RIDGE

5023602-RDG-XX-XX-RP-ME-510000
HIGH STREET, UXBRIDGE
27.03.2024

RIDGE

HIGH STREET, UXBRIDGE
DNA UXBRIDGE LTD

Prepared for

DNA Uxbridge LTD

Prepared by

Ridge and Partners LLP
2nd Floor, 100 Embankment
Cathedral Approach
Manchester
M3 7FA
Tel: 0161 833 9579

Contact

Monica Zambrano
Building Services Engineer
monicazambrano@ridge.co.uk
07391060394

Contact

Adam Imrie
Senior Sustainability Consultant
adamimrie@ridge.co.uk
07766775587

VERSION CONTROL

VERSION	DATE	DESCRIPTION	CREATED BY	REVIEWED BY
1.0	06.02.2024	DRAFT	CM	PD
2.0	07.03.2024	Updated with planners' comments	CM	PD
3.0	20.03.2024	Updated with the Be Lean, Be Clean, Be Green and Be Seen strategy	MZ	AI
4.0	27.03.2024	Updated based on comments	AI	PD

CONTENTS

1. EXECUTIVE SUMMARY

1.1. Overview

Ridge have been appointed to provide an Energy Strategy Report to align with National Planning Policy Framework (NPPF), and The London Plan. As part of this Energy Strategy Report, an Energy Modelling Calculation has been completed to ensure compliance with Building Regulations 2021 Part L – Conservation of Fuel and Power.

The proposals comprise the demolition of the existing buildings and structures on site to provide a mixed-use development comprising Hotel (Class C1), Co-Living (Class Sui Generis) and replacement commercial floor space (Class E). The proposals includes landscape improvements including the provision of a pocket park, car and cycle parking, and associated infrastructure.

This report provides an assessment of the energy usage of each of the proposed uses and presents the energy strategy that has applied the energy hierarchy set out in London Plan Policy SI: Minimising Greenhouse Gas Emissions.

1.2. Design Strategy

In accordance with local and regional policy, this report sets out the approach to minimising carbon dioxide emissions. The following design initiatives were adopted to reduce the operational energy demand of the building as much as possible. This design strategy has been developed in line with the Energy Hierarchy outlined in section 4.

BE LEAN:

Passive Improvements

- Improved thermal fabric performance and air permeability matching or exceeding the Part L minimum U-Values to reduce heat losses.
- Maximising natural ventilation in Co-Living areas through openable panels to reduce the reliance on mechanical ventilation.
- Passive solar control through orientation, layout, form, glazing percentages and G-Values to reduce heat gains and mitigate artificial cooling.
- Providing sufficient glazing to ensure natural daylighting targets are achieved and reduce the reliance on artificial lighting.

Optimised Systems & Efficiency Measures

- Efficient LED lighting.
- Energy efficient plant and white goods to reduce unregulated energy load.
- Integrating variable speed pumps and fans to reduce operational energy demand during off-peak hours.
- Highly efficient heat recovery on mechanical ventilation equipment to reduce fresh air heating and cooling loads.
- Occupancy controls to landlord areas on equipment to reduce off-peak energy loads.
- Smart controls of primary plant and plant within landlord areas to optimise performance and match energy usage with demand.
- Energy monitoring of landlord areas and primary plant to develop a real-life picture of energy use and carbon emissions.

BE CLEAN

District Heating network connection has been considered, with no existing connection nearby, plant space allowance will be provided for connection to a potential future network.

BE GREEN

Renewable Technologies

- Low carbon technologies such as Air Source Heat Pumps for heating, cooling, and hot water.
- Renewable technologies such as photovoltaic panels to offset energy consumption.

OUTLINE WATER CYCLE STRATEGY

- All installed water fixtures and fittings shall be specified to reduce water consumption. This includes the specification of low flow taps and dual flush toilets. The proposed development will target a water consumption rate of 105 Litres of water per person per day.

- Grey water recycling is not proposed as it has been regarded unfeasible on this site.

LONDON PLAN POLICY TARGETS

A minimum on-site reduction of at least 35 per cent beyond Building Regulations152 is required for major development. Residential development should achieve 10 per cent, and non-residential development should achieve 15 per cent through energy efficiency measures. Where it is clearly demonstrated that the zero-carbon target cannot be fully achieved on-site, any shortfall should be provided, in agreement with the borough, either:

Through a cash in lieu contribution to the borough's carbon offset fund, or
off-site provided that an alternative proposal is identified and delivery is certain

As set out in London Plan Policy SI2: Minimising Greenhouse Gas Emissions

RESULTS

An initial SAP and BRUKL assessment have been undertaken as a result of the design strategy implemented (refer to Section 9). The Proposed Development **complies with the London Plan based on the tables below:**

Co-Living Block		
	Regulated residential carbon dioxide savings	
	(Tonnes CO2 per annum)	(%)
Be lean: savings from energy demand reduction	31.6	20%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	96.8	60%
Cumulative on-site savings	128.4	79%
	(Tonnes CO2)	
Cumulative savings for off-set payment	1,008	-
Cash in-lieu contribution (£)	95,734	-

Hotel, Retail and Amenity spaces		
	Regulated non-residential carbon dioxide savings	
	(Tonnes CO2 per annum)	(%)
Be lean: savings from energy demand reduction	-215.9	-287%
Be clean: savings from heat network	229.5	305%
Be green: savings from renewable energy	-1.7	-2%
Cumulative on-site savings	11.9	16%
	(Tonnes CO2)	
Cumulative savings for off-set payment	1,900	-
Cash in-lieu contribution (£)	180,547	-

Note that the alternative methodology as discussed in section 11.5 to calculate the carbon savings, which aligns closer to the GLA policy rather than the energy modelling guidance, illustrates a carbon saving of **76%** between the Be Lean Target Emissions Rate (TER) and the Be Green (as designed) Building Emissions Rate (BER). The Be Lean TER as the baseline highlights the carbon savings of the improved fabric and change from gas heating to (renewable energy) Heat pumps. Where the GLA Modelling guide methodology ignores the carbon saving of moving from Gas to Electricity, hence the non-linear results above.

	Total regulated emissions (Tonnes CO2 / year)	CO2 savings (Tonnes CO2 / year)	Percentage savings (%)
Part L 2021 baseline	237.2		
Be lean	421.5	-184.3	-78%
Be clean	192.0	229.5	97%
Be green	96.9	95.1	40%
Total Savings	-	**140.3**	**59%**
	-	**CO2 savings off-set (Tonnes CO2)**	-
Off-set	-	**2,908.2**	-

Note that in the tables above, the three building elements exceed with the London Plan requirement percentage betterment of CO2 emissions through passive and active measures, where the residential development is required to achieve at least a 10% improvement and non-residential development is required to achieve at least 15% improvement.

2. INTRODUCTION

As Low Carbon Design Consultants, Ridge and Partners have been appointed by DNA Uxbridge Ltd to provide an Energy Strategy Statement to support a full planning application for the demolition of the existing buildings and structures on site to provide a mixed-use development comprising Hotel (Class C1), Co-Living (Class Sui Generis) and replacement commercial floor space (Class E). The proposals includes landscape improvements including the provision of a pocket park, car and cycle parking and associated infrastructure.

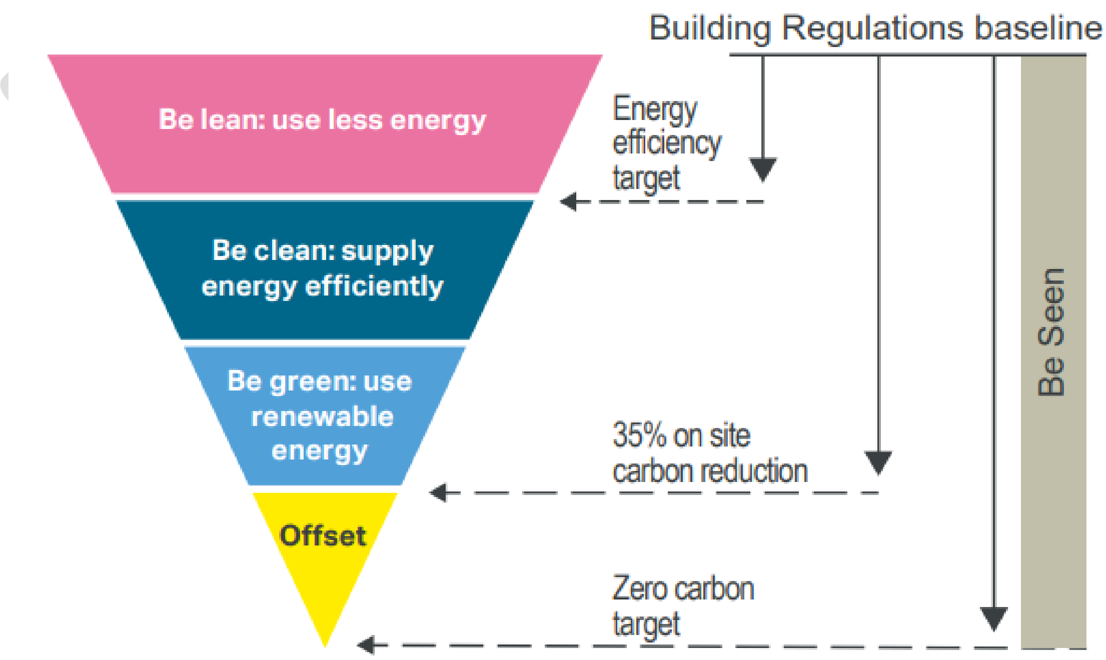
The purpose of the statement is to summarise the relevant policies, both National and Local, and demonstrate the methods used during the various options reviewed by Ridge & Partners set out in this report, and subsequent design, comply with such policies.

The document presented below outlines a preliminary energy strategy for the proposed works that demonstrates a low-carbon design philosophy. The "GLA Energy Hierarchy" methodology provides a design framework which was used to develop the proposed low-carbon energy strategy. The approach described by this methodology provides a staged process: Be Lean, Be Clean, and Be Green (Illustrated below) to assess design measures.

Each stage would focus on the following:

- Be Lean: Use Less Energy – Main aim is to reduce the buildings energy demand through "passive measures".
- Be Clean: Supply Energy Efficiently – consider connections to district heating networks
- Be Green: Use Renewables Energy – Assess the technical feasibility of incorporating a low or zero-carbon technology to further reduce the CO_2 emissions.
- Offset – Contribute to a carbon offset payment or propose an off-site renewable energy offset installation

