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RICHMOND INN

Energy Strategy

Hoare Lea

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Richmond Inn.
London Borough of Richmond Upon Thames.
Bridges Healthcare (Richmond) Limited.

SUSTAINABILITY

ENERGY STRATEGY
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Audit sheet.

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Contents.

1. Executive summary.

This report has been produced by Hoare Lea to outline the energy strategy for the proposed Richmond Inn development in Richmond, London. Hereafter referred to as the Proposed Development. The following strategy forms part of the full planning application and was carried out to consider alternative ways of meeting the requirements of Part L of the Building Regulations and the relevant policies of Richmond's Adopted Local Plan.

The site is located on the corner of Sheen Road and Church Road in the London Borough of Richmond upon Thames. The site is situated within the Sheen Road Conservation Area and, whilst the building is not statutorily listed, it is identified as a locally listed building under the Council's local list (also known as a 'Building of Townscape Merit'). The site is considered to mark the important junction of Sheen Road and Church Road, which are two key routes through this part of the borough.

Figure 1 below illustrates the location of the Proposed Development site within the Sheen Road Conservation Area.

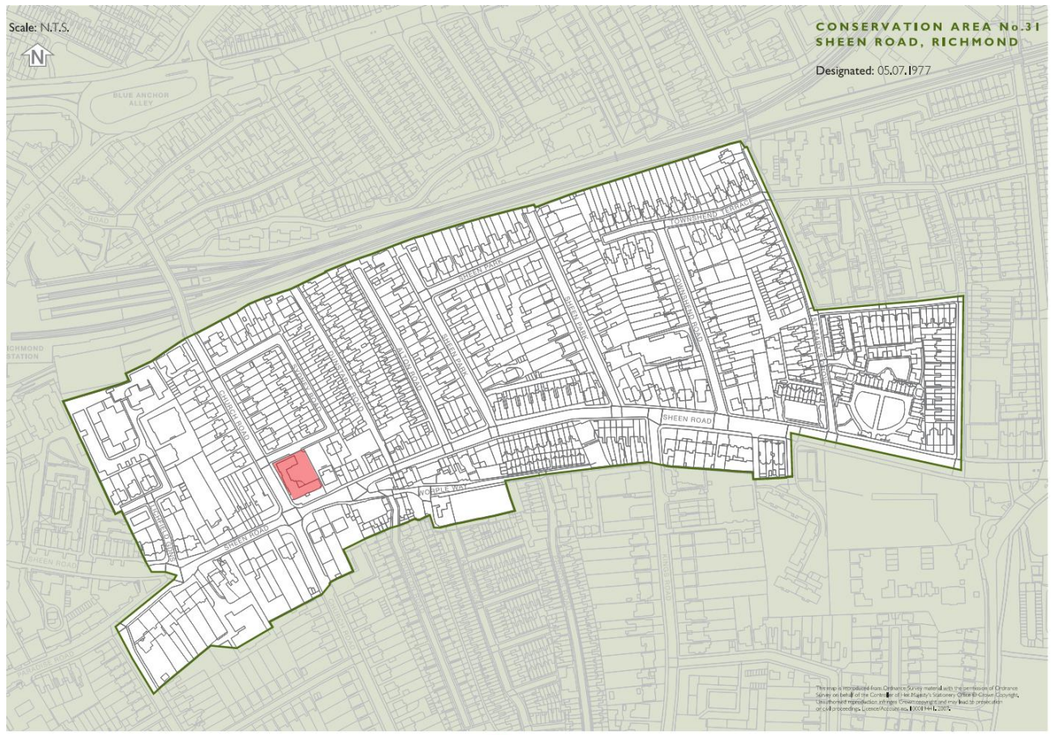


Figure 1 Proposed Development site (in red) location within the Sheen Road Conservation Area.

The Proposed Development.

The Proposed Development consists of partial demolition and extension of Richmond Inn for Class C2 visitor accommodation providing care and physiotherapy-led rehabilitation, highways works, car and cycle parking, refuse storage, landscaping and other associated works.

The Building of Townscape Merit will be retained and will undergo a major refurbishment, while the late 1990s sub-standard extension will be replaced by a highly sustainable and efficient new building. The refurbished elements will comply with the requirements of Building Regulations Approved Document Part L2B where feasible. The new build elements will be designed to comply with Building Regulations Approved Document Part L2A.

The proposal aims to deliver a carefully crafted high quality development that sits well within the immediate context of the Sheen Road Conservation Area and looks to respond to its surroundings, improving street frontage, landscape, and pedestrian experience on and around the site.

Energy Strategy Summary.

Due to limitations imposed by the constraints of the Sheen Road Conservation Area, passive and active measures to the existing and new parts of the building were proposed where feasible provide the cornerstone to the energy demand and CO_2 emission reduction achieved for the Proposed Development.

The Proposed Development is a major development but is not a GLA referable scheme. In line with the Richmond's Adopted Local Plan 2018 (and Draft Local Plan 2021) the Proposed Development will follow The London Plan Energy Hierarchy of 'Be Lean', 'Be Clean', and 'Be Green' to reduce the CO_2 emissions of the entire development. The regulated CO_2 emissions reduction target is zero-carbon with a minimum of 35% CO_2 reduction on-site. In addition, SAP 10 carbon factors have been adopted as per recommendations on the Greater London Authority (GLA) Energy Assessment Guidance (April 2020).

For the refurbishment of the retained building, an estimated CO_2 emission rate for the existing building (pre refurbishment) has been calculated through the Part L2A 2013 of the Building Regulations methodology based on National Calculation Methodology (NCM) in which the thermal modelling compliant software IES VE 2019.3.2.0, DSM Methodology has been used. Assumptions have been made regarding the building fabric parameters based on building age, site visit and information provided by the design team members, and the NCM construction database has also been used. Information regarding the current building services installed to the existing building has been received, and the NCM default efficiencies to installed building services have been used. This pre-refurbishment model has been used for the baseline of the CO_2 emission calculations. The carbon dioxide emissions for the pre refurbished building (baseline case) are then compared against carbon dioxide emissions for the proposed post refurbished building (BER).

For the new building element, the regulated CO_2 emissions, assuming the development complied with Part L 2013 of the Building Regulations using Building Regulations approved compliance software are established. The compliant IES VE 2019.3.2.0 using DSM methodology to assess the new building areas has been used. The Target Emission Rate (TER) output from this assessment was then used to calculate the baseline CO_2 emissions and compared against carbon dioxide emissions for the proposed new building (BER).

Be lean

The Proposed Development is anticipated to achieve approximately a 32% sitewide reduction in CO_2 emissions beyond the baseline scheme (using SAP 10 carbon factors) prior to the consideration of any Low or Zero Carbon (LZC) technologies, i.e., via passive design and energy efficiency measures. Section 4 details the target fabric and system performance parameters.

Be clean

There are no possible connections to an area wide low carbon heating distribution network. In addition, incorporation of an onsite CHP system has been deemed to be unsuitable, therefore a heat network and CHP technology have been discounted.

Be green
A number of renewable technologies have been appraised in terms of their technical, physical and financial feasibility, as potential renewable systems for use on the project. It was deemed that Air Source Heat Pumps (ASHPs) were considered the most appropriate technology. Following the incorporation of this renewable technology, the Proposed Development is anticipated to achieve approximately a further 35% sitewide reduction in CO_2 emissions beyond the Be Lean scheme (using SAP 10 carbon factors).

Proposed site-wide energy strategy

Overall, it is anticipated that the Proposed Development could achieve **67%** reduction in CO_2 emissions beyond the baseline scheme.

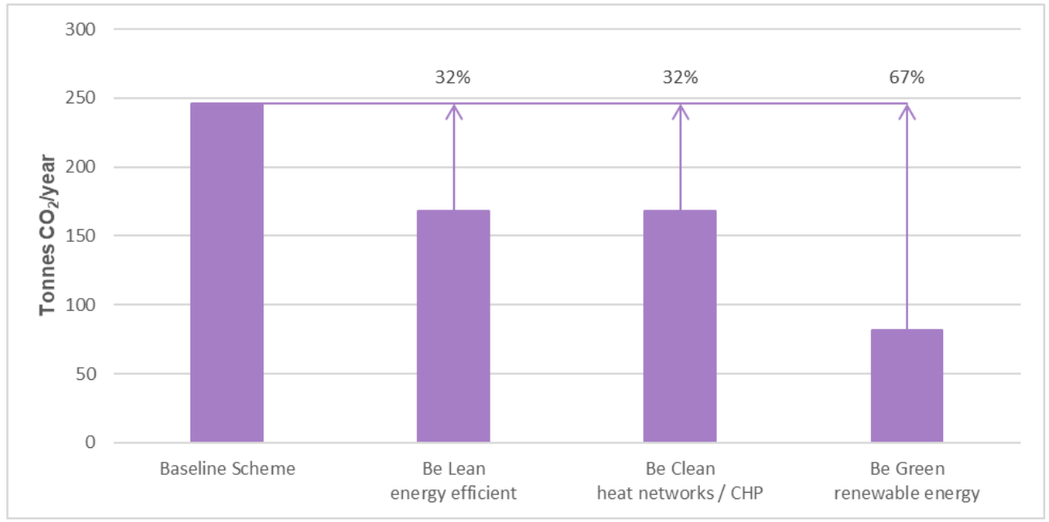


Figure 2: Sitewide regulated carbon emissions summary.

Overall Carbon Dioxide Emissions Reduction
Figure 3 below sets out how the proposed energy efficiency measures and LZC system reduce CO_2 emissions in line with the London Plan Energy Hierarchy.

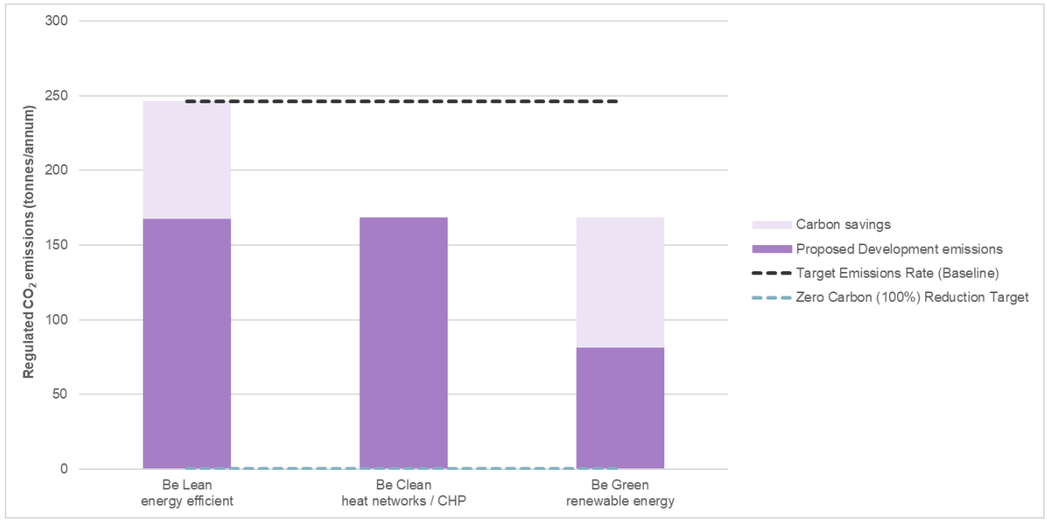


Figure 3: Sitewide regulated carbon emission, energy hierarchy and targets.

The estimated CO_2 emissions reductions are presented below in Table 1.

Table 1: Summary of regulated carbon emissions savings.

	Regulated Carbon Dioxide Emission Savings (tonnes CO_2/yr.)	
	Regulated	Unregulated
Baseline: Pre-Refurb & Part L 2013 Building Regulations with SAP 10 carbon factors	246	205
After energy demand reduction (Be Lean)	168	205
After heat network / CHP (Be Clean)	168	205
After renewable energy (Be Green)	82	205
	Regulated non-domestic carbon dioxide savings	
	(tonnes CO_2/yr.)	(%)
Savings from energy demand reduction	78	32%
Savings from heat network / CHP	0	0%
Savings from renewable energy	86	35%
Cumulative on-site savings	**164**	**67%**

To enable the Proposed Development to meet the Zero Carbon target, a one-off carbon offset payment of approximately £233,374 will be required in line with Richmond's Local Plan. This figure is based on a shortfall of 81.89 tonnes CO_2 per year for a period of 30 years at a rate of £95 / tonne of CO_2.

2. Introduction.

This report has been produced by Hoare Lea to outline the energy strategy for the proposed Richmond Inn development in Richmond, London. The site is located in the London Borough of Richmond upon Thames, on the corner of Sheen Road and Church Road, within the boundary of the Sheen Road Conservation Area in West London. The site comprises the existing Richmond Inn hotel, which is a 44-bed hotel which has been vacant since its closure in March 2020. The site extends to 0.13ha in total and comprises the hotel building (with ancillary meeting rooms and lounges) as well as a central courtyard area and surface car park for customers, which is accessed from Sydney Road.

The Conservation Area includes Sheen Road and the area to the north bounded by the railway line. It adjoins three other conversation areas to the South and West. Whilst the building is not statutorily listed, it is identified as a locally listed building (reference 82/00850/BTM) under the Council's local list (also known as a 'Building of Townscape Merit'). The site is considered to mark the important junction of Sheen Road and Church Road, which are two key routes through this part of the borough.

The site has a PTAL of 6a (excellent), being a four-minute walk from the rear entrance of Richmond Station and in close proximity to bus stops on Sheen Road and Church Road. The proposed use of the development is an alternative form of visitor accommodation with a focus on health and wellbeing (Use Class C2), accommodating 57 bedspaces.

