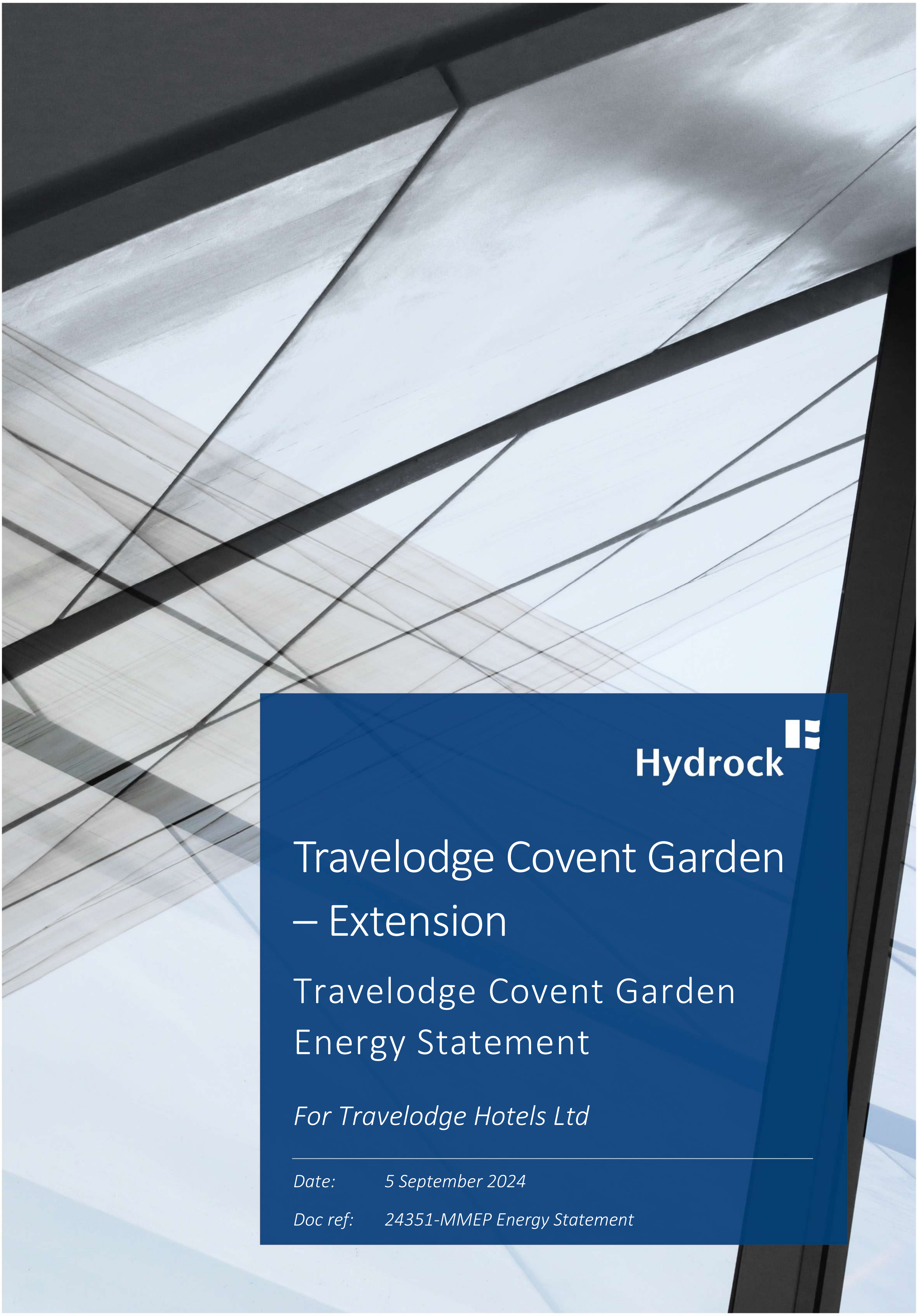

Hydrock

Travelodge Covent Garden – Extension

Travelodge Covent Garden Energy Statement

For Travelodge Hotels Ltd

Date: *5 September 2024*

Doc ref: *24351-MMEP Energy Statement*

Hydrock

DOCUMENT CONTROL SHEET

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Appendices

1. EXECUTIVE SUMMARY

1.1 General

This energy statement has been prepared for the proposed Travelodge Covent Garden, London, to address the requirements of 'The London Plan: Spatial Development Strategy for Greater London' (March 2021) and the 'Greater London Authority guidance on preparing energy assessments' (June 2022).

In accordance with 'Greater London Authority guidance on preparing energy assessments' (June 2022), the emission figures use the 'Approved Document L, Conservation of fuel and power, Volume 2: Buildings other than dwellings, 2021 edition incorporating 2023 amendments' to assess performance against the London Plan policies.

The proposed development has been designed to minimise operational carbon emissions. Savings are delivered through following the mayor's energy hierarchy which identifies three stages of an energy strategy. The carbon factors used to calculate regulated and unregulated emissions have been taken from SAP 10.2.

1.2 Use Less Energy via Energy Efficiency and Demand Reduction Measures (BE LEAN)

The following energy efficiency and demand reduction measures will be adopted:

- » Improve U-values of the external envelope.
- » Improve U-value of glazing.
- » Improve air permeability of the envelope.
- » Improved efficiency of the space heating, cooling and hot water.
- » Use of energy efficient lighting.
- » Use of intelligent lighting controls.
- » Use of variable speed pumps, fans and drives to match supply and demand.
- » Use of heat recovery to mechanical ventilation systems.

Following the incorporation of energy efficiency measures, the BER emissions of the development are 16.3 tonnes CO_2/annum, an improvement of 18.3% above the Baseline Building Regulations TER of 20.0 tonnes CO_2/annum.

1.3 Supply Energy Efficiently via Decentralised Energy (BE CLEAN)

Decentralised energy is an efficient means of generating and distributing heat and power. A combined heat and power (CHP) system has been considered for this development. CHP is recognised under 'SI3 Energy Infrastructure' of the London Plan as a compliant renewable energy technology.

