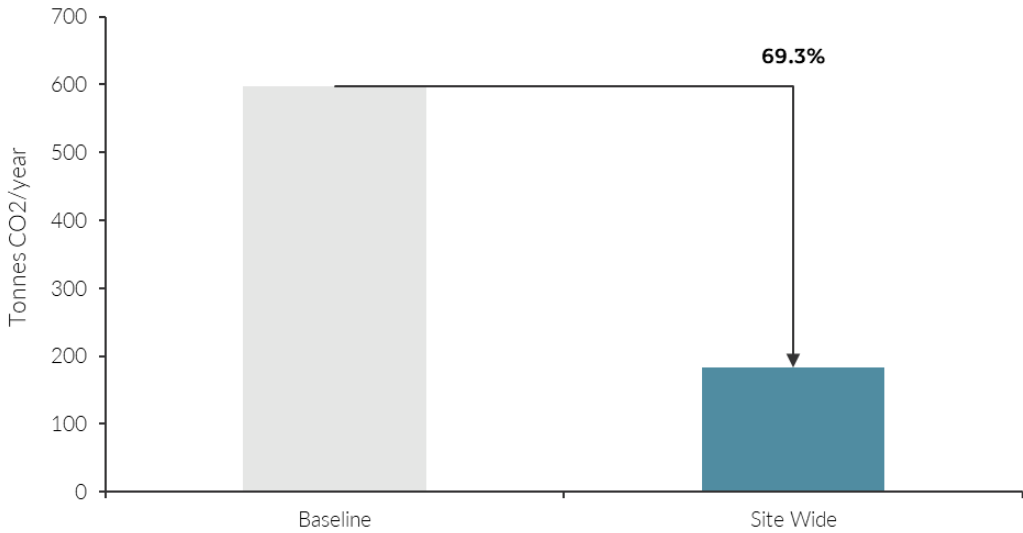


Figure 1: Sitewide carbon reduction summary

Overall, it is anticipated that the development will achieve up to a **69.3 % reduction in CO₂ emissions** beyond the Building Regulations Part L 2021 ‘baseline’.

This has not met the zero carbon target required by Reading Borough Council for residential developments.

This will require a carbon offset payment of £313,380.

SAP/EPC Ratings

The assessment also determines a predicted Energy Performance Certificate (EPC) Rating, or SAP Rating, for each dwelling.

Table 2: Sample EPC schedule.

Plot Reference	Assessment Reference	SAP Rating	SAP Rating
Unit 1	Unit 1 – Central ASHP	80	C
Unit 10	Unit 10 - Central ASHP	79	C
Unit 3	Unit 3 - Central ASHP	83	B
Unit 4	Unit 4 - Central ASHP	81	B
Unit 5	Unit 5 - Central ASHP	82	B
Unit 6	Unit 6 - Central ASHP	82	B
Unit 2	Unit 2 - Central ASHP	80	C
Unit 7	Unit 7 - Central ASHP	83	B
Unit 8	Unit 8 - Central ASHP	83	B
Unit 9	Unit 9 - Central ASHP	79	C

1. Introduction.

This strategy has been developed on behalf of McLaren (Broad Street Mall) Ltd and UREF III LP, hereafter referred to as 'the Applicant'. The following strategy forms part of the full planning application for the proposed multiuse development, Broad Street Mall, hereafter referred to as the Proposed Development. The Proposed Development consists of three residential tower blocks with the ground floor split into several non-domestic spaces.

1.1 The proposed development

The development consists of three interconnected tower blocks and an adjacent smaller residential block. The buildings are comprised of apartments and residential amenity and servicing space. The ground floor of the development also consists of a mix of non-domestic units, which include retail spaces, residential amenity and a gym.

1.2 Building Regulations Part L1 2021.

The building is being assessed against the Building Regulations Part L 2021.

Approved Document Part L (2021, England edition), here forward referred to as ADL 2021, is the Building Regulation relating to the conservation of fuel and power in buildings. ADL 2021 has two parts, Part L1 relates to dwellings and Part L2 relates to buildings other than dwellings.

Part L of the Building Regulations is the mechanism by which government is driving reductions in the regulated CO₂ emissions from refurbished, change of use and new buildings. For new buildings ADL 2021 has four performance metrics as follows:

- Primary energy target
- CO₂ emissions target
- Fabric Energy Efficiency (FEE) target
- Minimum standards for fabric and fixed building services.

In apartment buildings, compliance does not need to be achieved on a dwelling-by-dwelling basis and can be achieved on a building wide basis provided the dwellings are located within a contiguous thermal envelope.

As the development consists of a block of apartments, compliance with Part L1 2021 can be achieved if the average Dwelling Emission Rate (DER), Dwelling Primary Energy Rate (DPER) and Dwelling Fabric Energy Efficiency (DFEE) is no greater than the average TER, TPER or TFEE for each building. The average is calculated by a floor area weighting of the representative sample.

1.2.1 Limitations

The appraisals within the strategy are based on the Building Regulations Part L 2021 calculation methodology and should not be understood as a predictive assessment of likely future performance.

Occupants may operate their systems differently, and/or the weather may be different from the assumptions under Part L approved calculation methods, leading to differing energy requirements.

1.3 Unregulated Energy and Carbon.

The Part L compliance assessment only takes into account regulated energy uses (i.e., lighting, heating, cooling and ventilation) and does not consider unregulated energy uses. Unregulated sources include 'plug-in' consumption from items such as televisions, computers and fridge-freezers, etc.

Due to these energy requirements being excluded from the Part L appraisal an assessment of the unregulated CO₂ emissions of the Proposed Development has not been undertaken (typically required by sustainable construction and design SPD). It is therefore suggested to carry out a specific study for the in-use energy demands to explore further opportunity to decrease the operative costs and carbon emissions.

1.4 Calculation Tool.

The Part L1 2021 calculations were undertaken using Elmhurst Design SAP 10 software, which is approved for use in assessing the performance of buildings in accordance with the Building Regulations Part L1 2021. The Part L2 2021 calculations were undertaken using IESVE 2023.1.0 software, which is approved for use in assessing the performance of buildings in accordance with the Building Regulations Part L2 2021.

Disclaimer

The appraisals within this statement are based on Part L calculation methodology and should not be understood as a predictive assessment of likely future energy requirements or otherwise. Occupants may operate their systems differently, and / or the weather may be different from the assumptions made by Part L approved calculation methods, leading to differing energy requirements.

2. Overview of policy drivers.

The strategy will respond first and foremost to the Universal Challenges of the Climate Emergency facing humanity, in addition to national and local policy which will shape the baseline of performance, with the UN Sustainable Development Goals alongside best practice principles of masterplan design, delivery, and operation shaping the eventual strategy.

2.1 Global Challenges.

People the world over face three universal challenges to which any sustainable development must respond effectively to be successful.