Figure 9.2 - The energy hierarchy and associated targets

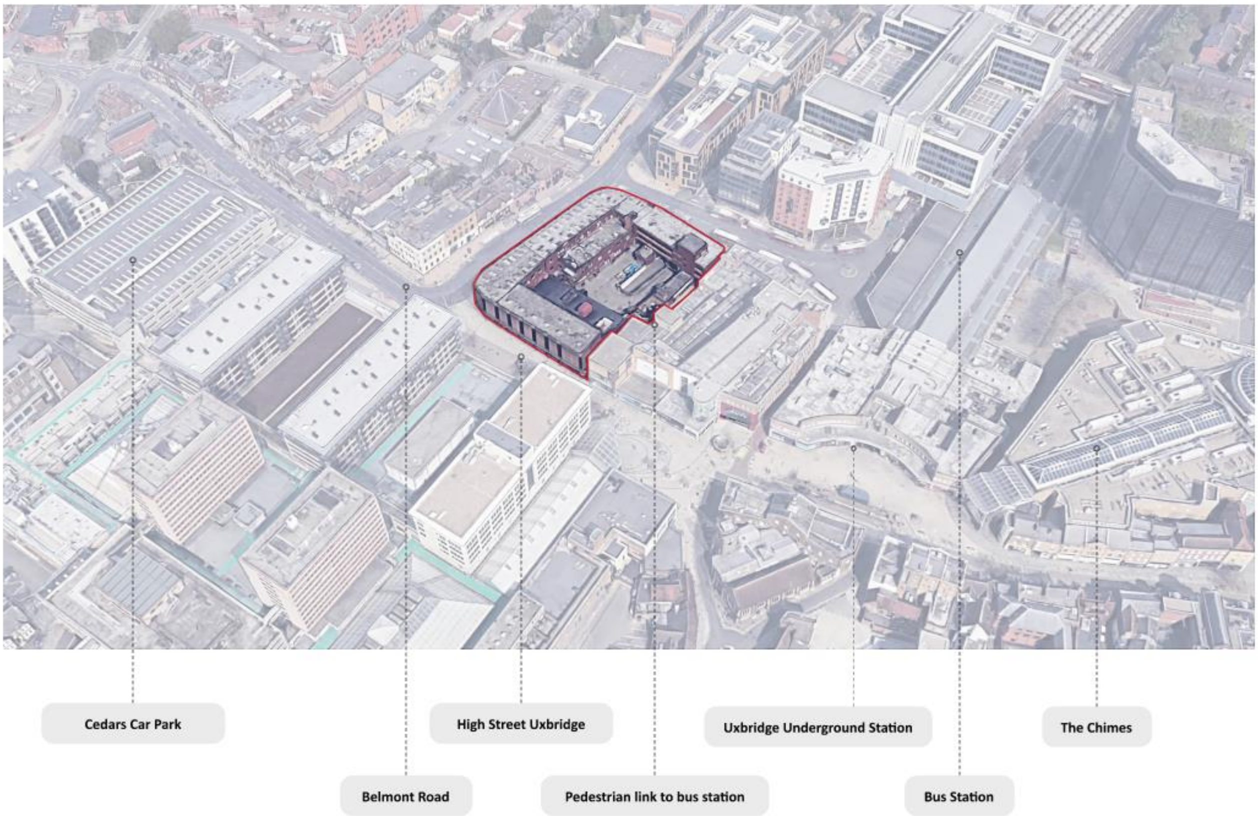


Source: Greater London Authority

3. DEVELOPMENT PROPOSALS

3.1. Description of Development Proposal

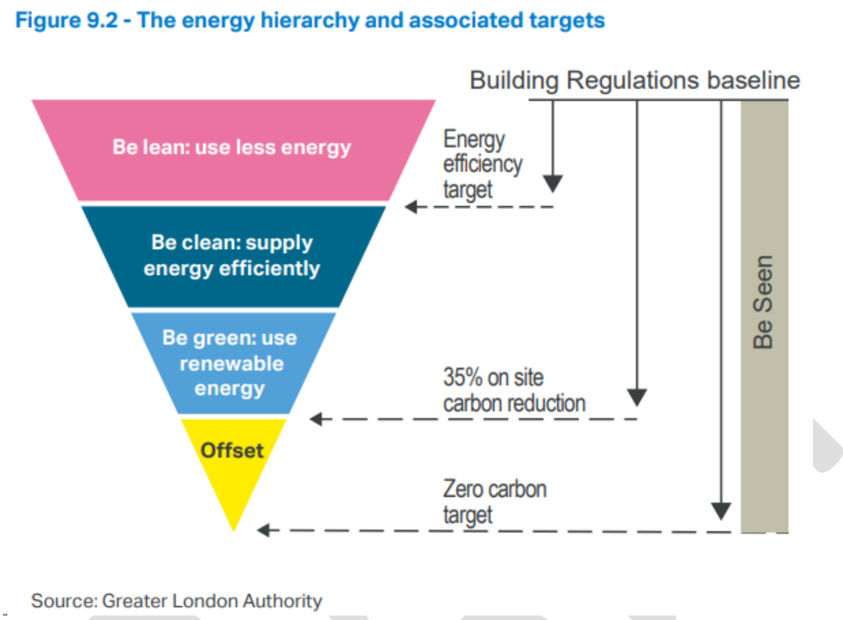
The proposals comprise the demolition of the existing buildings and structures on site to provide a mixed-use development comprising Hotel (Class C1), Co-Living (Class Sui Generis) and replacement commercial floor space (Class E). The proposals includes landscape improvements including the provision of a pocket park, car and cycle parking, and associated infrastructure.



Development Proposal

4. ENERGY HIERARCHY

In line with the draft definition of zero carbon, the London Plan energy hierarchy, shown in the figure below illustrates the pathway required to achieve this. Under Policy SI2 developers will initially be expected to secure high levels of energy efficiency and low energy demand. This is followed by the incorporation of on-site measures where these exist, such as low or zero carbon energy technologies and directly connected heat (not necessarily on-site).



Energy Hierarchy

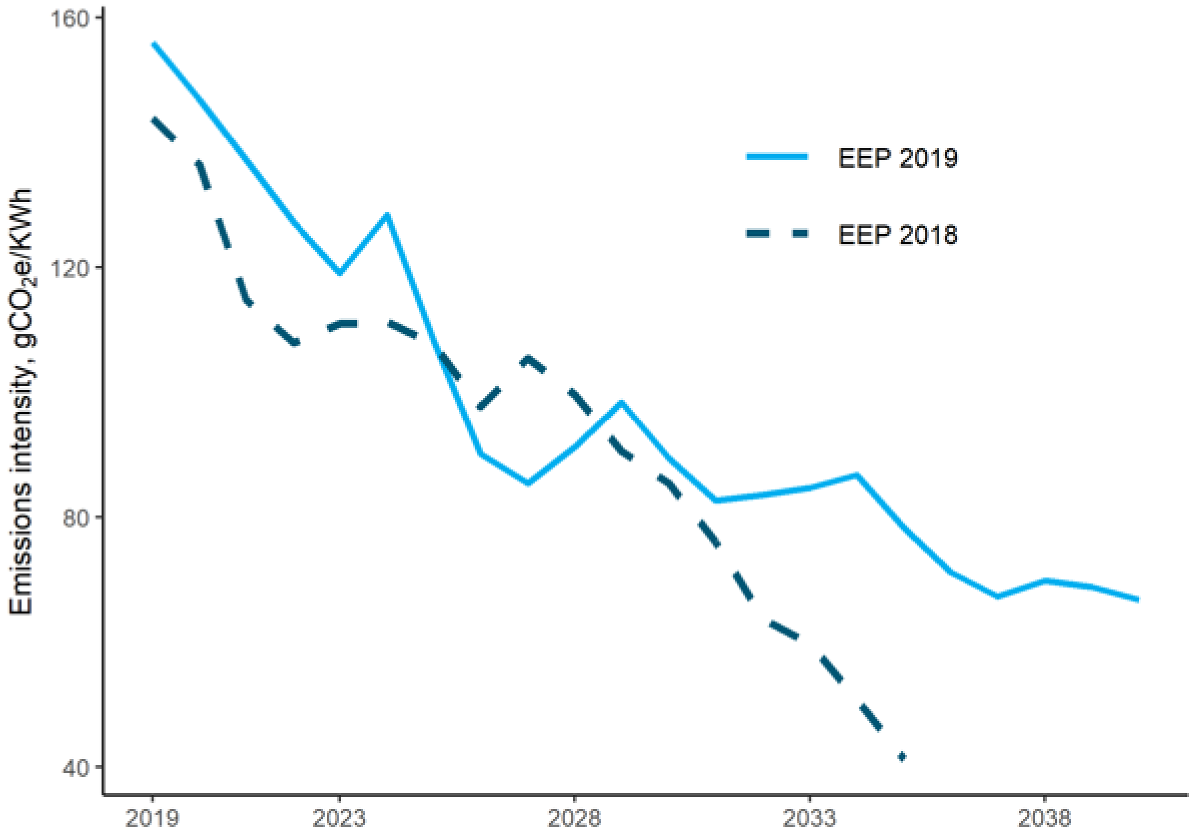
However, to achieve the highest level of carbon reductions it is intended that developers will be able to contribute to or co-ordinate investment in near or off-site infrastructure. This could include, for example, the connection of buildings to district heating networks (Be Clean) and investment in low or zero carbon technologies on buildings owned by the city or by public and community institutions.

4.1. Decarbonisation of the Electricity Grid

The National Grid in the UK is decarbonising rapidly. This permits the electrification of heat and heralds the end to combustion of fossil fuels as the main source of heating. The attractive alternative to combustion is heat transfer using heat pumps linked to ground source or air source energy.

The carbon factor of grid electricity was 495 grams of CO2 for each kWh of electricity generated in 2014 according to The Department for Environment, Food and Rural Affairs (Defra). This fell by 6.5% to 462 grams in 2015, and by a further 10.8% to 412 in 2016.

The Department for Business, Energy, and Industrial Strategy (BEIS) published its Energy and Emissions Projection (EEP) in October 2020 showing the projected Grid Carbon Factor falling dramatically from 156 grams in 2019 to just 67 grams in 2040.



Predicted Reduction in Grid Carbon Factor

Furthermore, the UK Government has passed laws that require the country to reduce all greenhouse gas emissions to net zero by 2050 and the phasing out of natural gas as a source of heating.

5. GOVERNMENT REVIEW POLICY

5.1. National Planning Policy Framework

A revised National Planning Policy Framework (NPPF) was updated and published in December 2023 which sets out the Government's planning policies for England and how they are expected to be applied.

At the heart of the Framework is a 'presumption in favour of sustainable development.' Section 14 of the National Planning Policy Framework (NPPF) specifically addresses the challenge of climate change. It states that:

'New development should be planned for in ways that: Avoid increased vulnerability to the range of impacts arising from climate change. When new developments are brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure; and can help to reduce greenhouse gas emissions, such as through its location, orientation, and design. Any local requirements for the sustainability of buildings should reflect the government's policy for national technical standard Local Plan and supplementary guidance.'

The planning system should support the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change. It should help to: shape places in ways that contribute to radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience; encourage the reuse of existing resources, including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure.

New development should be planned for in ways that: b) can help to reduce greenhouse gas emissions, such as through its location, orientation and design. Any local requirements for the sustainability of buildings should reflect the Government's policy for national technical standards.

5.2. The London Plan 2021

The Mayor of London has declared a climate emergency and has set an ambition for London to be net zero-carbon. The London Plan contains a range of climate mitigation policies, including a requirement for major developments to comply with the net zero-carbon target set out in Policy SI 2 by following the energy hierarchy and maximising on-site carbon reductions. The target requires a minimum on-site carbon reduction to be achieved and allows for any carbon shortfall to be paid as a cash-in-lieu contribution into the relevant local authority's carbon offset fund. All major development proposals must be accompanied by a detailed energy assessment to demonstrate how the zero-carbon target will be met.

The purpose of an energy assessment is to demonstrate that the proposed climate mitigation measures comply with the London Plan. It ensures that carbon reduction remains an integral part of the development's design and evolution. The energy assessment must clearly outline the CO_2 savings that will be achieved and the measures that will be put in place to reduce energy demand.

5.2.1. Policy SI 2 Minimising greenhouse gas emissions

A. Major development should be net zero-carbon. This means reducing greenhouse gas emissions in operation and minimising both annual and peak energy demand in accordance with the following energy hierarchy:
   1) be lean: use less energy and manage demand during operation.
   2) be clean: exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly.
   3) be green: maximise opportunities for renewable energy by producing, storing, and using renewable energy on-site.
   4) be seen: monitor, verify and report on energy performance.

B. Major development proposals should include a detailed energy strategy to demonstrate how the zero-carbon target will be met within the framework of the energy hierarchy.

C. A minimum on-site reduction of at least 35 per cent beyond Building Regulations is required for major development. Residential development should achieve 10 per cent, and non-residential development should achieve 15 per cent through energy efficiency measures. Where it is clearly demonstrated that the zero-carbon target cannot be fully achieved on-site, any shortfall should be provided, in agreement with the borough, either:
   1) through a cash in lieu contribution to the borough's carbon offset fund, or
   2) off-site provided that an alternative proposal is identified, and delivery is certain.

D. Boroughs must establish and administer a carbon offset fund. Offset fund payments must be ring-fenced to implement projects that deliver carbon reductions. The operation of offset funds should be monitored and reported on annually.

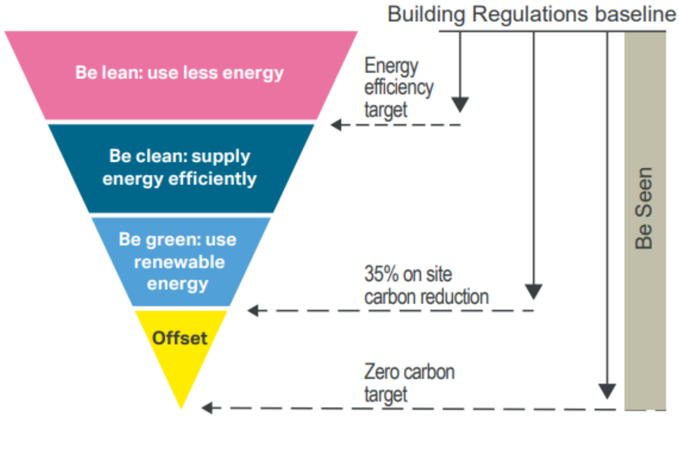
E. Major development proposals should calculate and minimise carbon emissions from any other part of the development, including plant or equipment, that are not covered by Building Regulations, i.e. unregulated emissions.

F. Development proposals referable to the mayor should calculate whole lifecycle carbon emissions through a nationally recognised Whole Life-Cycle Carbon Assessment and demonstrate actions taken to reduce life-cycle carbon emissions.

The energy hierarchy, adjacent, should inform the design, construction, and operation of new buildings. The priority is to minimise energy demand, and then address how energy will be supplied and renewable technologies incorporated. An important aspect of managing demand will be to reduce peak energy loadings.

Boroughs are encouraged to include BREEAM targets in their Local Plans where appropriate.

Figure 9.2 - The energy hierarchy and associated targets



Source: Greater London Authority

The move towards zero-carbon development requires comprehensive monitoring of energy demand and carbon emissions to ensure that planning commitments are being delivered. Major developments are required to monitor and report on energy performance, such as by displaying a Display Energy Certificate (DEC) and reporting to the Mayor for at least five years via an online portal to enable the GLA to identify good practice and report on the operational performance of new development in London.

5.2.2. Policy SI 4 Managing heat risk

A. Development proposals should minimise adverse impacts on the urban heat island through design, layout, orientation, materials, and the incorporation of green infrastructure.
B. Major development proposals should demonstrate through an energy strategy how they will reduce the potential for internal overheating and reliance on air conditioning systems in accordance with the following cooling hierarchy:
   1) reduce the amount of heat entering a building through orientation, shading, high albedo materials, fenestration, insulation, and the provision of green infrastructure.
   2) minimise internal heat generation through energy efficient design.
   3) manage the heat within the building through exposed internal thermal mass and high ceilings.
   4) provide passive ventilation.
   5) provide mechanical ventilation.
   6) provide active cooling systems.

5.2.3. Policy SI 5 Water infrastructure

A. In order to minimise the use of mains water, water supplies and resources should be protected and conserved in a sustainable manner.
   Development Plans should promote improvements to water supply infrastructure to contribute to security of supply. This should be done in a timely, efficient, and sustainable manner taking energy consumption into account.

