RIDGE

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HIGH STREET, UXBRIDGE
28.09.2024

HIGH STREET, UXBRIDGE
DNA UXBRIDGE LTD

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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 include 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 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:

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

A BRUKL assessment has been undertaken as a result of the design strategy implemented (refer to Section 15). The Proposed Development **complies with the London Plan based on the tables below:**

Table 1 GLA's Results on CO2 Emissions for Non-Residential Buildings

	Carbon Dioxide Emissions for non-residential buildings (Tonnes CO2 per annum)	
	Regulated	**Unregulated**
Baseline: Part L 2021 of the Building Regulations Compliant Development	129.0	129.6
After energy demand reduction (be lean)	109.5	129.6
After heat network connection (be clean)	109.5	129.6
After renewable energy (be green)	83.2	129.6

Table 2 GLA's Results on Regulated Non-Residential CO2 Savings

Hotel, Retail, Amenity spaces and Co-Living Block		
	Regulated non-residential carbon dioxide savings	
	(Tonnes CO2 per annum)	**(%)**
Be lean: savings from energy demand reduction	19.5	15%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	26.3	20%
Cumulative on-site savings	**45.8**	**36%**
Annual savings from off-set payment	83.2	-
	(Tonnes CO2)	
Cumulative savings for off-set payment	**2,496**	**-**
Cash in-lieu contribution (£)	**237,137**	**-**

Table 3 GLA's Summarized Results on Regulated Non-Residential CO2 Savings

	Total regulated emissions (Tonnes CO2 / year)	**CO2 savings (Tonnes CO2 / year)**	**Percentage savings (%)**
Part L 2021 baseline	129.0		
Be lean	109.5	19.5	15%
Be clean	109.5	0.0	0%
Be green	83.2	26.3	20%
Total Savings	-	45.8	36%
	-	**CO2 savings off-set (Tonnes CO2)**	-
Off-set	-	**2,496.2**	-

As seen on Table 3, Uxbridge CoLiving and Hotel achieves a 15% improvement on CO_2 emissions through passive and active measures implemented and achieves the 35% minimum on site carbon reduction beyond Part L 2021. Therefore, the offset value which will have to be paid into Hillingdon's borough's carbon offset fund is £237,137 in order to make up for any shortfall to achieve net-zero-carbon.

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 proposed development at High Street Uxbridge. The plans involve 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 also include landscape improvements, 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 in design to 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 – The 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
- Be Seen: Monitoring, verifying and reporting of the energy performance and output of the proposed systems.

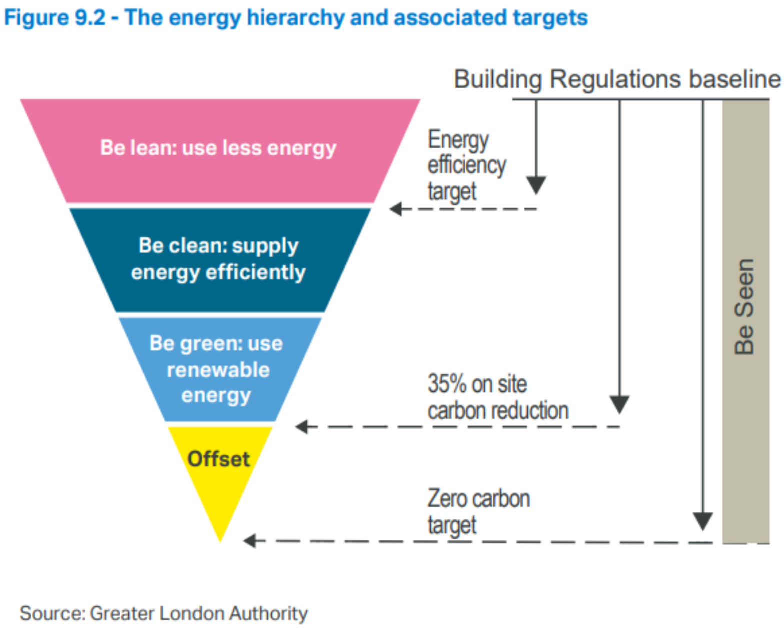


Figure 1 GLA's Energy Hierarchy

3. DEVELOPMENT PROPOSALS

3.1. Description of Development Proposal

The proposed developments comprise an area of:

- Hotel & Retail: 7149.9 m^2
- Co-Living Block: 14587.9 m^2

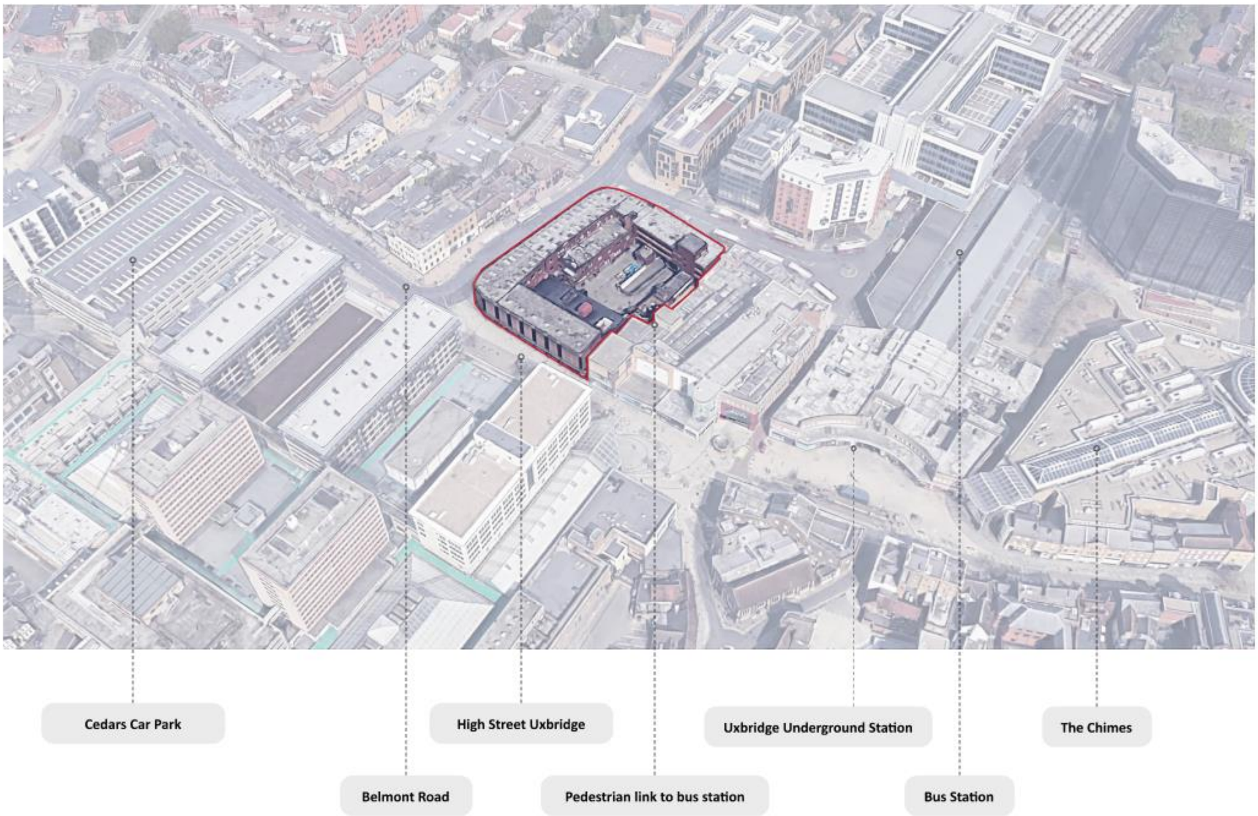


Figure 2 Development Proposal

4. ENERGY HIERARCHY

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).

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.