These are as follows:



Climate change

In 2019, the Intergovernmental Panel on Climate Change (IPCC) confirmed via publication that, in order to mitigate the most devastating impacts of climate change, the world must demonstrate net zero carbon emissions by 2050. Reflecting this urgent call for action, the Committee on Climate Change published *Net Zero – The UK’s contribution to stopping global warming*, identifying a route for the UK to achieve the net zero target. The UK government then joined a number of other nations in declaring a **Climate Emergency** and the target was ratified into law, meaning the UK has a legally binding obligation to reduce its emissions to zero by 2050 at the latest.

The built environment contributes around 40% (UKGBC) of our national greenhouse gas emissions footprint, so any new development must minimise its footprint on day 1 and demonstrate a realistic route to achieving net zero carbon in future in order to align with our commitments to national decarbonisation.

2.2 National Policy

Building Regulations: Approved Document Part L

Approved Document Part L (2021, England edition), here forward referred to as ADL 2021, is the Building Regulation relating to the conservation of fuel and power in buildings. ADL 2021 has two parts, Part L1 relates to dwellings and Part L2 relates to buildings other than dwellings. Both apply to the proposed development.

Part L of the Building Regulations is the mechanism by which government is driving reductions in the regulated CO₂ emissions from refurbished, change of use and new buildings. For new buildings ADL 2021 has four performance metrics as follows:

- Primary energy target
- CO₂ emissions target
- Fabric Energy Efficiency (FEE) target
- Minimum standards for fabric and fixed building services

2.3 Local Policy

This note provides an overview of Reading’s policy landscape, as relevant to the proposed development. The cited policies are not exhaustive. Please see Table 3 for further detail.

Relevant Local Planning Policy Documents

Key documents:

- Part 1: Reading Borough Local Plan (adopted November 2019)
- Sustainable Design and Construction: Supplementary Planning Document (SPD) (November 2019)

Reading Local Plan

The Reading Local Plan was adopted in November 2019 and is now the statutory Development Plan. It sets out the strategy for meeting the Borough’s needs from up to 2036, it outlines: the overall vision for Reading in 2036, Strategic Objectives (SO) and the Strategic Policies (broad policies for steering development). It is consistent with the Sustainable Community Strategy and has an ambition for Reading to be attractive and sustainable.

Table 3: Summary of local policies for energy and sustainability.

Policy	Relevant Policy Requirements
Reading Local Plan (2019)	Policy CC2 – BREEAM Standards required for non-resiential. Policy CC3 - All developments will demonstrate how they have been designed to incorporate measures to adapt to climate change. The following measures shall be incorporated into development: - Wherever possible, new buildings shall be orientated to maximise the opportunities for both natural heating and ventilation and reducing exposure to wind and other elements. Proposals involving both new and existing buildings shall demonstrate how they have been designed to maximise resistance and resilience to climate change for example by including measures such as solar shading, thermal mass, heating and ventilation of the building and appropriately coloured materials in areas exposed to direct sunlight, green and brown roofs, green walls, etc.
	Policy CC4 - Any development of more than 20 dwellings and/ or non-residential development of over 1,000 sq. m shall consider the inclusion of decentralised energy provision, within the site, unless it can be demonstrated that the scheme is not suitable, feasible or viable for this form of energy provision.
	Policy H5 - New build housing should be built to the following standards, unless it can be clearly demonstrated that this would render a development unviable: All major new-build residential development should be designed to achieve zero carbon homes. All other new build housing will achieve at a minimum a 19% improvement in the dwelling emission rate over the target emission rate, as defined in the 2013 Building Regulations. On developments of 20 or more new build dwellings, at least 5% of dwellings will be wheelchair user dwellings in line with M4(3) of the Building Regulations. Any market homes provided to meet this requirement will be ‘wheelchair adaptable’ as defined in part M, whilst homes where the Council is responsible for allocating or nominating an individual may be ‘wheelchair accessible’

Note: Sustainable Design and Construction SPD – Para 3.6 – 3.8 for Non-residential and Para 3.9 – 3.12 for residential developments. The following sections of this report demonstrate that the Proposed Development complies with the policy requirements.

Limitations:

The appraisals within this statement are based on Part L calculation methodology and should not be understood as a predictive assessment of likely future energy requirements or otherwise. Occupants may operate their Systems differently, and / or the weather may be different from the assumptions made by Part L approved calculation methods, leading to differing energy requirements.

3. Cooling and overheating.

In tandem with the energy and CO₂ emissions appraisal, an assessment has been undertaken to determine the risk of summertime overheating, and subsequently consider measures for the minimisation of cooling demand and mitigating risk of overheating.

3.1 Cooling hierarchy.

The London Plan Policy 5.9 (Overheating and Cooling) requests that developments should reduce potential overheating risk and reliance on air conditioning systems. A ‘cooling hierarchy’ is provided and the Proposed Development has sought to follow this hierarchy.

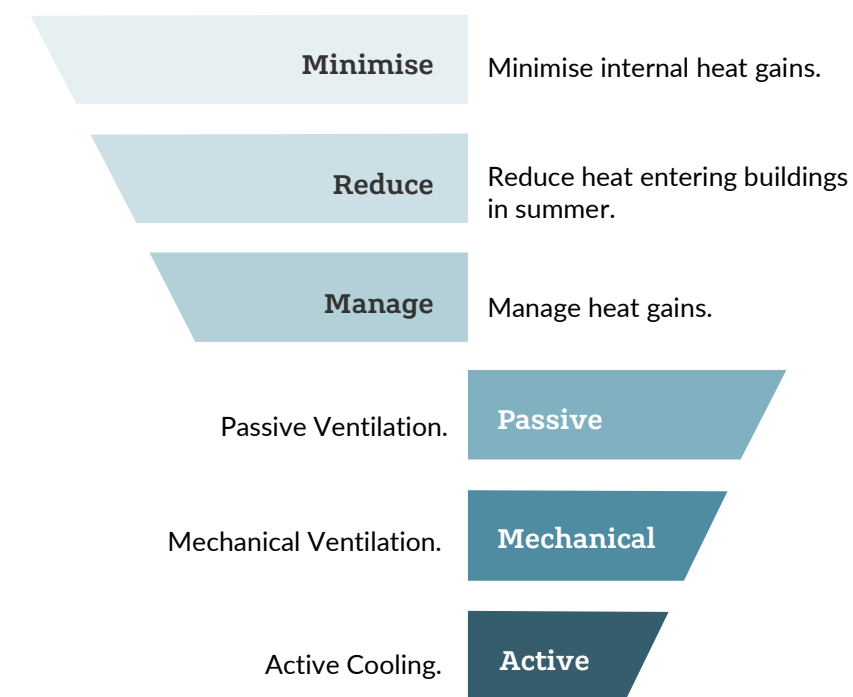


Figure 2: Cooling hierarchy.

3.2 Commercial Mitigation Strategy

Minimising internal heat gains

The following mitigation methods will be implemented to minimise the internal heat generation through energy efficient design at the Proposed development:

- Energy efficient lighting (i.e., LED) with low heat output.
- Insulation to heating and hot water pipework and minimisation of dead legs to avoid standing heat loss.
- Energy efficient equipment with low heat output to reduce unnecessary heat gain.