It is acknowledged the domestic hot water demand could provide a suitable base load for CHP incorporation within the building. The methodology of investigating CHP has been followed as per the Local Authority and GLA guidance. The guidance states to investigate Lean, Clean and Green options, as a result of our modelling greater savings have been deemed achievable through the use of air source heat pumps therefore CHP has been discounted.

Even though the proposed CHP unit would contribute towards the domestic hot water load for the proposed hotel, it is decided that greater CO_2 emission savings will be achievable through the use of air source heat pumps to generate hot water for the development.

1.4 Renewable Energy Technologies (BE GREEN)

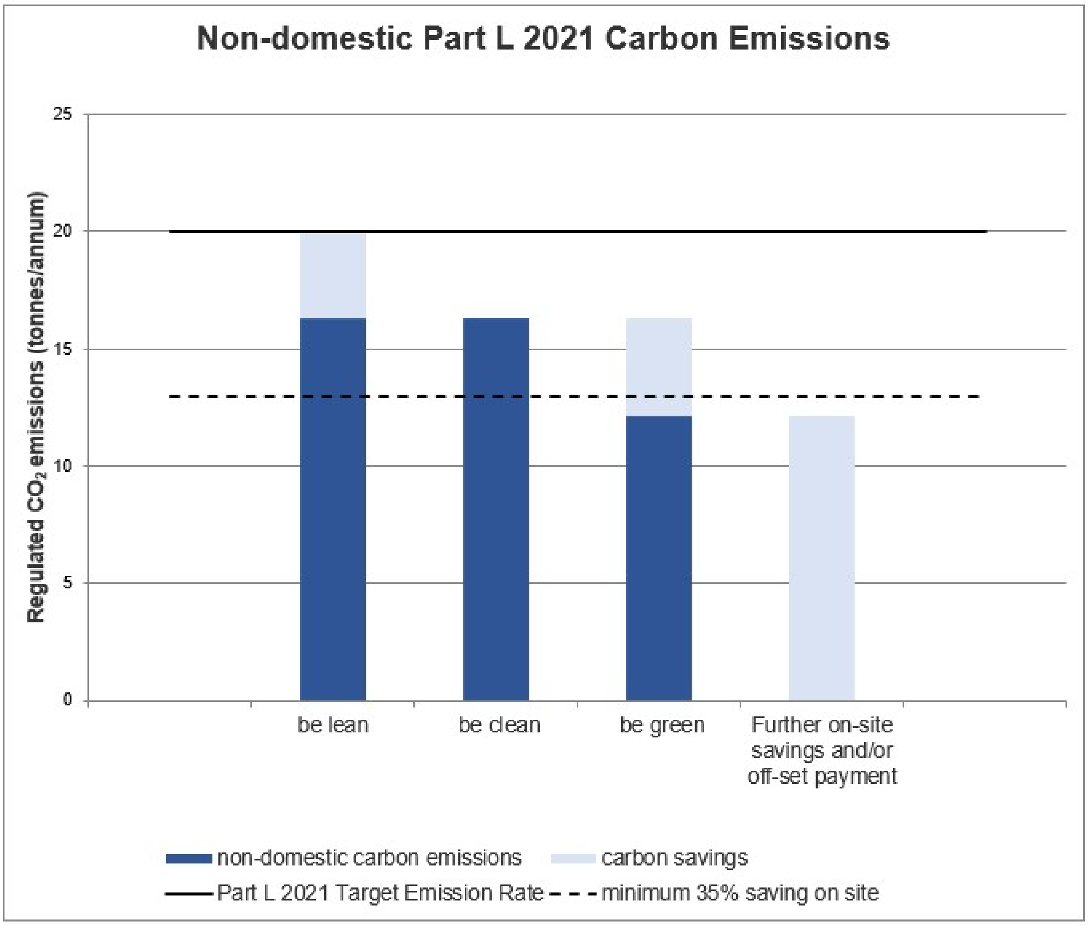
Air source heat pumps will be incorporated into the proposed hotel scheme as a source of low carbon energy to meet a significant proportion of the space heating and cooling, and hot water demand.

Following the incorporation of low and zero carbon technologies, the BER emissions of the development are 12.2 tonnesCO_2/annum, an improvement of 39% above the Baseline Building Regulations TER of 20.0 tonnes CO_2/annum.

From the calculations carried out a total carbon offset payment of £34,652.00 is required.

1.5 Summary of CO_2 Savings

The following chart summarises the carbon dioxide savings predicted for this project.



1.6 Predicted Achievements Compared to Targets

The total predicted CO_2 emissions for the development have been reduced by 39% (7.8 tonnes CO_2/annum) over the Baseline Building Regulations TER of 20.0 tonnes CO_2/annum.

The total predicted CO_2 emissions achieve the minimum 35.00% improvement over Building Regulations target of 13.0 tonnes to comply with The London Plan: Spatial Development Strategy for Greater London (March 2021) and the ‘Greater London Authority guidance on preparing energy assessments’ (June 2022).

2. INTRODUCTION

2.1 General

This energy statement has been prepared for the proposed extension of the Travelodge Covent Garden, London.

This statement provides an assessment of the energy consumption and associated carbon dioxide emissions for the proposed development utilising predicted consumption data and identifies the target amount of energy generation and carbon savings to be provided from decentralised energy and on-site renewable energy generation technology.

2.2 Targets

In order to comply with The London Plan: Spatial Development Strategy for Greater London (March 2021) and the 'Greater London Authority guidance on preparing energy assessments' (June 2022) an on-site reduction of at least 35.0% beyond the baseline of Part L of the current Building Regulations is required.

The calculated Baseline Building Regulations target CO_2 emissions is 20.0 tonnes of CO_2 per annum. Therefore, the minimum 35.00% target represents a target CO_2 emission saving of 7.0 tonnes, a target CO_2 emission of 13.0 tonnes of CO_2 per annum. The carbon factors used to calculate regulated and unregulated emissions have been taken from SAP 10.2.