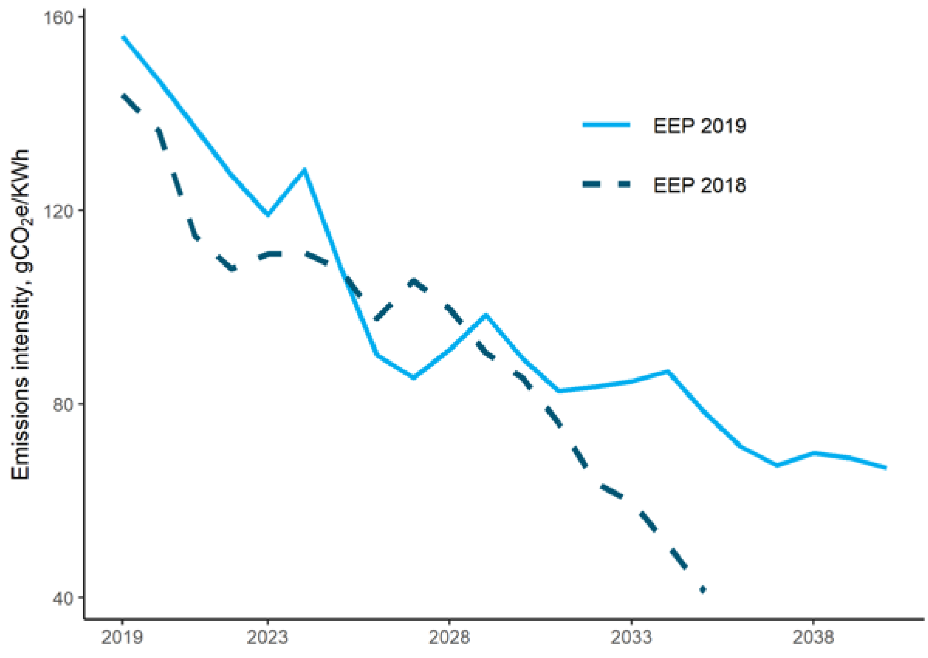


Figure 3 Predicted Reduction in Grid Carbon Factor

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.

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>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.

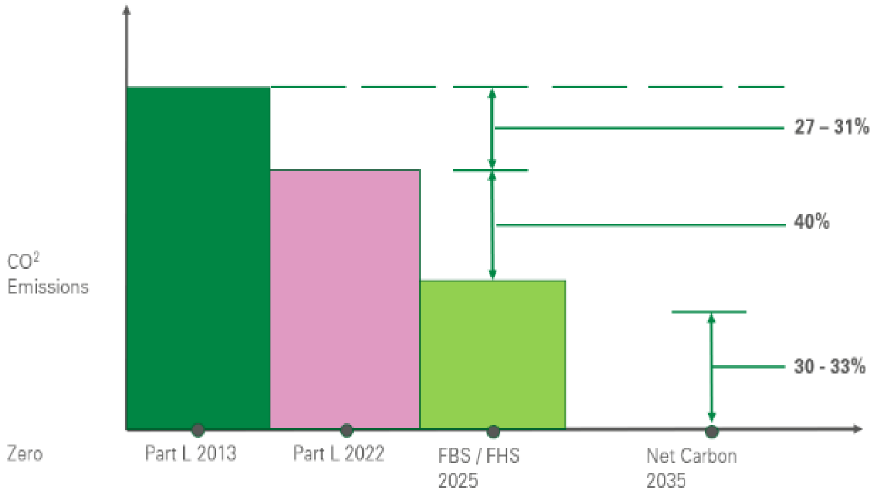


Figure 4 Part L 2022 Changes

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:

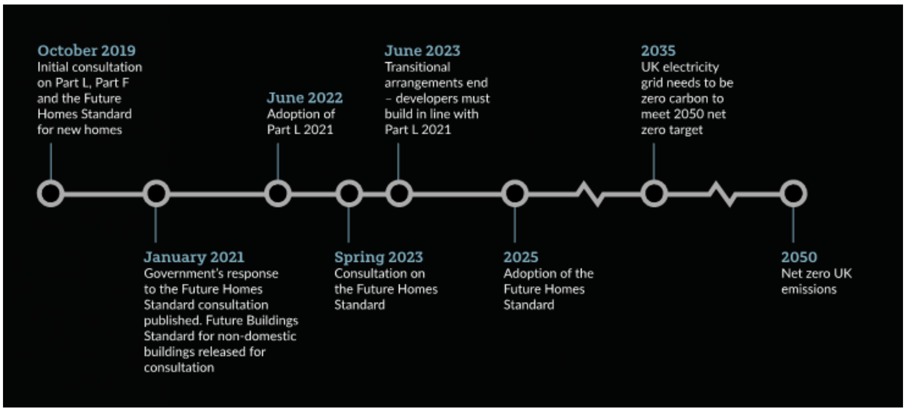


Figure 5 Future Homes Standard

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 Research 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:

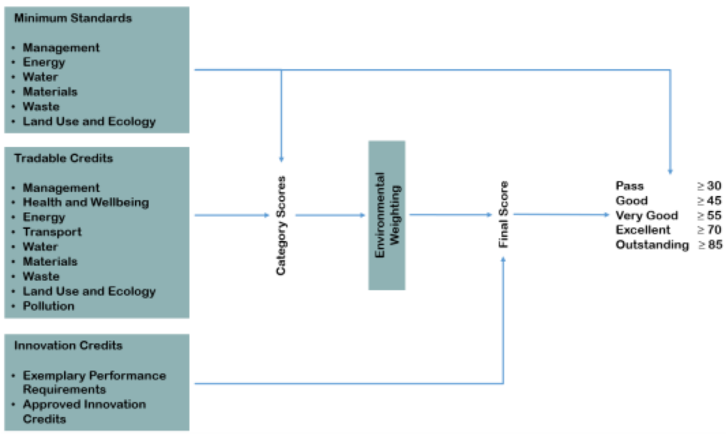


Figure 6 Process for Awarding BREEAM Ratings

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.

Environmental section	Weighting			
	Fully fitted out	Simple building	Shell and core only	Shell only
Management	11%	7.5%	11%	12%
Health and Wellbeing	14%	16.5%	8%	7%
Energy	16%	11.5%	14%	9.5%
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%

Figure 7 BREEAM environmental weighting

The weightings are:
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.

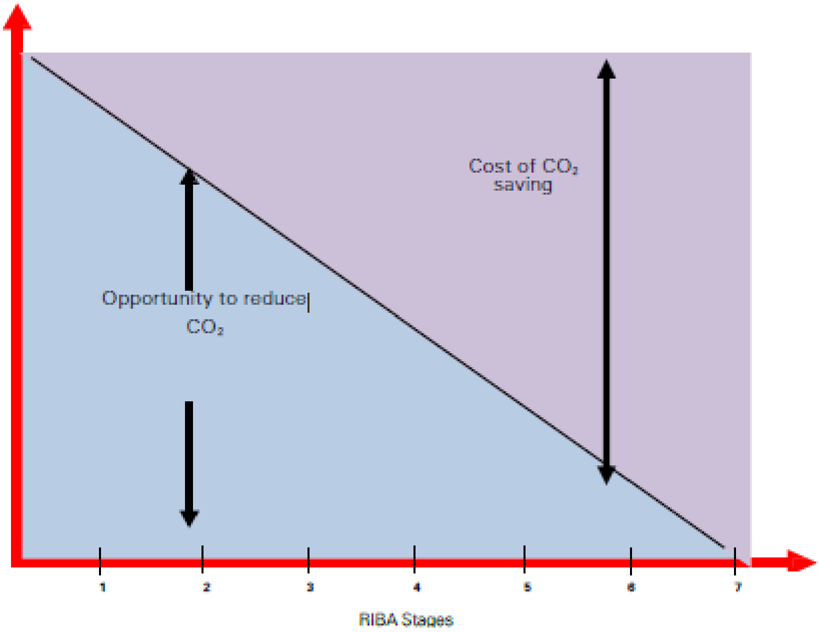


Figure 8 Costs of implementing design measures at each RIBA Stage

In this first instance, it is essential that the buildings 'passive measures' are optimised, and the design team works 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 aims to adhere to the following route where applicable to the scheme:

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 high emissions, 50th percentile) weather file, while sizing for cooling systems has been modelled with a London Design Summer Year (DSY1, 2050 high emissions, 50th percentile) weather file. In order to provide additional adaptability for future climate scenarios, the model is also tested using DSY2 and 3, high emissions, 50th percentile, weather files. 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 Daylight
  - Thermal Mass
  - Air tightness
  - 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.