The Proposed Development consists of partial demolition and extension of Richmond Inn for Class C2 visitor accommodation providing care and physiotherapy-led rehabilitation, highways works, car and cycle parking, refuse storage, landscaping and other associated works. The existing building facing Sheen Road will be retained and refurbished, while the later extensions constructed in the early 1990s will be demolished and rebuilt in the style of the surrounding conservation area. The assessment was carried out to consider alternative ways of meeting the requirements of Part L of the Building Regulations, and the relevant policies of the Richmond's Adopted Local Plan.

Figure 4 below illustrates the proposed view of the Proposed Development from Church Road looking south.

Figure 4: View of the Proposed Development from Church Road looking south (Ackroyd Lowrie Architects).

2.1 Approach to the energy strategy

This Energy Strategy will focus on Part L of the Building Regulations requirements, and the relevant policies of the Richmond's Adopted Local Plan. Although the Proposed Development is not a GLA referable scheme, it is a major development and therefore in line with The London Plan (March 2021) and the Richmond Local Plan (2018), will follow the Energy Hierarchy of 'Be Lean', 'Be Clean' and 'Be Green' to reduce the carbon dioxide emissions of the entire development. The zero-carbon target applies to major developments and a minimum of 35% reduction in carbon emissions on-site is also targeted. In addition, SAP 10 carbon factors have been adopted as per recommendations on the GLA Energy Assessment Guidance (April 2020).

The refurbished building will comply with the requirements of Building Regulations Approved Document Part L2B where feasible. The new building will be designed to comply with Building Regulations Approved Document Part L2A.

For the refurbishment of the retained building, an estimated CO_2 emission rate for the existing building (pre refurbishment) has been calculated through the Part L2A 2013 of the Building Regulations methodology based on National Calculation Methodology (NCM) in which the thermal modelling compliant software IES VE 2019.3.2.0, DSM Methodology has been used. Assumptions have been made to the building fabric parameters based on building age, site visit and information provided by the design team members, and the NCM construction database has also been used. Information regarding the current building services installed to the existing building has been received, and the NCM default efficiencies to installed building services have been used. This pre-refurbishment model has been used for the baseline of the CO_2 emission calculations. The carbon dioxide emissions for the pre refurbished building (baseline case) are then compared against carbon dioxide emissions for the proposed post refurbished building (BER).

For the new building element, the regulated CO_2 emissions, assuming the development complied with Part L 2013 of the Building Regulations using Building Regulations approved compliance software are established. The compliant IES VE 2019.3.2.0 using DSM methodology to assess the new building areas has been used. The Target Emission Rate (TER) output from this assessment was then used to calculate the baseline CO_2 emissions and compared against carbon dioxide emissions for the proposed new building (BER).SAP 10 carbon factors have been adopted across the scheme.

2.2 Definitions and limitations

Definitions:
The following definitions should be understood throughout this statement:

- **Energy demand:** the 'room-side' amount of energy which must be input to a space to achieve comfortable conditions. In the context of space heating, this is the amount of heat which is emitted by a radiator, or other heat delivery mechanism.
- **Energy requirement:** the 'system-side' requirement for energy (fuel). In the context of a space heating system using a gas boiler, this is the amount of energy combusted (e.g. gas) to generate useful heat (i.e. the energy demand).
- **Regulated CO_2 emissions:** the CO_2 emissions emitted as a result of the combustion of fuel, or 'consumption' of electricity from the grid, associated with regulated sources (those controlled by Part L of the Building Regulations).

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. Drivers.

An energy and sustainability policy review has been undertaken and is detailed in Appendix A. As a summary, planning policy applicable to the Proposed Development are outlined within this section.

3.1 The Building Regulations

Part L Conservation of Fuel and Power deals with energy efficiency requirements in the Building Regulations. New-build elements are assessed under Approved Document Part L2A of the Building Regulations. Refurbishment of the existing elements are assessed under Approved Document Part L2B. Please refer to Appendix B for further details on the current and future Part L of the Building Regulations.

3.2 Local

London Borough of Richmond upon Thames (LBRuT) Adopted Local Plan

In addition to the London Plan policy targets, a summary of additional pertinent local planning policy of the LBRuT are as follows:

- Major new non-residential buildings, including extensions, over 1000sqm will be required to meet zero carbon standards from 2019 and achieve BREEAM 'Excellent' standard.
- Require developments to contribute towards the Mayor of London target of 25% of heat and power to be generated through localised decentralised energy (DE) systems by 2025.

It is understood that the Draft Richmond Local Plan (2021) will be a material consideration in planning determination from 2024.

3.3 Grid decarbonisation

The FES 2021 document, produced by the National Grid, discusses how the UK's energy landscape is likely to change between now and 2050. Projections are made for four scenarios and Figure 5 combines these future trajectories with the actual carbon intensity of the National Grid since 2005.

Recent progress in the energy sector has seen emissions associated with electricity consumption reduce drastically in each scenario, however this is not reflected in the current Building Regulations.

The carbon factor for grid-supplied electricity in the current Building Regulations (2013) is 0.519kgCO2/kWh; this is a fair reflection of the performance of the grid at that time. However, in response to legally binding targets established in line with the Paris Agreement, significant progress has been made in decarbonising the electricity grid over the past six years, as can be seen in the graph below.

At the end of 2020, the Department for Business, Energy, and Industrial Strategy (BEIS) reported the carbon factor of electricity as having fallen to 0.136kgCO2/kWh (SAP 10.1 carbon factor); a 74% reduction compared to that in Part L, 2013. The consequence of this is a discrepancy between emissions calculated using current building regulations methodology from electrical plant and any technologies which offset grid electricity (such as solar PV) compared to the reality of their performance. This leads to the risk that buildings could be specified with technologies with the objective of reducing CO_2 emissions which, in fact, may not offer any real benefit in practice. The new Part L 2021 which will come into effect in June 2022 will adopt the SAP 10.1 carbon factors, reducing the gap between compliance and reality.

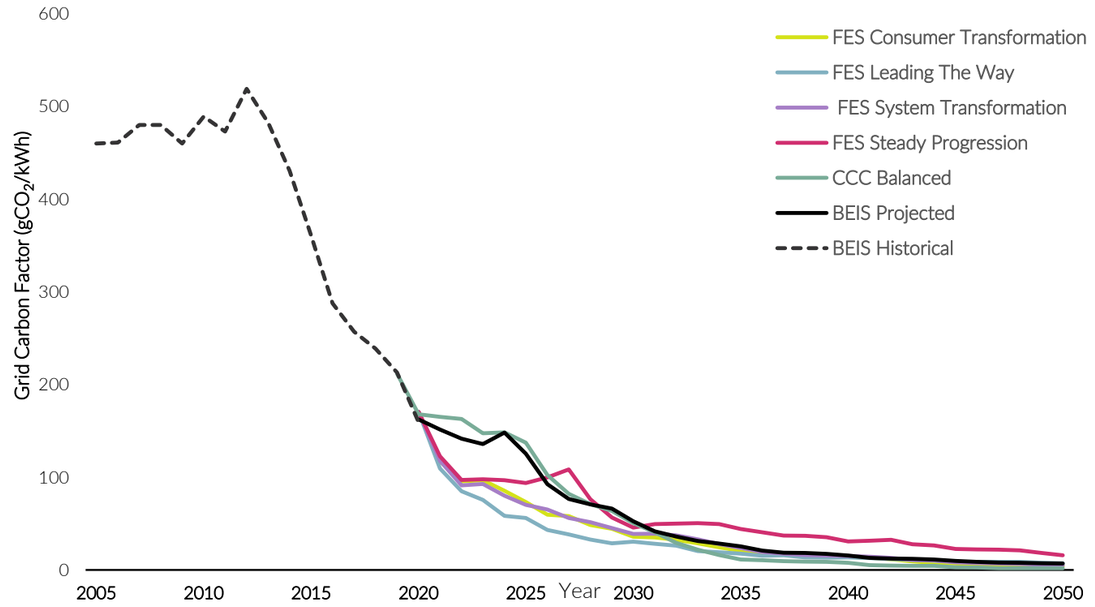


Figure 5: Historic and future projected carbon factor for the National Grid. Sources: *BEIS Green Book* (historic carbon factors); *National Grid Future Energy Scenarios (FES) 2021* (future projected carbon factors).

4. Be lean.

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 Proposed Development.

Be lean measures refer to passive design and energy efficient solutions. The Proposed Development is seeking to maximise the potential of the measures in the strategy outlined in the following sections.

4.1 Passive measures

The following passive design measures will be included in order to limit, as far as practically possible, the energy demands and CO_2 emissions arising from the Proposed Development.

The thermal envelope is the first 'line of defence' against the elements. By ensuring that the envelope is specified to limit heat-loss as far as is practically possible, the demand for space heating and cooling can be minimised.

The Proposed Development is within the Sheen Road Conservation Area. As such, opportunities for improvement to the fabric have been considered where feasible. The existing thermal envelope (windows, exposed floors and roofs) will be upgraded to meet the Part L2B standards for existing thermal elements, while the existing external walls will be upgraded with some spatial limitations. All new thermal building elements will supersede the minimum requirements for new thermal elements set out on Part L2B.

The new build elements are proposed with a high performing engineered façade with optimised U-values, appropriate proportion of glazing and a glazing g-value carefully selected to minimise solar gain in the summer, (but also to maximise solar gain in winter).

The main parameters that affect the thermal envelope are the following:

- Glazing Ratio and specification.
- Insulation (thermal conductivity).
- Fabric permeability.

Please refer to Table 3 for the proposed upgraded and new thermal elements.

4.1.1 Glazing ratio and specification

Amendments to the glazing ratio of the existing building and proposed glazing ratio to the new building are limited. However, new efficient glazing across the entire development has been proposed. Please refer to Table 3 for the proposed upgraded and new thermal elements.

4.1.2 Fabric permeability (ventilation losses)

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.

Considering the fabric improvement measures that will be adopted at the Proposed Development, it is anticipated that a positive improvement will be made to the permeability of the structure.

Without on-site testing, which is considered to be impractical owing to the current condition of the structure, it is not possible to accurately predict the existing fabric permeability. For the purpose of the energy demand and CO_2 emissions calculations, a measure of 15m^3/m^2.h at 50Pa has been adopted to the pre-refurbishment cases, in line with SAP and National Calculation Modelling (NCM) modelling guidance.

The refurbished building will have a balance between retained and upgraded existing thermal elements and newly constructed and glazing elements, therefore a fabric permeability of 8m^3/m^2.h at 50Pa is proposed to the refurbished building. An air permeability of 2.50m^3/m^2.h at 50Pa is proposed for the new building.

Table 2 below summarises the fabric parameters of the pre-refurbishment baseline scheme and the Proposed Development.

Table 2: Proposed Development Fabric Parameters

Elements		Pre-Refurb Thermal Elements	Post Refurb Upgraded Thermal Elements (Refurb Building)	New Thermal Elements (Extension to Refurb Building and New Building)
External walls	U-Value (W/m^2K)	1.70	0.70	0.13
Floors	U-Value (W/m^2K)	1.20	0.18	0.10
Roofs	U-Value (W/m^2K)	1.50	0.10	0.10
Windows / Glazed Doors	U-Value (W/m^2K)	3.10	1.30 (double glazing)	1.30 (double glazing)
	g-value	0.85	0.40	0.40
	Light transmittance	0.90	0.70	0.70
External solid doors	U-Value (W/m^2K	3.00	1.40	1.00
Air permeability	$m^3/(h.m^2)$ at 50 Pa	15.0	8.0	2.5
Thermal bridging	-	default	default	default

4.2 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.

4.2.1 Refurbished building

Table 3 below includes the building services parameters to be included in the Part L2B calculation for the refurbished building.

Table 3: Building Services Parameters - Refurbishment

	Pre-Refurb	Post Refurb	
		Be Lean	Be Green
Heating	Gas fired Boiler Efficiency 65% Emitter: Radiators	Gas fired boiler Efficiency 91% Emitter: FCU	ASHP Efficiency 410-440% Emitter: FCU
Cooling	None	ASHP Efficiency 440% Emitter: FCU	

	Pre-Refurb	Post Refurb	
		Be Lean	Be Green
Ventilation	Natural Ventilation Extract fan with grease filter to the kitchen Local extract fan to the ensuite bathrooms	Centralised Air Handling Units with Heat Recovery and Balanced Mechanical Ventilation with Heat Recovery	
DHW	Central DHW cylinder (1000 litres) Poor pipework and cylinder insulation	Gas fired boiler Efficiency 91% Central DWH cylinder (1000 litres), good pipework and cylinder insulation	ASHP (90% demand) Efficiency 290% Boiler (10% demand) Efficiency 95% Central DWH cylinder (1000 litres), good pipework and cylinder insulation
Lighting	Inefficient lighting (45 lm/W)	100% efficient lighting (90-110 lm/W)	

4.2.2 New building

Table 4 below includes the building services parameters to be included in the Part L2Acalculation for the new building.