3. POLICY REVIEW

3.1 National Planning Policy Framework

The National Planning Policy Framework (December 2023) sets out the Government's planning policies for England and how these should be applied. It provides a framework within which locally-prepared plans for housing and other developments can be produced. It sets out the Government's requirements for the planning system only to the extent that it is relevant, proportionate and necessary to do so. It provides a framework within which local people and their accountable councils can produce their own local and neighbourhood plans and as a material consideration in the determination of planning applications.

Within this context National Guidance says that:

a. The purpose of the planning system is to contribute towards achieving sustainable development, set out in chapter 2.
b. Sustainable development comprises of economic, social and environmental dimensions. These are interdependent and need to be pursued in mutually supportive ways, set out in chapter 2:
    - Economic - contributing to building a strong, responsive and competitive economy.
    - Social - supporting strong, vibrant and healthy communities.
    - Environmental - contributing to protecting and enhancing the natural, built and historic environment.
c. These objectives are not criteria against which every decision can or should be judged. Plans and decisions must take into account local circumstances to ensure sustainable development is responded to appropriately in different areas.
d. At the heart of the National Planning Policy Framework is a presumption in favour of sustainable development (paragraph 11), which should be seen as a golden thread running through both plan-making and decision-taking. For decision-making this means that:
    - Approving development proposals that accord with the development plan without delay; and
    - Where the development plan is absent, silent or relevant policies are out-of-date, granting permission unless:
        - any adverse impacts of doing so would significantly and demonstrably outweigh the benefits, when assessed against the policies in this Framework taken as a whole; or
        - specific policies in this Framework indicate development should be restricted.

Planning policies should follow the presumption in favour of sustainable development approach so development which is sustainable can be approved without delay. All plans should set clear policies that will guide how the presumption should be applied locally.

3.2 Regional Energy Policy

3.2.1 The London Plan (March 2021)

The following sections of the 'The London Plan: The Spatial Development Strategy for Greater London' (March 2021) are specifically pertinent to the production of this energy statement.

Policy SI2 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.

a. 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.

b. 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.

a. 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.

b. 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.

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

Policy SI3 Energy Infrastructure

a. Boroughs and developers should engage at an early stage with relevant energy companies and bodies to establish the future energy requirements and infrastructure arising from large-scale development proposals such as Opportunity Areas, Town Centres, other growth areas or clusters of significant new development.

b. Energy masterplans should be developed for large-scale development locations which establish the most effective energy supply options. Energy masterplans should identify:

1. major heat loads (including anchor heat loads, with particular reference to sites such as universities, hospitals and social housing)
2. heat loads from existing buildings that can be connected to future phases of a heat network
3. major heat supply plant including opportunities to utilise heat from energy from waste plants
4. secondary heat sources
5. opportunities for low temperature heat networks
6. possible land for energy centres and/or energy storage
7. possible heating and cooling network routes
8. opportunities for futureproofing utility infrastructure networks to minimise the impact from road works
9. infrastructure and land requirements for electricity and gas supplies
10. implementation options for delivering feasible projects, considering issues of procurement, funding and risk, and the role of the public sector.
11. opportunities to maximise renewable electricity generation and incorporate demand-side response measures.

a. Development Plans should:
   1. identify the need for, and suitable sites for, any necessary energy infrastructure requirements including upgrades to existing infrastructure
   2. identify existing heating and cooling networks and opportunities for expanding existing networks and establishing new networks.

a. Major development proposals within Heat Network Priority Areas should have a communal low-temperature heating system
   1. the heat source for the communal heating system should be selected in accordance with the following heating hierarchy:
      a. connect to local existing or planned heat networks
      b. use zero-emission or local secondary heat sources (in conjunction with heat pump, if required
      c. use low-emission combined heat and power (CHP) (only where there is a case for CHP to enable the delivery of an area-wide heat network)
      d. use ultra-low NOx gas boilers.
   2. CHP and ultra-low NOx gas boiler communal or district heating systems should be designed to ensure that they meet the requirements of policy SI1 (A).
   3. Where a heat network is planned but not yet in existence the development should be designed for connection at a later date.

a. Heat networks should achieve good practice design and specification standards for primary, secondary and tertiary systems comparable to those set out in the CIBSE/ADE Code of Practice CP1 or equivalent.

Policy SI4 Managing Heat Risk

a. Development proposals should minimise adverse impacts on of 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.

4. THE BUILDING REGULATIONS APPROVED DOCUMENT L (2021)

The development will comply with building regulation Part L2 2021.

Approved Document Part L Conservation of fuel and power Volume 2: Buildings other than dwellings (2021 edition).

4.1 Section 1: Calculating the target primary energy rate and target emission rate *(Regulations 24, 25, 25B, 26, 26C, 27 and 27C)*

A new building must be built to a minimum standard of total energy performance.

4.2 Section 2: Calculating the building primary energy rate and building emission rate

The building primary energy rate and the building emission rate must be calculated before work starts, using design values. Again, when work is complete, using figures for the building was constructed, and incorporating any changes that have been made during construction to the list of specifications, and the measured air permeability.

4.3 Section 3: Consideration of high-efficiency alternative systems *(Regulation 25A)*

The person undertaking the building work must analyse the technical, environmental and economic feasibility of using high-efficiency alternative systems in the building design. This analysis should be considered when designing the building.

4.4 Section 4: Limiting heat gains and losses *(Requirement L1(a) of Schedule 1)*

U-values should be assessed using the methods and conventions set out in the Building Research Establishment's BR 443.

4.5 Section 5: Minimum building services efficiencies and controls – general guidance *(Requirements L1(b)(i), (ii) and L2 of Schedule 1)*

For each new fixed building service in a new or existing building, the efficiency of the service should be no lower than the value set out in Section 6. If a proposed service is not covered in Section 6, the service should be shown to be no less efficient than a comparable service that is covered.

4.6 Section 6: System specific guidance

This section sets out minimum Building Regulations standards for fixed building services and other systems.