C. Development proposals should:
   1) through the use of Planning Conditions minimise the use of mains water in line with the Optional Requirement of the Building Regulations (residential development), achieving mains water consumption of 105 litres or less per head per day (excluding allowance of up to five litres for external water consumption)
   2) achieve at least the BREEAM excellent standard for the 'Wat 01' water category160 or equivalent (commercial development)
   3) incorporate measures such as smart metering, water saving and recycling measures, including retrofitting, to help to achieve lower water consumption rates and to maximise futureproofing.

E. Development proposals should:
   1) seek to improve the water environment and ensure that adequate wastewater infrastructure capacity is provided.
   2) take action to minimise the potential for misconnections between foul and surface water networks.

F. Development Plans and proposals for strategically or locally defined growth locations with particular flood risk constraints or where there is insufficient water infrastructure capacity should be informed by Integrated Water Management Strategies at an early stage.

5.3. London borough of Hillingdon local plan part 2 development management policies – 2020

The purpose of the document is to provide detailed policies that will form the basis of the Council's decisions on individual planning applications.

Reducing Carbon Emissions

Minimising carbon dioxide emissions sets out targets for carbon emissions reduction to be met by major development proposals. These targets are expressed as minimum improvements over the 'Target Emission Rate' outlined in the national 2013 Building Regulations and are as follows:

<u>Residential Development</u>
2013 – 2016: 35 per cent
2016 onwards: Zero carbon

<u>Non-residential Development</u>
2013 – 2016: 35 per cent
2016 – 2019: As per building regulations requirements
2019 onwards: Zero carbon

5.3.1. Policy DMEI 2: Reducing Carbon Emissions

A) All developments are required to make the fullest contribution to minimising carbon dioxide emissions in accordance with London Plan targets.

B) All major development proposals must be accompanied by an energy assessment showing how these reductions will be achieved.

C) Proposals that fail to take reasonable steps to achieve the required savings will be resisted. However, where it is clearly demonstrated that the targets for carbon emissions cannot be met onsite, the Council may approve the application and seek an off-site contribution to make up for the shortfall.

5.3.2. Policy DMEI 3: Decentralised Energy

A) All major developments are required to be designed to be able to connect to a Decentralised Energy Network (DEN).

B) Major developments located within 500 metres of an existing DEN, and minor new-build developments located within 100 metres, will be required to connect to that network, including provision of the means to connect to that network and a reasonable financial contribution to the connection charge, unless a feasibility assessment demonstrates that connection is not reasonably possible.

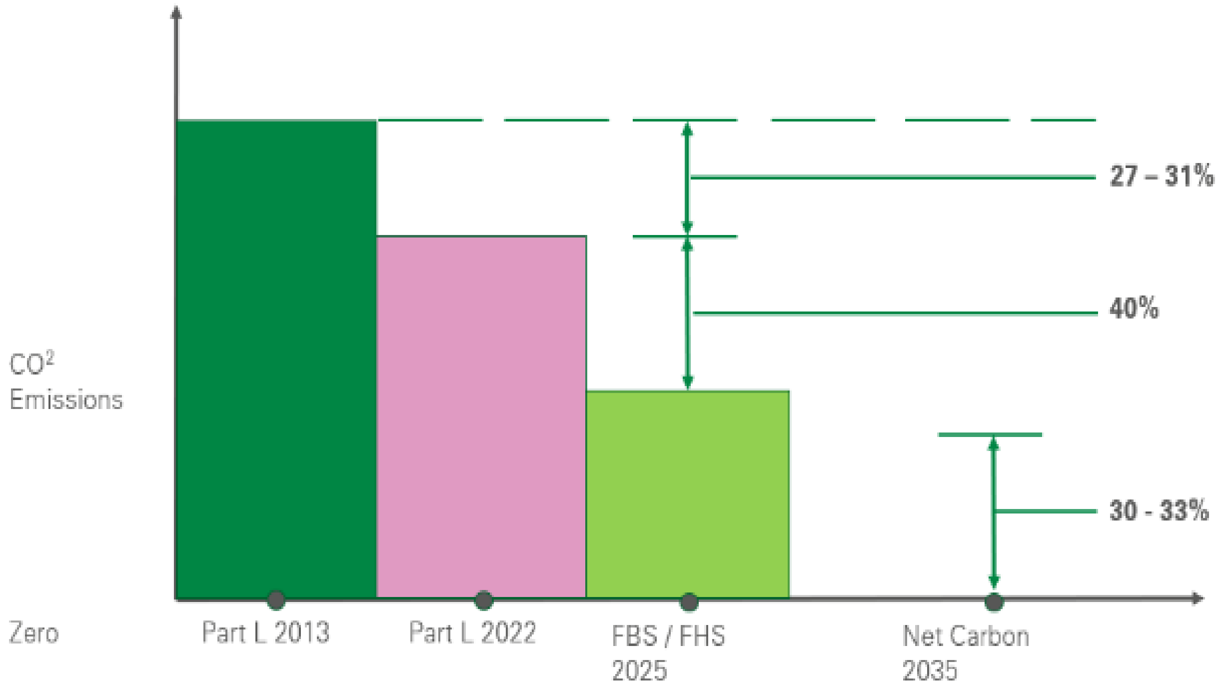
C) Major developments located within 500 metres of a planned future DEN, which is considered by the Council likely to be operational within 3 years of a grant of planning permission, will be required to provide a means to connect to that network and developers shall provide a reasonable financial contribution for the future cost of connection and a commitment to connect via a legal agreement or contract, unless a feasibility assessment demonstrates that connection is not reasonably possible.

D) The Council will support the development of DENs and energy centres in principle, subject to meeting the wider policy requirements of this plan and in particular on design and air quality.

6. REGULATORY FRAMEWORK

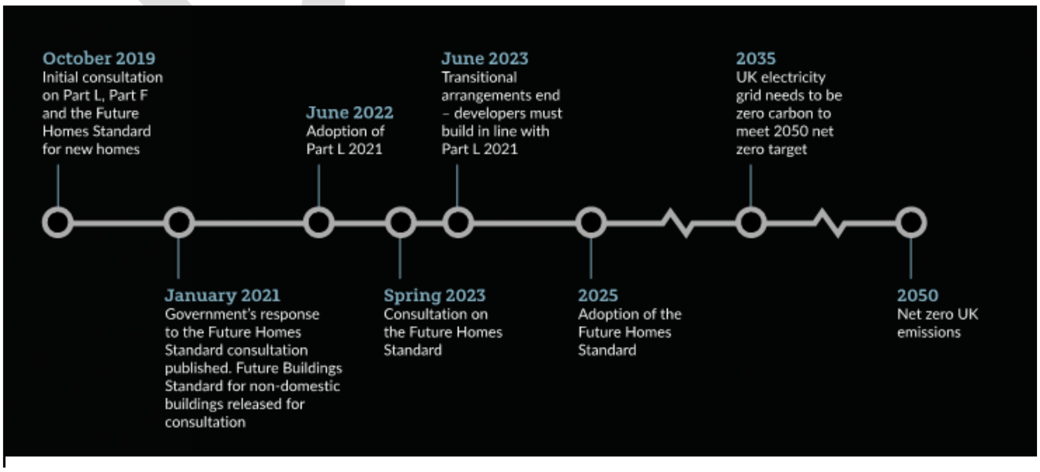
6.1. Building Regulations

The Part L 2021 building regulations came into effect in June 2022 with a transitional period of 12 months and has acted as an uplift to help the construction industry adapt to changing regulations and low carbon heating. The shows the timeline for the Part L 2021 regulations and displays that the new regulations require a 31% and 27% reduction in CO_2 emissions compared to the previous 2013 regulations for domestic buildings and non-domestic buildings respectively.



Part L 2022 Changes

The future building standards which will come into effect in 2025 will require CO2 emissions to be further decreased by 40% in comparison to current figures. The timeline for the future buildings standards is displayed in the below figure:



Future Homes Standard

A new performance metric has also been ushered in; primary energy has become the principal measure replacing CO_2 emissions as the main metric. CO_2 emissions are now less effective as a measure of energy performance as the electricity grid becomes decarbonised. If this was not addressed, this could result in a dwelling with low CO_2 emissions complying with regulations, despite having excessively high energy consumption. Consequently, the Primary Energy metric has been introduced to ensure that energy efficiency is directly measured rather than assuming it is linked to CO_2 emissions.

6.2. BREEAM

BREEAM (Building Establishment's Environmental Assessment Method) is the world's leading and most widely used environmental assessment method for commercial buildings.

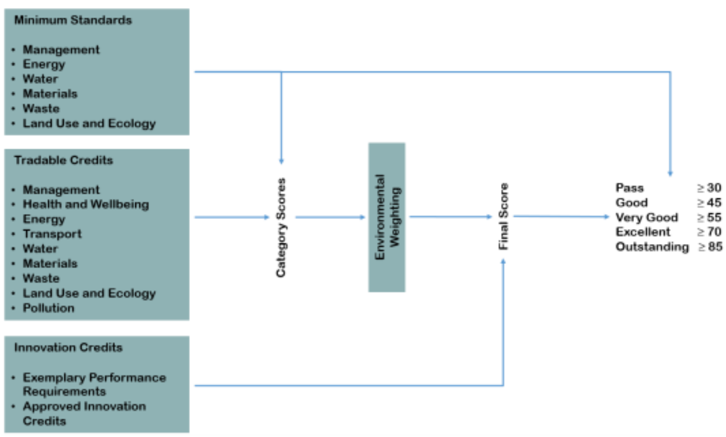
BREEAM UK New Construction scheme is a performance-based assessment method and certification scheme for new non-domestic buildings. The primary aim of BREEAM UK New Construction is to mitigate the life cycle impact of new buildings on the environment in a robust and cost-effective manner. This is achieved through integration and the use of the scheme by clients and their project team at key stages in the design and construction process.

The building's performance is assessed under a number of categories, including:

- Energy
- Water
- Transport
- Materials
- Land use.
- Pollution
- Health and wellbeing; and Management
- Waste

The assessment process provides in a report that covers the areas assessed, along with a formal certification on a scale of UNCLASSIFIED, PASS, GOOD, VERY GOOD, EXCELLENT and OUTSTANDING.

The diagram adjacent shows how the BREEAM assessment scores and rates a building:



Process for Awarding BREEAM Ratings

The BREEAM categories include a number of environmental elements that reflect the different options available when designing, procuring and constructing a building. Each environmental element has credits available that are awarded when compliance has been demonstrated.

For the building to meet a specific BREEAM rating, there are a series of minimum standards that must be achieved for that rating to be awarded. In addition to the credits, there are also innovation credits available that provide additional recognition of sustainable performance that goes beyond what is currently recognised and rewarded by the standard BREEAM credits.

The innovation credits are awarded for either meeting the BREEAM exemplary level requirements or by an application to BRE to have a specific feature, system or process recognised as ‘innovative’.

Each different BREEAM section has an environmental weighting applied to the scores which calculates the final BREEAM score. These factors have been derived from consensus-based research with groups such as the government, suppliers, and lobbyists.

The weightings are:

Environmental section	Weighting			
	Fully fitted out	Simple building	Shell and core only	Shell only
Transport	10%	11.5%	11.5%	14.5%
Water	7%	7.5%	7%	2%
Materials	15%	17.5%	17.5%	22%
Waste	6%	7%	7%	8%
Land Use and Ecology	13%	15%	15%	19%
Pollution	8%	6%	9%	6%
Total	100%	100%	100%	100%
Innovation (additional)	10%	10%	10%	10%

Once the weightings have been applied, the score is then assigned a BREEAM rating as follows:

BREEAM RATING	SCORE (%)
UNCLASSIFIED	<30
PASS	≥30
GOOD	≥45
VERY GOOD	≥55
EXCELLENT	≥70
OUTSTANDING	≥85

At this stage it is difficult to predict the exact number of BREEAM credits achievable by each Low and Zero Carbon Technology. These technologies will have an influence over the following:

- Ene 01 – Energy Performance – Up to 9 credits are available.
- Ene 01 – Predicting Operation Energy use – Up to 4 credits are available.
- Ene 04 – Low and Zero Carbon Technologies – Up to 3 (+1 innovation) credits are available.
- Pol 02 – Local Air Quality – Up to 2 credits are available.

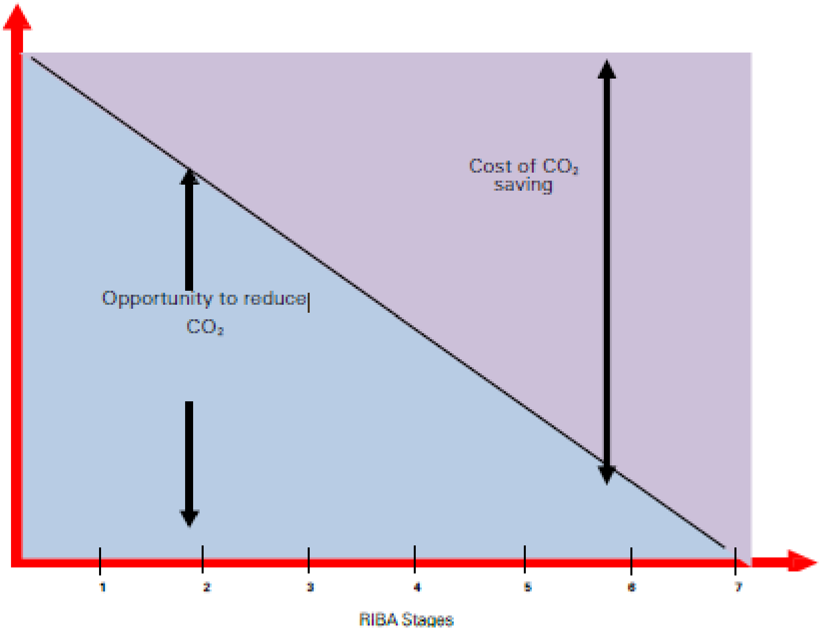
The BREEAM target for the proposed development is BREEAM Excellent

7. APPRAISAL OF SOLUTIONS

7.1. Summary

The strategic approach outlined, follows a specific appraisal of technologies at each stage of design and to achieve the overall goal of CO_2 reduction.