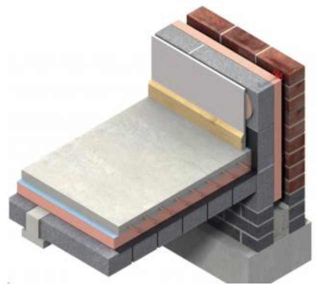
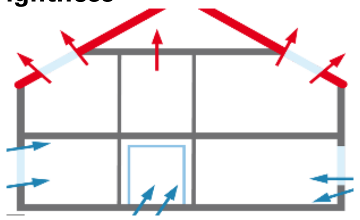
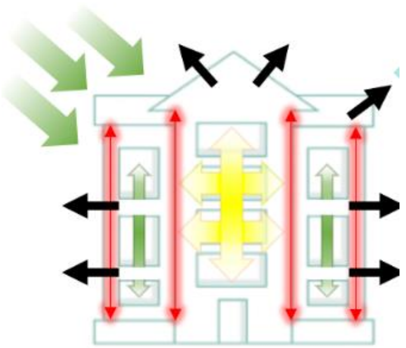
Secondly, the building will have a lower carbon footprint helping to stop the effects of climate change from increasing any further.

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 possible to be incorporated

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.
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.	N	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 were proved not viable when the overheating analysis was tested to the rooms of the Co Living Apartments of the proposed development. Therefore, natural ventilation won't be included as part of the analysis.
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.
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.

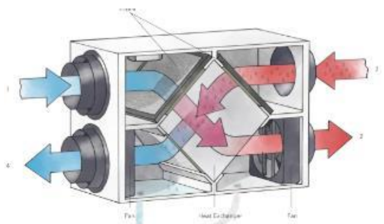
Adaption to climate change 	Average temperatures for central England have risen by approximately 1°C since the 1970s and this has resulted in higher peak temperatures, changing rain patterns, rising sea levels, in addition to unpredictable extreme weather events such as floods, droughts and freezing winters.	**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.

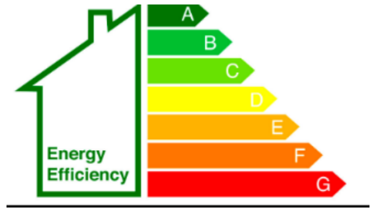
7.3. Active Design – (Be Lean: Meeting Demand Efficiently)

In addition to the passive measures, the Be Lean element of the GLA Energy Hierarchy 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. Mechanical Ventilation with Heat Recovery (MVHR) units will be installed within the Co-Living communal spaces. The Hotel and the Co-Living development will adopt heat recovery on the air handling plant that will supply fresh air to the concealed fan coil units in each bedroom/apartment as well as any amenity space on the Hotel.
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	P	Power factor correction could be used on the electrical supplies of the Proposed Development to improve energy efficiency.

	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.		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

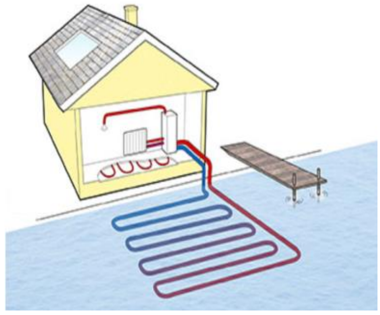
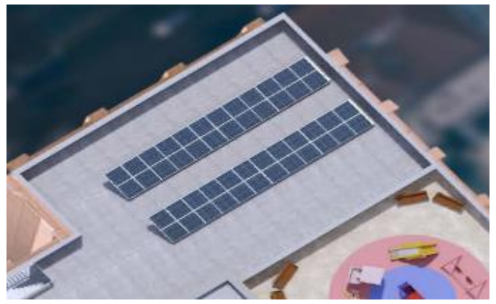
The following Low Zero Carbon (LZC) technologies have been identified and reviewed against their suitability on the Proposed Development:

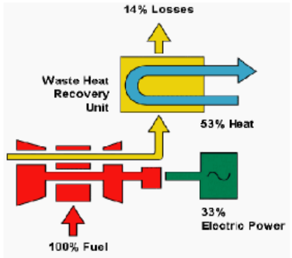
- Solar Water Heating
- Ground Source Heat Pumps
- Water Source Heat Pumps
- District Heating
- Biomass
- Wind Power
- Photovoltaic Electricity Generation
- Combined Heat and Power
- Air Source Heat Pumps
- Battery Storage

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 uses 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 it is 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 will 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.	**N**	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. Fan Coil Units (FCU's) will provide space heating and cooling to the Hotel rooms served from a Variable Refrigerant Flow (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 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

Energy modelling has been carried out to reflect the RIBA planning Stage 2 design. The modelling has been based on:

- Part L BRUKL – For Hotel and Retail
  - For an area of 7149.9 m^2
- Part L BRUKL – For Co-Living Block
  - For an area of 14587.9 m^2

The following BRUKLs 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.

It is necessary for the carbon emission reporting calculations to be undertaken using a Building Regulations approved compliance software.

IES Virtual Environment software has been used for all Part L 2021 energy modelling undertaken on this scheme – version 2023.5.2.0 (VE Compliance version 7.0.26.0).

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

The table below outlines the proposed U-values for the Proposed Development. At this stage, the proposed building aims to improve upon the notional values, which will assist in reducing the requirement of LZC technologies for compliance.

Co-Living Block, Amenity and Hotel

Table 4 U-Values Target and % Betterment for the Uxbridge CoLiving and Hotel

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	-

9.1.2. Target Air Permeability

Fabric air permeability is a measure of the volume of air that can penetrate through the fabric of a building, leading to ventilation heat loss and gain.

High air permeability can lead to uncomfortable drafts and dramatically increase the demand for space heating in winter (and space cooling in summer where relevant) when the airflow works in reverse i.e. cool air escaping from the building.

Co Living Block, Amenity and Hotel

Table 5 Air permeability for the Uxbridge CoLiving and Hotel

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.

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. Ventilation

Figure 9 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 heating 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.

Table 6 Ventilation Strategy for the Uxbridge CoLiving and Hotel

BUILDING USE	PARAMETER	PROPOSED DESIGN
Co-Living Block and Amenity Spaces	Mechanical Ventilation with Heat Recovery (MVHR)	Heat Recovery: 87%, SFP: 1.9 W/(l/s)
	Central Air Handling Units (Amenity)	Heat Recovery: 87% SFP: 1.9 W/(l/s)
	Central Air Handling Units (Residential Units)	Heat Recovery: 90% SFP: 0.52 W/(l/s)
	Mechanical Extract	SFP: 0.4 W/(l/s)
Hotel Block and Retail Spaces	Mechanical Ventilation with Heat Recovery (MVHR) (Retail)	Heat Recovery: 85%, SFP: 0.40 W/(l/s)
	Central Air Handling Units (Hotel)	Heat Recovery: 85% SFP: 1.1 W/(l/s)
	Mechanical Extract	SFP: 0.4 W/(l/s)

9.2.2. Lighting

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.

Table 7 Lighting Strategy for the Uxbridge CoLiving and Hotel

ROOM GROUPS	LIGHTING CONTROLS	LAMP EFFICACY (LM/W)
Amenity	Auto On/Dimmed	110
Hotel Bedroom/Bathroom	Manual On/ Auto Off	110
Circulation	Auto On/ Auto Off	120
Kitchen	Manual On/Off	130
Gym	Auto On/ Auto Off	130
Meeting + Office	Auto On/Auto Off	130
Plant	Manual On/Off	140

Reception	Auto On/Dimmed	110
Staff/Office/BOH	Auto On/Auto Off	130
Store	Hotel: Auto On/Auto Off CoLiving: Manual On/Off	140
Co-Living Bedrooms/Bathrooms	Manual On/ Auto Off	110
Public WCs	Auto On/Auto Off	120
Laundry	Auto On/Auto Off	130
Car Park	Auto On/ Auto Off	140
Retail	Auto On/Dimmed	100
Server	Manual On/Off	120
Cycle Store	Auto On/ Auto Off	140

9.2.3. Pipework Insulation

Heating and hot water pipework will be insulated in accordance with the requirements of the Building Regulations. This will serve to minimise heat gains and losses to / from pipework from source to use and improve system efficiency. Careful attention will be paid to insulating joints and knuckles to minimise standing heat losses.