4.7 Section 7: Air permeability and pressure testing *(Regulation 43)*

There is a minimum standard for air permeability of a new building, and each building must provide evidence to show this.

4.8 Section 8: Commissioning
(Regulations 44 and 44ZA and requirements L1(b)(iii) and L2(b) of Schedule 1)

Fixed building services must be commissioned to ensure that they use no more fuel and power than is reasonable in the circumstances. On-site electricity generation systems must be commissioned to ensure that they produce as much electricity as is reasonable in the circumstances. The commissioning process should involve testing and adjusting the fixed building services and on-site electricity generation as necessary and in accordance with the manufacturer's instructions.

4.9 Section 9: Providing information
(Regulations 40 and 40A)

For a new building, operating and maintenance instructions should be given to the owner of the building in a building log book. The log book should follow the guidance in CIBSE's TM31.

4.10 Section 10: New elements in existing buildings, including extensions
(Regulation 23(2) and requirement L1(a) of Schedule 1)

This section provides guidance for new elements in existing buildings.

4.11 Section 11: Work to elements in existing buildings
(Regulations 6, 22 and 23(1) and requirement L1(a) of Schedule 1)

This section provides guidance for work to fabric elements in existing buildings.

5. ENERGY EFFICIENCY AND DEMAND REDUCTION MEASURES (BE LEAN)

5.1 General

Prioritising a reduction in overall energy demand is the most effective way in which to minimise environmental impacts associated with energy use. The use of efficient technologies and renewables to supply the remaining load results in lower greenhouse gas emissions as compared with the use of conventional alternatives.

Cost effective measures can be adopted to reduce energy demand without making a significant impact on the design, appearance or character of the building. It is intended to implement energy efficiency measures to improve on the minimum standards required in Part L of the Building Regulations.

5.2 Proposed Development

The hotel operator has the following standard services strategy which is detailed within their Mechanical, Electrical and Public Health Services Standard Specification:

- Hot water via all electric air source heat pumps complete with buffer vessel and interface with the existing LPHW boiler plant
- Mechanically ventilated bedrooms heated and cooled via a 3-Pipe VRF Samsung heat pump system
- Reception and office heating and cooling via a 3-Pipe VRF Samsung heat pump system
- Linen rooms and toilets to have mechanical extract ventilation.

The following specific measures are proposed to achieve an energy demand reduction at the development:

- Improve U-values of the external envelope.
- Improve U-value of glazing.
- Improve air permeability of building envelope
- Improved efficiency of the space heating, cooling and hot water.
- Use of energy efficient lighting.
- Use of intelligent lighting controls.
- Use of variable speed pumps, fans and drives to match supply and demand.
- Improve efficiency of heat recovery to mechanical ventilation systems.

5.2.1 Drawings

The energy model has been developed based on the 'JWA Architect Limited' drawings as submitted with the planning application.

5.3 Building Regulations Methodology

5.3.1 General

The development has been modelled using the computer modelling package IES VE 2022 Part L2A 2021 Version 7.0.15 interfaced to SBEM Version 6.1.b.0.

The geographically nearest CIBSE Test Reference Year (TRY) has been used which is London.

The energy model has been produced to predict the actual energy consumption of the building. When a simulation is performed, a 'notional' building is created. This building has the same shape and patterns of use as the actual designed building, but makes standard assumptions regarding the heating, cooling and ventilation plant, lighting and building fabric. The energy consumption of this building is predicted using the software.

5.3.2 Non-Regulated Energy

The London Plan requires the unregulated energy demand and carbon emissions from the development to be shown.

The Part L 2021 software includes an indicative calculation for 'Equipment' within a building based upon historical data for similar buildings and uses. This includes the small power and process energy not taken into account within the Part L model.

The equipment energy predicted for the proposed development utilising the software 28.78 kWh/m^2 (58.34 MWh/annum), an equivalent of 7.93 tonnesCO_2/annum.

5.4 Improve U-values of the External Envelope

In order to reduce overall energy demand the following improved U-values will be targeted.

- External walls = 0.26W/m^{2}K.
- Roof = 0.18W/m^{2}K.
- Ground floor = 0.18 W/m^{2}K.
- Personnel door = 1.60 W/m^{2}K.

The improvements in the thermal efficiency of the building envelope represent an increase in performance above the minimum Building Regulations requirements.

5.5 Improve U-values of Glazing

The largest source of heat loss from the building after infiltration and ventilation is the windows.

In order to reduce overall energy, demand the following improved U-values will be targeted:

- Windows = 1.60W/m^{2}K (G Value = 0.40, light transmittance = 71.20%.)

The improvements in the thermal efficiency of the windows represent a significant increase in performance above the minimum Building Regulations requirements.

5.6 Improve Air Permeability of Building Envelope

Air leakage through the building envelope is a significant cause of energy loss.

In order to further reduce energy demand through the reduction of heat loss, the proposed hotel will target an air permeability of 3.00 m^3/ (h.m^2) at 50Pa.

5.7 Improved Efficiency of the Space Heating, Cooling, and Hot Water

Once the heat loss through the external building envelope has been reduced through improvements in the U-values, the efficiency of the delivered heat can be addressed to further reduce the heating and cooling demand within a building.

The hotel operator's Mechanical, Electrical and Public Health Services Standard Specification specifies heat pumps to generate space heating and cooling. The generation of heat from the heat pump is incorporated within section 7.1 of this report as a source of low carbon energy.

For the purposes of the Baseline energy model, the space heating will be generated via an electric heat pump with a Seasonal EER of 2.64. Hot water is assumed to be generated through a VRF Hydro Unit at 286.0% efficiency and space cooling will be via an electric heat pump system with a Seasonal EER of 8.0. This is done in line with the 'Greater London Authority guidance on preparing energy assessments (June 2021) which advises to use Part L2 (2021).

For the purposes of the Be Lean energy efficient energy model, the space heating and hot water are assumed to be generated through a VRF Hydro Unit with efficiencies for the notional building system type and performance values specified in Part L 2021. Space cooling will be via a heat pump system with a seasonal EER of 8.0.