As on the whole, it becomes more expensive to implement carbon reduction measures the further along the design process as the opportunities to reduce demand diminish.



Costs of implementing design measures at each RIBA Stage

In this first instance, it is therefore essential that the buildings 'passive measures' are optimised and the design teamwork in close collaboration with the user team to consider the future fit out demands.

The next stage is to adopt 'efficient technologies' such as heat recovery and variable speed drives etc. to meet the demand efficiency with the final approach of applying 'renewable and low carbon' technologies accordingly.

Our approach has followed the following route:

Reduce Demand
Meet demand efficiently.

Passive Measures:

- Thermal insulation
- Natural ventilation
- Natural daylight
- Thermal mass
- Air tightness
- Solar shading/Glass Specification
- A Rated White Goods

Active Measures:

- Low energy fit out.
- Heat recovery.
- Mixed mode ventilation
- Low energy lighting (LED)
- Power management
- Variable speed drives
- Demand Operated Systems
- Low Specific Fan Power
- Wastewater Heat Recovery

GLA:
Be Lean

Supply energy from low and zero carbon technology

- Combined heat power/tri-generation
- Biomass/biofuels
- Solar thermal hot water
- Ground source heat pumps (GSHP)
  - Open loop
  - Closed loop
- Photovoltaics
- Fuel cells.
- Air source heat pumps (ASHP)
- Wind
- Hydro

GLA:
Be Green

7.2. Passive Design Measures – (Be Lean: Reduce Demand)

This section looks at the proposed measures that will ensure the initial demand for energy in the building is low from the outset using passive measures – this design process is an important contribution to the Be Lean element of the GLA Energy Hierarchy

The **site location** is in Uxbridge, London; therefore, the weather file selection depends on how the building is assessed. For instance, Part O is modelled against the London Design Summer Year (DSY1, 2020 medium emissions, 50th percentile) weather file, while sizing for with cooling systems has been modelled with a London Design Summer Year (DSY1, 2050 medium emissions, 50th percentile) weather file to provide additional adaptability for future climate scenarios. The Part L compliance model has been tested against the appropriate weather file, Test Reference Year for London (London_TRY).

In terms of expected **building occupancy**, these are expected to be typical of buildings of this type with high occupancy in the evening and weekends for the Co Living Spaces.

The following measures are to be incorporated in the design:

- Passive Design
  - Thermal Insulation and Thermal Bridging
  - Natural Ventilation / Mixed mode
  - Natural Daylight
  - Thermal Mass
  - Air tightness
  - Solar Shading
  - Adaption to climate change

These measures promote the reduction of Energy use and carbon emissions in the first instance.

The passive design features at the Proposed Development mean that the development is well adapted to these risks.

Firstly, the energy demand has been reduced and therefore the building will be less affected by the decreased availability of energy.

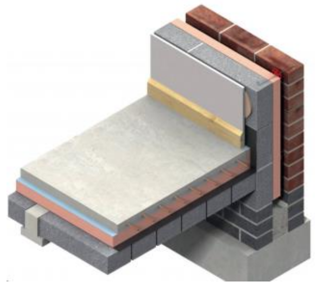
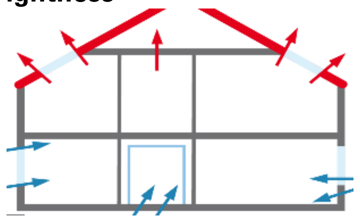
Secondly, the building will have a lower carbon footprint helping to stop the effects of climate change from increasing any further.

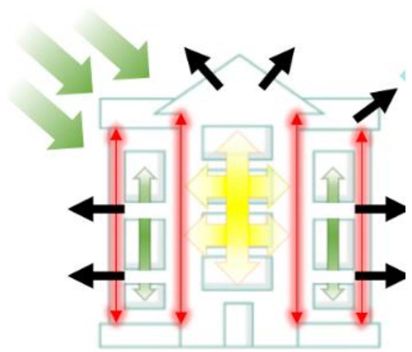
The expected increase in external temperatures could result in future overheating problems. Whilst the building cannot be relocated, by having low G-value glass, there is less solar heat gain entering the rooms.

The demand for cooling has also been reduced through by matching or exceeding the u-values stated in the Building Regulations.

This combination of passive design measures acts to stabilise the temperatures within the building and enable it to adapt to the likely extremes of both high and low temperatures.

Key:
Y – Yes could be incorporated
P – Possible
N – Not appropriate

Measure	Description	Suitable For Consideration	Commentary
Thermal Insulation 	Thermal insulation is the reduction of heat transfer (i.e., the transfer of thermal energy between objects of differing temperature) between objects in thermal contact or in range of radiative influence.	Y	Insulation is central to low energy construction to reduce unnecessary heat loss. The Part L building regulations set out limiting efficiencies U-values on which we intend to improve on, these improvements are shown in section 9. This will reduce the energy required to heat the spaces in the proposed new building. The future building standards will also need to be considered. This will come into effect in 2025 and will require CO_2 emissions to be further decreased by 40% in comparison to Part L 2021 current figures therefore careful consideration of thermal insulation must be made at design stage. The Proposed Development will adopt a high level of thermal insulation to reduce heat loss and thus reduce overall energy demand. Thermal insulation is essential to minimise heat losses and minimum standards Building Regulation U Values will be matched or exceeded.
Air Tightness 	Airtightness is the control of air leakage, i.e. the elimination of unwanted draughts through the external fabric of the building envelope. This may be achieved by the correct and proper installation of a vapour check or vapour barrier.	Y	The Proposed Development will target an air tightness that exceeds the minimum requirements of Part L 2021 building regulations to reduce air infiltration and unwanted draughts through the external fabric of the building envelope and so heating and cooling energy demand will be lowered. The current air tightness target for the Proposed Development is 3 m^3/ (h.m^2) at 50 Pa, this is a 63% improvement over the Part L minimum of 8 (m^3/(h.m^2) at 50 Pa.
Natural Ventilation 	Natural ventilation is a method of supplying fresh air to a building or room by means of passive forces, typically by wind speed or differences in pressure internally and externally. During design, natural ventilation is first considered before mechanical ventilation because this reduces carbon emissions.	Y	Natural ventilation to be used in a mixed mode approach with mechanically powered extract ventilation using MEV units to counter space overheating. This will help to reduce on site carbon emissions by reducing the operation profile of electrically driven ventilation fans and cooling plant. The internal planning, building geometry and external topography will be optimised to take full advantage of natural ventilation. Careful attention to the placement of openable windows and interior partitions can greatly increase the natural flow of air through a building by capturing the prevailing winds. Openable panels will provide a level of natural ventilation to the rooms of the Co Living Apartments of the proposed development.
Natural Daylight 	Natural light is light that is generated naturally, the common source of which is the Sun. This is as opposed to artificial light, which is typically produced by electrical appliances such as lamps.	Y	To reduce the energy used for artificial lighting the natural daylight entering occupied spaces will be maximised by optimising window size and orientation. Dimmable lighting with photocells will sense if the illuminance level of the space has been met and reduce lighting levels as required. North facing windows are particularly effective at providing useful daylight and will be incorporated on the building. The buildings orientation and fenestration strategy will take advantage of passive solar gains and natural daylight to reduce heating energy and the need for artificial lighting.
Solar Shading 	Solar shading is a method by which solar radiation in the form of heat and light can be mitigated in a building. While natural heat and light are essential in most buildings and modern architecture uses it more and more there are occasions when the levels are too high. This leads to overheating and too much light. Solar shading is a general term for a range of methods used to reduce the amount of solar gain.	P	Whilst maximising daylight care must be taken to ensure that direct sunlight does not cause glare in the spaces and does not cause excessive solar gains in summer which will cause spaces to overheat. This is managed by solar shading on affected windows. Some examples of solar shading are canopies, solar control glazing, balconies, internal blinds, and curtains which could be adopted on the Proposed Development Solar shading is not proposed on the scheme, however low G-Value glass on specific elevation and recessed will help to prevent unwanted solar gain entering the spaces of the Proposed Development

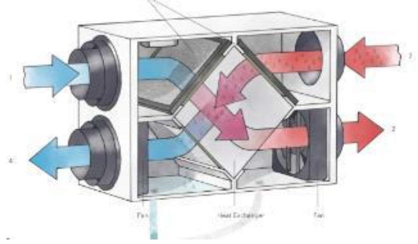
Thermal Mass 	Thermal mass describes a materials capacity to absorb, store and release heat. For example, water and concrete have a high capacity to store heat and are referred to as 'high thermal mass' materials. Insulation foam, by contrast, has very little heat storage capacity and is referred to as having 'low thermal mass'. A common analogy is thermal mass as a kind of thermal battery. Though thermal mass has always been an aspect of buildings, only in recent years has it evolved as a tool to be deployed in the conservation of energy. However thermal mass does not offer a 'one size fits all' concept.	**N**	Thermal mass such as concrete can absorb large amounts of heat energy which prevents spaces from overheating. The thermal mass can be cooled overnight when the space is not occupied to further reduce energy needed for cooling when the space is occupied. The Proposed Development will be of medium lightweight structure with a concrete flat roof.
Adaption to climate change 	Average temperatures for central England have risen by approximately 1°C since the 1970s and this has resulted in higher temperatures, changing rain patterns, rising sea levels, in addition to unpredictable extreme weather events such as floods, droughts and freezing winters. Risks of climate change include the increased likelihood of increased external temperatures which could lead to staff illness and therefore lower productivity, damage to equipment due to the high internal building temperatures in addition to increased cooling demand.	**Y**	An uplift in fabric improvements on a development can maximise the retention of heat in winter and reduce heat gains in summer. These improvements will help combat the extremes expected as a result of climate change. G-Values will be carefully selected to maximise natural light and thus reduce reliance on artificial lighting without introducing unwanted thermal gain during the summer months.

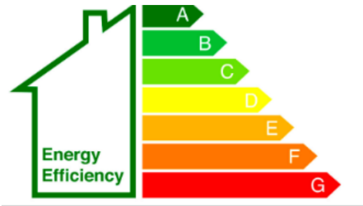
7.3. Active Design – (Be Lean: Meeting Demand Efficiently)

In addition to the passive measures, the Be Lean element of the GLA Energy Hierarchy, in addition to passive measures can benefit from active design. This section looks at technologies that will be used to ensure that energy demand is further reduced and met efficiently:

- Mechanical ventilation heat recovery
- Demand operated systems.
- Variable speed drives on fans and pumps
- Power management
- Low energy fit out.
- Sub metering.
- LED Lighting
- Waste Water Heat Recovery
- BMS

Key:
Y – Yes could be incorporated
P – Possible
N – Not appropriate

Technology	Description	Suitable For Consideration	Commentary
Mechanical Ventilation Heat Recovery (MVHR) 	MVHR provides fresh filtered air into a building whilst retaining most of the energy that has already been used in heating the building. Heat Recovery Ventilation is the solution to the ventilation needs of energy-efficient buildings.	Y	Where fresh air is mechanically supplied, and stale warm air extracted by mechanical ventilation, heat recovery will be used to recycle up to 90% of the heat from the extracted air to warm the incoming air. The re-use of waste heat in the mechanical ventilation systems could provide a significant step towards reducing CO_2 emissions. MVHR units also work to pre-cool warm fresh air during summer months in order to reduce the cooling energy required in air-conditioned spaces. Mechanical Ventilation with Heat Recovery (MVHR) units will be installed within the Co-Living communal spaces. The Hotel development will adopt heat recovery on the air handling plant that will supply fresh air to the concealed fan coil units in each bedroom as well as any amenity space.
Demand Operated Systems 	The control of the heating, cooling, ventilation, and lighting systems is fundamental to the energy efficiency of buildings. The use of the following measures can reduce energy consumption: Zoned thermostatic control; Time control; Variable flow control; BMS (Building Management System) automated control; Lighting PIR (Passive Infra-Red Sensor) control; Daylight linked lighting control; CO_2 detection; and Energy management control.	Y	Where ventilation, heating and cooling is provided to a space that may not always be in use, occupancy sensors will be used, this will be fundamental to the energy efficiency of each building. These will shut down the systems serving the spaces when they are not required and turn them back on instantly when they are required. The use of the following measures will be encouraged: Zoned thermostatic control; Time control; Variable flow control; BMS (Building Management System) automated control; Lighting PIR (Passive Infra-Red Sensor) control; Daylight linked lighting control; CO_2 detection; and Energy management control. The use of passive infra-red (PIR) for lighting,heating, ventilation will be adopted where feasible. Typically, this will be in the form of PIR sensors in small spaces and microwave sensors in larger areas.
Variable Speed Drives	Variable speed drives and controls allow an energy system to modulate during periods of low demand. Using variable speed drive pumps therefore uses less energy than traditional pumps, which run at a constant speed.	Y	All pumps and fans would be provided with variable speed motors which will speed up and slow down as the demand increases or reduces to conserve energy. These can be used in conjunction with the demand operated systems to reduce the speed of pumps and fan motors to a minimum to conserve energy. Variable speed drives can be adopted on all fan and pump motors where possible to reduce energy consumption.