Reducing the amount of heat entering the building in summer

The following mitigation methods will be implemented to reduce the amount of heat entering the building in summer within the proposed development:

- Facades have been developed with suitable glazing-to-solid ratios, with particular focus on south facing orientations. Glazing ratios for the development are provided in Appendix A.

- Suitable g-values will be specified to further control solar heat gains as required; and
- Buildings will have the capability for internal blinds to be installed to improve occupant comfort.

Manage heat gains.

- Opportunities to expose thermal mass to help to further regulate internal temperatures will be explored where possible, although the potential use of cross-laminated timber (CLT) slabs does mean that the main soffits will be thermally lightweight.

Passive ventilation

The potential for passive ventilation via opening facades to facilitate a mixed-mode ventilation strategy has been considered within the facade design and will be evaluated further during the next stage of design.

Mechanical ventilation

Mechanical ventilation is an important element of building services, to maintain good indoor air quality throughout the day by providing fresh air and extracting vitiated air. Providing fresh air minimises the risk of stale and stagnant air and limits the risk of condensation and mould growth as well as benefitting the occupants’ physical and mental wellbeing. Heat recovery mechanisms will be provided to save heating energy.

Mechanical ventilation plant will be located away from pollution sources, typically at roof level. It is anticipated that the design flow rates specified will aid the regulation of internal temperatures in summer months.

Active cooling

As the final step active cooling is specified, in order to keep internal temperatures within acceptable limits. The façade and building services have the ability to enable a fan coil unit cooling solution.

3.3 Part O: Residential Assessment methodology.

Thermal comfort methodology has been used to assess the occupied spaces within a representative sample of 7 No. Dwellings to determine their risk of overheating during the summer period (May to September inclusive).

The spaces have been assessed against criteria stated within CIBSE Technical Memorandum 59 (TM59): Design methodology for the assessment of overheating risk in homes, in accordance with the dynamic thermal modelling method, applying the relevant Part O parameters.



During design development passive design principles have been adopted to reduce overheating risk which including retaining modest glazing %. The assessment has utilised dynamic simulation modelling to anticipate the internal temperatures likely to be experienced within the apartments during the summer months.

The model developed for this study consists of the following input parameters to determine the thermal conditions within the occupied spaces:

- Fabric performance,
- Ventilation strategy,
- Internal gains,
- Occupancy profiles, and;
- External weather conditions taken from CIBSE London weather centre future climate data:
DSY1_London Heathrow_2020High50 (Design Summer Year 1: 2020, high emissions scenario (50th percentile).

The geometry used to assess proposed dwellings was determined by drawings received from the project architect:

Table 4: Architectural Information.

Drawing Type	Document Package	Data Type	Date Received
Plans, Sections, Elevations	Revit Model	DWG/REVIT	31/10/2023

For further information on Part O and the calculation parameters see Appendix C.

3.4 Overheating results.

CIBSE TM59 is shown to be satisfied when the following criteria are achieved for naturally ventilated spaces:

- Criterion A is achieved when the threshold temperature is not exceeded for more than 3% of the occupied hours.
- Criterion B is achieved when the operative temperature in bedrooms (from 10 pm to 7 am) does not exceed 26 °C for more than 1% of annual hours.

Or, for mechanically ventilated spaces:

-the CIBSE fixed temperature test must be followed, i.e., all occupied rooms should not exceed an operative temperature of 26 °C for more than 3% of the annual occupied annual hours,

Table 5: Passive Design - Natural Ventilation CIBSE TM59 results

Sample Dwellings	TM59 Criterion A Rooms that are passing	TM59 Criterion B Rooms that area failing	Pass %
9 Bedrooms	7	2	77%
7 Living/Kitchen	0	7	100%
Sample Dwellings	TM59 Criterion B Rooms that are passing	TM59 Criterion B Rooms that area failing	Pass %
21 Bedrooms	0	9	0%

As ALL bedrooms failed under the naturally ventilation assessment a tempered air solution has been proposed working at a ventilation rate of 80-100l/s.

There is also a restriction on openable windows at night for the south, east and west façade, this is due to external noise levels:

Therefore, this tempered air solution will satisfy both the overheating (Part O) and acoustic requirements.

Table 6: Tempered Air – Natural Ventilation CIBSE TM59 results

Sample Dwellings	TM59 Criterion A Rooms that are passing	TM59 Criterion B Rooms that area failing	Pass %
9 Bedrooms	9	0	100%
7 Living/Kitchen	7	0	100%
Sample Dwellings	TM59 Criterion B Rooms that are passing	TM59 Criterion B Rooms that area failing	Pass %
21 Bedrooms	9	0	100%

Communal Corridor Overheating Check

CIBSE TM59 states that whilst there is no mandatory target for communal corridors, if an operative temperature of 28°C is exceeded for more than 3% of annual hours, then this should be identified as a significant risk within the TM59 overheating report.

The modelling demonstrated the corridors of the Proposed Development pass this test.

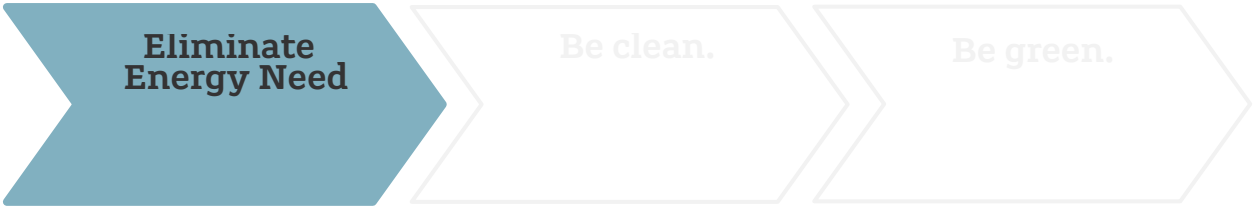
Table 5: CIBSE TM59 results for communal corridors.

Communal Corridor Check	% Annual hours above 28°C	Result
A-L01-Corridor	0.6	PASS
A-L28-Corridor	0.6	PASS
C-L18-Corridor	1.5	PASS

The results for the overheating assessment are shown below for each occupied space within the sample apartments assessed. Detailed results charts are provided in Appendix C.

4. Energy Strategy approach and modelling parameters.

Passive design and energy efficiency measures form the basis for the reduction in overall energy demand and carbon emissions for the Proposed Development. This energy strategy aims to reduce the energy demand initially by optimising the envelope and building services within the development.



4.1 Passive design and energy efficiency features

Passive Design measures are those which reduce the demand for energy within buildings, without consuming energy in the process.

These are the most robust and effective measures for reducing CO₂ emissions as the performance of the solutions, such as wall insulation, is unlikely to deteriorate significantly with time, or be subject to change by future property owners. In this sense, it is possible to have confidence that the benefits these measures will continue at a similar level for the duration of their installation.