9.2.4. Metering and Controls

- 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 Clean: Supply Energy Efficiently – Connections to District Heating Networks

The following sections discuss the infrastructure and clean energy supply measures that have been considered for the Proposed Development in order to further reduce regulated CO_2 emissions and outline the technologies that will be implemented.

9.3.1. Decentralised Energy Networks

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.

As seen from the picture below (Figure 10), High Steet, Uxbridge is 4.44km away from an existing district heat network. There is also another proposed district heat network just 22.95m away, however, the future date of availability is currently unknown as per Appendix G.

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, see Figure 11, refer to Appendix H to see the complete image.

Figure 10 GLA's Heat Map – Uxbridge CoLiving and Hotel

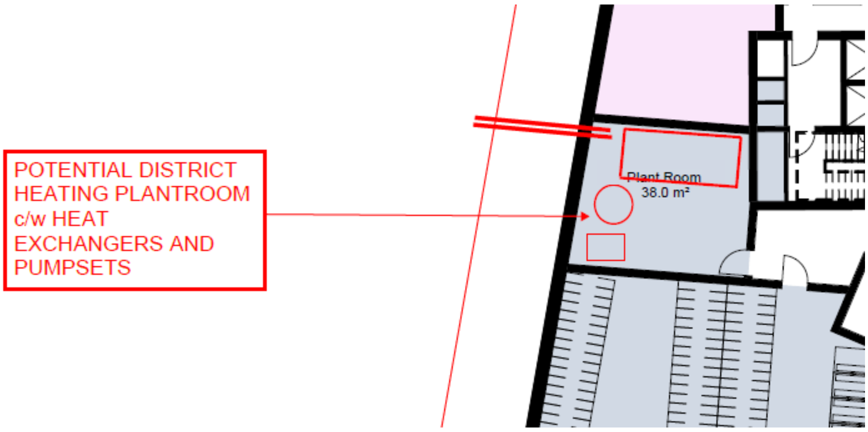


Figure 11 Allowance for District Heating on the Plant Room of Uxbridge CoLiving and Hotel

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.

9.4. Be Green: Renewable and Low Carbon Technologies

The following sections discuss the renewable energy generation measures that have been considered, and those which will be implemented at the Proposed Development.

Renewable technologies harness energy from the environment and convert this to a useful form. Many renewable technologies are available. However, not all these are commercially viable, suitable for the location or appropriate for the Proposed Development.

Technologies considered for the Proposed Development include:
- Photovoltaics
- Air Source Heat Pumps

9.4.1. Photovoltaics Panels

We have sought to maximise the amount of PV on the building. We have undertaken a detailed assessment to determine the optimum PV Configuration.

The Proposed Development has included a PV strategy for the Co-Living block only. In which the PV panels will be located on the roof of the Co-Living block, maximizing the way the total available space in which PV can be allocated. The locations of where these panels will be located are illustrated in the figure below:

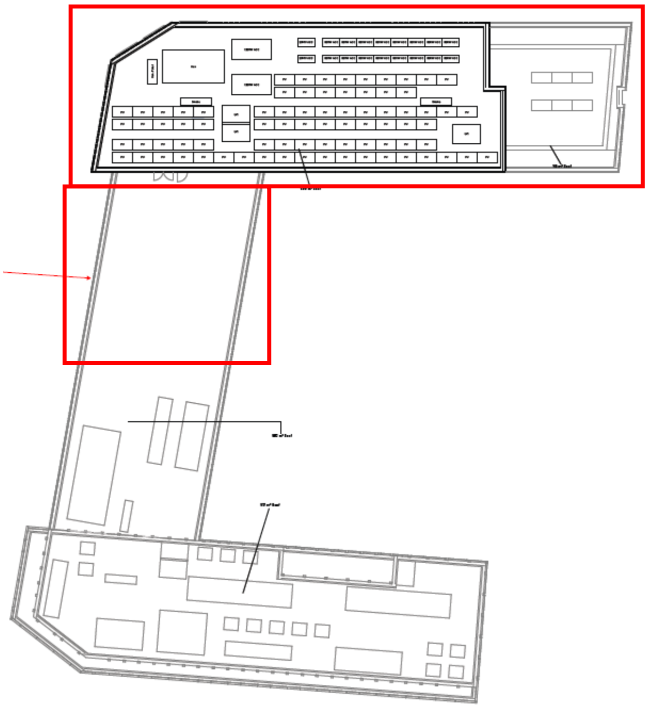


Figure 12 PV location drawing within the CoLiving Block

As seen from the figure above, PV has been maximized on all available spaces of the Co-Living block. Most of the space is proposed to be occupied by these panels and the rest of the available space will be occupied by plant systems as seen on the figure.

Note that the terrace located below the CoLiving development is not roof space, is external amenity space and therefore, can't be used to place PV.

Table 8 PV Strategy for the Uxbridge CoLiving

PV FOR CO-LIVING UXBRIDGE	
KWP	65.2 kWp
TOTAL YIELD	49,744 kWh/year
TOTAL M²	285.2 m²
SHADING %	7.6%

Dynamic simulation modelling has been taken with the London weather file been used to estimate the total generation of the Uxbridge Co-Living Block PV Array. This provides a reliable and benchmarked estimate of the PV Performance.

Based upon the proposed PV solution, a total PV array size of **285.2m²** will be required across the Co-Living roof and the lower-level external terrace. It is estimated that these panels will generate approximately **49,744 kWh/annum.**

9.4.2. Air Source Heat Pumps

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. **These shall be optimised to a mean flow temperature of 43°C to maximise the seasonal efficiency**. Additionally, the heat pump system shall be dedicated to space heating and domestic hot waterOur Proposed ASHP system shall achieve a SCOP of 3.15 or greater.

Peak lopping will be also available through the hybrid units for a short period of time during the day. Cooling along with the rest of the measures will mitigate the risk of overheating

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.

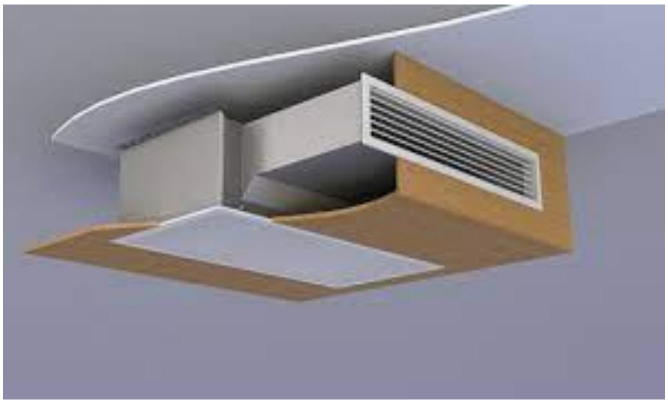


Figure 14 Typical VRF to Fan Coil Units in Hotel Rooms

Space Heating/Cooling

Table 9 Heating/Cooling Strategy for the Uxbridge CoLiving and Hotel

BUILDING USE	SYSTEM	DESCRIPTION & INPUTS
Co-Living Block and Amenity Spaces	Local MVHR VRF (Amenity)	Heat Source: Electricity SCOP: 5.98* SEER: 9.16*
	NV ASHP Rads	Heat Source: Electricity SCOP: 3.13
	Central AHU VRF (Co-Living Amenity)	Heat Source: Electricity SCOP: 5.98* SEER: 9.16*
	Central AHU VRF (Co-Living Apts)	Heat Source: Electricity SCOP: 6.19* SEER: 9.16*
Hotel Block and Retail Spaces	NV ASHP Rads	Heat Source: Electricity SCOP: 3.66
	Central AHU VRF (Hotel)	Heat Source: Electricity SCOP: 5.98* SEER: 9.16*
	Local MVHR VRF (Retail)	Heat Source: Electricity SCOP: 5.98* SEER: 9.16*

*Refer to the Mitsubishi Seasonal Efficiency 2020 Spec attached. The Image below shows mentioned efficiencies as part of the Mitsubishi spec.