			
Power Management 	Power management is a computing device feature that allows users to control the amount of electrical power consumed by an underlying device, with minimal impact on performance. It enables the switching of devices in various power modes, each with different power usage characteristics related to device performance.	**P**	Power factor correction could be used on the electrical supplies of the Proposed Development to improve energy efficiency. Provision including allocation of spare plant space will be made for future introduction of power factor correction into the Proposed Development if required, this will follow a survey undertaken after 6 months of operation.
Low Energy Fit Out 	A low energy fit out is an interior development of a building that is low carbon in its design, operation, and entire lifecycle.	**Y**	All goods and appliances should be highly energy efficient to reduce energy demand.
Sub-metering 	Building submetering is a meter within your building or facility for specific energy measurements.	**Y**	Power, lighting, major plant, and separate tenancy areas will be individually metered to allow energy consumption to be pinpointed and reviewed if it is excessive. Baselines and targets will also be set to help reduce energy use. The individual Co-Living apartments will be metered individually, the hotel building as a whole will be bulk metered.
LED Lighting 	An LED lamp or LED light bulb is an electric light that produces light using light-emitting diodes. LED lamps are significantly more energy-efficient than equivalent incandescent lamps and can be significantly more efficient than most fluorescent lamps	**Y**	Extensively adopted LED fittings will be used throughout the scheme to limit the energy associated with internal and external lighting. LED lighting will be used throughout the Proposed Development.
BMS Optimisation 	A building management system is a computer-based control system installed in buildings that controls and monitors the building's mechanical and electrical equipment such as ventilation, lighting, power systems, fire systems, and security systems.	**P**	The Proposed Development may be provided with an intelligent building management system that will learn how the building operates and optimise the function of the ventilation, heating, and cooling systems within the Co-Living and hotel building.

7.4. Be Green LZC Technologies

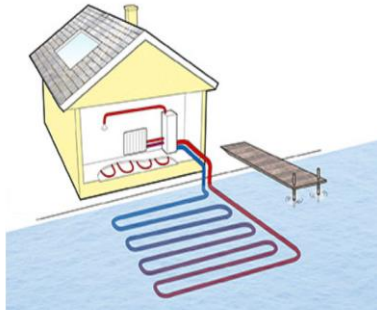
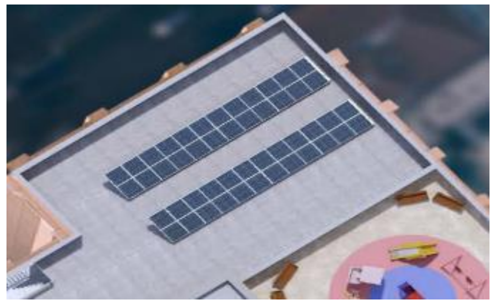
The following Low Zero Carbon (LZC) technologies have been identified and reviewed against their suitability on the Proposed Development:

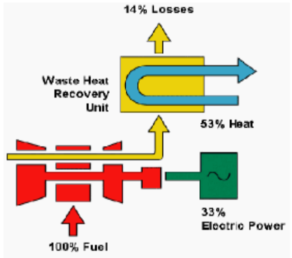
- Solar Water Heating
- Ground Source Heat Pumps
- Water Source Heat Pumps
- District Heating
- Biomass
- Wind Power
- Photovoltaic Electricity Generation
- Combined Heat and Power
- Air Source Heat Pumps
- Battery Storage

These services are described in more detail below and their suitability discussed.

Key:
Y – Yes could be incorporated
P – Possible
N – Not appropriate

Technology	Description	Suitable For Consideration	Commentary
Solar Thermal Water Heating 	Solar thermal water heating systems use heat from the sun to pre-heat domestic hot water. Solar thermal water heating systems are generally composed of solar thermal collectors and a fluid system to move the heat from the collector to a storage tank to store the heat for subsequent use. The system requires solar panels on the roof, ideally south facing, linked to hot water storage cylinders.	**N**	In the case of multi-dwelling, multi-storey blocks the available roof area, pitch and orientation is critical. The solar energy collection and pipework distribution strategy would centre on collecting and storing thermal energy in cylinders or tanks in plant rooms. Solar thermal alone will not meet the scheme's targets and would require large roof areas to make any meaningful contribution to the energy strategy. Additionally domestic hot water loads are relatively large given the Proposed Development is predominantly residential based. The roof space of the Proposed Development would be better utilised for PV panels and plant equipment as such there would be limited space to utilise this technology therefore not considered for the Proposed Development.
Ground Source Heat Pumps 	Ground Source Heat Pumps (GSHP) can be used to extract heat from the ground by circulating a fluid through a system of pipes buried underground to a heat exchanger which transfers the energy to the distribution network. This can provide space heating and/or domestic hot water. Ground source heat pumps have the advantage that they can act as a source of both heating and cooling for the buildings. Ground source heat pumps are either open-loop (abstracting and rejecting water to the aquifer below the site) or closed-loop using boreholes and energy piles.	**N**	Low grade heat generated, efficiency of system dependent on low distribution temperatures. Average Co-efficient of Performance (CoP) of around 4-6 meaning that for every unit of electricity used to pump the heat, 4-6 units of heat are produced, making this an efficient way of heating a building. Extensive underground boreholes/pipework difficult to install due to availability of land therefore this technology can be discounted for the Proposed Development.

Water Source Heat Pumps 	Water Source Heat Pumps (WSHP) work in a similar way to GSHP, with the exception that the pipes are submerged into a river, stream, lake, or the sea. The fluid is pumped through the system and absorbs energy from the surrounding water. WSHP can be either an open-loop or closed-loop system.	**N**	Low-grade heat generated, efficiency of system dependent on low distribution temperatures. Average Co-efficient of Performance (CoP) of around 4-6 meaning that for every unit of electricity used to pump the heat, 4-6 units of heat are produced, making this an efficient way of heating a building. Extensive underground boreholes/pipework difficult to install due to availability of land and no suitable water courses nearby with enough volume therefore water source heat pumps are discounted.
District Heating 	Energy sources include heat from CHP and to a lesser extent, geothermal.	**P**	Lower carbon emission factors than traditional fuel sources. Potentially able to achieve renewable targets without other technologies. There is currently no district heating network in close proximity to the proposed development although there is a future provision planned. Space allowance will be made for potential future connections.
Biomass 	Biomass heating systems burn biomass material in a biomass boiler in order to heat water in the same way that gas boilers burn gas. Biomass materials include all land and water-based vegetation, e.g. wood chips, wood pellets, wood waste and fast-growing coppice trees such as willow. The carbon dioxide emitted from burning biomass is balanced by that absorbed during the fuel's production. Biomass heating therefore approaches a low carbon process. Biomass boilers require fuel storage for the fuel source.	**N**	Could be adopted to offset heating and hot water however high NO_X levels would be a concern in city centre environment. Sourcing of materials and transporting large volumes of fuel to site would also be prohibitive due to the location of the site. The biomass boilers and their associated wood store that would be required to serve the Proposed Developments energy demands would be too large to be considered viable. Maintenance requirements and reliability would also be a cause for concern. Not considered for the Proposed Development.
Wind Power 	Wind power is one of the cleanest and safest methods of generating electricity. Wind turbines use the wind's forces to turn a rotor which in turn generates electricity. Wind power is used in large scale wind farms for national electrical grids as well as in small individual turbines or building integrated turbine.	**N**	Relatively high anticipated electricity demand for the building. Therefore, no potential issues with utilisation, i.e. availability will match demand. As the UK is one of the windiest countries in Europe, wind power is one of the best sources of renewable energy – dependent upon location. Wind power is unfeasible due to the fact the Proposed Development is in an urban area and local wind conditions may not be sufficient to provide enough power.
Photovoltaic Electricity Generation 	Photovoltaic (PV) modules are devices or banks of devices that use the photovoltaic effect to generate electricity directly from sunlight. Until recently, their use has been limited due to high manufacturing costs. In buildings current applications include PV on the roof, PV curtain walling systems and PV louvred external shading devices. Typically, photovoltaics would be installed on a south facing roof.	**Y**	Relatively high anticipated daytime electricity demand for the Proposed Development. Therefore, no potential issues with utilisation, i.e. availability will match demand. The PV panels are used to generate electricity reducing CO_2 emissions. Capital cost has dropped significantly in recent years. Potential for PV panels to be installed at roof space to offset a percentage of the electrical demand.

Combined Heat and Power (CHP)  	A CHP unit provides heating as well as electrical power. The electricity generated by the CHP plant can be distributed around a development and into the electrical network if needed. The use of this co-generation improves the overall efficiency of the primary energy delivered to the site with a corresponding reduction in the development's CO_2 emissions. The amount of thermal energy provided by the CHP unit will be dependent on the calculated thermal base load for the buildings.	**N**	Relatively low cost of CHP unit if integrated into a gas boiler and domestic water cylinder strategy. High maintenance costs result in marginal returns on small to medium sized installations. Not considered as is not compatible with future de-carbonisation of the grid and reduction of use of fossil fuels.
Air Source Heat Pumps (ASHP)  	Air source heat pumps work in a similar way to GSHPs but extract thermal energy from the surrounding air and transfer it into water. Air source heat pumps can be fitted on the façade or on the roof, but care should be taken when mounting the units to avoid any acoustic problems associated with operating the fans as the outdoor units typically operate with sound levels in the range 55 - 60dB(A). The efficiency of ASHP is measured by Coefficient of Performance (CoP); this is the ratio of units of heat output for each unit of electricity used to drive the system. Average CoP is around 2-4 although some systems may produce a greater rate of efficiency.	**Y**	The ASHP system offers an attractive solution in terms of the de-carbonisation of the grid and the omission of natural gas to the site. The average CoP of air source heat pumps is around 2-4 although some systems may produce a greater rate of efficiency. This means that for every kW of electric power the heat pumps use, 2-4 kW of heat energy is generated, this results in reduced carbon emissions and operational energy. Following the appraisal of the Proposed Development and site, Air Source Heat Pumps (ASHP) have been selected as the preferred low carbon technology and will be used to generate heating, cooling & hot water to the Hotel and Co-Living buildings. Each apartment on the Co-Living Block will have a connection to a centralised air source heat pump hot water cylinder which will provide the apartments hot water needs. FCU's will provide space heating and cooling to the Hotel rooms served from a VRF system, and MVHR's & FCU's will be provided to serve the amenity and commercial areas of the Co Living and Hotel via a Variable Refrigerant Flow (VRF) system.

8. OUTLINE WATER CYCLE STRATEGY

All installed water fixtures and fittings shall be specified to reduce water consumption. This includes the specification of low flow taps and dual flush toilets. The proposed development will target a water consumption rate of 105 Litres of water per person per day.

Grey water recycling is not proposed as it has been regarded unfeasible on this site.

9. PROPOSALS

Initial BRUKL and SAP assessments are to be undertaken and once complete this section will be populated with the inputs that have been used. Energy modelling has been carried out to reflect the RIBA planning Stage 2 design. The modelling has been based on:

- SAP Calculations – For Co-living
- Part L BRUKL – For commercial

The following BRUKL and SAP results relate to a RIBA Stage 2 design and will be subject to a design development due to the next stages. The results produced are run using the Part L 2021 Building Regulations.

The following software's have been adopted for each of the different categories:

- Part L BRUKL – IES VE
- SAP's – Elmhurst Energy

9.1. Be Lean: Passive Measures – (Reduced Demand)

In accordance with London Plan energy hierarchy, the 'Be Lean' part of the hierarchy of the London Plan refers to the demand reduction in buildings. In the first instance, the team have maximised passive measures to reduce the initial load of the building in terms of thermal heating and artificial lighting loads with the following measures:

9.1.1. Target Building Fabric U-Values

Co-Living Residential (SAP)

Building Fabric Element	Limiting U-Value (W/m^2K)	Target U-Value (W/m^2K)	% Betterment
Walls	0.26	0.15	42.3
Floors	0.18	0.15	16.7
Flat Roofs	0.18	0.15	16.7
Windows	1.60	1.40	12.5
Personnel Doors	1.60	1.60	-

Co Living Amenity (BRUKL)

Building Fabric Element	Limiting U-Value (w/m^2K)	Target U-Value (w/m^2K)	% Betterment
Walls	0.26	0.15	42.3
Floors	0.18	0.15	16.7
Flat Roofs	0.18	0.15	16.7

Windows	1.60	1.40	12.5
Personnel Doors	1.60	1.60	-

Hotel (BRUKL)

Building Fabric Element	Limiting U-Value (w/m²K)	Target U-Value (w/m²K)	% Betterment
Walls	0.26	0.15	42.3
Floors	0.18	0.15	16.7
Flat Roofs	0.18	0.15	16.7
Windows	1.60	1.40	12.5
Personal Doors	1.60	1.60	-
Rooflights	2.20	1.40	36.36

9.1.2. Target Air Permeability

Co Living Residential (SAP)

Air Permeability	Limiting Air Permeability	Target Air Permeability	% Betterment
m$_3$/ (h.m$_2$) at 50 Pa	8	3	62.5

Co Living Amenity (BRUKL)

Air Permeability	Limiting Air Permeability	Target Air Permeability	% Betterment
m$_3$/ (h.m$_2$) at 50 Pa	8	3	62.5

Hotel (BRUKL)

Air Permeability	Limiting Air Permeability	Target Air Permeability	% Betterment
m$_3$/ (h.m$_2$) at 50 Pa	8	3	62.5

9.1.3. Glass Specification

Glazing that limits the amount of unwanted solar gain will be used to avoid habitable rooms from overheating with G-Values of 0.4.