5.8 Use of Energy Efficient Lighting

Lighting accounts for a significant proportion of the predicted electrical consumption and carbon emissions of the building.

The following lighting efficiency and controls have been assumed in line with the standard hotel operator's lighting:

- En-suite Bathrooms: 110 lm/W, manual lighting control.
- Bedrooms: 110 lm/W, manual lighting control.
- Circulation: 110 lm/W, auto on/auto off.
- Kitchen: 110 lm/W, manual lighting control.
- Linen Rooms: 110 lm/W, auto on/auto off.
- Office, Staffroom: 110 lm/W, manual lighting control.
- Plant: 110 lm/W, manual lighting control.
- Reception, Foyer: 110 lm/W, manual lighting control.
- Toilet: 110 lm/W, auto on/auto off.
- Store: 110 lm/W, auto on/auto off.

5.9 Use of Intelligent Lighting Controls

Even with efficient lamps and luminaires, the energy used for lighting can be wasted in various ways. There are a number of ways of lighting control, local manual switching, timed control, reset control (manual on, timed off), occupancy control (presence detectors) and photoelectric switching and dimming. Lighting controls should ensure that light is provided in the right amount, in the right place for the required time.

Section 5.8 of this report details the proposed lighting controls to the hotel.

5.10 Use of Variable Speed Pumps, Fans and Drives to Match Supply and Demand

There are a number of ways to control the pump or fan speed with the most efficient being an inverter. An inverter rectifies the alternating current to a direct current supply and then uses this to produce a smooth variable frequency alternating current output to the pump/fan motor. Controlling the frequency of the output device provides the desired speed modulation for the motor driving the fan or pump. As power consumption falls by the cube of the speed, cutting the motor speed to match the demand dramatically reduces electricity consumption (i.e., cutting speed from 100% to 80% halves the energy use, reducing the speed further to 50% reduces the energy use to 15%).

Variable speed equipment, particularly fans will be utilised on this project wherever possible.

5.11 Improve Efficiency of Heat Recovery to Mechanical Ventilation Systems

Where it is necessary to provide ventilation, it is good practice to recover the heat from the extract air to pre heat the fresh air being introduced to the building. A typical heat recovery system will recover between 40-70% of the heat that would have been lost to atmosphere.

Whilst there is an offset of additional resistance to the ventilation system fan due to the heat recovery device this is normally offset by the energy recovery from the extract air which can give, in some cases a payback of 2-5 years for the additional capital outlay.

A heat recovery efficiency of 70% had been assumed for the reception and offices.

5.12 CO_2 Emissions

The baseline energy model is included within Appendix A. The energy model includes the proposed energy efficiency and demand reduction measures. In accordance with the 'Greater London Authority guidance on preparing energy assessments' (June 2022), the emission figures use the Part L2 recommendations to assess performance against the London Plan policies. The GLA Carbon Emission Reporting Spreadsheet is included within Appendix C.

	Carbon dioxide emissions for non-domestic buildings (Tonnes CO_2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2021 of the Building Regulations Compliant Development	20.0	7.9
After energy demand reduction	16.3	7.9

	Regulated non-domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	(%)
Savings from energy demand reduction	3.7	18.3

In respect of Part L 2021 Building regulations, following the incorporation of energy efficiency measures, the BER emissions of the development are 16.3 tonnesCO_2/annum, an improvement of 18.3% above the Baseline Building Regulations TER of 20.0 tonnesCO_2/annum when utilising the Part L2 (2021) minimum performance values. The carbon factors used to calculate regulated and unregulated emissions have been taken from SAP 10.2.

This improvement is greater than the GLA Guidance for non-residential buildings to achieve at least a 15% improvement on Building Regulations from energy efficient measures alone.

5.13 Energy Demand Reporting

Following the incorporation of energy efficiency measures, the total energy demand for the building is reported in the table below. These are the delivered energy requirements at the point of use.

Use	Energy demand following energy efficiency measures (kWh/m2/year)						
	Space Heating	Cooling	Auxiliary	Lighting	Hot Water	Unregulated Energy	Total
Hotel	4.55	0.82	0.83	9.75	42.71	21.88	58.66

This energy use intensity is greater than the GLA target of 55 kWh/m2/year. This is due to the building use as a hotel which has a high hot water demand. As the hot water will be provided via air source heat pumps, deemed a low carbon technology, it is sought that this exceedance of the target is accepted.

6. DECENTRALISED ENERGY (BE CLEAN)

6.1 General

Policy SI3 Energy Infrastructure of The London Plan requires that possible connection to existing heating or cooling networks should be evaluated before site wide combined heat and power systems are investigated.

The high year-round domestic hot water demand makes the use of a combined heat and power plant potentially feasible for this building. However, the pattern of demand for both heat and electricity across the day needs to be considered which has implications for the economic feasibility of combined heat and power plant.

A combined heat and power system is an efficient way of generating electricity onsite with the benefit of reduced fuel costs (gas being cheaper than electricity) and reduced carbon emissions. Heat generated from the gas engine can be used to produce hot water for heating and domestic hot water. CHP for heating and hot water will potentially be suitable however the proposed hotel's requirement for heating via heat pumps means a CHP scheme will only be suitable for the hot water installation.

6.2 Operator Constraints

CCHP (Combined Cooling and Heating Power) requires cooling to form a significant element of the development's energy consumption. The proposed requirement for cooling via water source pumps means CCHP would not be feasible.

6.3 Site Constraints

In accordance with Policy SI 3 Energy infrastructure of The London Plan existing heating networks have been investigated for possible connection.

The London Heat Map network has been consulted however no nearby district heating opportunities have been identified.

6.4 Engineering Feasibility

Integrated CHP into a hotel facility without the type of constant base load which would normally be provided by leisure facilities requires careful consideration since the CHP units need to be sized to match the available base load without excessive cycling which would reduce the effectiveness and life expectancy of the units.