	Fabric performance A ‘fabric first’ approach has been taken in order to reduce the energy demand and CO₂ emissions from the Proposed Development. The overriding objective for the façade design of all of the new building elements will be to achieve the optimum balance between providing natural daylighting benefits to reduce the use of artificial lighting, the provision of passive solar heating to limit the need for space heating in winter and limiting summertime solar gains to reduce space cooling demands. Thermal Insulation The new elements will Proposed Development will benefit from an efficient thermal envelope. Typically, demand for space heating can be dominant in dwellings, whilst space heating is less dominant in commercial spaces such as retail (lighting dominant). Heat losses and gains will be controlled by the optimisation of the fabric, i.e., ensuring appropriate levels of glazing to control winter heat loss and summer heat gain. Reducing the thermal transmittance of the building envelope where appropriate will help to reduce both heating and cooling requirement and result in lower energy requirements.
	Space cooling No dedicated cooling system is proposed for the dwelling’s, tempered air is to be supplied via the MVHR units. Some cooling will be provided for the non-domestic elements, efficient systems are proposed in line with the standards outlined in the Non-Domestic Building Services Guide (2013).
	Mechanical ventilation MVHR units are an important addition to the building services to maintain good indoor air quality. Providing fresh air minimises the risk of stale and stagnant air and limits the risk of condensation and mould growth. Coupled to a heat exchanger, the warmth in extracted air can be recovered and delivered to the supply air. In this mode, the MVHR unit reduces space heating demand. The heat

	recovery mechanism will be provided with a bypass to avoid returning hot air to the dwellings in summer months.
	Natural daylight and lighting strategy Lighting tends to provide a significant contribution to regulated CO₂ emissions. As such, the implementation of energy efficiency lighting design is paramount to reducing overall emissions for these spaces. Therefore, it is anticipated that the Proposed Development will be supplied with efficient electric lighting ‘Light Emitting Diodes’ (LED) or similar low energy lamps. The lighting specification for the Proposed Development will be carried out in conjunction with lighting control systems incorporating daylight linkage and presence detection. As well as reduced energy requirement that will be achieved by implementing these strategies, the contribution to the cooling requirements and internal heat gains will be reduced. This will further reduce the total energy requirements and CO₂ emissions of each building.

4.2 Fabric Permeability.

Fabric permeability is a measure of how ‘leaky’ a structure is. Air leakage can occur in both directions i.e., both out of, and into a building. The volume of air that either enters or leaves the building leads to additional energy demand as generally the air either cools (in winter) or heats (in summer) the building. An air permeability of 3.00m³/m².h at 50Pa is proposed for the building.

Table 5 below summarises the fabric parameters of the Proposed Development for the development’s domestic elements.

Table 2: Proposed fabric performance

Building element	Target performance
Air permeability (m ³ /h.m ² at (50Pa))	3.00
External wall u-value (W/m ² .K)	0.15
Windows (W/m ² .K)	1.20
Sheltered Wall (W/m ² .K)	0.20
Roof u-value (W/m ² K)	0.11
Exposed floor u-value (W/m ² K)	0.11
Doors – Opaque (W/m ² .K)	1.00
Glazing performance	
Residential Glazing g-value (Light Transmittance)	0.40 (≥0.7)
Residential Glazing g-value (Light Transmittance) – southwest & corner apartments only	0.30 (≥0.7)
Ground Floor Retail g-value (Light Transmittance)	0.28 (≥0.7)
Frame factor assumption (%)	10%

4.1 Active measures.

In addition to the passive design measures, the following energy efficiency measures will be included in the Proposed Development in order to limit the demand for primary energy. Table 6. below includes the building services parameters to be included in the preliminary Part L calculation for both the domestic and non-domestic elements.

Table 3: Proposed system parameters

	Domestic	Non-Domestic
Heating	Centralised ASHP SCOP 3.0 to HIU	Centralised VRF ASHP SCoP 4.2
Cooling	Tempered Air only.	Centralised VRF ASHP SEER 5.5
Ventilation	Nuaire MRXBOXAB-ECO Balanced Mechanical Ventilation with Heat Recovery	SFP – 1.50 W/(l/s) 80% Heat recovery
Lighting	100% efficient lighting at 90lm/W	100-120 lm/W as per MEP Scheme Design.
Domestic Hot Water	Centralised ASHP to HIU 95% + Electric Boiler Top-up 5% HIU Standing Losses 1.44kWh/day	Point of Use Electric

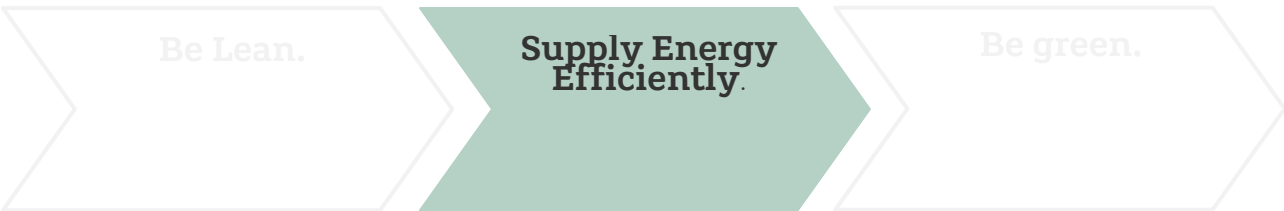
Utilising the passive and active elements as listed within this section the Proposed Development achieves compliance with the fabric energy efficiency requirements of Part L 2021.

Table 4 Dwelling Fabric Energy Efficiency

	Dwelling fabric energy efficiency (DFEE) kWh/year	Target fabric energy efficiency (TFEE) kWh/year	Percentage variance
Area-weighted average:	29.8	30.4	2.06%

5. Supply energy efficiently.

This stage of the energy hierarchy refers to the use of heat networks or on-site Combined Heat and Power (CHP) in order to provide energy and reducing consumption from the national grid and gas networks, through the generation of electricity, heating and cooling on-site.



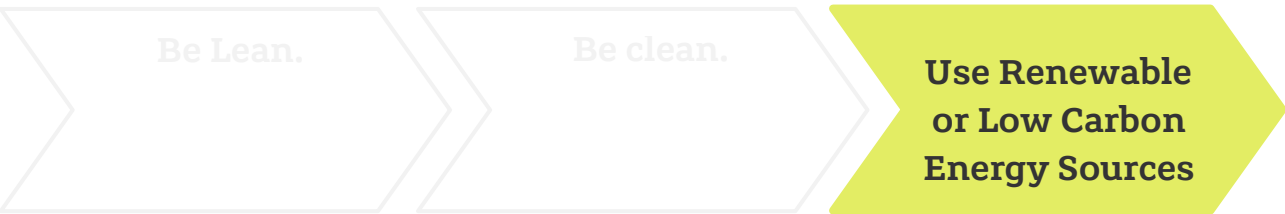
5.1 Network and technologies.