Designing the Proposed Development with U-values and Air Permeability that are lower than the minimum Building Regulations values is essential to reducing the initial demand for energy in the building from the outset using passive measures. For the Proposed Development, U-Values and Air Permeability that match or exceed Building Regulations have been used which will result in less energy required to maintain comfortable conditions inside the buildings as well as the buildings performing better as an insulator.

Passive design measures will allow the Proposed Development to maximise the use of natural sources of cooling and ventilation to maintain comfortable conditions within the internal spaces and will also allow the heating systems of the residential blocks to perform more efficiency.

Perforated Ventilation Opening Panels

Utilising these passive measures will consequently reduce energy consumption and CO_2 emissions of the Proposed Development as less energy will be required for the space heating and space cooling requirements.

The Co living block will adapt the use of perforated opening panels to facilitate purge ventilation coupled with Mechanical Extract Ventilation (MEV) to reduce the use of supplementary VRF Cooling in the residential areas. The panels are designed to be utilised with MEV for peak summer conditions with rapid ventilation with the trickle ventilation utilised for general background ventilation. An example of perforated opening panels is shown in in the image adjacent. Please see Ventilation Strategy Report 5023602-RDG-XX-XX-RP-M-570000 for further details.

9.2. Energy Efficiency Measures – (Meeting Demand Efficiency)

The next stage of the design development, in accordance with London Plan energy hierarchy, was to establish energy efficiency measures to meet the demand of the Proposed Development, these being: -

9.2.1. Mechanical Ventilation Heat Recovery

Typical Utility Cupboard MVHR configuration

Ventilation with heat recovery is a mechanical system that ensures there is minimal heat loss when ventilating a room. The system/units work by extracting the stale air inside the building and feeding it through filters whilst also extracting the heat energy so that it's not exhausted to the outside but transferred back into the building with the filtered incoming air. The main components of MVHR units are a heat recovery cell (where the indoor heat is extracted and supplied into the outside air coming into the building), fans (pull in the air and blow out the air), and filters (filtering outside air from dust and particles inside the unit, protecting longevity and efficiency). Alongside this, units come with a summer bypass, meaning they can control the amount of energy recovered this is controlled either manually or by an electronic sensor. Benefits of MVHR units include, filtered air, minimal heat losses, mitigates overheating, and retains heat that would usually be exhausted to the outside environment.

MVHR units are proposed for all areas within the Hotel block and Co-Living Communal spaces, these units will provide fresh air and heat recovery to these areas. This reduces any required cooling load which can significantly reduce the CO_2 emissions of the Proposed Development and will also assist in providing comfortable living conditions.

Summer bypass mode will be used on the units during the summer periods which will reject heat instead of recovering. This will be used to avoid summertime overheating as during the warmer months of the year, heat recovery will not be required in the habitable spaces.

Typical Exposed MVHR configuration

Further Energy Efficiency Measures

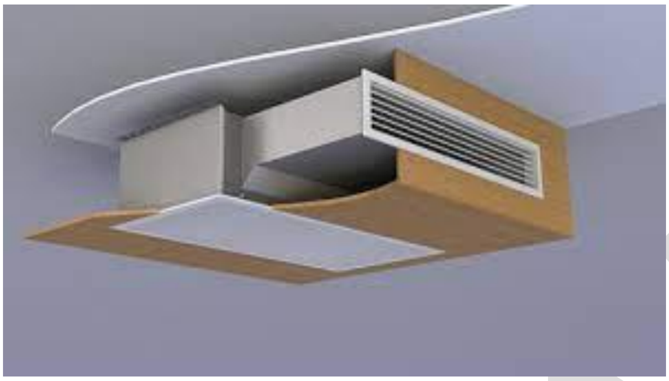
- High efficiency/Low specific fan power (SFP's) ventilation fans which will used to reduce the energy consumption of the Proposed Development's air handling systems.
- High efficiency LED lighting throughout. Lights in communal spaces will be coupled with demand operated lighting where appropriate via daylight diming and absence/presence detection which turns lights off when no occupancy is detected. This reduces energy consumption and CO_2 emissions associated with lighting in the Proposed Development.

- Dedicated time, date & temperaure control systems to VRF heating/cooling units in Co Living Apartments
- Variable speed operation of of mechanical plant equipment to reduce regulated energy demand.
- BMS operation of amenity spaces building services systems.

9.3. Be Green: Renewable and Low Carbon Technologies

The penultimate stage of the London Plan energy hierarchy has been to establish what renewable and low carbon technologies can be adopted. Following the appraisal of the Proposed Development and site, Air Source Heat Pumps (ASHP) will be used to generate heating, cooling, and hot water for the Proposed Development.

The average CoP of air source heat pumps is around 3-4 although some systems may produce a greater rate of efficiency. This means that for every kW of electric power the heat pumps use, 3-4 kW of heat energy is generated, this results in reduced carbon emissions and operational energy.



Variable Refrigerant Flow (VRF) heat pumps with will also provide heating and cooling throughout the proposed Co Living block and hotel development. The VRF condensers will serve indoor fan coil units in a VRF refrigerant system typically providing CoPs in the region of 5-6 depending on the season and internal loads.

Fan coil units will provide heating and cooling in the amenity spaces working in conjunction with localised MVHR units.

Typical VRF Fan Coil to Amenity Spaces

9.3.1. Low Carbon Technologies

Co Living Residential (SAP)

HVAC System Used: Heat Pumps Heat Network	
Distribution: Space and Water Separate	
Space Community Heating	
Distribution Loss	Calculated
Distribution Loss Value	1.05
SAP Code	2304
Heat Pump Efficiency	6.19
Water Community Heating	
Distribution Loss	Calculated
Distribution Loss Value	1.05
Heat Pump Efficiency	3.13

Mechanical Ventilation Type: Mechanical extract ventilation	
MV Reference Number	500765
SFP (W/(l/s)	0.19
HR efficiency	-

Co Living Amenity (BRUKL)

HVAC System Used: Local MVHR with VRF (Amenity)					
	Heating Efficiency	**Cooling Efficiency**	**Radiant Efficiency**	**SFP (W/(l/s)**	**HR efficiency**
Value Used	5.98	9.16	0	0.70	0.89
Standard Value	2.5	N/A	N/A	2^	N/A
HVAC System Used: Direct Electric MVHR					
	Heating Efficiency	**Cooling Efficiency**	**Radiant Efficiency**	**SFP (W/(l/s)**	**HR efficiency**
Value Used	1.00	-	0.53	-	-
Standard Value	2.5	N/A	N/A	2^	N/A
HVAC System Used: Local MVHR VRF					
	Heating Efficiency	**Cooling Efficiency**	**Radiant Efficiency**	**SFP (W/(l/s)**	**HR efficiency**
Value Used	5.98	9.16	0	0.70	0.75
Standard Value	2.5	N/A	N/A	2^	N/A

DHW System: Heat Pump		
	Water heating efficiency	**Storage loss factor (kWh/l*day)**
Value Used	3.80	500
Standard Value	2	N/A
Automatic monitoring &targeting with alarms for out-of range- values for this HVAC system		Yes

Hotel (BRUKL)

HVAC System Used: Central AHU VRF					
	Heating Efficiency	**Cooling Efficiency**	**Radiant Efficiency**	**SFP (W/(l/s)**	**HR efficiency**
Value Used	5.98	9.16	0	1.40	0.78
Standard Value	2.5	N/A	N/A	2^	N/A
HVAC System Used: MVHR Direct Electric					
	Heating Efficiency	**Cooling Efficiency**	**Radiant Efficiency**	**SFP (W/(l/s)**	**HR efficiency**
Value Used	1.0	-	0.04	-	-
Standard Value	2.5	N/A	N/A	2^	N/A
HVAC System Used: No Heat, Extract Only					
	Heating Efficiency	**Cooling Efficiency**	**Radiant Efficiency**	**SFP (W/(l/s)**	**HR efficiency**
Value Used	2.75	-	0.04	-	-
Standard Value	2.5	N/A	N/A	2^	N/A
HVAC System Used: Local MVHR VRF					
	Heating Efficiency	**Cooling Efficiency**	**Radiant Efficiency**	**SFP (W/(l/s)**	**HR efficiency**
Value Used	5.98	9.16	0	0.70	0.75
Standard Value	2.5	N/A	N/A	2^	N/A

DHW System: Heat Pump		
	Water heating efficiency	**Storage loss factor (kWh/l*day)**
Value Used	3.80	4500
Standard Value	2	N/A

Automatic monitoring &targeting with alarms for out-of range- values for this HVAC system	Yes

10. PREDITECTED CARBON EMISSIONS

An initial Part L assessment has been undertaken with the results displayed below.

10.1. Carbon Emissions and Operational Energy Savings

The following SAP and BRUKL results relate to a RIBA Stage 2 design and will be subject to a design development at the next stages. The SAP and BRUKL results are shown in Appendix 2.

10.1.1. Co Living Residential Areas (SAP Results)

Target dwelling CO_2 emission rate (TER), $kgCO_2/m^2/yr$	28.14
Dwelling CO_2 emission rate (DER), $kgCO_2/m^2/yr$	5.23
Target primary energy rate (TPER), $kWhCO_2/m^2/yr$	156.55
Dwelling primary energy rate (DPER), $kWh/m^2/yr$	57.20
Target Fabric Energy Efficiency (TFEE), $kWh/m^2/yr$	43.21
Dwelling Fabric Energy Efficiency (DFEE), $kWh/m^2/yr$	30.65
Do the buildings emission and primary energy rates exceed the targets?	NO

The proposed solutions will provide an improvement on the target CO_2 emission rate and an improvement on the target primary energy rate. The dwelling fabric energy efficiency will also be at a betterment over the target fabric energy efficiency.

10.1.2. Co Living Amenity Areas (BRUKL Results)

In summary, the building emission rate is lower than the target emissions rate and the building primary energy rate is lower than the target primary energy rate.

Target CO2 emission rate (TER), $kgCO_2/m^2$. annum	2.36	
Building CO2 emission rate (BER), $kgCO_2/m^2$. annum	2.05	
Target primary energy rate (TPER), $kWh/m^2/yr$	25.98	
Building primary energy rate (BPER), $kWh/m^2/yr$	22.71	
Do the buildings emission and primary energy rates exceed the targets?	BER=<TER	BPER=<TPER

The proposed options will provide a betterment on the target CO_2 emission rate and a betterment on primary energy rate.

10.1.3. Hotel (BRUKL Results)

In summary, the building emission rate is lower than the target emissions rate and the building primary energy rate is lower than the target primary energy rate.

Target CO2 emission rate (TER), $kgCO_2/m^2$. annum	11.78	
Building CO2 emission rate (BER), $kgCO_2/m^2$. annum	9.88	
Target primary energy rate (TPER), $kWh/m^2/yr$	128.04	
Building primary energy rate (BPER), $kWh/m^2/yr$	107.28	
Do the buildings emission and primary energy rates exceed the targets?	BER=<TER	BPER=<TPER

The proposed option will provide a betterment on the target CO_2 emission rate and a betterment on primary energy rate.

11. LONDON PLAN RESULTS

11.1. Baseline Energy Demand Assessment

The baseline energy demand assumptions have been calculated by simulating the building (Hotel, Co-Living, and Co-Living Amenity spaces). Note that the assumptions used are those in line with the energy guidance of the London Plan for the notional specification of new buildings and the be lean stage of the guidance.

Additionally, the notional building's Target Emission Rate (TER) from the final proposed building specification is obtained with the calculation of the regulated CO2 emissions through the approved compliance software (Integrated Environmental Solutions IES – Virtual Environment VE) by being compliant with Part L 2021 of the Building Regulations and SAP Elmhurst Energy carbon emission factors.

Therefore, the results for the Hotel, Co-Living and Co-Living Amenity space are shown on the tables below:

Co-Living Block		
	Carbon Dioxide Emissions for residential buildings (Tonnes CO2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2021 of the Building Regulations Compliant Development	162.0	TBA

Hotel, Retail and Amenity spaces		
	Carbon Dioxide Emissions for non-residential buildings (Tonnes CO2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2021 of the Building Regulations Compliant Development	75.2	71.1

11.2. Be Lean

The 'Be Lean' part of the hierarchy of the London Plan refers to the demand reduction in buildings, as mentioned in previous sections of this report. Hence, passive measures must be adopted in order to achieve the London Plan targets. Section 9.1 includes a number of proposals that are included as part of the design for the proposed development.

Section 9.1.1 of this report analyses percentage betterment between the 2021 Part L Building Regulations limiting fabric values against the target fabric values, for the 3 building blocks Fabric U-Values. In addition to this analysis, the Target Fabric Energy Efficiency of the Co-Living space is bettered by the Dwelling Fabric Energy Efficiency as also seen in section 10.1.1.

	Target Fabric Energy Efficiency (kWh/m^2)	Dwelling Fabric Energy Efficiency (kWh/m^2)	Improvement (%)
Development total	26.26	23.45	11

Based on the London Plan guidance, the 'Be Lean' part of the hierarchy must assume space heating demand on the development. The reason why space heating must be assumed as part of the 'Be Lean' section is that demand reduction is better demonstrated through the percentage improvement of the BER/DER over the Target CO2 Emissions Rate. A reduction in CO2 emissions is accomplished as part of the analysis and can be seen in the below table.