Table 4: Building Services Parameters - New

	New Building	
	Be Lean	Be Green
Heating	Gas fired boiler Efficiency 91% Emitter: FCU	ASHP, Efficiency 410-440% Emitter FCU
Cooling	ASHP, Efficiency 440% Emitter FCU	
Ventilation	Balanced Mechanical Ventilation with Heat Recovery	
DHW	Gas fired boiler, efficiency 91% Central DHW cylinder (2000 litres), good pipework and cylinder insulation	ASHP (90% demand), efficiency 290% Boiler (10% demand), efficiency 95% Central DHW cylinder (2000 litres), good pipework and cylinder insulation
Lighting	100% efficient lighting (90-110 lm/W)	

4.3 Be lean summary

The baseline for the refurbished elements has been estimated using the CO_2 emissions rate for the existing building (pre-refurbishment) while the notional building TER has been used for the new-build elements, using SAP 10 carbon factors. The overall regulated CO_2 emissions for the energy efficient scheme is approximately 32% below that of the baseline scheme, as Figure 6 below shows.

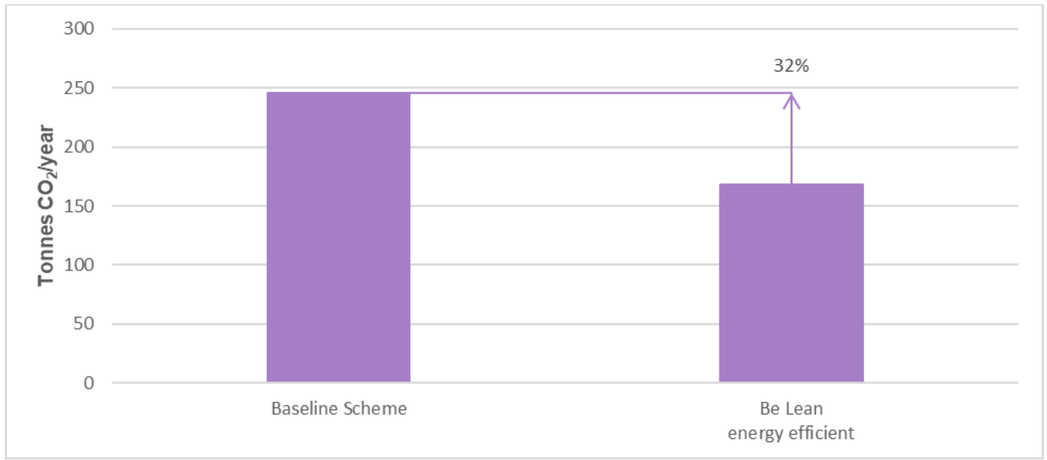


Figure 6: Proposed Development Regulated Carbon Dioxide Emissions at Be Lean stage

The pre refurbishment baseline BRUKL document can be seen in Appendix C, the post refurbishment Be Lean BRUKL document can be seen in Appendix D and the new building Be Lean BRUKL document can be seen in Appendix E.

4.4 Overheating and Cooling

Policy LP 20 (B) Climate Change Adaptation of the Richmond's Local Plan states new development, in their layout, design, construction, materials, landscaping and operation, should minimise the effects of overheating as well as minimise energy consumption in accordance with the following cooling hierarchy. This policy seeks to reduce potential overheating and reliance on air conditioning systems, therefore reducing the impact of the urban heat island effect.

Below are the steps of the cooling hierarchy and the proposal to demonstrate compliance:

1. Minimise internal heat generation through energy efficient design.
   - Heat generation will be minimised through the specification of energy efficient ventilation systems, insulation on pipework and low energy lighting.

1.
2. Reduce the amount of heat entering a building in summer through orientation, shading, fenestration, albedo and insulation. Note there are constraints due to the conservation nature of the Proposed Development.

   The amount of heat entering the building will be reduced by:
   - Energy efficient facades to the new building with appropriate proportions of glazing.
   - A glazing shading coefficient carefully selected to minimise solar gain in the summer, but also to maximise solar gain in winter on both refurbished and new buildings.

3. Manage the heat within the building through exposed internal thermal mass and high ceilings.
   - No changes can be done to building fabric and floor to ceiling heights on the existing building due to its 'Building of Townscape Merit' status. However, ceiling height in the new non-domestic building has been maximised within the constraints of the overall building heights and massing.

4. Passive Ventilation.
    - Passive ventilation (openable windows) has been incorporated within the Proposed Development, especially on the rooms facing the courtyard which are subject to lower levels of noise. In addition, there will be a certain amount of natural ventilation through infiltration.
5. Mechanical Ventilation.
    - Ventilation will be provided by Air Handing Units (AHUs) and Mechanical Ventilation with Heat Recovery (MVHR) units. These units will incorporate a summer by-pass, which will allow the unit to supply fresh air without heat being transferred from the extract air into this supply air.
6. Active Cooling Systems.
    - Active cooling is proposed to all occupied spaces, including main front of house circulation areas. However, the active cooling demand has been minimised in line with the cooling hierarchy.

4.4.1 Proposed Development Active Cooling

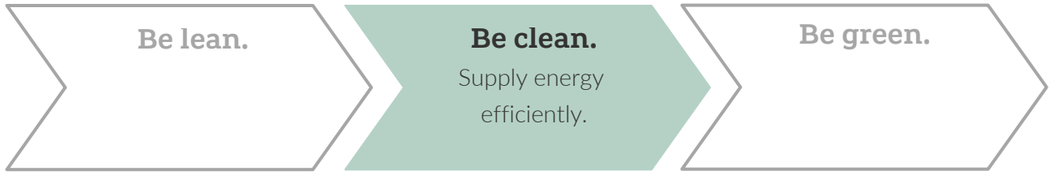
The Proposed Development will be designed with comfort cooling. Table 5 below confirms actual cooling demand is lower that of the notional buildings. These actual and notional cooling demands have been extracted from the BRUKL output document, please refer to Appendix D (Refurb building) and Appendix E (New Building) for figures.

Table 5: Proposed Development Actual and Notional Area Weighted Average Cooling Demand

	Area Weighted Average Building Cooling Demand (MJ/m²)	
	Refurbished Building	New Building
Actual	304.0	87.7
Notional	704.3	129.1

5. Be clean.

"Be Clean" measures are those which serve to reduce the overall emissions of the development through the inclusion of low-carbon technologies such as Combined Heat and Power (CHP) engines.



5.1 Be clean: network and technologies

The following sections detail considerations of the infrastructure and low-carbon energy supply measures that have been considered.

Decentralised heat networks

Large areas of London are identified as a Heat Network Priority Area, i.e. areas where heat density is sufficient for heat networks to provide a competitive solution for supplying heat to buildings and consumers. The Proposed Development is located within an area of low heat density, as identified by the London Heat Map (http://www.londonheatmap.org.uk).

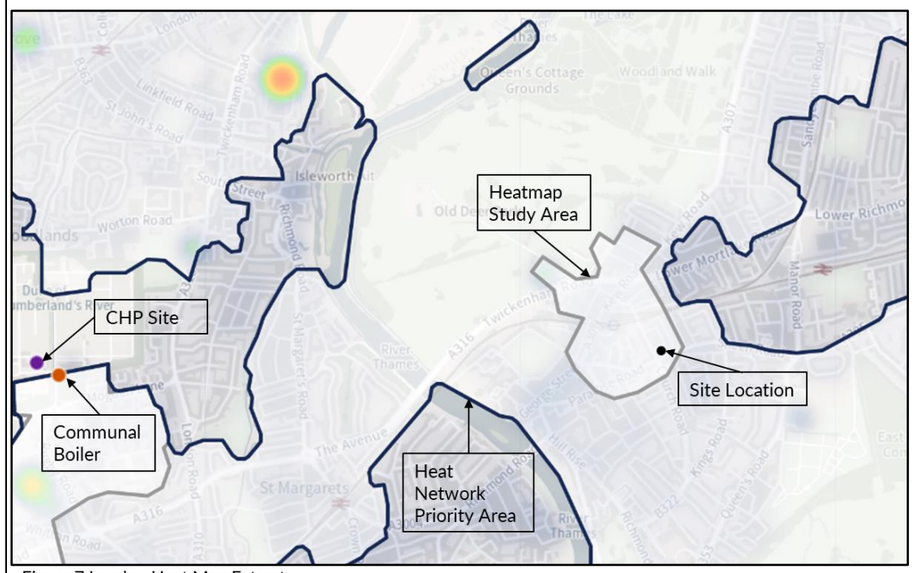


Figure 7 London Heat Map Extract

The nearest existing heat network to the site is the Pimlico District Heating Network (DHN), located over 10.9km to the North East of the site. The nearest proposed network is the Hampton Wilk DHN, almost 5.3km to the South West of the site. The London Heat Map highlights these schemes, as seen in Figure 6 above.

The project team has engaged with Richmond Council (RC) to understand if there are any current or future plans to extend nearby heat sources or any other nearby DHN into the area. The RC did not provide response, however the correspondence can be seen in Appendix F.

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.

5.2 Be clean summary

No connection opportunities to existing district heating networks in the vicinity of the site have been identified.

CHP is not proposed due to poor carbon reduction and adverse air quality impacts. However, the proposed site wide energy centre will be future proofed to allow connectivity to an area wide heating network if one become available in the future.

Therefore, no further carbon reductions are envisaged for the Be clean stage of the energy hierarchy.

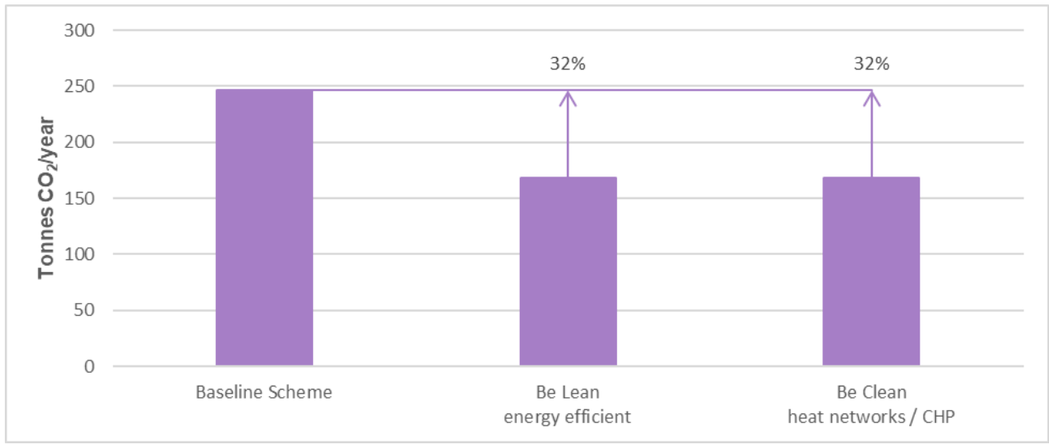


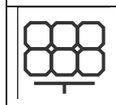
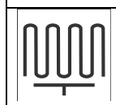
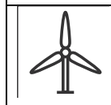
Figure 8: Proposed Development Regulated Carbon Dioxide Emissions at Be Clean stage.

6. Be green.

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 deliver 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 centre locations.

	**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. One existing building has been retained and the remaining area is relatively small and, therefore, does not provide the area necessary to introduce a suitable number of bore holes on site. Ground Source Heat Pumps are not considered a feasible option and are not proposed.
	**Water source heat pumps** Water source heat pumps use bodies of water, such as rivers, lakes or oceans to provide heating or cooling energy to a building. Although the River Thames is 0.6 miles from the building site, it is not in close proximity to consider this technology as suitable.
	**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 volume of external plant space required to meet the energy needs of the refurbished and extended building would be relatively low due to the small scale of the site, resulting in a lower impact on the amenity of both residents and neighbours.
	The mid height of the building allows the external plant to be positioned away from adjacent properties, despite the tight urban condition, to avoid visual and acoustic impacts. Additional acoustic screening will be required around the plant. Air Source Heat Pumps are therefore considered a feasible option and are proposed.
	**Photovoltaics** Photovoltaic panels harness energy from sunlight 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. Solar irradiance analysis on the site has shown an opportunity for the deployment of solar photovoltaic technologies for onsite electricity generation. The provision and location of PV panels has been reviewed, with consideration of the following aspects: - Over shading - Area required for access - Area required for plant Although there is the potential for PV array installation, this renewable technology has not been currently proposed.
	**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. 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.
	**Wind turbine** For efficient operation and to yield high energy output, wind turbines require a consistent 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. Moreover, mounting wind turbines on the roof of the building could result in unacceptable vibration and resonance being felt within occupied spaces. The turbines are also likely to generate noise which may be a nuisance to neighbouring residential properties. This scenario is likely to result in the turbines being switched off. Therefore, given the complexities of installing this technology, the use of wind turbines is not proposed 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 taken for such plant is high. Furthermore, fuel deliveries in dense urban locations can prove difficult and security of fuel supply is an important consideration. The reasons listed above alongside high maintenance implications and air quality implications mean that biomass boilers are not considered a suitable technology for the scheme.

6.2 Be green summary

Through the measures (ASHPs) outlined in the Be green stage, it is anticipated that overall, approximately **67%** reduction in CO_2 emissions can be achieved beyond the baseline. Figure 10 below shows the revised estimated reduction in regulated carbon dioxide emissions.