In line with policy aspirations, the following sections summarise the considerations of the low-carbon energy supply measures that have been considered, and those which will be implemented at the Proposed Development.

	Decentralised heat and energy networks Offsite heating network There are currently no District Heat Networks (DHNs) in close proximity to the Proposed Development, therefore at present a connection is not possible.
	Combined heat and power (CHP) Changes to the carbon factor of grid electricity have meant that previously favoured systems such as Combined Heat and Power (CHP) are becoming much less carbon efficient. In fact, CHP systems are now expected to lead to greater carbon emissions than conventional gas-fired boilers due to their lower efficiency. Due to the decarbonisation of the electricity grid, schemes using CHP engines for the delivery of heating energy at the Proposed Development leads to a net increase in carbon emissions (over the baseline). Furthermore, CHP engines are an on-site source of particulate pollutants which will adversely affect local air quality. In light of grid decarbonisation and increased focus on air quality, CHP is therefore not proposed.
	Communal heat and energy networks driven by heat pumps. On-site centralised air-source heat pumps will supply both space conditioning and domestic hot water. Heat pump technology, driven by grid electricity, enables the use of 'free heat' from the environment and is therefore a highly efficient source of energy.

6. Use renewable or low carbon (LZC) energy sources.

The final step of the energy hierarchy explores the feasibility of Low and Zero Carbon (LZC) technologies to allow for the production of renewable energy onsite in order to offer a further reduction in carbon emissions.



6.1 Low and zero carbon (LZC) technology assessment.

Renewable or zero carbon technologies harness energy from the environment and convert this to a useful form. Many renewable technologies are available, however, not all of these are commercially viable or suitable for city locations. Technology deemed appropriate and incorporated within the design are highlighted in the table below.

	Photovoltaics Photovoltaic panels harness energy from daylight and convert this into useful energy in the form of electricity. A PV system requires viable roof space in order for the system array to be installed and function effectively. Suitability to Proposed Development: 20m ² required for Part L2A calculation. These could be roof mounted across Block C. A solar PV array can provide a significant reduction in CO ₂ and is considered appropriate for the Proposed Development but currently not included in the Residential SAP calculations completed to date. 80m ² could be used for the Part L1 calculation i.e. 1No 400W Panel per C-Rated dwelling but must be connected to dwelling otherwise no EPC benefit.
	Solar thermal Solar Thermal Panels are similar to PV Panels in that they harness energy from solar. This technology however converts solar into thermal energy that can offset the demand on hot water generation systems. Suitability to Proposed Development: As above, roof area is available for solar panels. However, it would be to prioritise solar PVs, since the electrical output from PV panels will be more suitable for implementation with the electrical led Energy Strategy and building energy usage. Therefore, solar thermal is not proposed for the development.
	Ground source heat pumps Ground Source systems work to extract heat or cooling energy from the ground. They are generally slightly more efficient than air source systems, as the ground temperature is more stable over the course of the year relative to air temperature. There are four common varieties of ground source systems:

	- Vertical, open loop, direct cooling (i.e., without heat pump) - Vertical, open loop, with heat pump - Horizontal, closed loop, with heat pump - Vertical, closed loop, with heat pump Regardless of the type of ground source heat loop used, all would require extensive below ground works to bury and install the system on site. Ground Source Heat Pumps are not considered a feasible option and are not proposed.
	Air source heat pumps Air source heat pumps (ASHP) use thermodynamic principles to convert heat from the air into useable heat within the building. Unlike some other sources of renewable energy, heat pumps do require energy (typically electricity or gas) to pump and compress refrigerant through the system. However, under the Renewable Energy Directive 2009/28/EC they are classified as renewable technologies provided that the final energy output significantly exceeds the primary energy input required to drive the heat pump. ASHP need to be located externally with access to the ambient air, typically at roof level. Suitability to Proposed Development: The main benefits of ASHPs are that they can provide both heating and cooling as the heat pump can be operated in reverse, and they are suitable for centralised heat networks. They are easy to install (more so than GSHP) and require very little maintenance once installed. This solution requires a large outdoor space at roof or ground level to accommodate ASHPs to provide a portion of the heat demand. ASHPs are considered an appropriate technology for areas of the Proposed Development. These will be roof mounted across Blocks A, B & D.
	Wind turbine For efficient operation and to yield high energy output, wind turbines require a smooth laminar flow of air. The Proposed Development is located within a dense urban environment therefore the wind flow profile is erratic and consequently, is not conducive to high annual yields. Suitability to Proposed Development: Moreover, mounting wind turbines on the roofs of the Proposed Development could result in unacceptable vibration and resonance being felt within the occupied spaces. The turbines are also likely to generate noise which may be a nuisance to neighbouring properties. This scenario could result in the turbines being switched off. Considering the impacts described above, the limited CO₂ emission benefit and visual impact of wind turbines on the character and appearance of the area, the use of micro wind turbines will not be implemented at the Proposed Development.
	Biomass Biomass boilers burn wood fuel or other bio-fuel sources to generate heat. These boilers can operate at high efficiencies, comparable to condensing gas boilers. However, they require a large fuel store to maintain continuous operation during the winter months. As such, area take for such plant is high. Furthermore, fuel deliveries in city-centre locations can prove difficult and security of fuel supply is an important consideration. Suitability to Proposed Development:

	The calculations indicate that the use of a biomass boiler could yield good, regulated CO₂ emissions savings however this would also lead to in an increase of NOx emissions from the Site and require a store footprint for the biomass fuel which would take up additional building footprint. As such, the use of biomass boilers at the Proposed Development is considered to be unsuitable.
--	---

6.2 Proposed heating infrastructure.

With the recognition that the generation of electricity is much greener now than it used to be due to the decarbonisation of the grid, along with the reduction of the electricity carbon factors, a centralised Air Source Heat Pump (ASHP) system is considered an appropriate heat infrastructure for this development, with use of top-up electric boilers. This has been adopted as the preferred option.

The distribution losses will be designed to comply with the latest CIBSE CP1 Guidance and a DLF of 1.29 has been accounted for in this energy strategy.

7. Energy strategy results.

The strategy has been developed using the energy hierarchy which utilises a fabric first approach to maximise reduction in energy through passive design measures. The following table provides a summary of the energy strategy for the Proposed Development for both the dwelling and site wide scale.

The Residential SAP L1A 2021 calculations totalled 10 number from Blocks A, B, C & D which equates to represent 16% of the development's residential footprint,

The non-Residential communal amenity space has been modelled using IESVE 2022 in its entirety to ensure Part L2A 2021 compliance.