Co-Living Block		
	Regulated residential carbon dioxide savings	
	(Tonnes CO2 per annum)	**(%)**
Be lean: savings from energy demand reduction	**31.6**	**20%**

Hotel, Retail and Amenity spaces		
	Regulated non-residential carbon dioxide savings	
	(Tonnes CO2 per annum)	**(%)**
Be lean: savings from energy demand reduction	**-215.9**	**-287%**

Note that in the tables above, the three building elements exceed with the London Plan requirement percentage betterment of CO2 emissions through passive and active measures, where the residential development is required to achieve at least a 10% improvement and non-residential development is required to achieve at least 15% improvement.

Active measures in the hotel (mentioned in Section 9.2), include central AHU featuring MVHR with localised heating and cooling measures to provide thermal comfort.

Whereas the Co-Living rooms are naturally ventilated via an openable panel and trickle ventilation, they will feature localised supplementary cooling with local mechanical extract ventilation (MEV) to provide additional purge ventilation.

11.3. Be Clean

The 'Be Clean' part of the hierarchy includes the exploitation of local energy resources (such as secondary heat) and to supply energy efficiently and cleanly by connecting the building's systems to district heating networks. In order to achieve this, High Street, Uxbridge has to be close to a heat network.

As seen from the picture above, High Steet, Uxbridge is 4.44km away from an existing district heat network. However, it is also 22.95m away from a proposed district heat network, however, the future date of availability is currently unknown. Section 5.3.2 of this report, notes one of the subsections from Policy DMEI 3 that states that a major development will need to confirm no DEN within 500m or considered to be operational within 3 years of a grant of planning permission by the Council. The proposed strategy for High Street Uxbridge looks to future-proof any future district heating network by allowing for plant space suitable for potential plate heat exchangers and pump sets associated with a DEN connection, to ensure compliance.

The proposed heating strategy will feature high-efficiency air-source heat pumps located on the roof of the building with connections to localised fan-coil units within co-living studios, communal areas and hotel rooms. The proposed low zero carbon technology allows for more robust thermal comfort provision within the spaces by providing both heating and cooling featuring exceptional Seasonal COPs. This strategy provides a solution to the excessive noise issues highlighted at the site via the acoustic report.

Combined Heat and Power is not proposed as part of the heating strategy. Additionally, based on the London Plan and the paragraph above, technology options such as heat pumps promote the decarbonization of the heat network and thus, should be included in the 'Be Clean' section of the energy hierarchy.

After having carried out the 'Be Clean' proposals (This Section, Section 7.3, and Section 9.2), there is a considerable CO2 reduction in non-domestic and domestic emissions when compared to the Part L baseline carbon emissions factors.

Co-Living Block		
	Regulated residential carbon dioxide savings	
	(Tonnes CO2 per annum)	(%)
Be lean: savings from energy demand reduction	**31.6**	**20%**
Be clean: savings from heat network	**0.0**	**0%**

Hotel, Retail and Amenity spaces		
	Regulated non-residential carbon dioxide savings	
	(Tonnes CO2 per annum)	(%)
Be lean: savings from energy demand reduction	**-215.9**	**-287%**
Be clean: savings from heat network	**229.5**	**305%**

To comment on the non-residential results, this appears to be due to the methodology associated with the London plan policy, there is a significant uplift in energy usage from the baseline to the Be Lean figure (215.9 tonnes CO_2/yr) due to the baseline energy strategy featuring a more similar overall strategy to the Be Green solution than the Be Lean. This is a nuance relating to the Part L notional building that is used as target emissions rate. The Be Lean results feature gas fired boilers i.e. no renewable *green* heat pumps where as the Baseline is the target of the Be Green proposed solution where both feature heat pumps and therefore have a lower energy demand overall. It is important to highlight that the fabric, i.e. passive measures, of the building improve significantly between the baseline and the Be Lean scenario – illustrated in section 9.1.1.

11.4. Be Green

In line with Policy SI 2 of the London Plan, an assessment of possible feasible renewable energy technologies is carried out on Section 7.4 and Section 9.3.1. of this report.

Additional to Section 9.3.1, Photovoltaic Panels are inputted into the Co-Living block generating an assumed total output of 106.3 kW (0.13 kWp per studio), panels will have to be located facing a West orientation with none to little overshading.

The use of low carbon technologies such as those mentioned above, photovoltaic panels and heat pumps, give us a reduced percentage in CO2 emissions for the residential and non-residential blocks as can be seen below:

Co-Living Block		
	Regulated residential carbon dioxide savings	
	(Tonnes CO2 per annum)	(%)
Be lean: savings from energy demand reduction	31.6	20%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	96.8	60%
Cumulative on-site savings	128.4	79%
	(Tonnes CO2)	
Cumulative savings for off-set payment	1,008	-
Cash in-lieu contribution (£)	95,734	-

Be Green GLA Energy Assessment Guidance June 2022 results

Hotel, Retail and Amenity spaces		
	Regulated non-residential carbon dioxide savings	
	(Tonnes CO2 per annum)	(%)
Be lean: savings from energy demand reduction	-215.9	-287%
Be clean: savings from heat network	229.5	305%
Be green: savings from renewable energy	-1.7	-2%
Cumulative on-site savings	11.9	16%
	(Tonnes CO2)	
Cumulative savings for off-set payment	1,900	-
Cash in-lieu contribution (£)	180,547	-

Be Green GLA Energy Assessment Guidance June 2022 results

11.5. Be GREEN Alternative Methodology CO2 calculation (Be LEAN TER as Baseline)

The results above for the Hotel, Retail and Amenity spaces follow the GLA Energy Assessment Guidance published June 2022 dictate that a baseline should be established using the TER from the final proposed *(Be Green)* results. As per the extract:

6.8. To determine the CO_2 emissions baseline, applicants should use the Target Emission Rate (TER) from the final proposed building specification, i.e. the rate from the modelling results of the 'be green' stage of the energy hierarchy. In some cases the TER may include low carbon or renewable energy generation. The carbon emissions reporting spreadsheet enables the CO_2 emission savings over the baseline to be accounted for at each stage of the energy hierarchy.

This methodology does not provide an expected result to illustrate a reduction in energy from baseline>Be Lean>Be Green.

This is acknowledged in the Energy Assessment Guidance Cover letter in the following paragraph (not an issue for the residential element of the development):

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

However section 7.7 of the energy assessment guidance describes the aim of illustrating the CO2 savings:

The applicant must clearly identify the extent to which Part L 2021 of the Building Regulations is exceeded through the use of these demand reduction measures alone, i.e. the percentage improvement of the BER/DER over the Target CO_2 Emissions Rate (TER)[19] before the inclusion of a heat network connection and use of on-site renewables. Where the TER includes on-site renewable generation from PV, the carbon emissions reporting spreadsheet will automatically enable savings from 'be lean' measures only to be reported.

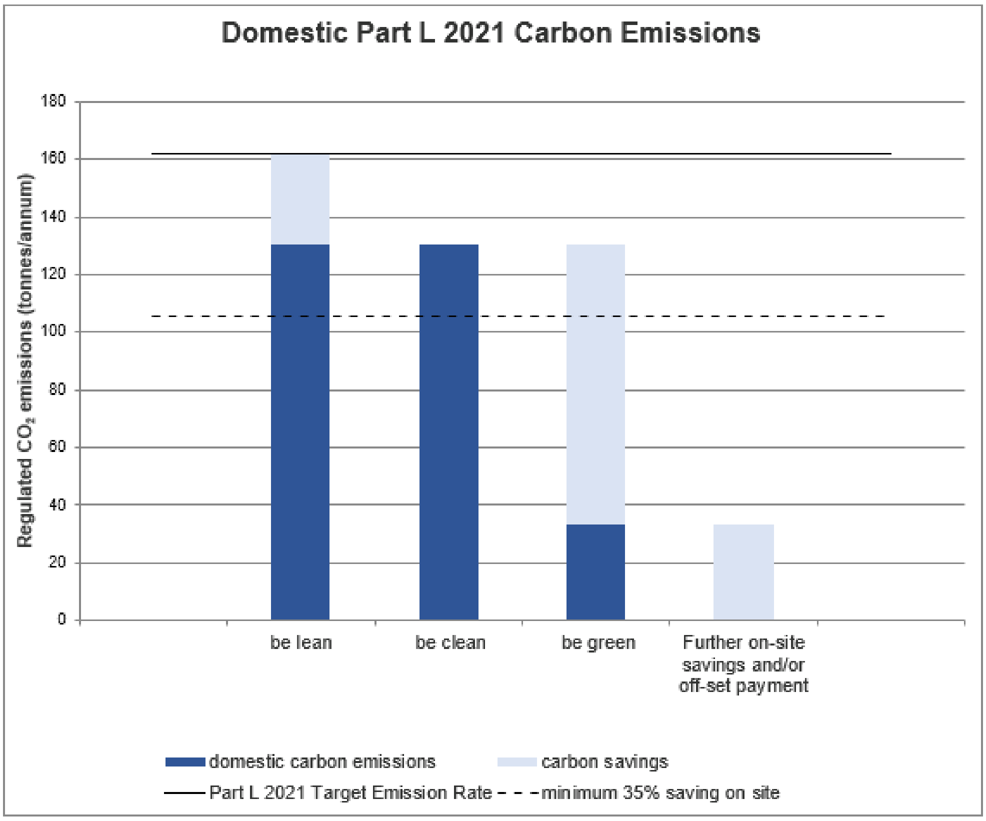
Following the spirit of the GLA guidance, an alternative table of results has been produced using the Be Lean modelling results Target Emissions Rate, to calculate the carbon savings, which aligns closer to the GLA policy rather than the energy modelling guidance.

Hotel, Retail and Amenity spaces		
	Regulated non-residential carbon dioxide savings	
	(Tonnes CO2 per annum)	**(%)**
Be lean: savings from energy demand reduction	-23.0	-9%
Be clean: savings from heat network	229.5	87%
Be green: savings from renewable energy	-5.7	-2%
Total Cumulative Savings	**200.7**	**76%**
	(Tonnes CO2)	
Cumulative savings for off-set payment	**1,900**	**-**
Cash in-lieu contribution (£)	**180,547**	**-**

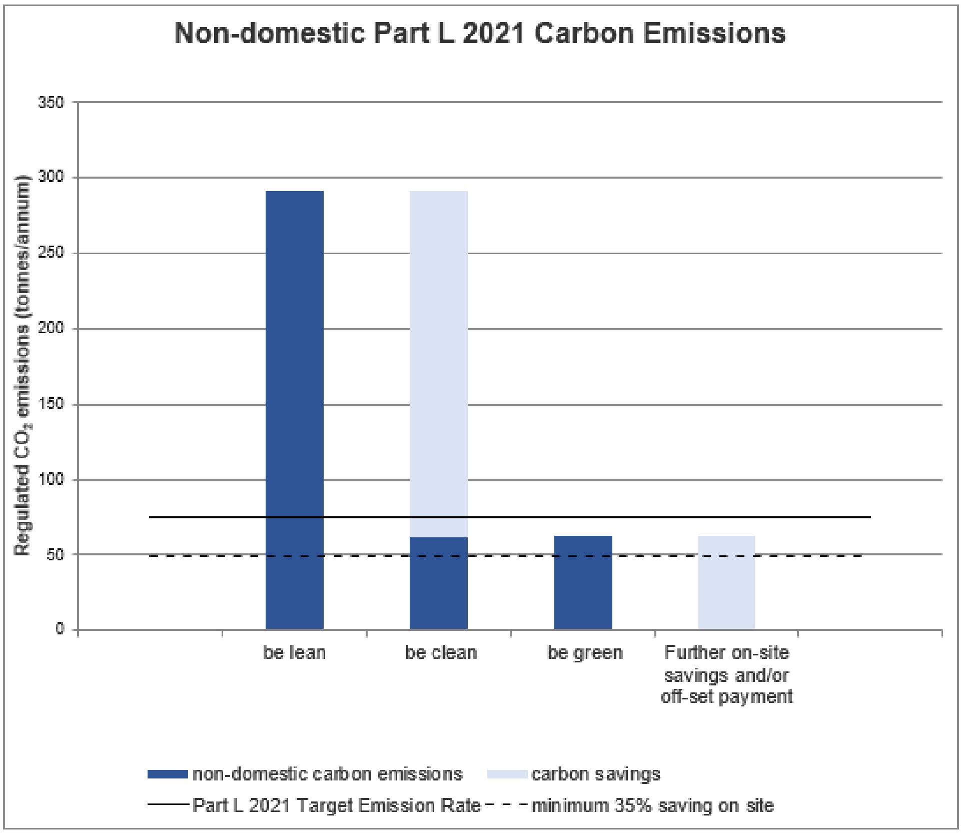
GLA Be Lean TER as Baseline results

This illustrates a **carbon saving of 76%** between the Be Lean Target Emissions Rate (TER) and the Be Green (as designed) Building Emissions Rate (BER). The Be Lean TER as the baseline highlights the carbon savings of the improved fabric and change from gas heating to (renewable energy) Heat pumps. Where the GLA Modelling guide methodology ignores the carbon saving of moving from Gas to Electricity, hence the non-linear results above.

The introduction of high-efficiency heat pumps for the domestic hot water system provides the most significant energy and carbon reduction on site due to the high hot water demands associated with residential and hotel building types in the National Calculation Methodology.



Domestic Part L 2021 Carbon Emissions
Regulated CO2 emissions (tonnes/annum)
180
160
140
120
100
80
60
40
20
0
be lean
be clean
be green
Further on-site savings and/or off-set payment
domestic carbon emissions
carbon savings
Part L 2021 Target Emission Rate
minimum 35% saving on site



Non-domestic Part L 2021 Carbon Emissions
Regulated CO2 emissions (tonnes/annum)
350
300
250
200
150
100
50
0
be lean
be clean
be green
Further on-site savings and/or off-set payment
non-domestic carbon emissions
carbon savings
Part L 2021 Target Emission Rate
minimum 35% saving on site

11.6. Be Seen

The 'Be Seen' part of the energy hierarchy refers to the monitoring and reporting of electricity input and heat output of the Heat Pumps energy performance post-construction to ensure that the actual carbon performance of the development is aligned with the Mayor of London's net-zero carbon target.