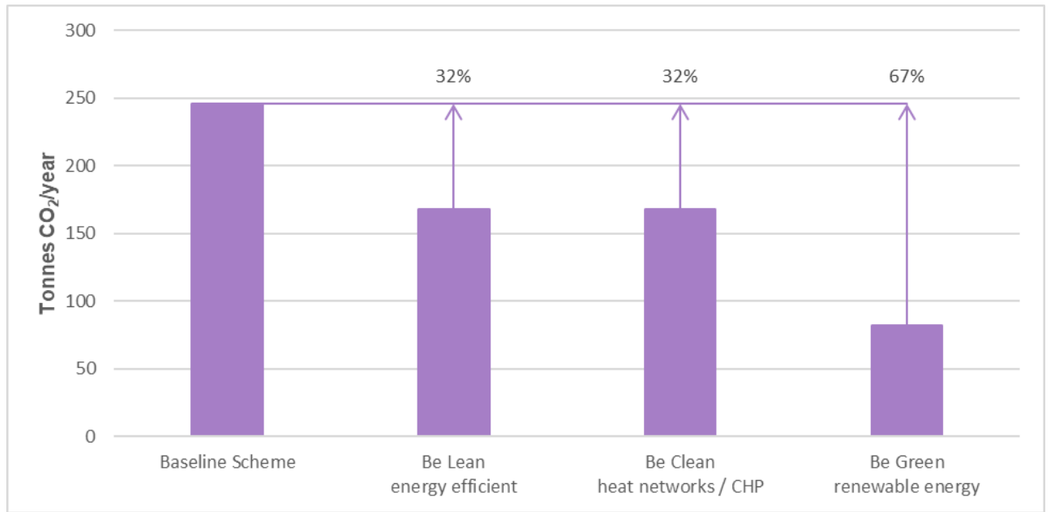


Figure 9: Proposed Development Regulated Carbon Dioxide Emissions at Be Green stage.

Please note that the GLA carbon emissions reporting spreadsheet has been used to calculate the carbon emissions reduction using SAP 10 carbon factors. Please refer to Appendix I for the TER and BER SAP 10 values and accompanying document *'220504 2324491 Richmond Inn - GLA Carbon Emission Reporting Spreadsheet SAP 10'*.

7. Conclusion.

This strategy has shown that the Proposed Development will result in a highly efficient, low-carbon scheme.

New, high efficiency servicing equipment and efficient façades will minimise the energy usage of the building. Using the London Plan energy hierarchy, the strategy has been developed to ensure that the Proposed Development is efficient and economical.

This strategy has been prepared to demonstrate that at the planning stage, the Applicant and design team have given due consideration to the principles of energy and sustainability, and how these could be implemented for the Proposed Development.

The refurbished elements will comply with the requirements of Building Regulations Approved Document Part L2B where feasible. The new build elements will be designed to comply with Building Regulations Approved Document Part L2A.

Though the Proposed Development is a major development, it is not referrable to the GLA and, therefore, in line with The London Plan (2021) and the Richmond Local Plan 2018, will follow the Energy Hierarchy of 'Be Lean', 'Be Clean' and 'Be Green' to reduce the carbon dioxide emissions of the entire development. The zero-carbon target applies to major developments and is therefore targeted.

7.1 The energy strategy

The strategy has been developed using the 'Be Lean, Clean and Green' energy hierarchy which utilises a fabric first approach to maximise reduction in energy through passive design measures.

Table 6 provides a summary for the Proposed Development, utilising SAP 10 carbon factors.

Table 6: Energy Strategy summary.

Be lean	**Target of 32% regulated carbon emission reduction against baseline scheme.** High energy efficient building fabric and building services will be utilised to reduce carbon emissions and energy demand through good practice passive design measures.
Be clean	**No further carbon emission reduction** Incorporation of an onsite district heating and a CHP system has been deemed to be unsuitable, therefore a heat network and CHP technology has been discounted.
Be gree	**Target of 67% sitewide regulated carbon emission reduction against baseline scheme via ASHPs.** Utilisation of air source heat pumps is anticipated to reduce energy consumption and carbon emissions for the Proposed Development.

7.1 Overall carbon dioxide emissions reduction

The following provides details in the percentage carbon reduction seen from the baseline scheme.

Table 7: Carbon reduction breakdown.

	Sitewide (% reduction from Part L baseline scheme)
Be lean.	32%
Be clean.	0%
Be green.	67%

Through the measures outlined in the Energy Strategy, it is anticipated that overall, approximately 67% reduction in CO_2 emissions could be achieved beyond the baseline scheme, inclusive of all measures.

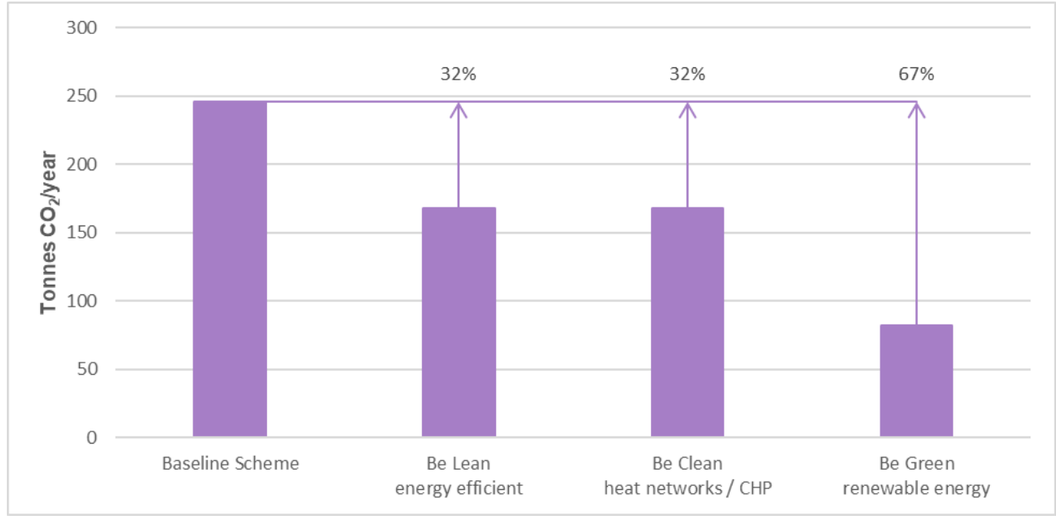


Figure 10: Sitewide regulated carbon reduction targets.

The estimated CO_2 emissions reductions are presented below in Table 8 which outlines the anticipated CO_2 emissions reductions.

Table 8: Summary of regulated carbon emissions savings.

	Regulated Carbon Dioxide Emission Savings (tonnes CO_2/yr.)	
	Regulated	Unregulated
Baseline: Pre-Refurb & Part L 2013 Building Regulations with SAP 10 carbon factors	246	205
After energy demand reduction (Be Lean)	168	205
After heat network / CHP (Be Clean)	168	205
After renewable energy (Be Green)	82	205
	Regulated non-domestic carbon dioxide savings	
	(tonnes CO_2/yr.)	(%)
Savings from energy demand reduction	78	32%
Savings from heat network / CHP	0	0%
Savings from renewable energy	86	35%
Cumulative on-site savings	164	67%

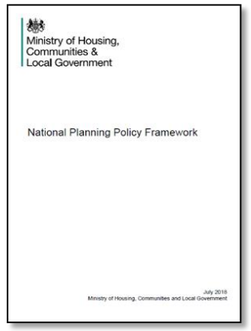
To enable the Proposed Development to meet the Zero Carbon target, a one-off carbon offset payment of approximately £233,374 will be required in line with Richmond's Local Plan. This figure is based on a shortfall of 81.89 tonnes CO_2 per year for a period of 30 years at a rate of £95 / tonne of CO_2.

The energy strategy for the Proposed Development has addressed the key elements of Richmond's Local Plan on energy and will make a positive contribution to reducing the county's CO_2 emissions.

Appendix A – Regional and Local Policies.

National Planning Policy Framework, February 2019

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



The purpose of the framework is to aid in the achievement of a sustainable development by providing guidance towards policy building that would meet the economic, social, and environmental objectives. The GLA's guidance on producing energy assessments is detailed and prescriptive. As such, responding to the relevant policies from the London Plan becomes process driven; however, the eventual strategy should seek to be as holistic and cognisant of the wider consequences of strategy decisions to the health, wellbeing, and comfort of occupants and both the social and environmental impact.

The priority actions of the framework are as follows:

- Local planning policies and decisions should exploit any opportunity to make the location sustainable, Potential actions are:
  a. Improving quality of building designs to enable sustainable use of resources such as energy and water
  b. Design of development should also reflect the local aspirations
  c. Create an environment that promotes health and well-being e.g. improve access for walking or cycling
- Policies should plan for future challenges such as climate change, flooding, and coastal change
  d. Reduce vulnerability by incorporating resistant and resilient designs
  e. Implementing designs that would reduce overall greenhouse gas emissions throughout lifecycle of building
  f. Increase use of renewable energy and low carbon energy sources
- Policies and decisions should prioritise the conservation and enhancement of natural environment
  g. Protect and enhance valued landscape, biodiversity sites and geological value and soils
  h. Protect the intrinsic character and beauty of the countryside and their accompanying ecosystem
  i. Maintain character of undeveloped coast
  j. Minimise impacts on and provide net gains for biodiversity
  k. preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability.
- Promote the use of sustainable materials all stages of development.

The applicable Development Plan for the Proposed Development is the LBRuT: Local Plan 2018, together with the London Plan (2021). Please refer to the following sections for further details.

Regional Planning Guidance

The London Plan, March 2021

Regional policy is contained within the London Plan 2021.

The London Plan Policy SI2 (Minimising Greenhouse Gas Emissions) states that developments should make the fullest contribution to minimising carbon dioxide emissions in accordance with the energy hierarchy: be lean, be clean and be green.

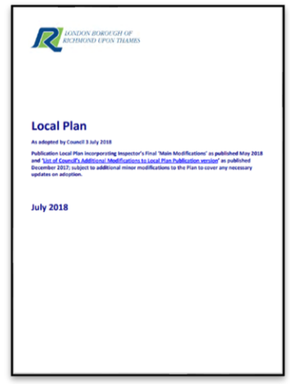
Carbon reduction: minimum of 35% on site carbon reduction target. Minimum of 10% reduction over baseline (pre-refurb and Part L2A) at Be Lean stage.

For the refurbishment elements of the Proposed Development, these targets will be applied to improvement beyond the pre-development 'baseline'. For the new-build elements this target will be applied to improvement over a Part L2A 2013 compliant building.

Development should reduce the impact on existing biodiversity or green space with a principle of no net loss of overall green cover is required. Development should be air quality neutral.

London Borough of Richmond upon Thames: Local Plan (2018).

The LBR Local Plan sets out the strategic planning framework for the borough for the next 15 years (2018-2033).



The policies set out in the Local Plan follow the approach of the presumption in favour of sustainable development and show how it is expressed locally. The Council states within its aim to ensure that planning applications that accord with policies in the adopted Local Plan and the London Plan will be approved without delay unless material considerations indicate otherwise.

The Local Plan has 3 inter-related themes of 'Protecting Local Character', 'A Sustainable Future' and 'Meeting People's Needs' that run through the Local Plan and form the basis of the Strategic Vision.

Strategic Objectives:

The Vision is supported by three strategic objectives (SO) to maintain and enhance the borough:

- SO1: Protecting Local Character
  - Villages and historic environment
  - Residential quality of life
  - Natural environment, open spaces, and the borough's rivers.
- SO2: A sustainable future
  - Sustainable growth and transport
  - The borough and its interrelationship with Greater London and the South East
  - A sustainable and smart borough
- SO3: Meeting people's needs
  - Facilities to meet needs
  - The borough's centres Jobs and the local economy

These strategies are aimed to be achieved through adopting the following key policies which have been identified as relevant for the Rehabilitation Hotel development:

Protecting local character (SO 1):

- Maintain and enhance the borough's attractive villages, including the unique, distinctive and recognisable local characters of the different village areas and their sub-areas.
- Protect and, where possible, enhance the environment including the heritage assets, retain and improve the character and appearance of established residential areas, and ensure new development and public spaces are of high-quality design.

A sustainable future (SO 2):

- Minimise and mitigate the effects of climate change by requiring high levels of sustainable design and construction including reductions in carbon dioxide emissions by minimising energy consumption, promoting decentralised energy and the use of renewable energy as well as requiring high standards of water efficiency.
- Promote and encourage development to be fully resilient to the future impacts of climate change in order to minimise vulnerability of people and property; this includes by risk of flooding, water shortages, subsidence and the effects of overheating.
- Optimise the use of land and resources by ensuring new development takes place on previously developed land, reusing existing buildings and encouraging remediation and reuse of contaminated land.
- Reduce or mitigate environmental impacts and pollution levels (such as air, noise, light, odour, fumes water and soil) and encourage improvements in air quality, particularly along major roads and areas that already exceed acceptable air quality standards.
- Ensure local environmental impacts of development are not detrimental to the health, safety and the amenity of existing and new users or occupiers of a development or the surrounding area.
- Promote safe and sustainable transport choices, including public transport, cycling and walking, for all people, including those with disabilities.
- Encourage improvements to public transport, including quality and connectivity of transport interchanges, and support the use of Smart City technology and practices.
- Promote sustainable waste management through minimising waste and providing sufficient land for the reuse, recycling and treatment of waste, and minimise the amount of waste going to landfill in line with the West London Waste Plan.

Meeting people's needs (SO 3):

- Ensure there is adequate provision of facilities for community and social infrastructure that are important for the quality of life of residents, and which support the growing population, by protecting existing and, where required, securing new facilities and services that meet people's needs.
- Ensure there continues to be good provision of, and access to, local services and facilities that meet the needs of our communities.
- Facilitate inward investment and support businesses, particularly small and medium-sized enterprises and creative industries to grow the employment base of the borough.
- Encourage the creation of healthy environments and support healthy and active lifestyles, including through measures to reduce health inequalities. This includes ensuring there is an appropriate range of health facilities that meet local needs and tackling childhood obesity by restricting access to unhealthy foods, particularly fast food takeaways, in proximity to schools.
- Promote inclusive and sustainable communities, social interaction, cohesive, healthy and dementia-friendly communities, and enable the older population to remain independent and active for longer.