Including a CHP system to generate the domestic hot water is not a feasible option in the case of this hotel expansion. Due to the size of the hotel expansion being significantly smaller than the overall size of the hotel itself, this will cause issues such as excessive cycling as mentioned above, which would reduce the effectiveness and life expectancy of the units. Therefore, it would not be feasible to include CHP into the design.

The base load for the hotel would be provided by the hot water requirements. The hot and cold and water services will be provided by an all-electric source heat pumps complete with buffer vessel and interface with the existing LPHW boiler plant. This will provide 98% efficiency.

6.5 CO_2 Emissions

In accordance with the 'Greater London Authority guidance on preparing energy assessments' (June 2022), the emission figures use the Part L2 (2021) regulations to assess performance against the London Plan policies. The GLA Carbon Emission Reporting Spreadsheet is included within Appendix C.

	Carbon Dioxide Emissions for Non-Domestic Buildings (Tonnes CO2 Per Annum)	
	Regulated	Unregulated
Baseline: Part L 2021 of the Building Regulations Compliant Development	20.0	7.9
After energy demand reduction	16.3	7.9
After heat network connection	16.3	7.9

	Regulated Non-Domestic Carbon Dioxide Savings	
	Tonnes CO_2 Per Annum	%
Savings from energy demand reduction	3.7	18.3
Savings from heat network connection	0.0	0.0

The BER emissions of the development are 16.3 tonnesCO_2/annum. No decentralised energy sources were considered in the 'Be Clean' stage.

6.6 Summary

The methodology of investigating CHP has been followed as per the Local Authority and GLA guidance. The guidance states to investigate Lean, Clean and Green options, as a result of our modelling greater savings have been deemed achievable through the use of air source heat pumps therefore CHP has been discounted.

Even though a CHP unit would contribute towards the domestic hot water load for the proposed hotel, it is decided that greater CO_2 emission savings utilising the Part L2 (2021) regulations will be achievable through the use of air source heat pumps to generate hot water for the development.

7. RENEWABLE ENERGY TECHNOLOGIES (BE GREEN)

7.1 General

The feasibility of a number of potentially appropriate renewable energy technologies has been investigated for the proposed development.

Technology	Suitable?	Observations
Air source heat pumps	√	Proposed to generate space heating and cooling.
Ground source heat pumps	X	Existing building and lack of available ground space precludes formation of boreholes.
Biomass hot water	X	Insufficient plant, fuel storage and delivery space at basement/ground floor for fuel storage. Fuel delivery difficulties.
Solar water heating	X	Not compatible with the ASHP providing the hot water.
Photovoltaics	X	Roof space has been designated as green roof. Overshading issues and potential glare risk to surrounding buildings.
Wind turbines	X	Poor yield within urbanised area and likely planning issues.

The hotel operator's specification requires the use of heat pumps within the bedrooms, foyer, reception and offices to provide heating and cooling.

The hotel operator utilises Samsung as their preferred heat pump manufacturer. The proposed air source heat pumps will provide heating with a seasonal COP of 5.49 and cooling with a seasonal EER of 8.00 based upon manufacturer's information from Samsung's technical data as shown in Appendix D.

It is proposed for domestic hot water that all-electric air source heat pumps complete with buffer vessel and interface with the existing LPHW boiler plant is utilised. Travelodge has been investigating different heat pumps to provide hot water. The current preferred system is Mitsubishi Q-Ton with an efficiency of 4.03.

Potential carbon emission savings from biomass are significant however there is limited ground floor area for biomass fuel storage and plant space.

It is acknowledged that the potential energy saving from solar water heating could be significant, however this technology is not compatible with the preferred ASHP option providing hot water.

A suitable option for the hotel which would be compatible with the air source heat pumps is the incorporation of a solar photovoltaic array to generate zero carbon energy. However, the roof area and configuration of the new roof means that the area available for a solar photovoltaic array is limited. The new roof area has been designated as green roof, introducing PV panels would reduce the amount of green roof. Issues with overshading, glare to surrounding buildings and maintenance have been investigated and shown PV to not be feasible.

A wind turbine would be able to provide zero carbon energy, however the yield would be compromised by the urbanised surroundings creating greater wind turbulence.

7.2 CO_2 Emissions

Air source heat pumps will be incorporated into the proposed hotel scheme as a source of low carbon energy to meet the space heating and cooling, and hot water demand.

The energy model has been rerun to include the proposed low carbon energy sources and the results are included within Appendix B. In accordance with the 'Greater London Authority guidance on preparing energy assessments' (June 2022), the emission figures use the Part L2 (2021) guidelines to assess performance against the London Plan policies. The GLA Carbon Emission Reporting Spreadsheet is included within Appendix C.

	Carbon dioxide emissions for non-domestic buildings (Tonnes CO_2 per annum)	
	Regulated	**Unregulated**
Baseline: Part L 2021 of the Building Regulations Compliant Development	20.0	7.9
After energy demand reduction	16.3	7.9
After heat network connection	16.3	7.9
After renewable energy	12.2	7.9

	Regulated non-domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	**(%)**
Savings from energy demand reduction	3.7	18.3
Savings heat network connection	0.0	0.0
Savings from renewable energy	4.2	20.8
Total Cumulative Savings	7.8	39.1

In respect of Part L 2021 Building regulations compliance, following the incorporation of low and zero carbon technologies, the BER emissions of the development are 12.2 tonnes CO_2/annum, an improvement of 39% above the Baseline Building Regulations TER of 20.0 tonnes CO_2/annum.

This improvement is greater than the GLA Guidance for non-residential buildings to achieve at least a 20% improvement on Building Regulations from onsite renewable energy alone.

7.3 Carbon Offset Payment

From the calculations carried out within the GLA spreadsheet shown in Appendix C, a total carbon offset payment of £34,652.00 is required.

7.4 Summary

The total predicted CO_2 emissions for the development have been reduced by 39% (7.8 tonnes CO_2 per annum) over the Baseline Building Regulations TER of 20.0 tonnes CO_2/annum when utilising Part L2 (2021) regulations. The carbon factors used to calculate regulated and unregulated emissions have been taken from SAP 10.2.