Therefore, this means that post- construction readings from heat meters and heat patterns, domestic hot water meters and real consumption, actual SCoP in use versus specification figures, standing losses between central plant and flats.

Residential

The calculation of regulated carbon emissions can be seen in the table below following the outlined methodology of SAP results for the Studios. It should be noted this is the figure associated with the studios and does not account for the lower EUI expected in the corridors etc. It is anticipated the overall EUI including corridors would be less than the target EUI in the table below.

Building type	Energy Use Intensity (kWh/m²/year)	Space Heating (kWh/m²/year)
Residential	35	15
School	65	15
Office	55	15
Hotel	55[23]	15
All other non-residential	55	15

Residential Co-Living Block						
Building type	**EUI (kWh/m2 /year) (excluding renewable energy)**	**Space heating demand (kWh/m2/year) (excluding renewable energy)**	**EUI value from Table 4 of the guidance (kWh/m2/year) (excluding renewable energy)**	**Space heating demand from Table 4 of the guidance(kWh/m2/ year) (excluding renewable energy)**	**Methodology used ('be seen' methodology)**	**Explanatory notes (if expected performance differs from the Table 4 values in the guidance)**
Residential	57.20	10.56	35	15	Part L1 – SAP 10.2 & dwellings/ & landlord circulation	Corridor area not included in SAP EUI calculation, actual EUI anticipated to be below the 55 kwh/m2/yr threshold.

Non-Residential

Hotel, Retail and Amenity spaces						
Building type	**EUI (kWh/m2/ year) (excluding renewable energy)**	**Space heating demand (kWh/m2/yea r) (excluding renewable energy)**	**EUI value from Table 4 of the guidance (kWh/m2/year) (excluding renewable energy)**	**Space heating demand from Table 4 of the guidance(kWh/m2/ year) (excluding renewable energy)**	**Methodology used ('be seen' methodology)**	**Explanatory notes (if expected performance differs from the Table 4 values in the guidance)**
Hotel	TBA	TBA	TBA	TBA	TM54	To be completed during Stage 3 design

The Be Seen figures for the non-residential elements are to be developed during stage 3 once more specific information is available to provide a TM54 methodology calculation.

12. PART O - ALIGNING WITH POLICY SI 4 MANAGING HEAT RISK

A Part O: Overheating assessment has been carried out on the Co-Living elements of the proposed development. It was found, due to the excessive noise noted in the acoustician's report, that openings were not possible at night time. Due to the high internal gains associated with TM59 'Studio' templates, compliance was not possible without active cooling as part of the solution. Passive measures including reduced glazing, increased natural and mechanical ventilation were tested but it was identified that active cooling would be required to achieve compliance with Part O against London Heathrow DSY1 2020High50 weather file.

The iterations of the non-compliant Part O reports that features passive and mechanical ventilation measures can be provided upon request.

13. CONCLUSION

This report has set out the methodology in which the design team have approached the design of the proposed Hight Street, Uxbridge development and how the strategies of The London Plan and the Government guidelines have been adopted.

Our strategy has sought to reduce the carbon emissions for the building using a Lean, Clean, Green, and Seen approach and these findings have been applied to the Proposed Development.

The Proposed Development has been designed with U-values and air permeability that exceed or are an improvement over the minimum Building Regulations values which is essential in reducing the initial demand for energy and associated CO_2 emissions of the building. Through using passive improvement measures, the resultant design proved that less energy was required to maintain comfortable conditions inside the building as well as the building performing better as an insulator. Adopting this approach will also allow the Proposed Development to maximise the use of efficient sources of cooling and ventilation which will assist in maintaining comfortable conditions within the internal spaces and will also allow the heating and cooling system to perform optimally.

Energy efficiency measures have then been evaluated to assess which measures suit the Proposed Development best. High-efficiency LED lighting will be used throughout coupled with demand-operated lighting where appropriate in the form of daylight dimming, & absence/presence detection, this will reduce energy consumption and CO_2 emissions associated with lighting within the Proposed Development.

Central and Local Mechanical Ventilation with Heat Recovery (MVHR) with high-efficiency heat pump heating and cooling is proposed as the strategy for ventilation and comfort within the hotel and non-residential areas of the development. These systems will provide fresh air and heat recovery to the individual rooms of the development. Heat Recovery reduces the required cooling & heating load which will in turn reduce CO_2 emissions that the development produces.

Natural ventilation with additional Mechanical Extract Boost Ventilation combined with high-efficiency heat pump heating and cooling is proposed as the strategy for ventilation and comfort within the residential spaces of the development. These units will allow user control over fresh air and highly efficient thermal comfort solutions to heat and cool those spaces. The low-energy, high-COP solutions provide a strategy that can achieve thermal comfort whilst reducing the CO_2 emissions that the development produces.

Various renewable and low zero carbon technologies have been assessed and this report has established that the best technologies adopted to the Proposed Development are:

- Centralised (ASHP) Hot Water cylinders to provide hot water to the residential apartments of the Co-Living Block
- VRF ASHPs to provide space heating and cooling to the Co-Living block as well as the bedrooms and amenity areas of the Hotel.
- Photovoltaic roof-mounted panels to offset a percentage of the proposed developments energy demand on the Co-Living block.

This system was chosen to align with the government's policy on the phasing out of fossil fuels and the subsequent decarbonisation of the National Grid.

The proposals presented also support the governments and local authorities' policy on phasing out fossil fuels and as the grid decarbonises will offer further carbon reductions.

Following the GLA Energy Assessment guidance, this report has shown a total reduction of 79% in CO_2 emissions for the Residential block and 16% in CO2 emissions for the Non-Residential block based on the London Plan approach. Final figures of CO_2 reduction can be seen on the table below. Site wide reductions cover a 59% reduction in annual savings.
With the alternative, Be Lean TER baseline, the non-residential proposal demonstrates through the implementation of Lean and Green solutions a CO2 emissions reduction of 76% - See section 11.5

Co-Living Block		
	Regulated residential carbon dioxide savings	
	(Tonnes CO2 per annum)	(%)
Be lean: savings from energy demand reduction	31.6	20%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	96.8	60%
Cumulative on-site savings	128.4	79%
	(Tonnes CO2)	
Cumulative savings for off-set payment	1,008	-
Cash in-lieu contribution (£)	95,734	-

Hotel, Retail and Amenity spaces		
	Regulated non-residential carbon dioxide savings	
	(Tonnes CO2 per annum)	(%)
Be lean: savings from energy demand reduction	-215.9	-287%
Be clean: savings from heat network	229.5	305%
Be green: savings from renewable energy	-1.7	-2%
Cumulative on-site savings	11.9	16%
	(Tonnes CO2)	
Cumulative savings for off-set payment	1,900	-
Cash in-lieu contribution (£)	180,547	-

	Total regulated emissions (Tonnes CO2 / year)	CO2 savings (Tonnes CO2 / year)	Percentage savings (%)
Part L 2021 baseline	237.2		
Be lean	421.5	-184.3	-78%
Be clean	192.0	229.5	97%
Be green	96.9	95.1	40%
Total Savings	-	**140.3**	**59%**
	-	CO2 savings off-set (Tonnes CO2)	-
Off-set	-	**2,908.2**	-

14. APPENDICES

Co Living Development (SAP Results)

See separate SAP results.

RIDGE

Co Living Development (BRUKL Results)

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

5023602_Co-living Amenity Part L Model as designed GREEN

As designed

Date: Wed Mar 20 10:14:14 2024

Administrative information

Building Details

Address: Address 1, City, Postcode

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.25

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.25

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

Foundation area [m²]: 830.16

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

Target CO_2 emission rate (TER), $kgCO_2/m^2annum$	2.36	
Building CO_2 emission rate (BER), $kgCO_2/m^2annum$	2.05	
Target primary energy rate (TPER), kWh_{PE}/m^2annum	25.98	
Building primary energy rate (BPER), kWh_{PE}/m^2annum	22.71	
Do the building's emission and primary energy rates exceed the targets?	BER =< TER	BPER =< TPER

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

Fabric element	$U_{a-Limit}$	U_{a-Calc}	U_{i-Calc}	First surface with maximum value
Walls*	0.26	0.15	0.15	SP00001D:Surf[3]
Floors	0.18	0.15	0.15	SP00001D:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.15	0.15	010000E5:Surf[0]
Windows** and roof windows	1.6	-	-	No windows, galzed doors, or roof windows in building
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	-	-	No personnel doors in building
Vehicle access & similar large doors	1.3	-	-	No vehicle access doors in building
High usage entrance doors	3	-	-	No high usage entrance doors in building

$U_{a-Limit}$ = Limiting area-weighted average U-values [W/(m²K)]
U_{a-Calc} = Calculated area-weighted average U-values [W/(m²K)]
U_{i-Calc} = Calculated maximum individual element U-values [W/(m²K)]
* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
** Display windows and similar glazing are excluded from the U-value check.
*** Values for rooflights refer to the horizontal position.
^ For fire doors, limiting U-value is 1.8 W/m²K
NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air permeability	Limiting standard	This building
m³/(h.m²) at 50 Pa	8	3

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m²]	3601.8	3601.8
External area [m²]	5385.5	5385.5
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	3	3
Average conductance [W/K]	1222.16	1089.21
Average U-value [W/m²K]	0.23	0.2
Alpha value* [%]	25.12	10

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

Building Use

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

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	0.4	0.2
Cooling	4.16	5.88
Auxiliary	2.41	3.83
Lighting	8	9.61
Hot water	0.56	0.22
Equipment*	90.82	90.82
TOTAL**	**15.53**	**19.76**

* 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	2
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*0*	*2*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	97.32	99.34
Primary energy [kWh_{PE}/m²]	22.71	25.98
Total emissions [kg/m²]	2.05	2.36

Hotel Development (BRUKL Results)

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

5023602_Hotel Part L Model as designed GREEN dhw COP 3.66

As designed

Date: Wed Mar 20 11:52:53 2024

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.25

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.25

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

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Foundation area [m²]: 611.89

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

Target CO_2 emission rate (TER), $kgCO_2/m^2$annum	11.78	
Building CO_2 emission rate (BER), $kgCO_2/m^2$annum	9.88	
Target primary energy rate (TPER), kWh_{PE}/m^2annum	128.04	
Building primary energy rate (BPER), kWh_{PE}/m^2annum	107.28	
Do the building's emission and primary energy rates exceed the targets?	BER =< TER	BPER =< TPER

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

Fabric element	$U_{a-Limit}$	U_{a-Calc}	U_{i-Calc}	First surface with maximum value
Walls*	0.26	0.15	0.15	SP000033:Surf[0]
Floors	0.18	0.15	0.15	BS000016:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.15	0.15	010000E5:Surf[0]
Windows** and roof windows	1.6	1.43	1.43	L000000B:Surf[0]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	-	-	No personnel doors in building
Vehicle access & similar large doors	1.3	-	-	No vehicle access doors in building
High usage entrance doors	3	-	-	No high usage entrance doors in building

$U_{a-Limit}$ = Limiting area-weighted average U-values [W/(m²K)]
U_{a-Calc} = Calculated area-weighted average U-values [W/(m²K)]
U_{i-Calc} = Calculated maximum individual element U-values [W/(m²K)]

* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
** Display windows and similar glazing are excluded from the U-value check.
*** Values for rooflights refer to the horizontal position.
^ For fire doors, limiting U-value is 1.8 W/m²K
NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air permeability	Limiting standard	This building
m³/(h.m²) at 50 Pa	8	3

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m²]	6621.1	6621.1
External area [m²]	5664.6	5664.6
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	3	3
Average conductance [W/K]	2462.26	2624.06
Average U-value [W/m²K]	0.43	0.46
Alpha value* [%]	25.48	10

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

Building Use

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

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	5.56	5.72
Cooling	2.71	3.01
Auxiliary	5.03	10.29
Lighting	6.73	7.48
Hot water	52.56	61.22
Equipment*	31.94	31.94
TOTAL**	**72.58**	**87.72**

* 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]

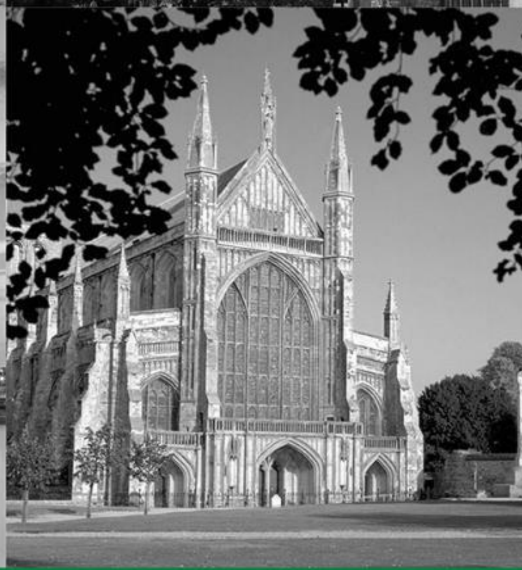
	Actual	Notional
Photovoltaic systems	0	1.06
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*0*	*1.06*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	104.22	92.96
Primary energy [kWh_{PE}/m^2]	107.28	128.04
Total emissions [kg/m²]	9.88	11.78





RIDGE

www.ridge.co.uk