Local Plan: Key Policies:

The Council aims to ensure that local environmental impacts of all development proposals do not lead to detrimental effects on the health, safety and the amenity of existing and new users or occupiers of the development site, or the surrounding land.

Local Environmental Impacts, Pollution and Land Contamination (Policy LP 10):

Air Quality

The whole of the borough has been declared as an Air Quality Management Area (AQMA) and as such any new development and its impact upon air quality must be considered. The Council promotes good air quality design and new technologies. Developers should secure at least 'Emissions Neutral' development. To consider the impact of introducing new developments in areas already subject to poor air quality, the following will be required:

- An air quality impact assessment, including where necessary, modelled data.
- Mitigation measures to reduce the development's impact upon air quality, including the type of equipment installed, thermal insulation and ducting abatement technology.
- Measures to protect the occupiers of new developments from existing sources.
- Strict mitigation for developments to be used by sensitive receptors such as schools, hospitals and care homes in areas of existing poor air quality; this also applies to proposals close to developments used by sensitive receptors.

Noise and Light:

The Council encourages good acoustic design to ensure occupiers of new and existing noise sensitive buildings are protected. The Council also seeks to ensure that artificial lighting in new developments does not lead to unacceptable impacts. This includes the assessment of new and pre-existing noise/light levels, mitigation measures where applicable, time restriction on development activities where noise cannot be sufficiently mitigated, promotion of good acoustic and lighting design, and use of new technologies.

Construction and demolition

The Council aims to manage and limit environmental disturbances during construction and demolition as well as during excavations and construction of basements and subterranean developments. To deliver this the Council requires the submission of Construction Management Statements (CMS) for all major development, any basement of subterranean development, developments of sites in confined locations or near sensitive receptors, or if substantial demolition/excavation works are proposed.

Climate change adaptation (Policy LP 20):

The Council aims to promote and encourage development to be fully resilient to the future impacts of climate change in order to minimise vulnerability of people and property. New development, in their layout, design, construction, materials, landscaping and operation, should minimise the effects of overheating as well as minimise energy consumption in accordance with the following cooling hierarchy:

- Minimise internal heat generation through energy efficient design.
- Reduce the amount of heat entering a building in summer through shading, reducing solar reflectance, fenestration, insulation and green roofs and walls.
- Manage the heat within the building through exposed internal thermal mass and high ceilings.
- Passive ventilation.
- Mechanical ventilation.
- Active cooling systems (ensuring they are the lowest carbon options).

Opportunities to adapt existing buildings, places and spaces to the likely effects of climate change should be maximised and are supported.

Sustainable Design and Construction (Policy LP 22)

Developments will be required to achieve the highest standards of sustainable design and construction to mitigate the likely effects of climate change. Applicants are required to complete the following:

- Development of 1 dwelling unit or more, or 100sqm or more of non-residential floor space (including extensions) will be required to complete the Sustainable Construction Checklist SPD. A completed Checklist must be submitted as part of the planning application.
- Development that results in a new residential dwelling, including conversions, change of use, and extensions that result in a new dwelling unit, will be required to incorporate water conservation measures.
- New non-residential buildings over 100sqm will be required to meet BREEAM 'Excellent' standard.

Reducing Carbon Dioxide Emissions
Developers are required to incorporate measures to improve energy conservation and efficiency as well as contributions to renewable and low carbon energy generation. Proposed developments are required to meet the following minimum reductions in carbon dioxide emissions:

- All new major residential developments (10 units or more) should achieve zero carbon standards in line with London Plan policy.
- All non-residential buildings over 100sqm should achieve a 35% reduction. From 2019 all major non-residential buildings should achieve zero carbon standards in line with London Plan policy.

Targets are expressed as a percentage improvement over the target emission rate (TER) based on Part L of the 2013 Building Regulations. This should be achieved by following the Energy Hierarchy:

Figure 11: Energy hierarchy.

Decentralised Energy Networks
The Council requires developments to contribute towards the Mayor of London target of 25% of heat and power to be generated through localised decentralised energy (DE) systems by 2025. The following will be required:

- All new development will be required to connect to existing DE networks where feasible. This also applies where a DE network is planned and expected to be operational within 5 years of the development being completed.
- Development proposals of 50 units or more, or new non-residential development of 1000sqm or more, will need to provide an assessment of the provision of on-site decentralised energy (DE) networks and combined heat and power (CHP).
- Where feasible, new development of 50 units or more, or new non-residential development of 1000sqm or more will need to provide on-site DE and CHP; this is particularly necessary within the clusters identified for DE opportunities in the borough-wide Heat Mapping Study. Where on-site provision is not feasible, provision should be made for future connection to a local DE network should one become available.

Applicants are required to consider the installation of low, or preferably ultra-low, NOx boilers to reduce the amount of NOx emitted in the borough. Local opportunities to contribute towards decentralised energy supply from renewable and low-carbon technologies will be encouraged where appropriate.

Retrofitting
High standards of energy and water efficiency in existing developments will be supported wherever possible through retrofitting. Householder extensions and other development proposals that do not meet the thresholds set out in this policy are encouraged to complete and submit the Sustainable Construction Checklist SPD as far as possible, and opportunities for micro-generation of renewable energy will be supported in line with other policies in this Plan.

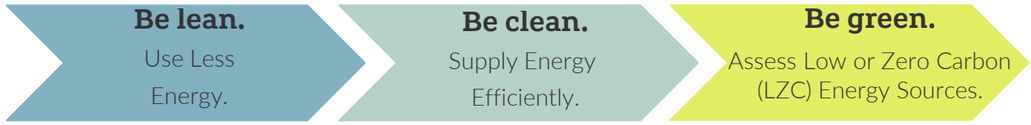
Water (Policy LP 23):
London is classified as 'seriously' water stressed, meaning that more water is taken from the environment than the environment can sustain in the long term. Therefore, high standards of water efficiency will be required in new developments to address the fact that drinking water is becoming an increasingly limited resource in this borough.

The borough's water resources and supplies will be protected by resisting development proposals that would pose an unacceptable threat to the borough's rivers, surface water and groundwater quantity and quality. This includes pollution caused by water run-off from developments into nearby waterways. The Council encourages proposals that seek to increase water availability or protect and improve the quality of rivers or groundwater

New major residential or major non-residential development will need to ensure that there is adequate water supply, surface water, foul drainage, and sewerage treatment capacity to serve the development. Applicants for major developments will be required to provide evidence in the form of written confirmation as part of the planning application that capacity exists in the public sewerage and water supply network to serve their development.

Waste (Policy LP 24):
The Council will ensure that waste is managed in accordance with the waste hierarchy, which is to reduce, reuse or recycle waste as close as possible to where it is produced. Proposals affecting existing waste management sites, as well as proposals for new or additional waste management facilities, will be assessed against the policies of the West London Waste Plan (2015).

Health and wellbeing (Policy LP 30):
The Council promotes and supports healthy and active lifestyles and measures to reduce health inequalities. The Council will support development that results in a pattern of land uses and facilities that encourage:



- Sustainable modes of travel such as safe cycling routes, attractive walking routes and easy access to public transport to reduce car dependency.
- Access to green infrastructure, including river corridors, local open spaces as well as leisure, recreation and play facilities to encourage physical activity.
- Access to local community facilities, services and shops which encourage opportunities for social interaction and active living, as well as contributing to dementia-friendly environments.
- Access to local healthy food, for example, allotments and food growing spaces.
- Access to toilet facilities which are open to all in major developments where appropriate (linked to the Council's Community Toilet Scheme).
- An inclusive development layout and public realm that considers the needs of all, including the older population and disabled people.
- Active Design which encourages wellbeing and greater physical movement as part of everyday routines.

This policy will be delivered by requiring developments to comply with the following:

- A Health Impact Assessment must be submitted with all major development proposals.
- The Council will manage proposals for new fast-food takeaways (A5 uses) located within 400 metres of the boundaries of a primary or secondary school in order to promote the availability of healthy foods.
- Existing health facilities will need to be retained where these continue to meet, or can be adapted to meet, residents' needs.
- Applications for new or improved facilities or loss of health and social care facilities will be assessed in line with the criteria set out in the Social and Community Infrastructure policy.

Draft Richmond Local Plan (December 2021)

The London Borough of Richmond Upon Thames has recently concluded its consultation period (January 2022) on the draft Local Plan, which sets out the vision for the City over the next 15 years and is anticipated to be adopted in 2024. Although the Richmond Local Plan had only been adopted in July 2018, commencing a new Local Plan was agreed in 2019 in the context of changes in national and regional policy and guidance, including a revised National Planning Policy Framework (NPPF) (2019) and changes to the London Plan.

The NPPF requires Local Plans to include strategic policies to address priorities for the development and use of land. The strategic policies of this Local Plan which most impact the Proposed Development are as follows:

- Policy 1. Living Locally and the 20- minute neighbourhood
- Policy 2. Spatial Strategy: Managing the scale and location of change in the borough
- Policy 3. Tackling the climate emergency
- Policy 4. Minimising Greenhouse gas emissions and promoting energy efficiency
- Policy 5. Energy Infrastructure
- Policy 7. Waste and the circular economy
- Policy 8. Flood risk and sustainable drainage
- Policy 9. Water resources and infrastructure
- Policy 17: Supporting our centres and promoting culture
- Policy 21. Protecting the Local Economy
- Policy 27. Telecommunications and digital infrastructure
- Policy 28. Local character and design quality
- Policy 34. Green and Blue Infrastructure
- Policy 47. Sustainable travel choices
- Policy 49. Social and Community Infrastructure
- Policy 50. Education and Training
- Policy 51. Health and Wellbeing

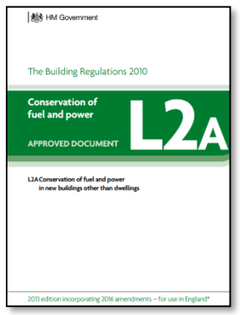
Supplementary Planning Documents
Supporting guidance documents, albeit not summarised here, include:

- The Localism Act 2011
- Neighbourhood Planning 2020
- West London Waste Plan 2015

Appendix B – Part L of the Building Regulations.

Building Regulations Part L.
Part L of the Building Regulations is the mechanism by which government is driving reductions in the regulated CO_2 emissions from new buildings. This section provides a summary of the requirements contained within the Part L documentation and the proposed update to the Part L regulations.

Current Requirements: Part L2A 2013
The Building Regulations Part L covers the conservation of fuel and power. Part L2A 2013 applies to new non-domestic buildings. There are five criteria in Part L2A when demonstrating compliance.



Criterion 1 - Achieving the Target Emission Rate (TER)
Criterion 2 - Limits on design flexibility
Criterion 3 - Limiting the effects of solar gains in summer
Criterion 4 - Building performance consistent with Building Emission Rate (BER)
Criterion 5 - Provision for energy efficient operation of the building

To gain compliance, only Criterion 1 and parts of Criterion 4 (which states that Building Emissions Rate remains consistent from design through to construction) are regulation and therefore mandatory. The approaches to meet the other criteria are 'reasonable provision' and alternative proposals are permissible. This should be checked with the Building Control Body (BCB) to confirm that they meet the energy efficiency requirements.

Criterion 1
The calculated CO_2 emission rate for the building known as the Building Emission Rate (BER) must not be greater than the Target Emission Rate (TER).

Criterion 2
The performance of the building fabric and the heating, cooling, hot water, ventilation, and fixed lighting systems should achieve reasonable standards of energy efficiency.

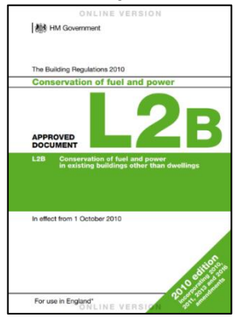
Criterion 3
Requires that all buildings, irrespective of whether they are air-conditioned or not, to limit their solar gains during the summer period to either:

- Reduce the need for air-conditioning; or
- Reduce the installed capacity of any air-conditioning system that is installed.

Criterion one to three will be addressed within the energy strategy.

Currently, the proposed development will be assessed in accordance with the Building Regulations Part L2A.

Current Requirements: Part L2B 2013



On a national level, the Building Regulations Part L2B covers the energy efficiency requirements to renovation and extension of existing non-domestic buildings. Alterations to existing non-domestic buildings fall under the Building Regulations Part L2B 2013.

For existing buildings upgrading is generally only required for elements that are to be substantially replaced or renovated, or where there is a change of use.

Simplistically, the following circumstances would trigger Part L2B requirements to be followed:

- Provision, extension, alteration or renovation of thermal elements e.g. upgrading external wall / floor U-values.
- Amendments to controlled fittings and services – e.g. windows / external doors and HVAC systems.
- Extensions – extensions over 100m^2 and greater than 25% of total useful floor area of the existing building should be carried out in accordance with Part L2A (new buildings).
- Consequential improvements – required when existing buildings over 1,000m^2 is extended or capacity of heating or cooling per m^2 is increased.
- Material alterations to existing buildings and material change of use / energy status.