The total predicted CO_2 emissions achieve the minimum 35.00% improvement over Building Regulations target of 13.0 tonnes to comply with The London Plan: Spatial Development Strategy for Greater London (March 2021) and the ‘Greater London Authority guidance on preparing energy assessments’ (June 2022) when utilising Part L2 (2021) regulations.

8. THERMAL COMFORT

8.1 General

'Policy SI 4 Managing heat risk' of The London Plan seeks to reduce the risk of overheating and excessive heat generation. As the proposed hotel is air conditioned it is appropriate to use CIBSE Guide A to produce the dynamic overheating model. CIBSE Guide A outlines the requirements that air-conditioned spaces need to meet in order for the thermal comfort to be acceptable to the building inhabitants.

CIBSE Guide A provides recommended winter and summer temperature ranges for a variety of building room types. The temperature ranges are based upon stated metabolic rates and clothing insulation levels typical of the respective building room type. CIBSE Guide A states that the threshold temperatures can be extended slightly to an acceptable level where a Proportion of People Dissatisfied is 12%.

The proposed extension comprises of 55 no. 'windowless' rooms. Heat gains will be minimal from this. Openable windows will not be possible due to the challenges from an acoustic point of view with this hotel being on a busy area on a major road.

To retrofit purge ventilation would have a significantly negative impact on the building structure.

Two different scenarios were simulated for Thermal Comfort.

The first scenario involved looking at how the energy model would run without active cooling. The purpose of this is to show whether the building overheats without active cooling installed despite the inclusion of all viable measures from the cooling hierarchy.

The second scenario involved looking at the energy model with active cooling being implemented.

The cooling hierarchy has been followed to reduce the potential for overheating and reliance on air conditioning systems as follows:

- Energy efficient design of the building envelope including thermal insulation representing a significant increase in performance above the minimum Building Regulations requirements.
- Low g-value glazing and proposed Brown Roof above first floor and at roof top plant room level to reduce heat build-up and solar gain.
- Internal blinds and curtains where required to reduce heat gain.
- Manage the heat within the building through exposed internal thermal mass and high ceilings
- Provide mechanical ventilation

Active cooling in the form of low energy air source heat pumps system will be incorporated following these actions.

The below table shows the area weighted average for the actual and notional cooling demand:

	Area weighted average building cooling demand (kWh/m^2)
Actual	0.83
Notional	1.42

The actual building's cooling demand is shown to be lower than the notional as required within The London Plan: Spatial Development Strategy for Greater London (March 2021) and the 'Greater London Authority guidance on preparing energy assessments' (June 2022).

8.2 Assumptions & Inputs

The following assumptions/inputs have been made for the thermal comfort modelling of the proposed building:

- The development has been modelled using the computer modelling package IES VE 2022
- Site location is London.
- The weather files used are:
  - London Weather Centre DSY1 for the 2020s, high emissions, 50% percentile scenario.
  - London Weather Centre DSY2 – 2003.
  - London Weather Centre DSY3 – 1976.
- Thermal element performance values are detailed in sections 5.4, 5.5, & 5.6.

The following internal gains, occupancy and ventilation have been assumed:

	People			**Profile**
	No or density	**Sensible W**	**Latent W**	
Bedroom	2 people	80	35	17:00 – 09:00
Office	2 people	90	50	08:00 – 18:00
Reception	1 person per 10m²	90	50	06:00 – 23:00

	Lighting W/m²	**Profile**
Bedroom	1.42	06:00 – 09:00 & 17:00 – 23:00
Office	21.91	08:00 – 18:00
Reception	10.85	24 hours
Corridor	1.75	24 hours
Linen Room	4.00	08:00 – 18:00

	Equipment (sensible) W/m²	Profile
Bedroom	10.00	06:00 – 09:00 & 17:00 – 23:00
Office	5.00	08:00-18:00
Reception	5.00	06:00 – 23:00

The occupancy for the occupied areas of the proposed building is based upon expectations of occupancy within the building, and heat gains as stated within the CIBSE Guide A.

	Ventilation Strategy	Flow Rate	Profile
Bedroom	Natural Ventilation	N/A	N/A
Office	Central Supply & Extract	10l/s per person	08:00 – 18:00
Reception	Central Supply & Extract	10l/s per person	24 hours

For all spaces an infiltration rate of 0.15 air changes per hour has been assumed which is equivalent to the air permeability target of 3.0m^3/hour.m^2 at 50Pa as stated within the CIBSE Guide A for this type of building.

8.3 Results

8.3.1 London DSY1 for the 2020s, high emissions, 50% percentile scenario

Following the implementation of active cooling for the DSY1 scenario, none of the occupied spaces exceed the recommended temperature thresholds as defined by CIBSE Guide A 'Environmental Design', Table 1.5 for the Summer range of days 121 – 273.

Zone	No. and % of Occupied Hours					
	<=19.30°C		>19.3°C to <=26.70°C		>26.70°C	
Bedroom	0	0%	3672	100%	0	0.00%
Reception	0	0%	3672	100%	0	0.00%

Zone	No. and % of Occupied Hours					
	<=19.30°C		>19.30°C to <=27.70°C		>27.70°C	
Office	0	0%	3672	100%	0	0.00%

8.3.2 London DSY2 – 2003

Following the implementation of active cooling for the DSY2 scenario, none of the occupied spaces exceed the recommended temperature thresholds as defined by CIBSE Guide A 'Environmental Design', Table 1.5 for the Summer range of days 121 – 273.

Zone	No. and % of Occupied Hours					
	<=19.30°C		>19.30°C to <=26.70°C		>26.70°C	
Bedroom	0	0.00%	3672	100%	0	0.00%
Reception	0	0.00%	3672	100%	0	0.00%

Zone	No. and % of Occupied Hours					
	<=19.30°C		>19.30°C to <=27.70°C		>27.70°C	
Office	0	0.00%	3672	100%	0	0.00

8.3.3 London DSY3 – 1976

Following the implementation of active cooling for the DSY3 scenario, none of the occupied spaces exceed the recommended temperature thresholds as defined by CIBSE Guide A 'Environmental Design', Table 1.5 for the Summer range of days 121 – 273.