Eliminate Energy Need	High energy efficient building fabric and building services have been utilised to reduce carbon emissions and energy demand through good practice passive measures with a 2.06% reduction upon the 2021 TFEE achieved.
Supply Energy Efficiently	Air source heat pumps are considered an appropriate technology for areas of the Proposed Development. On the residential this is explicitly for the Heating & DHW production via ASHPs. For Block A, B, C & D: Non-Residential elements a VRF centralised air source heat pumps will provide space heating and hot water.
Use Renewable or Low Carbon (LZC) Energy Sources	The air source heat pumps will run on grid electricity, avoiding the use of fossil gules. Roof mounted PV could also be implemented at the Proposed Development to further reduce carbon emissions.

7.1 Results

Through the measures outlined in the energy strategy, it is anticipated that overall, up to a 69.3% reduction in CO₂ emissions can be achieved beyond the Building Regulations Part L 2021 baseline.

Table 10 details the performance levels achieved against the Part L 2021 compliance metrics for the domestic, non-domestic and overall site areas.

Table 5: Regulated carbon savings – Zone 1 & Zone 2.

	Building/ Dwelling Primary Emission Rate (BPER/ DPER)	Target Primary Energy Rate (TPER)	% Reduction over the Target Primary Energy Rate (TPER)	Building/ Dwelling Emission Rate (BER/ DER)	Target Emission Rate (TER)	% Reduction over Target Emission Rate (TER)
	kWh/m ²	kWh/m ²		kgCO ₂ e/m ²	kgCO ₂ e/m ²	
Residential	47.11	81.99	42.5%	4.41	14.78	70.2%
Non-Residential	18.8	27.79	32.3%	1.75	2.61	32.9%
Site Wide						69.3%

Please refer to Appendix A for the sample SAP reports and Appendix B for the BRUKL document.

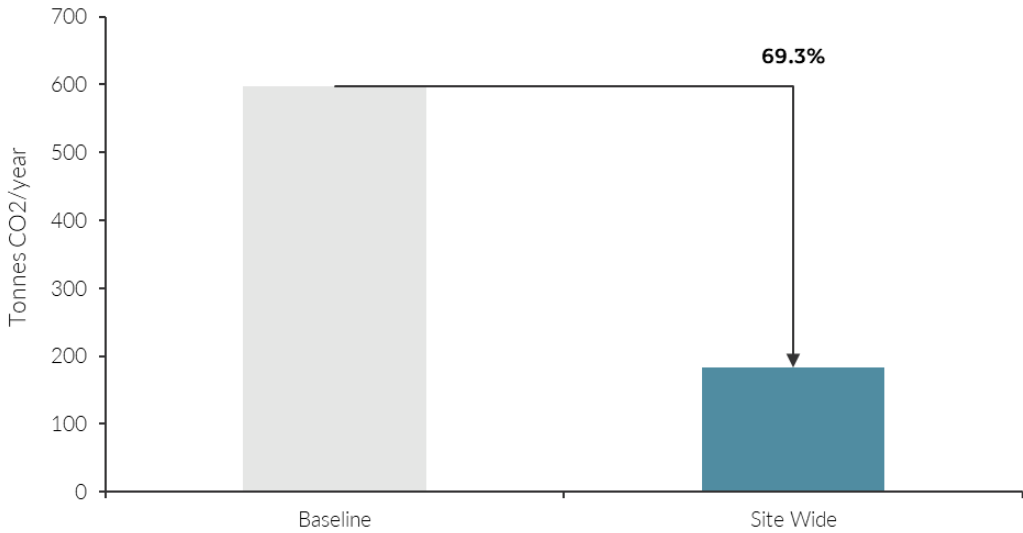


Figure 3: Sitewide - Regulated carbon emissions summary.

Proposed site-wide energy strategy.

Overall, it is anticipated that the development will achieve up to a 69.3 % reduction in CO₂ emissions beyond the Building Regulations Part L 2021 ‘baseline’.

This has not met the zero carbon target required by Reading Borough Council for residential developments therefore a carbon offsetting calculation has been provided in the following section 7.2.

7.2 Carbon Offsetting.

New build housing should be built to the following standards, unless it can be clearly demonstrated that this would render a development unviable:

All major new-build residential development should be designed to achieve zero carbon homes.

For every tonne of carbon emissions, the developer must pay £1,800 (£60 for 30 years) towards offsetting in Reading, with this offsetting related directly to energy efficiency or renewable energy contributions in the local area. The council is in the process of developing guidance on how the offset contributions will be spent.

	Site-Wide Regulated Carbon Dioxide (tonnes CO ₂ /yr.)	
	Regulated	Unregulated
Baseline: Part L 2021 Building Regulations	583	
After energy demand reduction (Be Lean)	583	
After heat network / CHP (Be Clean)	583	
After renewable energy (Be Green)	174	
	Site-Wide Regulated domestic carbon	
	(tonnes CO ₂ /yr.)	(%)
Savings from energy demand reduction	0	0.0%
Savings from heat network / CHP	0	0.0%
Savings from renewable energy	409	70.2%
Cumulative on-site savings	409	70.2%
Total target savings	583.4	100.0%
Shortfall	174	29.8%
GLA Offset Payment Rate (£/tCO ₂)	£1,800	
Total Offset Payment	£313,380	

Appendix A: Part L1 Results.

Dwelling reference	GIA	Multiplier	Total area	CO ₂ emissions			Primary Energy			Fabric energy efficiency			Overall compliance
				Target Emissions Rate (TER)	Dwelling Emission Rate (DER)	Variance	Target Primary Energy Rate (TPER)	Dwelling Primary Energy Rate (DPER)	Variance	Target Fabric Energy Efficiency (TFEE)	Dwelling Fabric Energy Efficiency (DFEE)	Variance	
-	m ²	-	m ²	kgCO ₂ /m ² /yr.	kgCO ₂ /m ² /yr.	%	kWh/m ² /yr	kWh/m ² /yr	%	kWh/m ² /yr	kWh/m ² /yr	%	-
A.01.02 - Level 01	60.93	3	182.79	16.76	5.32	68.26%	92.68	56.3	39.25%	39.91	43.53	-9.07%	NO
C.01.11 - Level 01	50.67	1	50.67	18.74	5.3	71.72%	103.99	56.39	45.77%	42.75	40	6.43%	YES
A.04.04 - Level 04	88.48	21	1858.08	12.87	3.78	70.63%	71.23	40.24	43.51%	30.25	29.55	2.31%	YES
A.04.08 - Level 04	37.29	22	820.38	17.8	5.22	70.67%	99.6	56.06	43.71%	28.1	26.92	4.20%	YES
B.04.03 - Level 04	61.58	21	1293.18	15.08	4.55	69.83%	83.43	48.52	41.84%	32.87	32.49	1.16%	YES
B.04.09 - Level 04	43.3	21	909.3	16.42	4.93	69.98%	91.45	52.87	42.19%	28.76	27.45	4.55%	YES
C.04.01 - Level 04	90.8	3	272.4	12.69	3.7	70.84%	69.74	39.42	43.48%	30.7	29.47	4.01%	YES
C.04.10 - Level 04	68.92	8	551.36	12.55	3.88	69.08%	69.47	41.57	40.16%	23.23	23.07	0.69%	YES
C.18.01 - Level 18	58.79	1	58.79	19.19	5.67	70.45%	105.39	59.9	43.16%	50.07	48.8	2.54%	YES
A.28.05 - Level 28	68.74	1	68.74	17.13	5.27	69.24%	94.42	55.78	40.92%	44.39	46.14	-3.94%	NO
	Total	102	6065.69	14.78	4.41	70.15%	81.99	47.11	42.54%	30.42	29.80	2.06%	YES

Appendix B: Part L2 BRUKL.