Reasonable provision for newly constructed thermal elements such as those constructed as part of an extension must meet the minimum standards for controlled fittings and for new thermal elements set out in Table B1 below:

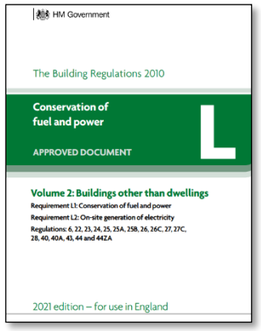
Table B1: Standards for controlled fittings and for new thermal elements (non-domestic)

	Fittings / Elements	Standard U-Value (W/m2K)
Controlled Fittings	Windows, roof windows and roof lights	1.80
	Glazed pedestrian door	1.80
	All other pedestrian doors	1.80
	High usage entrance door for people	3.50
	Vehicle access and similar large doors	1.50
New Thermal Element	External walls	0.28
	Pitched roof with insulation at ceiling level	0.16
	Pitched roof with insulation at rafter level	0.18
	Flat roof or roof with integral insulation	0.18
	Floors	0.22
U-values must be calculated using the methods and conventions set out in BR 443 and should be based on the whole unit		

Regulation 28 of Part L2B of the Building Regulations may require additional work (consequential improvements to energy performance) to be undertaken to make the existing building more energy efficient when certain types of building work are proposed, as long as it is technically, functionally, and economically feasible.

Where the work involves the provision or extension of controlled services, reasonable provision must be demonstrated by following the guidance set out in the Non-Domestic Building Services Compliance Guide 2013 edition.

Approved Document L, Volume 2: Buildings other than dwellings (2021).



This document gives guidance on how to comply with Part L of Schedule 1 to the Building Regulations and the energy efficiency requirements for buildings other than dwellings. The report will come into effect in June 2022 and introduces and uplifts standards with the aim of achieving a 27% reduction in carbon emissions over the current Part L2A 2013 regulations. This document gives guidance for building work in both new and existing buildings. The uplift in standards will include a combination of building fabric and building service improvements, and low carbon technologies.

Transitional metrics for developments will apply to individual buildings, rather than an entire development, and the transitional period will be one year. Any buildings not started beyond that point will be subject to the most up to date Building Regulations.

For buildings to remain under current regulation or for transitional arrangements to apply to an individual building, developers will be required to:

- Submit a building / initial notice or deposited plans by 15th June 2022, and
- Commence work on each individual building by June 2023.

Any notices/plans submitted after June 2022, Part L 2021 regulation will apply. Likewise, if plans are submitted yet work is not commenced on an individual building by June 2023, then Part L 2021 applies.

Commencement activities include:

- Excavation for strip or trench foundations or for pad footings.
- Digging out and preparation of ground for raft foundations.
- Vibro-floatation (stone columns) piling, boring for piles or pile driving.
- Drainage works specific to the building(s) concerned.

A new non-domestic Future Buildings Standard is expected to be implemented in 2025, alongside a Future Homes Standard. It is intended that aligning to the Future Buildings Standard will make non-domestic buildings zero carbon ready by 2025.

Key Changes.

Building Fabric: Fabric improvements will include the introduction of higher minimum standards for thermal performance (U-values) and air permeability, in comparison with current Part L2 2013.

Table B9: Part L2 2021 uplifts in building fabric performance.

Element	Part L2 2013	Part L2 2021
Roof (flat roof)	0.25	0.18
Roof (pitched roof)	0.25	0.16
External wall	0.35	0.26
Floor	0.25	0.18
Swimming pool basin	0.25	0.25
Windows	2.20	1.60 OR Window Energy Rating Band B
Rooflights	2.20	2.20
Pedestrian doors (inc. glazed doors)	2.20	1.60
Vehicle access doors	1.50	1.30
High usage entrance doors	3.50	3.00
Roof ventilation (inc. smoke vents)	3.50	3.00
Air permeability	10.0 $m^3/h.m^2$@50Pa	8.0 $m^3/h.m^2$@50Pa

The improved building fabric standards will apply to new insulating elements in all of the following cases: elements in new buildings; new elements in extension of existing buildings; new or replacement elements in existing buildings.

Building Services:

- Increase in minimum efficiency standards for building services:
  - Minimum efficiency standards improved across the board compared to the current values stated in the Non-domestic Building Services Guide.
  - Additionally, new guidelines will be introduced around the sizing of building services to ensure that these match building demand more closely for greater efficiency.
- Low carbon heating technologies:
  - Heat pumps and heat networks will be prioritised over gas heating, and their low carbon benefits will be recognised in the NCM (National Calculation Methodology) for Part L2 through the introduction of a new carbon factors to align with the natural gas factor.
  - The NCM will also be updated to include solar PV in the notional ("baseline") building, unless a heat pump is specified to meet 100% of the actual building's space heat demand. This is intended to discourage excessive levels of solar PV in the actual building being used as a means of overcoming poor fabric performance.
- Self-regulating devices:
  - New regulations will be introduced to require that buildings must have self-regulating devices (e.g. TRVs, Thermostats, Room controllers) when a heating or cooling system is installed.
- Building automation and control systems (BACS):
  - Introduction of a new requirement mandating for buildings that have a space heating or air conditioning system with an effective rated output over 180kW should be equipped with BACS.
- Energy sub-metering for monitoring of as-built performance:
  - Intention to continue referencing CIBSE TM39 as the standard to which new buildings should be sub-metered. As well as meeting CIBSE TM39, the sub-metering installation should also enable a useful comparison to be made between design-stage energy forecasts, such as CIBSE TM54, and measured results (using a representative building archetype).
- Lighting:
  - Revised minimum efficacies for lighting installed in new non-domestic buildings to reflect improvements in LED lighting in recent years:
    - 100 luminaire lm/cW for general lighting.
    - 80 luminaire lm/cW for display lighting.
  - The revised general lighting minimum will be beneficial for EPC calculations with 'Shell' lighting, where the minimum efficacy is currently set at 70 lm/cW.
- Commissioning and handover:

- Commissioning requirements for new non-domestic buildings to be extended to cover both BACS, and on-site electricity generation systems.
- Handover information must include a Building Logbook, Operating and Maintenance instructions for fixed building services, and Energy benchmarking information in accordance with CIBSE TM54 (buildings over 1,000 sqm).

Demonstrating Compliance:

To comply, a newly constructed building must meet the minimum energy performance requirements for Target primary energy rate (TPER) and Target emission rate (TER).

The TPER compliance metric is a change from Part L2 2013, whereby new building compliance is measured only against the TER metric.

Primary energy is a reflection of how much raw fuel is used to generate a unit of final energy, from extraction to transportation to use. As such, renewable energy will perform well under primary energy metrics, especially when specified on-site.

The TPER metric will require a greater emphasis on reducing energy demand of the building, and in turn reduce consumption from grid supplied energy. This is expected to be achieved through a combination of fabric energy efficiency, efficient building services, and low and zero carbon technologies.

The Approved Document L (2021) notes that "the TPER and TER are not likely to be met by using the minimum standards for fabric". This will be an adjustment for the typical base build warehouse development, as currently use of minimum building fabrics standards is common practice.

Non-domestic
A 27% reduction in regulated carbon emissions is proposed over the Part L 2013 baseline for non-domestic buildings.

Proposed metrics for the revised Part L 2021 for non-domestic buildings include:

- Primary energy metric.
- CO_2 emission target.

Changes are proposed for minimum fabric and fixed services standards, as well as the National Calculation Methodology that underpins the Part L assessment. Part L 2021 updates also propose a 74% reduction in electricity carbon factor from current regulations. This makes electric servicing strategies significantly more desirable from a carbon perspective.

Carbon factors for natural gas and grid supplied electricity have been revised in new Part L 2021 and the SAP 10.1 figures noted in the table below have been adopted.

Table B10: Current, SAP 10 and SAP 10.1 carbon factors for natural gas and grid supplied electricity.

Fuel	Part L 2013 Carbon Factor ($kgCO_2/kWh$)	SAP10 Carbon Factor ($kgCO_2/kWh$) (aligned with GLA guidance)	Proposed SAP10.1 Carbon Factor ($kgCO_2/kWh$)
Mains Gas	0.216	0.210	0.210
Electricity (average)	0.519	0.233	0.136

It is recommended that the project building control officer or approved inspector is consulted to confirm expectations in relation to future regulation.

Appendix C – BRUKL document, Pre-Refurb Building Baseline.

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Richmond Inn (Pre-Refurb Part L2B) Baseline

As designed

Date: Tue Apr 26 01:07:30 2022

Administrative information

Building Details

Address: 50-56 Sheen Rd, London, TW9 1UG

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.13

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.13

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

Certifier details

Name: HL

Telephone number:

Address: , ,

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

The building does not comply with England Building Regulations Part L 2013

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	75.8
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	75.8
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	186.9
Are emissions from the building less than or equal to the target?	BER > TER
Are as built details the same as used in the BER calculations?	Separate submission

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

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

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	1.7	1.7	01000012:Surf[0]
Floor	0.25	1.2	1.2	GF000011:Surf[8]
Roof	0.25	1.5	1.5	RM000016:Surf[0]
Windows***, roof windows, and rooflights	2.2	3.1	3.1	01000012:Surf[2]
Personnel doors	2.2	3	3	GF00000A:Surf[2]
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

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

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

* There might be more than one surface where the maximum U-value occurs.

** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

*** Display windows and similar glazing are excluded from the U-value check.

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	15

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- HVAC 03 - All areas Radiator

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.65	-	0	0	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems. (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

2- HVAC 02 - Restaurant Radiator

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.65	-	0	0	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

3- HVAC 01 - Kitchen Radiator

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.65	-	0	0	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

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

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
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 supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

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	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
01-101	-	-	1	-	-	-	-	-	-	-	N/A
01-101	-	-	1	-	-	-	-	-	-	-	N/A
01-102	-	-	1	-	-	-	-	-	-	-	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	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
01-102	-	-	1	-	-	-	-	-	-	-	N/A
01-102	-	-	1	-	-	-	-	-	-	-	N/A
01-103	-	-	1	-	-	-	-	-	-	-	N/A
01-103	-	-	1	-	-	-	-	-	-	-	N/A
01-104	-	-	1	-	-	-	-	-	-	-	N/A
01-105	-	-	1	-	-	-	-	-	-	-	N/A
01-120	-	-	1	-	-	-	-	-	-	-	N/A
01-120	-	-	1	-	-	-	-	-	-	-	N/A
01-121	-	-	1	-	-	-	-	-	-	-	N/A
01-121	-	-	1	-	-	-	-	-	-	-	N/A
02-204	-	-	1	-	-	-	-	-	-	-	N/A
02-201	-	-	1	-	-	-	-	-	-	-	N/A
02-201	-	-	1	-	-	-	-	-	-	-	N/A
02-202	-	-	1	-	-	-	-	-	-	-	N/A
02-202	-	-	1	-	-	-	-	-	-	-	N/A
02-202-Dormer	-	-	1	-	-	-	-	-	-	-	N/A
02-203	-	-	1	-	-	-	-	-	-	-	N/A
02-203	-	-	1	-	-	-	-	-	-	-	N/A
02-204	-	-	1	-	-	-	-	-	-	-	N/A
02-220	-	-	1	-	-	-	-	-	-	-	N/A
02-221	-	-	1	-	-	-	-	-	-	-	N/A
02-221	-	-	1	-	-	-	-	-	-	-	N/A
02-221	-	-	1	-	-	-	-	-	-	-	N/A
02-?	-	-	1	-	-	-	-	-	-	-	N/A
GF-001	-	-	1	-	-	-	-	-	-	-	N/A
GF-001	-	-	1	-	-	-	-	-	-	-	N/A
GF-002	-	-	1	-	-	-	-	-	-	-	N/A
GF-003	-	-	1	-	-	-	-	-	-	-	N/A
GF-019	-	-	1	-	-	-	-	-	-	-	N/A
GF-019	-	-	1	-	-	-	-	-	-	-	N/A
GF-020	-	-	1	-	-	-	-	-	-	-	N/A
GF-020	-	-	1	-	-	-	-	-	-	-	N/A
02-202	-	-	1	-	-	-	-	-	-	-	N/A
02-220	-	-	1	-	-	-	-	-	-	-	N/A
02-220 Dormer	-	-	1	-	-	-	-	-	-	-	N/A
GF-004	-	-	1	-	-	-	-	-	-	-	N/A
01-105	-	-	1	-	-	-	-	-	-	-	N/A
LG-Kitchen	-	-	-	-	-	-	-	-	1.6	-	N/A
02-205	-	-	1	-	-	-	-	-	-	-	N/A

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
01-101	-	45	-	81

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
01-101	-	45	-	28
01-102	-	45	-	29
01-102	-	45	-	44
01-102	-	45	-	46
01-103	-	45	-	37
01-103	-	45	-	72
01-104	-	45	-	76
01-105	-	45	-	35
01-120	-	45	-	54
01-120	-	45	-	57
01-121	-	45	-	62
01-121	-	45	-	54
01-Circ 4	-	45	-	43
01-Circ 2	-	45	-	104
01-Circ 3	-	45	-	75
01-Stair 3	-	45	-	76
02-Lobby	-	45	-	41
02-204	-	45	-	35
02-201	-	45	-	18
02-201	-	45	-	65
02-202	-	45	-	26
02-202	-	45	-	44
02-202-Dormer	-	45	-	0
02-203	-	45	-	66
02-203	-	45	-	32
02-204	-	45	-	71
02-220	-	45	-	46
02-221	-	45	-	53
02-221	-	45	-	58
02-?	-	45	-	13
02-Circ 3	-	45	-	102
02-Circ 2	-	45	-	37
02-Circ 2	-	45	-	46
02-Stair 3	-	45	-	62
GF-001	-	45	-	62
GF-001	-	45	-	71
GF-002	-	45	-	98
GF-003	-	45	-	118
GF-019	-	45	-	58
GF-019	-	45	-	55
GF-020	-	45	-	55
GF-020	-	45	-	68
GF-Circ 5	-	45	-	81