R32 HVRF Heat Recovery - High Efficiency

Seasonal Efficiency	Best Possible		Standard		Part L	
	SEER (C)	SCOP	SEER (C)	SCOP	SEER (C)	SCOP
PURY-EM200YNW-A1	6.55	3.76	5.87	3.50	11.37	5.80
PURY-EM250YNW-A1	6.64	3.69	5.62	3.50	10.22	5.42
PURY-EM300YNW-A1 – 2 x main HBC	7.17	3.62	6.01	3.50	10.75	6.30
PURY-EM300YNW-A1 – 1 x main HBC	6.32	3.48	5.29	3.36	9.16	5.98
PURY-EM350YNW-A1 – 2 x main HBC	7.23	3.56	6.01	3.50	10.82	6.14
PURY-EM350YNW-A1 – 1 x main HBC	6.36	3.29	5.29	3.23	8.84	7.65
PURY-EM400YNW-A1	6.61	3.55	5.64	3.50	9.90	6.11
PURY-EM450YNW-A1	6.78	3.55	5.59	3.50	10.17	6.16
PURY-EM500YNW-A1	6.59	3.60	5.12	3.50	9.88	6.19

Figure 15 Mitsubishi ASHP SCoPs and SEERs chosen

Domestic Hot Water

Table 10 Domestic Hot Water Strategy for the Uxbridge CoLiving and Hotel

BUILDING USE	SYSTEM	DESCRIPTION & INPUTS
Co-Living Block and Amenity Spaces	DHW ASHP	Air Source Heat Pumps DHW Efficiency: 1 SCOP: 3.13 Storage: 3945 L Storage losses: 0.0047 (kWh/(L*day)) Secondary Circulation Circulation losses: 8 W/m Pump power: 0.2 kW Loop Length: 130m
Hotel Block and Retail Spaces	DHW ASHP	Air Source Heat Pumps DHW Efficiency: 1 SCOP: 3.66 Storage: 3945 L Storage losses: 0.0047 (kWh/(L*day)) Secondary Circulation Circulation losses: 8 W/m Pump power: 0.2 kW Loop Length: 90m

10. GLA MODELLING RESULTS

The GLA Energy Assessment Guidance (June 2022) sets out the calculation procedure that has to be followed to demonstrate how the GLA emission reduction targets have been met via the implementation of the energy hierarchy.

This latest version of this guidance – released in June 2022 – is based on Part L compliance calculation outputs following the Part L 2021 methodology. This update to the guidance also includes the requirement to report the Energy Use Intensity (EUI) and space heating demand of the development.

The first step in the emission calculation process is establishing the regulated CO_2 emissions baseline, assuming the development complied with Part L 2021 of the Building Regulations.

To determine the CO_2 baseline, applicants are advised to utilise the Target Emission Rate (TER) from the 'Be Green' stage of the energy hierarchy modelling.

CO_2 emissions for the Be Lean, Be Clean and Be Green steps of the energy hierarchy are to utilise the Building Emission Rate (BER) values from versions of the IES model representing the iterative application of the design measures applied across these stages.

The BRUKL output documents for the stages of the energy hierarchy are included in the Appendix 15. According to the GLA's Carbon Emission Reporting spreadsheet, the CO_2 emissions results for the non-residential development (Hotel, Co-Living and Co-Living Amenity spaces) can be found on the table below:

Table 11 GLA's Results on CO2 Emissions for Non-Residential Buildings

	Carbon Dioxide Emissions for non-residential buildings (Tonnes CO2 per annum)	
	Regulated	**Unregulated**
Baseline: Part L 2021 of the Building Regulations Compliant Development	129.0	129.6
After energy demand reduction (be lean)	109.5	129.6
After heat network connection (be clean)	109.5	129.6
After renewable energy (be green)	83.2	129.6

Additionally, the regulated non-residential (Hotel, Co-Living and Co-Living Amenity spaces) CO_2 savings according to the GLA's Carbon Emission Reporting spreadsheet, would be:

Table 12 GLA's Results on Regulated Non-Residential CO2 Savings

	Regulated non-residential carbon dioxide savings	
	(Tonnes CO2 per annum)	**(%)**
Be lean: savings from energy demand reduction	19.5	15%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	26.3	20%
Total Cumulative Savings	**45.8**	**36%**
Annual savings from off-set payment	83.2	-
	(Tonnes CO2)	
Cumulative savings for off-set payment	**2,496**	-
Cash in-lieu contribution (£)	**237,137**	-

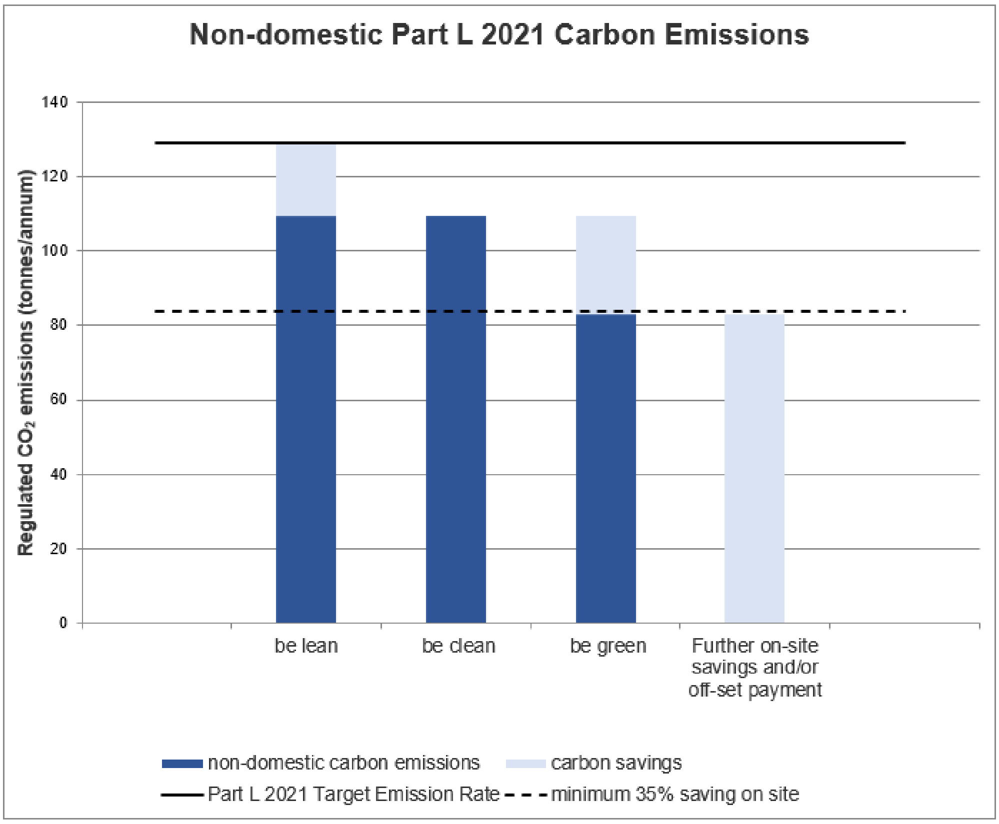


Figure 16 Non-domestic Part L 2021 CO2 Emissions

This illustrates a **carbon saving of 36%** between the Be Green Target Emissions Rate (TER) and the Be Green (as designed) Building Emissions Rate (BER). **As seen on Table 12, Uxbridge CoLiving and Hotel achieves a 15% improvement on CO_2 emissions through passive and active measures implemented and achieves the 35% minimum on site carbon reduction beyond Part L 2021. Therefore, the offset value which will have to be paid into Hillingdon's borough's carbon offset fund is £237,137 in order to make up for any shortfall to achieve net-zero-carbon.**

The introduction of high-efficiency heat pumps and photovoltaic panels for the Co-Living block provides the most significant energy and carbon reduction on site in comparison to the Be Lean assessment, where no photovoltaic panels are included and Air Source Heat Pumps follow the GLA guidance section 7.9, where the heat pumps will have an efficiency of 2.64 for space heating and 2.86 for hot water.