BRUKL Output Document **HM Government**
Compliance with England Building Regulations Part L 2021

Project name

Broad Street Mall As designed

Date: Thu Nov 16 15:32:19 2023

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.19

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.19

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

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Foundation area [m²]: 1324.39

The CO₂ emission and primary energy rates of the building must not exceed the targets

Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	2.61
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	1.75
Target primary energy rate (TPER), kWh _m /m ² .annum	27.79
Building primary energy rate (BPER), kWh _m /m ² .annum	18.8
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	0.15	0.15	L0000008:Surf[0]
Floors	0.18	0.11	0.11	ZL000001:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.11	0.11	ZL000001:Surf[1]
Windows** and roof windows	1.6	1.2	1.2	L0000008:Surf[4]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors ^Δ	1.6	1	1	L0000008:Surf[3]
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 certain 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.
^Δ 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

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- Block A

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(Us)]	HR efficiency
This system	4.2	5.5	0	-	0.8
Standard value	2.5*	5	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

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

2- Block B

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(Us)]	HR efficiency
This system	4.2	5.5	0	-	0.8
Standard value	2.5*	5	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

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

3- Block C

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(Us)]	HR efficiency
This system	4.2	5.5	0	-	0.8
Standard value	2.5*	5	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

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

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

*No zones in project where local mechanical ventilation, exhaust, or terminal unit is applicable"

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
A-L00-Retail 2	120	80	1.875
B-L00-Retail 3	120	80	1.875
B-L00-Retail 4	120	80	1.875
Circulation	100	-	-
B-L00-Main Entrance	120	-	-
B-L00-Retail 5	120	80	1.875
B-L00-Gym	120	-	-
B-L00-Gym Store	120	-	-
B-L00-Studio	120	-	-
B-L00-Delivery Store	100	-	-
B-L00-Acc WC	120	-	-
B-L00-Staff Room	120	-	-
B-L00-Office	120	-	-

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
B-L00-Corridor & Stairs		100	-	-
B-L00-Corridor		100	-	-
B-L00-Corridor		100	-	-
C-L00-Retail 6		120	80	1.875
C-L00-Entrance		120	-	-
C-L00-AOD Varies		100	-	-
C-L00-Car Park		100	-	-
C-L00-Retail 7		120	80	1.875
B-L01-Amenity		120	-	-
B-L01-Amenity		120	-	-
B-L01-Amenity		120	-	-
B-L01-Delivery Store		100	-	-
B-L01-Stairs & Circ		100	-	-
C-L01-Stairs & Circ		100	-	-
C-L01-Amenity		120	-	-
B-L24-Amenity		120	-	-
B-L24-Amenity		120	-	-
B-L24-Corridor		100	-	-
B-L24-Stairs		100	-	-
B-L24-Corridor		100	-	-
A-L00-Retail 1		120	80	1.875
A-L00-Entrance		120	-	-

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?
A-L00-Retail 2	NO (-66.6%)	NO
B-L00-Retail 3	NO (-24.7%)	NO
B-L00-Retail 4	NO (-1.5%)	NO
Circulation	NO (-95.1%)	NO
B-L00-Main Entrance	NO (-1.7%)	NO
B-L00-Retail 5	NO (-17.5%)	NO
B-L00-Gym	NO (-6.5%)	NO
B-L00-Gym Store	N/A	N/A
B-L00-Studio	N/A	N/A
B-L00-Delivery Store	N/A	N/A
B-L00-Acc WC	N/A	N/A
B-L00-Staff Room	N/A	N/A
B-L00-Office	N/A	N/A
B-L00-Corridor & Stairs	NO (-55%)	NO
B-L00-Corridor	N/A	N/A
B-L00-Corridor	N/A	N/A
C-L00-Retail 6	NO (-85.1%)	NO
C-L00-Entrance	NO (-34.4%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
C-L00-Retail 7	NO (-4%)	NO
B-L01-Amenity	NO (-28.5%)	NO
B-L01-Amenity	NO (-40.7%)	NO
B-L01-Amenity	NO (-50.1%)	NO
B-L01-Delivery Store	N/A	N/A
B-L01-Stairs & Circ	N/A	N/A
C-L01-Stairs & Circ	N/A	N/A
C-L01-Amenity	N/A	N/A
B-L24-Amenity	NO (-45.9%)	NO
B-L24-Amenity	NO (-55.4%)	NO
B-L24-Corridor	N/A	N/A
B-L24-Stairs	N/A	N/A
B-L24-Corridor	NO (-62%)	NO
A-L00-Retail 1	NO (-6.5%)	NO
A-L00-Entrance	NO (-50.7%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters			Building Use	
	Actual	Notional	% Area	Building Type
Floor area [m ²]	4513.5	4513.5	56	Retail/Financial and Professional Services
External area [m ²]	4866.7	4866.7		Restaurants and Cafes/Drinking Establishments/Takeaways
Weather	LON	LON		Offices and Workshop Businesses
Infiltration [m ³ /hm ² @ 50Pa]	3	3		General Industrial and Special Industrial Groups
Average conductance [W/K]	1164.09	1693.7		Storage or Distribution
Average U-value [W/m ² K]	0.24	0.35	5	Hotels
Alpha value* [%]	25	10		Residential Institutions: Hospitals and Care Homes
				Residential Institutions: Residential Schools
				Residential Institutions: Universities and Colleges
				Secure Residential Institutions
			40	Residential Spaces
				Non-residential Institutions: Community/Day Centre
				Non-residential Institutions: Libraries, Museums, and Galleries
				Non-residential Institutions: Education
				Non-residential Institutions: Primary Health Care Building
				Non-residential Institutions: Crown and County Courts
				General Assembly and Leisure, Night Clubs, and Theatres
				Others: Passenger Terminals
				Others: Emergency Services
				Others: Miscellaneous 24hr Activities
				Others: Car Parks 24 hrs
				Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m ²]		
	Actual	Notional
Heating	3.32	6.15
Cooling	2.07	1.78
Auxiliary	0	0
Lighting	7.31	10.08
Hot water	0.67	0.61
Equipment*	16.94	16.94
TOTAL**	13.37	18.62

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

Energy Production by Technology [kWh/m ²]		
	Actual	Notional
Photovoltaic systems	0.71	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	0.71	0

Energy & CO ₂ Emissions Summary		
	Actual	Notional
Heating + cooling demand [MJ/m ²]	79.88	91.23
Primary energy [kWh _{eq} /m ²]	18.8	27.79
Total emissions [kg/m ²]	1.75	2.61

HVAC Systems Performance									
System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity									
Actual	58.2	50.3	3.9	3.4	0	4.12	4.11	4.2	5.5
Notional	72.6	38	7.3	2.3	0	2.78	4.63	****	****
[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity									
Actual	52.2	33.4	3.5	2.3	0	4.12	4.11	4.2	5.5
Notional	63.7	34.2	6.4	2.1	0	2.78	4.63	****	****
[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity									
Actual	68.7	31.3	4.6	2.1	0	4.12	4.11	4.2	5.5
Notional	92.2	29.7	9.2	1.8	0	2.78	4.63	****	****
[ST] No Heating or Cooling									
Actual	0	0	0	0	0	0	0	0	0
Notional	0	0	0	0	0	0	0	****	****

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

Appendix C: Part O Results.