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
GF-Circ 2	-	45	-	50
GF-Circ 4	-	45	-	56
GF-Circ 3	-	45	-	56
GF-Stair 3	-	45	-	94
LG-Restaurant/Bar	-	45	15	539
LG-BOH/Service Corridor	-	45	-	237
02-202	-	45	-	35
02-220	-	45	-	45
02-220 Dormer	-	45	-	0
GF-004	-	45	-	105
01-105	-	45	-	111
LG-Kitchen	-	45	-	1660
02-205	-	45	-	102

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
01-101	NO (-40.2%)	NO
01-101	YES (+1%)	NO
01-102	N/A	N/A
01-102	N/A	N/A
01-102	NO (-35.2%)	NO
01-103	YES (+11.3%)	NO
01-103	NO (-23.5%)	NO
01-104	NO (-41%)	NO
01-105	N/A	N/A
01-120	NO (-58.2%)	NO
01-120	NO (-54%)	NO
01-121	NO (-46.7%)	NO
01-121	NO (-40%)	NO
02-204	N/A	N/A
02-201	NO (-40.9%)	NO
02-201	NO (-64.2%)	NO
02-202	N/A	N/A
02-202	NO (-72.3%)	NO
02-202-Dormer	NO (-82.5%)	NO
02-203	NO (-63.3%)	NO
02-203	NO (-43%)	NO
02-204	NO (-68.9%)	NO
02-220	NO (-80.2%)	NO
02-221	NO (-70.4%)	NO
02-221	NO (-74.1%)	NO
02-?	NO (-68%)	NO
GF-001	YES (+15.1%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
GF-001	NO (-10.6%)	NO
GF-002	NO (-5.7%)	NO
GF-003	NO (-51.5%)	NO
GF-019	NO (-45.5%)	NO
GF-019	NO (-61.6%)	NO
GF-020	NO (-33.2%)	NO
GF-020	YES (+1.5%)	NO
LG-Restaurant/Bar	NO (-66.2%)	NO
02-202	NO (-79%)	NO
02-220	NO (-80.1%)	NO
02-220 Dormer	NO (-89.4%)	NO
GF-004	NO (-55.8%)	NO
01-105	NO (-66.9%)	NO
02-205	NO (-75.8%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of 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
Area [m²]	905.7	905.7
External area [m²]	1384.5	1384.5
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	15	3
Average conductance [W/K]	2373.47	765.83
Average U-value [W/m²K]	1.71	0.55
Alpha value* [%]	10.02	10

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

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
100	**C1 Hotels**
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	346.98	75.95
Cooling	0	0
Auxiliary	52.79	18.47
Lighting	32.68	20.89
Hot water	313.06	182.87
Equipment*	43.05	43.05
TOTAL**	**745.51**	**298.18**

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

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	724.48	235.7
Primary energy* [kWh/m²]	1067.61	433.58
Total emissions [kg/m²]	186.9	75.8

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

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] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	274.7	0	131.6	0	218.3	0.58	0	0.65	0
	Notional	51.5	0	16.6	0	78.3	0.86	0	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	1162.7	0	556.9	0	3.9	0.58	0	0.65	0
	Notional	383	0	123.4	0	1.9	0.86	0	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	851.6	0	407.9	0	39.3	0.58	0	0.65	0
	Notional	282.1	0	90.9	0	15.4	0.86	0	----	----
[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

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	1.7	01000012:Surf[0]
Floor	0.2	1.2	GF000011:Surf[8]
Roof	0.15	1.5	RM000016:Surf[0]
Windows, roof windows, and rooflights	1.5	3.1	01000012:Surf[2]
Personnel doors	1.5	3	GF00000A:Surf[2]
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	-	No High usage entrance doors in building

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	15

Appendix D – BRUKL document, Post-Refurb Building Be Lean.

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Richmond Inn (Refurb Part L2B) Be Lean

As designed

Date: Wed May 04 10:45:59 2022

Administrative information

Building Details

Address: 50-56 Sheen Rd, London, TW9 1UG

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.13

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.13

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

Certifier details

Name: HL

Telephone number:

Address: , ,

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

The building does not comply with England Building Regulations Part L 2013

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	80.5
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	80.5
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	85.9
Are emissions from the building less than or equal to the target?	BER > TER
Are as built details the same as used in the BER calculations?	Separate submission

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

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

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.66	0.7	01000012:Surf[0]
Floor	0.25	0.18	0.18	GF000011:Surf[8]
Roof	0.25	0.1	0.1	RM000016:Surf[0]
Windows***, roof windows, and rooflights	2.2	1.3	1.3	01000012:Surf[2]
Personnel doors	2.2	1.4	1.4	GF00000A:Surf[2]
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

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

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	8

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	0.9 to 0.95

1- HVAC 03 - FCU (MVHR) - All areas

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	2.8	0	1.6	0.8
Standard value	0.91*	3.2	N/A	1.6^	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.

2- HVAC 02 - FCU (AHU02) - Restaurant

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	2.8	0	1.52	0.82
Standard value	0.91*	3.2	N/A	1.6^	0.65
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.

3- HVAC 01 - FCU (AHU01) - Kitchen

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	2.8	0	1.54	0.83
Standard value	0.91*	3.2	N/A	1.6^	0.65
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.

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

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
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 supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

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	1.9	1.6	0.5	1.1	0.5	1	**Zone**	**Standard**
01-101	-	-	-	-	-	-	-	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	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
01-101	-	-	-	-	-	-	-	0.2	-	-	N/A
01-102	-	-	-	-	-	-	-	0.2	-	-	N/A
01-102	-	-	-	-	-	-	-	0.2	-	-	N/A
01-102	-	-	-	-	-	-	-	0.2	-	-	N/A
01-103	-	-	-	-	-	-	-	0.2	-	-	N/A
01-103	-	-	-	-	-	-	-	0.2	-	-	N/A
01-104	-	-	-	-	-	-	-	0.2	-	-	N/A
01-105	-	-	-	-	-	-	-	0.2	-	-	N/A
01-120	-	-	-	-	-	-	-	0.2	-	-	N/A
01-120	-	-	-	-	-	-	-	0.2	-	-	N/A
01-121	-	-	-	-	-	-	-	0.2	-	-	N/A
01-121	-	-	-	-	-	-	-	0.2	-	-	N/A
01-Circ 4	-	-	-	-	-	-	-	0.2	-	-	N/A
01-Circ 2	-	-	-	-	-	-	-	0.2	-	-	N/A
01-Circ 3	-	-	-	-	-	-	-	0.2	-	-	N/A
02-Lobby	-	-	-	-	-	-	-	0.2	-	-	N/A
02-204	-	-	-	-	-	-	-	0.2	-	-	N/A
02-201	-	-	-	-	-	-	-	0.2	-	-	N/A
02-201	-	-	-	-	-	-	-	0.2	-	-	N/A
02-202	-	-	-	-	-	-	-	0.2	-	-	N/A
02-202	-	-	-	-	-	-	-	0.2	-	-	N/A
02-202-Dormer	-	-	-	-	-	-	-	0.2	-	-	N/A
02-203	-	-	-	-	-	-	-	0.2	-	-	N/A
02-203	-	-	-	-	-	-	-	0.2	-	-	N/A
02-204	-	-	-	-	-	-	-	0.2	-	-	N/A
02-220	-	-	-	-	-	-	-	0.2	-	-	N/A
02-221	-	-	-	-	-	-	-	0.2	-	-	N/A
02-221	-	-	-	-	-	-	-	0.2	-	-	N/A
02-?	-	-	-	-	-	-	-	0.2	-	-	N/A
02-Circ 3	-	-	-	-	-	-	-	0.2	-	-	N/A
02-Circ 2	-	-	-	-	-	-	-	0.2	-	-	N/A
02-Circ 2	-	-	-	-	-	-	-	0.2	-	-	N/A
GF-001	-	-	-	-	-	-	-	0.2	-	-	N/A
GF-001	-	-	-	-	-	-	-	0.2	-	-	N/A
GF-002	-	-	-	-	-	-	-	0.2	-	-	N/A
GF-003	-	-	-	-	-	-	-	0.2	-	-	N/A
GF-019	-	-	-	-	-	-	-	0.2	-	-	N/A
GF-019	-	-	-	-	-	-	-	0.2	-	-	N/A
GF-020	-	-	-	-	-	-	-	0.2	-	-	N/A
GF-020	-	-	-	-	-	-	-	0.2	-	-	N/A
GF-Circ 5	-	-	-	-	-	-	-	0.2	-	-	N/A
GF-Circ 2	-	-	-	-	-	-	-	0.2	-	-	N/A
GF-Circ 4	-	-	-	-	-	-	-	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	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
GF-Circ 3	-	-	-	-	-	-	-	0.2	-	-	N/A
LG-Restaurant/Bar	-	-	-	-	-	-	-	0.2	-	-	N/A
02-202	-	-	-	-	-	-	-	0.2	-	-	N/A
02-220	-	-	-	-	-	-	-	0.2	-	-	N/A
02-220 Dormer	-	-	-	-	-	-	-	0.2	-	-	N/A
GF-004	-	-	-	-	-	-	-	0.2	-	-	N/A
01-105	-	-	-	-	-	-	-	0.2	-	-	N/A
LG-Kitchen	-	-	-	-	-	-	-	0.8	0.8	-	N/A
02-205	-	-	-	-	-	-	-	0.2	-	-	N/A

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
01-101	-	90	-	60
01-101	-	90	-	21
01-102	-	90	-	22
01-102	-	90	-	33
01-102	-	90	-	35
01-103	-	90	-	27
01-103	-	90	-	54
01-104	-	90	-	57
01-105	-	90	-	26
01-120	-	90	-	40
01-120	-	90	-	43
01-121	-	90	-	46
01-121	-	90	-	40
01-Circ 4	-	100	-	39
01-Circ 2	-	100	-	94
01-Circ 3	-	100	-	68
01-Stair 3	-	110	-	31
02-Lobby	-	100	-	55
02-204	-	90	-	27
02-201	-	90	-	13
02-201	-	90	-	48
02-202	-	90	-	20
02-202	-	90	-	33
02-202-Dormer	-	90	-	0
02-203	-	90	-	50
02-203	-	90	-	24
02-204	-	90	-	53
02-220	-	90	-	34
02-221	-	90	-	40
02-221	-	90	-	43

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
02-?	-	90	-	10
02-Circ 3	-	100	-	92
02-Circ 2	-	100	-	34
02-Circ 2	-	100	-	42
02-Stair 3	-	110	-	25
GF-001	-	90	-	47
GF-001	-	90	-	54
GF-002	-	90	-	74
GF-003	-	90	-	89
GF-019	-	90	-	43
GF-019	-	90	-	41
GF-020	-	90	-	41
GF-020	-	90	-	51
GF-Circ 5	-	100	-	73
GF-Circ 2	-	100	-	45
GF-Circ 4	-	100	-	51
GF-Circ 3	-	100	-	51
GF-Stair 3	-	110	-	38
LG-Restaurant/Bar	-	90	60	359
LG-BOH/Service Corridor	-	110	-	97
02-202	-	90	-	27
02-220	-	90	-	34
02-220 Dormer	-	90	-	0
GF-004	-	90	-	79
01-105	-	90	-	83
LG-Kitchen	-	100	-	747
02-205	-	90	-	77

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
01-101	NO (-73.4%)	NO
01-101	NO (-54.9%)	NO
01-102	N/A	N/A
01-102	N/A	N/A
01-102	NO (-71.3%)	NO
01-103	NO (-50.5%)	NO
01-103	NO (-66%)	NO
01-104	NO (-73.5%)	NO
01-105	N/A	N/A
01-120	NO (-81.4%)	NO
01-120	NO (-79.5%)	NO
01-121	NO (-76.2%)	NO
01-121	NO (-73.2%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
01-Circ 4	N/A	N/A
01-Circ 2	N/A	N/A
01-Circ 3	N/A	N/A
02-Lobby	N/A	N/A
02-204	N/A	N/A
02-201	NO (-73.7%)	NO
02-201	NO (-84.1%)	NO
02-202	N/A	N/A
02-202	NO (-87.8%)	NO
02-202-Dormer	NO (-91%)	NO
02-203	NO (-83.8%)	NO
02-203	NO (-74.7%)	NO
02-204	NO (-86.1%)	NO
02-220	NO (-91.2%)	NO
02-221	NO (-86.8%)	NO
02-221	NO (-88.5%)	NO
02-?	NO (-85.7%)	NO
02-Circ 3	N/A	N/A
02-Circ 2	N/A	N/A
02-Circ 2	N/A	N/A
GF-001	NO (-48.7%)	NO
GF-001	NO (-60.2%)	NO
GF-002	NO (-58%)	NO
GF-003	NO (-78.5%)	NO
GF-019	NO (-75.7%)	NO
GF-019	NO (-82.9%)	NO
GF-020	NO (-70.1%)	NO
GF-020	NO (-53.2%)	NO
GF-Circ 5	N/A	N/A
GF-Circ 2	N/A	N/A
GF-Circ 4	YES (+8.2%)	NO
GF-Circ 3	NO (-82.9%)	NO
LG-Restaurant/Bar	NO (-84.7%)	NO
02-202	NO (-91.3%)	NO
02-220	NO (-91.8%)	NO
02-220 Dormer	NO (-94.7%)	NO
GF-004	NO (-80.1%)	NO
01-105	NO (-85.1%)	NO
LG-Kitchen	NO (-88.7%)	NO
02-205	NO (-89.1%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of 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
Area [m²]	905.7	905.7
External area [m²]	1384.5	1384.5
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	8	3
Average conductance [W/K]	724.87	765.83
Average U-value [W/m²K]	0.52	0.55
Alpha value* [%]	10.05	10

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

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
100	**C1 Hotels**
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	62.89	33.43
Cooling	3.31	7.98
Auxiliary	42	37.91
Lighting	14.03	20.89
Hot water	193.5	182.87
Equipment*	43.05	43.05
TOTAL**	**315.73**	**283.08**

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

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	227.88	212.62
Primary energy* [kWh/m²]	493.17	463.78
Total emissions [kg/m²]	85.9	80.5

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

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] Fan coil systems, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	17.2	258.7	5.8	20.6	148.8	0.82	3.49	0.91	4.4
Notional	3	514.5	1	37.7	124.5	0.86	3.79	----	----
[ST] Fan coil systems, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	294.1	27.3	99.7	2.2	32.3	0.82	3.49	0.91	4.4
Notional	113.1	126.8	36.4	9.3	34.1	0.86	3.79	----	----
[ST] Fan coil systems, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	228.2	18	76.9	1.4	31.9	0.82	3.47	0.91	4.4
Notional	136.7	63	44	4.6	32.1	0.86	3.79	----	----
[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

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.13	LG00003C:Surf[10]
Floor	0.2	0.18	GF000011:Surf[8]
Roof	0.15	0.1	RM000016:Surf[0]
Windows, roof windows, and rooflights	1.5	1.3	01000012:Surf[2]
Personnel doors	1.5	1.4	GF00000A:Surf[2]
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	-	No High usage entrance doors in building

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	8

Appendix E – BRUKL document, New Building Be Lean.