10.1. Be Lean

The results in the tables above demonstrate that the integration of the proposed energy usage reduction measures in this non-domestic scheme results in a regulated CO_2 emission reduction of approximately 15%.

This achieves the minimum GLA planning requirement for the development to achieve a 15% carbon reduction at Be Lean.

10.2. Be Clean

As the proposed development is not using a CHP plant or have a district heat network connection, this stage of the energy hierarchy is considered to have the same results as the ones from the Be Lean stage.

10.3. Be Green

The results from the tables above demonstrate that the integration of PV and ASHP technologies has resulted in further carbon reduction savings. A reduction of 36% is achieved.

10.4. 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, the developer commits to ensuring that the design, construction and execution of the Uxbridge development incorporate provisions for post-construction monitoring. This includes, but is not limited to, 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.

The developer shall ensure that such monitoring mechanisms are implemented in compliance with applicable legal, regulatory, and environmental standards, and shall maintain the monitoring systems in good working order.

11. NON-RESIDENTAL PREDICTED ENERGY USE

The calculation of regulated carbon emissions can be seen in the table below following the outlined methodology of IES results. It is anticipated that the overall EUI including corridors would be less than the target EUI in the table below.

Building type	Energy Use Intensity (kWh/m^2/year)	Space Heating (kWh/m^2/year)
Residential	35	15
School	65	15
Office	55	15
Hotel	55[23]	15
All other non-residential	55	15

Figure 17 GLA's EUI Benchmark

Table 13 GLA's Results on Energy Usage Intensity for Non-Residential Building Type

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)
Hotel	60.61	11.95	55	15	Part L2 – approved DSM & CIBSE TM54	See note below*
Co-Living Block	61.36	10.38	55	15	Part L2 – approved DSM & CIBSE TM54	See note below*

*Hotel and CoLiving overall EUI differs from values in GLA's guidance Table 4 because the EUI calculation accounts for the Retail equipment gains and therefore, increases the overall equipment gains in the development.

12. COST TO OCCUPANTS

Based on the above analysis, we can estimate the energy costs to occupants by calculating the peak output of each ASHP which are used for space heating and hot water generation. A capital cost has been estimated based upon £401.90 per kW for generation.

CoLiving ASHPs

	Heating	Hot Water	Totals
Peak Output (kW)	1478.28	1449.22	-
ASHP CoP	6.19	3.13	
Design Life expectancy (years)	15-20	15-20	
Energy generation, emission savings and simple payback			
Capital Cost*	£594,117	£582,438	£1,176,554
Energy Generated (kWh/annum)	1,718,737	1,591,985	3,310,721
System electrical energy consumption (kW/annum)	4,577,100		4,577,100
Maintenance per annum**	£8,912	£8,737	£17,648
ASHP running costs***	£62,086	£113,728	£175,813
Offset running cost (Gas fired boiler) ****	£99,144	£91,832	£190,976
Annual running cost saving	£37,058	-£21,895	£15,163
Net Annual Cost	£70,997	£122,464	£193,462
Simple payback (yrs)	17.5	4.0	21.5

*Based on a cost rate of £401.90/kW output
**Maintenance costs based on an annual service of £200
***ASHPs running costs: Gas Tariff (£0.0548/kWh) and Electricity Tariff (£0.2236/kWh)
****Typical boiler CoP (%): 95%
******Fuel emissions factor: Natural gas - 0.21 kgCO2/kWh Grid displaced electricity – 0.146 kgCO2/kWh

The ASHP technology provides an estimated ASHP running costs of £175,813, an annual saving of £15,163 and a payback time of 21.5 years.

Hotel ASHPs

	Heating	Hot Water	Totals
Peak Output (kW)	750.6	665.14	-
ASHP CoP	5.98	3.66	
Design Life expectancy (years)	15-20	15-20	
Energy generation, emission savings and simple payback			
Capital Cost*	£301,664	£267,318	£568,982
Energy Generated (kWh/annum)	1,718,737	1,591,985	3,310,721
System electrical energy consumption (kW/annum)	2,165,822		2,165,822
Maintenance per annum**	£4,525	£4,010	£8,535
ASHP running costs***	£64,266	£97,259	£161,525
Offset running cost (Gas fired boiler) ****	£99,144	£91,832	£190,976
Annual running cost saving	£34,878	-£5,427	£29,452
Net Annual Cost	£68,791	£101,269	£170,059
Simple payback (yrs)	8.9	2.5	11.4

*Based on a cost rate of £401.90/kW output
**Maintenance costs based on an annual service of £200
***ASHPs running costs: Gas Tariff (£0.0548/kWh) and Electricity Tariff (£0.2236/kWh)
****Typical boiler CoP (%): 95%
******Fuel emissions factor: Natural gas - 0.21 kgCO2/kWh Grid displaced electricity – 0.146 kgCO2/kWh

The ASHP technology provides an estimated ASHP running costs of £161,525, an annual saving of £29,452 and a payback time of 11.4 years.

13. 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 nighttime. Due to the internal gains associated with required 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. Refer to the results below for further information.

Table 14 Results from the Part O for the CoLiving Development

WEATHER FILES	SPACE	OVERHEATING COMPLIANCE
London_LHR_DSY1_2020High50	CoLiving Bedrooms and Amenity Spaces	43 / 43
London_LHR_DSY2_2020High50		43 / 43
London_LHR_DSY3_2020High50		43 / 43

The Table 15 below presents those results of the notional cooling demand for the Hotel and the CoLiving, is better than the actual cooling demand of both building types. This is due to the improved heat retention obtained from the betterment in U-Values, and the increased solar gain obtained from the worse G-values, between the actual and notional buildings.

Table 4 of this document states the U-Values used and the Energy Strategy Report of this project details the reduced heat loss through the building envelope and optimized solar heat gain. This leads to a greater energy efficiency, lower heating requirements, and a more comfortable indoor environment, especially in a temperature climate like London.

Table 15 Total Cooling Demand for Uxbridge CoLiving and Hotel.

Building Type		Area weighted average non-residential cooling demand (MJ/m2)	Total area weighted non-residential cooling demand (MJ/yr)
Hotel	Actual	93.10	665638.43
	Notional	47.90	342462.32
CoLiving	Actual	29.30	427410.79
	Notional	18.89	275523.59

14. 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 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 ensures less energy was required to maintain comfortable conditions inside the building as well as the building performing better as an insulator.

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 and 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 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 reduces 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 CoLiving 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's methodology, this report has shown a total reduction of 36% in CO_2 emissions for the Non-Residential developments. Final figures of CO_2 reduction can be seen on the table below. Site wide reductions cover a 36% reduction in annual savings as well as 2,496.2 tonnes of CO2 as carbon savings offset.

Table 16 GLA's Summarized Results on Regulated Non-Residential CO2 Savings

	Total regulated emissions (Tonnes CO2 / year)	**CO2 savings (Tonnes CO2 / year)**	**Percentage savings (%)**
Part L 2021 baseline	129.0		
Be lean	109.5	19.5	15%
Be clean	109.5	0.0	0%
Be green	83.2	26.3	20%
Total Savings	-	45.8	36%
	-	**CO2 savings off-set (Tonnes CO2)**	-
Off-set	-	**2,496.2**	-

15. APPENDICES

Appendix A. Co Living Development Be Green (BRUKL Results)

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

CoLiving Part L GREEN As designed

Date: Fri Oct 25 14:22:59 2024

Administrative information

Building Details

Address:

Certifier details

Name:

Telephone number:

Address: , ,

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.26

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.26

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

Foundation area [m²]: 1056.97

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

Target CO_2 emission rate (TER), $kgCO_2/m^2annum$	3.82	
Building CO_2 emission rate (BER), $kgCO_2/m^2annum$	1.92	
Target primary energy rate (TPER), kWh_{PE}/m^2annum	41.15	
Building primary energy rate (BPER), kWh_{PE}/m^2annum	20.37	
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	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	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	SP00001D:Surf[16]
Windows** and roof windows	1.6	1.4	1.4	SP00001D:Surf[1]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	1.6	1.6	LM000054:Surf[0]
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

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

RIDGE

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m²]	14587.9	14587.9
External area [m²]	12460.9	12460.9
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	3	3
Average conductance [W/K]	4078.33	4970.29
Average U-value [W/m²K]	0.33	0.4
Alpha value* [%]	25.26	10