Part O-Building Regulations 2021

The Part O of the Building Regulations 2021 requires that, if compliance is to be demonstrated via dynamic thermal modelling (such as in this case), then the following guidance should be followed.

- a. CIBSE’s TM59 methodology for predicting overheating risk (criteria illustrated in 3.1 of this report)

b. Limits on the use of CIBSE’s TM59 methodology:

i. When a room is occupied during the day (8am to 11pm), openings should be modelled to do all of the following.

– Start to open when the internal temperature exceeds 22°C.

– Be fully open when the internal temperature exceeds 26°C.

– Start to close when the internal temperature falls below 26°C.

– Be fully closed when the internal temperature falls below 22°C.

ii. At night (11pm to 8am), openings should be modelled as fully open if both of the following apply.

– The opening is on the first floor or above and not easily accessible.

– The internal temperature exceeds 23°C at 11pm.

iii. When a ground floor or easily accessible room is unoccupied, both of the following apply.

– In the day, windows, patio doors and balcony doors should be modelled as open, if this can be done securely.

– At night, windows, patio doors and balcony doors should be modelled as closed.

iv. An entrance door should be included, which should be shut all the time.

c. Limiting solar gains: Solar gains in summer should be limited by any of the following means.

i. Fixed shading devices, comprising any of the following.

– Shutters.

– External blinds.

– Overhangs.

– Awnings.

ii. Glazing design, involving any of the following solutions.

– Size.

– Orientation.

– g-value.

– Depth of the window reveal.

iii. Building design – for example, the placement of balconies.

iv. Shading provided by adjacent permanent buildings, structures or landscaping.

d. Internal blinds and curtains should not be taken into account.

e. Foliage, such as tree cover, should not be taken into account.

f. Removing excess heat: Excess heat should be removed from the residential building by any of the following means.

– Opening windows (the effectiveness of this method is improved by cross-ventilation).

– Ventilation louvres in external walls.

– A mechanical ventilation system.

– A mechanical cooling system

- g. The building should be constructed to meet requirement O1 using passive means as far as reasonably practicable.

CIBSE TM59 overview

Overheating in all spaces was previously quantified by the number of occupied hours annually that the internal temperature exceeds a maximum temperature irrespective of external temperature.

The CIBSE TM59 criteria for predominantly naturally ventilated spaces use both an adaptive comfort and a fixed threshold approach:

Adaptive comfort:

Adaptive comfort is where the overheating threshold is dynamic. It is based on the comparison of the anticipated internal conditions against criteria which establishes a maximum acceptable room temperature calculated from the running ‘mean’ outdoor temperature. Research has shown that comfortable room temperatures vary with the external temperature conditions and occupants are generally more accepting of warmer room temperatures if the weather is also warm outside.

Fixed threshold:

CIBSE TM59 criterion B, used to assess bedrooms only, uses a static measurement where the threshold is fixed. The risk of overheating is quantified by the number of occupied hours annually that the internal conditions exceed a maximum temperature, irrespective of external temperature. It therefore does not vary in line with the external conditions like the adaptive comfort approach. This criterion is required to be satisfied within bedrooms only.

CIBSE TM59 criteria

CIBSE TM59 considers the risk of overheating by assessing occupied spaces against two criteria detailed in the table below.

Table 6: TM59 Natural Ventilation Criteria Summary

Criterion A	For Living Rooms, Kitchens and Bedrooms: Criteria sets a limit for the number of hours that the operative temperature can exceed the threshold comfort temperature. To satisfy Criterion 1, the following must not occur for more than 3% of occupied hours: The difference between the actual operative temperature, and the maximum acceptable temperature* is equal to or greater than 1 degree during May to September.
Criterion B	For Bedrooms Only: Criteria states that peak bedroom temperatures should not exceed an absolute threshold of 26 °C. To satisfy Criterion 2, the operative temperature in the bedrooms from 10 pm to 7 am shall not exceed 26 °C for more than 1% of annual hours (33 Hours).

* Maximum acceptable temperature: CIBSE sets a maximum acceptable temperature of 3°C above the comfort temperature (for new buildings).

Table 7: TM59 Natural Ventilation Room Results

		Criterion (a) % occupied hours dT > 1K			Criterion (b) Total hours > 26°C		
Rooms	Shading Type	Passive design	Tempered air	Pass Threshold	Passive design	Tempered air	Pass Threshold
A-L01-U03-1B1P-Double Bedroom		4.9	0.1	3	342	5	33
A-L01-U03-1B1P-Living/ Kitchen		6.3	0	3	N/A	N/A	33
A-L28-U04--Living/Kitchen/Bedroom		4.1	0	3	N/A	2	33
A-L28-U05-2B3P-Double Bedroom		3.2	1	3	172	20	33
A-L28-U05-2B3P-Living/ Kitchen		5.6	2.6	3	N/A	N/A	33
A-L28-U05-2B3P-Single Bedroom		2.6	1	3	123	17	33
C-18-U05-1B2P-Double Bedroom		2.5	0.7	3	161	14	33
C-18-U05-1B2P-Living/Kitchen		3.6	1.4	3	N/A	N/A	33
C-L01-05-2B4P-Double Bedroom		2	0.7	3	36	11	33
C-L01-05-2B4P-Living/Kitchen		3.8	1.7	3	N/A	N/A	33
C-L01-05-2B4P-Double Bedroom		1.8	0.5	3	36	13	33
B-L18-07-2B3P-Kitchen/Living		4.6	2.3	3	N/A	N/A	33
B-L18-07-2B3P-Single Bedroom		3.2	0.3	3	227	13	33
B-L18-06-1B1P-Double Bedroom		1.3	0.1	3	37	5	33
B-L18-06-1B1P-Kitchen/Living		1.9	0	3	N/A	N/A	33
B-L18-07-2B3P-Double Bedroom		3	0.9	3	199	20	33



HOLLIE BROWN
SUSTAINABILITY CONSULTANT

+44 208 585 9545
holliebrown@hoarelealea.com

HOARELEA.COM

Western Transit Shed
12-13 Stable Street
London
N1C 4AB
England