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Richmond Inn (Part L2A) Be Lean

As designed

Date: Wed May 04 10:29:15 2022

Administrative information

Building Details

Address: 50-56 Sheen Rd, London, TW9 1UG

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.13

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.13

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

Certifier details

Name: HL

Telephone number:

Address: , ,

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	73
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	73
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	72.6
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

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

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

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.13	0.13	LG000012:Surf[1]
Floor	0.25	0.1	0.1	LG000025:Surf[4]
Roof	0.25	0.1	0.1	RM00000F:Surf[0]
Windows***, roof windows, and rooflights	2.2	1.3	1.3	LG000012:Surf[0]
Personnel doors	2.2	1	1	LG000000:Surf[2]
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

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

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

* There might be more than one surface where the maximum U-value occurs.

** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

*** Display windows and similar glazing are excluded from the U-value check.

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	2.5

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	0.9 to 0.95

1- HVAC 02 - FCU (MVHR)_GF/1F/2F

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	2.8	0	1.6	0.8
Standard value	0.91*	3.2	N/A	1.6^	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems. (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.

2- HVAC 01 - FCU (MVHR)_LGF

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	2.8	0	1.6	0.8
Standard value	0.91*	3.2	N/A	1.6^	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.

1- DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.91	0.003
Standard value	2*	N/A

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

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
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 supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

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	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
01-106	-	-	-	-	-	-	-	0.2	-	-	N/A
01-107	-	-	-	-	-	-	-	0.2	-	-	N/A
01-108	-	-	-	-	-	-	-	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	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
01-109	-	-	-	-	-	-	-	0.2	-	-	N/A
01-110	-	-	-	-	-	-	-	0.2	-	-	N/A
01-111	-	-	-	-	-	-	-	0.2	-	-	N/A
01-112	-	-	-	-	-	-	-	0.2	-	-	N/A
01-113	-	-	-	-	-	-	-	0.2	-	-	N/A
01-114	-	-	-	-	-	-	-	0.2	-	-	N/A
01-115	-	-	-	-	-	-	-	0.2	-	-	N/A
01-116	-	-	-	-	-	-	-	0.2	-	-	N/A
01-117	-	-	-	-	-	-	-	0.2	-	-	N/A
01-118	-	-	-	-	-	-	-	0.2	-	-	N/A
01-119	-	-	-	-	-	-	-	0.2	-	-	N/A
01-Circ 1	-	-	-	-	-	-	-	0.2	-	-	N/A
02-210	-	-	-	-	-	-	-	0.2	-	-	N/A
02-210	-	-	-	-	-	-	-	0.2	-	-	N/A
02-210	-	-	-	-	-	-	-	0.2	-	-	N/A
02-210	-	-	-	-	-	-	-	0.2	-	-	N/A
02-210	-	-	-	-	-	-	-	0.2	-	-	N/A
02-210	-	-	-	-	-	-	-	0.2	-	-	N/A
02-210	-	-	-	-	-	-	-	0.2	-	-	N/A
02-210	-	-	-	-	-	-	-	0.2	-	-	N/A
02-210	-	-	-	-	-	-	-	0.2	-	-	N/A
02-210	-	-	-	-	-	-	-	0.2	-	-	N/A
02-210	-	-	-	-	-	-	-	0.2	-	-	N/A
02-210	-	-	-	-	-	-	-	0.2	-	-	N/A
02-210-Dormer	-	-	-	-	-	-	-	0.2	-	-	N/A
02-210-Dormer	-	-	-	-	-	-	-	0.2	-	-	N/A
02-211	-	-	-	-	-	-	-	0.2	-	-	N/A
02-211-Dormer	-	-	-	-	-	-	-	0.2	-	-	N/A
02-212	-	-	-	-	-	-	-	0.2	-	-	N/A
02-212-Dormer	-	-	-	-	-	-	-	0.2	-	-	N/A
02-213	-	-	-	-	-	-	-	0.2	-	-	N/A
02-214	-	-	-	-	-	-	-	0.2	-	-	N/A
02-Circ 1	-	-	-	-	-	-	-	0.2	-	-	N/A
GF-005	-	-	-	-	-	-	-	0.2	-	-	N/A
GF-006	-	-	-	-	-	-	-	0.2	-	-	N/A
GF-007	-	-	-	-	-	-	-	0.2	-	-	N/A
GF-008	-	-	-	-	-	-	-	0.2	-	-	N/A
GF-009	-	-	-	-	-	-	-	0.2	-	-	N/A
GF-010	-	-	-	-	-	-	-	0.2	-	-	N/A
GF-012	-	-	-	-	-	-	-	0.2	-	-	N/A
GF-013	-	-	-	-	-	-	-	0.2	-	-	N/A
GF-014	-	-	-	-	-	-	-	0.2	-	-	N/A
GF-015	-	-	-	-	-	-	-	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	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
GF-016	-	-	-	-	-	-	-	0.2	-	-	N/A
GF-017	-	-	-	-	-	-	-	0.2	-	-	N/A
GF-018	-	-	-	-	-	-	-	0.2	-	-	N/A
GF-Circ 1	-	-	-	-	-	-	-	0.2	-	-	N/A
GF-011	-	-	-	-	-	-	-	0.2	-	-	N/A
LG-Changing	-	-	-	-	-	-	-	0.2	-	-	N/A
LG-Lobby	-	-	-	-	-	-	-	0.2	-	-	N/A
LG-Office	-	-	-	-	-	-	-	0.2	-	-	N/A
LG-Physio	-	-	-	-	-	-	-	0.2	-	-	N/A
LG-Gym	-	-	-	-	-	-	-	0.2	-	-	N/A
LG-Pools	-	-	-	-	-	-	-	0.2	-	-	N/A

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
01-106	-	90	-	57
01-107	-	90	-	81
01-108	-	90	-	62
01-109	-	90	-	67
01-110	-	90	-	77
01-111	-	90	-	66
01-112	-	90	-	66
01-113	-	90	-	61
01-114	-	90	-	59
01-115	-	90	-	61
01-116	-	90	-	74
01-117	-	90	-	69
01-118	-	90	-	73
01-119	-	90	-	75
01-Circ 1	-	100	-	330
01-Linen	110	-	-	24
01-Stair 1	-	110	-	29
01-Stair 2	-	110	-	32
02-210	-	90	-	27
02-210	-	90	-	76
02-210	-	90	-	63
02-Stair 2	-	110	-	30
02-210	-	90	-	65
02-210	-	90	-	72
02-210	-	90	-	78
02-210	-	90	-	41
02-210	-	90	-	69
02-210	-	90	-	67

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
02-210	-	90	-	71
02-210	-	90	-	64
02-210	-	90	-	78
02-210-Dormer	-	90	-	0
02-210-Dormer	-	90	-	0
02-211	-	90	-	64
02-211-Dormer	-	90	-	0
02-212	-	90	-	63
02-212-Dormer	-	90	-	0
02-213	-	90	-	62
02-214	-	90	-	59
02-Circ 1	-	100	-	339
02-Stair 1	-	110	-	29
GF-005	-	90	-	61
GF-006	-	90	-	73
GF-007	-	90	-	69
GF-008	-	90	-	67
GF-009	-	90	-	71
GF-010	-	90	-	55
GF-012	-	90	-	81
GF-013	-	90	-	59
GF-014	-	90	-	61
GF-015	-	90	-	81
GF-016	-	90	-	64
GF-017	-	90	-	78
GF-018	-	90	-	76
GF-Circ 1	-	100	-	331
GF-Linen	110	-	-	15
GF-011	-	90	-	64
GF-Stair 2	-	110	-	32
GF-Stair 1	-	110	-	29
LG-Bike Store	110	-	-	29
LG-Bin Store	110	-	-	12
LG-Changing	-	100	-	64
LG-Lobby	-	100	60	615
LG-Office	110	-	-	108
LG-Physio	-	110	-	309
LG-Stair 1	-	110	-	22
LG-Stair 2	-	110	-	24
LG-Store	110	-	-	17
LG-Gym	-	110	-	240
LG-Pools	-	110	-	268

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
01-106	NO (-74.5%)	NO
01-107	NO (-75.8%)	NO
01-108	NO (-68.3%)	NO
01-109	NO (-80.2%)	NO
01-110	NO (-78.9%)	NO
01-111	NO (-79.2%)	NO
01-112	NO (-79.7%)	NO
01-113	NO (-85.6%)	NO
01-114	NO (-81.7%)	NO
01-115	NO (-69.4%)	NO
01-116	NO (-74.2%)	NO
01-117	NO (-68.9%)	NO
01-118	NO (-65.7%)	NO
01-119	NO (-67.8%)	NO
01-Circ 1	NO (-75.7%)	NO
02-210	N/A	N/A
02-210	NO (-64.5%)	NO
02-210	NO (-65.7%)	NO
02-210	NO (-84.9%)	NO
02-210	NO (-68%)	NO
02-210	NO (-61.1%)	NO
02-210	N/A	N/A
02-210	NO (-83.4%)	NO
02-210	NO (-74.7%)	NO
02-210	NO (-75.5%)	NO
02-210	NO (-59.9%)	NO
02-210	NO (-74%)	NO
02-210-Dormer	NO (-91.2%)	NO
02-210-Dormer	NO (-90.8%)	NO
02-211	NO (-83.9%)	NO
02-211-Dormer	NO (-90.8%)	NO
02-212	NO (-84.2%)	NO
02-212-Dormer	NO (-90.8%)	NO
02-213	NO (-85.9%)	NO
02-214	NO (-80.5%)	NO
02-Circ 1	NO (-76.6%)	NO
GF-005	NO (-59.2%)	NO
GF-006	NO (-65.7%)	NO
GF-007	NO (-64.4%)	NO
GF-008	NO (-63.8%)	NO
GF-009	NO (-68.7%)	NO
GF-010	NO (-83.7%)	NO
GF-012	NO (-76.3%)	NO
GF-013	NO (-84.2%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
GF-014	NO (-74.7%)	NO
GF-015	NO (-79.6%)	NO
GF-016	NO (-71.2%)	NO
GF-017	NO (-72.3%)	NO
GF-018	NO (-72%)	NO
GF-Circ 1	NO (-77.1%)	NO
GF-011	NO (-72.5%)	NO
LG-Changing	N/A	N/A
LG-Lobby	NO (-63.1%)	NO
LG-Office	NO (-81.4%)	NO
LG-Physio	NO (-79.9%)	NO
LG-Gym	NO (-73.9%)	NO
LG-Pools	NO (-76.2%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of 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
Area [m^2]	1754.5	1754.5
External area [m^2]	2106.8	2106.8
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	3	3
Average conductance [W/K]	533.9	1097.77
Average U-value [W/m^2K]	0.25	0.52
Alpha value* [%]	10.02	10

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

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
96	**C1 Hotels**
4	**C2 Residential Institutions: Hospitals and Care Homes**
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	23.13	34.68
Cooling	2.15	3.43
Auxiliary	29.56	27.31
Lighting	9.07	13.16
Hot water	216.19	200.42
Equipment*	16.68	16.68
TOTAL**	**280.09**	**279**

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

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	95.46	154.41
Primary energy* [kWh/m^2]	415.91	418.22
Total emissions [kg/m^2]	72.6	73

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

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] Fan coil systems, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	126.2	68.8	42.6	5.5	36.5	0.82	3.47	0.91	4.4
	Notional	144.8	86.9	46.7	6.4	35.7	0.86	3.79	----	----
[ST] Fan coil systems, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	62.2	18.9	21	1.5	30.5	0.82	3.47	0.91	4.4
	Notional	112.6	42.2	36.3	3.1	28.8	0.86	3.79	----	----
[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

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.13	LG000012:Surf[1]
Floor	0.2	0.1	LG000025:Surf[4]
Roof	0.15	0.1	RM00000F:Surf[0]
Windows, roof windows, and rooflights	1.5	1.3	LG000012:Surf[0]
Personnel doors	1.5	1	LG000000:Surf[2]
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	-	No High usage entrance doors in building

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	2.5