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

Building Use

% Area	Building Type
	Retail/Financial and Professional Services
	Restaurants and Cafes/Drinking Establishments/Takeaways
4	**Offices and Workshop Businesses**
	General Industrial and Special Industrial Groups
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
91	**Residential Institutions: Universities and Colleges**
	Secure Residential Institutions
2	**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
3	**Others: Car Parks 24 hrs**
	Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	3.19	6.65
Cooling	1.36	1.13
Auxiliary	2.07	7.22
Lighting	5.72	7.27
Hot water	4.77	5.45
Equipment*	39.82	39.82
TOTAL**	**17.11**	**27.71**

* 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	3.41	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*3.41*	*0*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	88.39	85.37
Primary energy [kWh_{PE}/m²]	20.37	41.15
Total emissions [kg/m²]	1.92	3.82

Appendix B. Co Living Development Be Lean (BRUKL Results)

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

CoLiving Part L Lean

As designed

Date: Thu Oct 24 12:09:28 2024

Administrative information

Building Details

Address:

Certifier details

Name:

Telephone number:

Address: , ,

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.26

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.26

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

Foundation area [m²]: 1056.97

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

Target CO_2 emission rate (TER), $kgCO_2/m^2annum$	3.82	
Building CO_2 emission rate (BER), $kgCO_2/m^2annum$	2.88	
Target primary energy rate (TPER), kWh_{PE}/m^2annum	41.09	
Building primary energy rate (BPER), kWh_{PE}/m^2annum	30.8	
Do the building's emission and primary energy rates exceed the targets?	BER =< TER	BPER =< TPER

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

Fabric element	$U_{a-Limit}$	U_{a-Calc}	U_{i-Calc}	First surface with maximum value
Walls*	0.26	0.15	0.15	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	SP00001D:Surf[16]
Windows** and roof windows	1.6	1.4	1.4	SP00001D:Surf[1]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	1.6	1.6	LM000054:Surf[0]
Vehicle access & similar large doors	1.3	-	-	No vehicle access doors in building
High usage entrance doors	3	-	-	No high usage entrance doors in building

$U_{a-Limit}$ = Limiting area-weighted average U-values [W/(m²K)]

U_{a-Calc} = Calculated area-weighted average U-values [W/(m²K)]

U_{i-Calc} = Calculated maximum individual element U-values [W/(m²K)]

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

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

*** Values for rooflights refer to the horizontal position.

^ For fire doors, limiting U-value is 1.8 W/m²K

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

Air permeability	Limiting standard	This building
$m^3/(h.m^2)$ at 50 Pa	8	3

RIDGE

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m²]	14587.9	14587.9
External area [m²]	12460.9	12460.9
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	3	3
Average conductance [W/K]	4078.33	4970.29
Average U-value [W/m²K]	0.33	0.4
Alpha value* [%]	25.26	10

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

Building Use

% Area	Building Type
	Retail/Financial and Professional Services
	Restaurants and Cafes/Drinking Establishments/Takeaways
4	**Offices and Workshop Businesses**
	General Industrial and Special Industrial Groups
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
91	**Residential Institutions: Universities and Colleges**
	Secure Residential Institutions
2	**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
3	**Others: Car Parks 24 hrs**
	Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	6.45	6.69
Cooling	1.22	1.05
Auxiliary	2.07	7.21
Lighting	5.72	7.27
Hot water	5.22	5.45
Equipment*	39.82	39.82
TOTAL**	**20.68**	**27.66**

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

Energy Production by Technology [kWh/m²]

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

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	87.05	84.41
Primary energy [kWh_{PE}/m²]	30.8	41.09
Total emissions [kg/m²]	2.88	3.82

Appendix C. Co Living Development Be Clean (BRUKL Results)

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

CoLiving Part L Clean

As designed

Date: Fri Nov 01 16:44:59 2024

Administrative information

Building Details

Address:

Certifier details

Name:

Telephone number:

Address: , ,

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.26

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.26

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

Foundation area [m²]: 1056.97

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

Target CO_2 emission rate (TER), $kgCO_2/m^2annum$	3.82	
Building CO_2 emission rate (BER), $kgCO_2/m^2annum$	2.88	
Target primary energy rate (TPER), kWh_{PE}/m^2annum	41.09	
Building primary energy rate (BPER), kWh_{PE}/m^2annum	30.8	
Do the building's emission and primary energy rates exceed the targets?	BER =< TER	BPER =< TPER

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

Fabric element	$U_{a-Limit}$	U_{a-Calc}	U_{i-Calc}	First surface with maximum value
Walls*	0.26	0.15	0.15	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	SP00001D:Surf[16]
Windows** and roof windows	1.6	1.4	1.4	SP00001D:Surf[1]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	1.6	1.6	LM000054:Surf[0]
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

RIDGE

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m²]	14587.9	14587.9
External area [m²]	12460.9	12460.9
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	3	3
Average conductance [W/K]	4078.33	4970.29
Average U-value [W/m²K]	0.33	0.4
Alpha value* [%]	25.26	10

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

Building Use

% Area	Building Type
	Retail/Financial and Professional Services
	Restaurants and Cafes/Drinking Establishments/Takeaways
4	**Offices and Workshop Businesses**
	General Industrial and Special Industrial Groups
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
91	**Residential Institutions: Universities and Colleges**
	Secure Residential Institutions
2	**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
3	**Others: Car Parks 24 hrs**
	Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	6.45	6.69
Cooling	1.22	1.05
Auxiliary	2.07	7.21
Lighting	5.72	7.27
Hot water	5.22	5.45
Equipment*	39.82	39.82
TOTAL**	**20.68**	**27.66**

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

Energy Production by Technology [kWh/m²]

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

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	87.05	84.41
Primary energy [kWh_{PE}/m²]	30.8	41.09
Total emissions [kg/m²]	2.88	3.82

Appendix D. Hotel Development Be Green (BRUKL Results)

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

Hotel Part L GREEN

As designed

Date: Thu Oct 24 12:43:46 2024

Administrative information

Building Details

Address:

Certifier details

Name:

Telephone number:

Address: , ,

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.26

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.26

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

Foundation area [m²]: 634.83

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	10.25	
Building CO_2 emission rate (BER), $kgCO_2/m^2$annum	7.72	
Target primary energy rate (TPER), kWh_{PE}/m^2annum	111.53	
Building primary energy rate (BPER), kWh_{PE}/m^2annum	84.28	
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	BS000022:Surf[1]
Windows** and roof windows	1.6	1.4	1.4	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]	7149.9	7149.9
External area [m²]	6052.1	6052.1
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	3	3
Average conductance [W/K]	2886.97	2735.32
Average U-value [W/m²K]	0.48	0.45
Alpha value* [%]	25.29	10

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

Building Use

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

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	2.66	4.54
Cooling	4.19	2.87
Auxiliary	2.84	10.3
Lighting	9.66	11.16
Hot water	37.83	46.66
Equipment*	48.18	48.18
TOTAL**	**57.18**	**75.52**

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

Energy Production by Technology [kWh/m²]

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

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	136.79	93.31
Primary energy [kWh_{PE}/m^2]	84.28	111.53
Total emissions [kg/m²]	7.72	10.25

Appendix E. Hotel Development Be Lean (BRUKL Results)

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

Hotel Part L Lean

As designed

Date: Thu Oct 24 12:19:41 2024

Administrative information

Building Details

Address:

Certifier details

Name:

Telephone number:

Address: , ,

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.26

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.26

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

Foundation area [m²]: 634.83

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

Target CO_2 emission rate (TER), $kgCO_2/m^2annum$	10.25	
Building CO_2 emission rate (BER), $kgCO_2/m^2annum$	9.44	
Target primary energy rate (TPER), kWh_{PE}/m^2annum	111.59	
Building primary energy rate (BPER), kWh_{PE}/m^2annum	102.78	
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	BS000022:Surf[1]
Windows** and roof windows	1.6	1.4	1.4	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

RIDGE

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m²]	7149.9	7149.9
External area [m²]	6052.1	6052.1
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	3	3
Average conductance [W/K]	2886.97	2735.32
Average U-value [W/m²K]	0.48	0.45
Alpha value* [%]	25.29	10

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

Building Use

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

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	4.65	4.47
Cooling	4.12	2.99
Auxiliary	2.84	10.3
Lighting	9.6	11.16
Hot water	48.41	46.66
Equipment*	48.18	48.18
TOTAL**	**69.62**	**75.57**

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

Energy Production by Technology [kWh/m²]

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

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	139.03	94.56
Primary energy [kWh_{PE}/m²]	102.78	111.59
Total emissions [kg/m²]	9.44	10.25

Appendix F. Hotel Development Be Clean (BRUKL Results)

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

Hotel Part L Clean

As designed

Date: Fri Nov 01 16:33:27 2024

Administrative information

Building Details

Address:

Certifier details

Name:

Telephone number:

Address: , ,

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.26

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.26

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

Foundation area [m²]: 634.83

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

Target CO_2 emission rate (TER), $kgCO_2/m^2annum$	10.25	
Building CO_2 emission rate (BER), $kgCO_2/m^2annum$	9.44	
Target primary energy rate (TPER), kWh_{PE}/m^2annum	111.59	
Building primary energy rate (BPER), kWh_{PE}/m^2annum	102.78	
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	BS000022:Surf[1]
Windows** and roof windows	1.6	1.4	1.4	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]	7149.9	7149.9
External area [m²]	6052.1	6052.1
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	3	3
Average conductance [W/K]	2886.97	2735.32
Average U-value [W/m²K]	0.48	0.45
Alpha value* [%]	25.29	10

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

Building Use

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

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	4.65	4.47
Cooling	4.12	2.99
Auxiliary	2.84	10.3
Lighting	9.6	11.16
Hot water	48.41	46.66
Equipment*	48.18	48.18
TOTAL**	**69.62**	**75.57**

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

Energy Production by Technology [kWh/m²]

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

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	139.03	94.56
Primary energy [kWh_{PE}/m²]	102.78	111.59
Total emissions [kg/m²]	9.44	10.25

Appendix G. Evidence of no district heating

Reply from Metropolitan - 27-SEP-24

Good Evening Mr Daniels,

Thank you for coming back to me.

Unfortunately, there is no way of retro fitting the district heating system. It can only done when in the construction phase.

As a result, we will not be able to extend Metropolitan's heating process to your site.

If you have any further questions or queries, please do not hesitate to contact us on 02920 100346 between 8am and 8pm Monday to Friday and 9am to 1pm Saturday or send us a contact form by clicking this link https://www.metropolitanlocal.co.uk/contact-us/

Kind Regards,

Gill

Metropolitan Customer Service team

Reply | Reply All | Forward

Peter Daniels
To Monica Zambrano
Cc Osariemen Erhahon; Ben Pritchard
Thu 24/10/2024 14:15

District heating.docx
63 KB

Hi Monica,

1. The lower roof is all external amenity space, apart from the plant indicated in the bottom corner so it can't be used.
2. We have had no response from the local authority, but we did receive a response from Metropolitan and local district heating operator (see attached).
3. See earlier email.

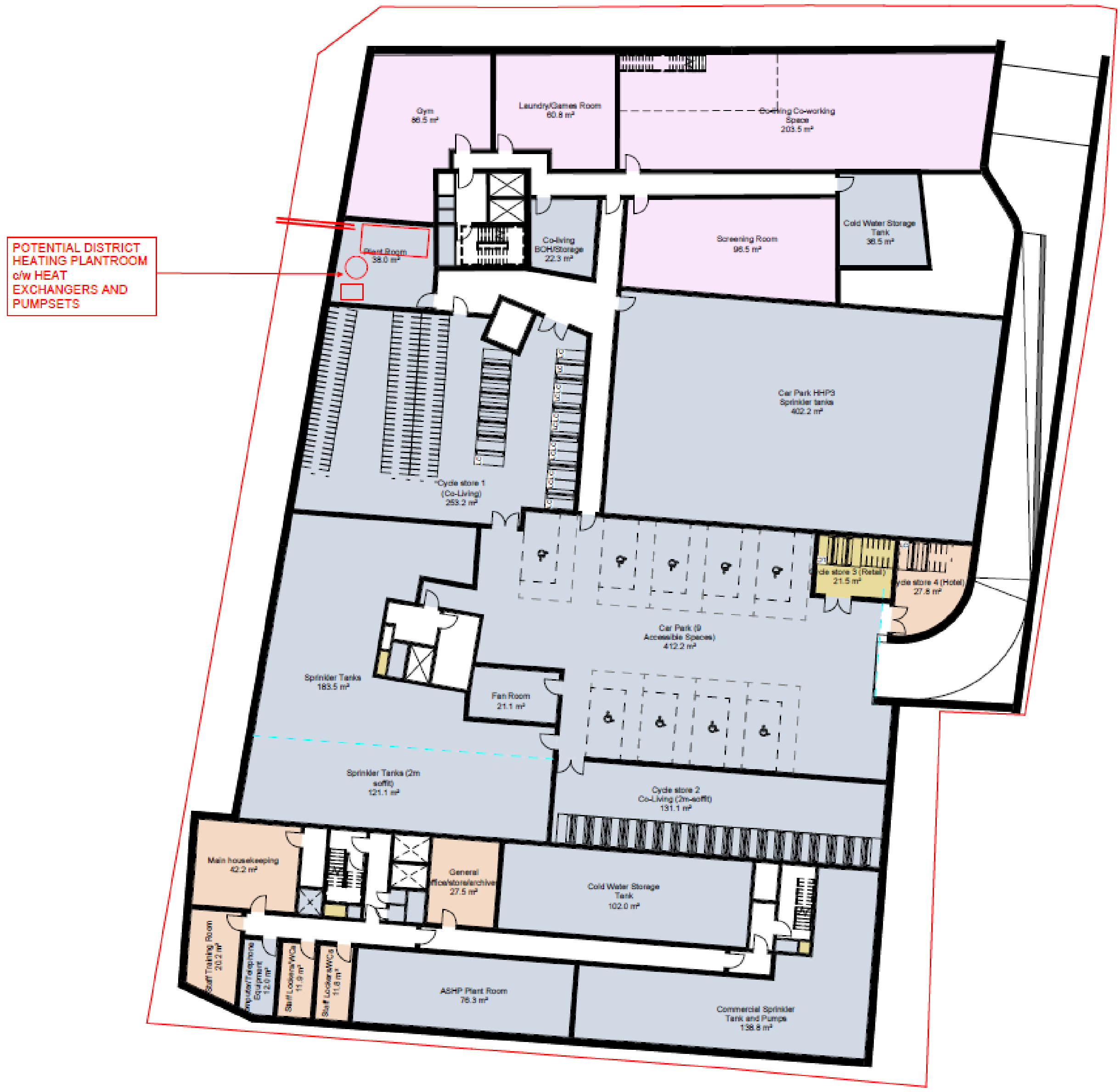
Kind regards

Peter

Peter Daniels | Senior Associate

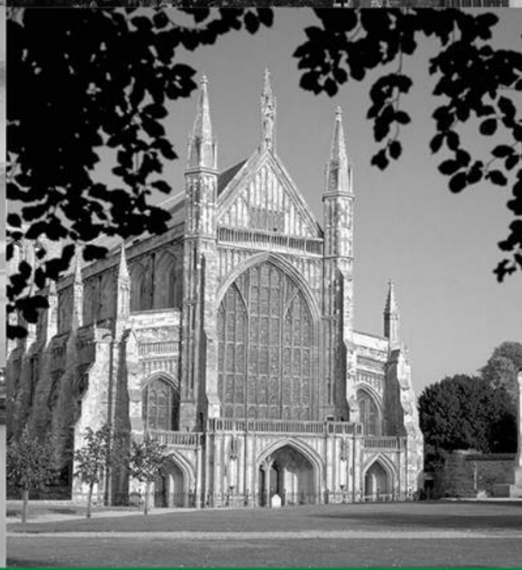
RIDGE

Appendix H. Plant room drawing: Allowance for future district heating connections







RIDGE

www.ridge.co.uk