Zone	No. and % of Occupied Hours					
	<=19.30°C		>19.30°C to <=26.70°C		>26.70°C	
Bedroom	0	0.00%	3672	100%	0	0.00%
Reception	0	0.00%	3672	100%	0	0.00%

Zone	No. and % of Occupied Hours					
	<=19.30°C		>19.30°C to <=27.70°C		>27.70°C	
Office	0	0.00%	3672	100%	0	0%

8.4 Summary

A dynamic thermal model has been undertaken assessed against the requirements stated in CIBSE Guide A for overheating. For each occupied space; bedrooms, offices, and reception, the results show that for the temperature ranges stated as acceptable within CIBSE Guide A they fall within this range.

The below table shows the area weighted average for the actual and notional cooling demand:

	Area weighted average building cooling demand (kWh/m²)
Actual	0.83
Notional	1.42

The actual building's cooling demand is shown to be lower than the notional as required within The London Plan: Spatial Development Strategy for Greater London (March 2021) and the 'Greater London Authority guidance on preparing energy assessments' (June 2022).

9. SUMMARY

9.1 General

As far as possible energy efficiency measures will be applied to the development to improve the performance beyond the minimum requirements in Part L of the Building Regulations.

Air source heat pumps will be incorporated into the proposed hotel scheme as a source of low carbon energy to meet a significant proportion of the space heating and cooling, and hot water demand.

9.2 CO_2 Emissions

A summary of the results in line with the GLA Carbon Emission Reporting Spreadsheet is below.

	Carbon dioxide emissions for non-domestic buildings (Tonnes CO_2 per annum)	
	Regulated	**Unregulated**
Baseline: Part L 2013 of the Building Regulations Compliant Development	20.0	7.9
After energy demand reduction	16.3	7.9
After heat network connection	16.3	7.9
After renewable energy	13.1	7.9

	Regulated non-domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	**(%)**
Savings from energy demand reduction	3.7	18.3
Savings from heat network connection	0.0	0.0
Savings from renewable energy	4.2	20.3
Total Cumulative Savings	7.8	39.1

The total predicted CO_2 emissions for the development have been reduced by 39% (7.8 tonnes CO_2 per annum) over the Baseline Building Regulations TER of 20.0 tonnes CO_2/annum when utilising Part L2 (2021) regulations. The carbon factors used to calculate regulated and unregulated emissions have been taken from SAP 10.2.

From the calculations carried out a total carbon offset payment of £34,652.00 is required.

The total predicted CO_2 emissions achieve the minimum 35.00% improvement over Building Regulations target of 13.0 tonnes to comply with The London Plan: Spatial Development Strategy for Greater London (March 2021) and the 'Greater London Authority guidance on preparing energy assessments' (June 2022) when utilising Part L2 (2021) regulations.

Appendix A Energy Model Data – Baseline and Be Lean, Incorporating Energy Efficiency and Demand Reduction Measures

BRUKL Output Document

Compliance with England Building Regulations Part L 2021

HM Government

Project name

Travelodge Covent Garden Extension — As built

Date: Thu Jul 13 14:36:54 2023

Administrative information

Building Details

Address: Travelodge London Covent Garden, London, WC2B 5RE

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.20

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.20

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

Foundation area [m²]: 548.09

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

Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	9.93	
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	8.11	
Target primary energy rate (TPER), $kWh_{PE}/m^2.annum$	107.62	
Building primary energy rate (BPER), $kWh_{PE}/m^2.annum$	88.05	
Do the building's emission and primary energy rates exceed the targets?	BER =< TER	BPER =< TPER

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

Fabric element	$U_{a-Limit}$	U_{a-Calc}	U_{i-Calc}	First surface with maximum value
Walls*	0.26	0.22	0.22	LF000003:Surf[2]
Floors	0.18	0.18	0.18	NW000013:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.16	0.16	LF000003:Surf[1]
Windows** and roof windows	1.6	1.6	1.6	NW000043:Surf[1]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	1.6	1.6	NW000043:Surf[2]
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

Building services

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

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	0.9 to 0.95

1- Lobby - Heating via Split Heat Pump

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	2.64	8	0	-	0.7
Standard value	2.5*	5	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

2- Bedrooms - Heating & Cooling via HVRF System

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	2.64	8	0	0.4	0.7
Standard value	2.5*	N/A	N/A	2^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. ^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.					

3- Restaurant - Casette type split heat system heat pump

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	2.64	8	0	-	0.7
Standard value	2.5*	5	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

4- Reception - Heating via Split Heat Pump with Heat Recovery

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	2.64	8	0	-	0.7
Standard value	2.5*	5	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

1- Hot Water System - Hot Water

	Water heating efficiency	**Storage loss factor [kWh/litre per day]**
This building	2.86	-
Standard value	2*	N/A
* Standard shown is for all types except absorption and gas engine heat pumps.		

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

General lighting and display lighting	**General luminaire**	**Display light source**	
Zone name	**Efficacy [lm/W]**	**Efficacy [lm/W]**	**Power density [W/m²]**
Standard value	95	80	0.3
LINEN	110	-	-

General lighting and display lighting	General luminaire	Display light source	
Zone name	**Efficacy [lm/W]**	**Efficacy [lm/W]**	**Power density [W/m²]**
Standard value	95	80	0.3
ENTRANCE	110	-	-
KITCHEN EXTENSION	110	-	-
LINEN	110	-	-
CORRIDOR	110	-	-
CORRIDOR	110	-	-
LINEN	110	-	-
Bedroom	110	-	-
BAR & SEATING AREA	110	80	1.875
LINEN	110	-	-
FIRE ESCAPE	110	-	-
Bedroom	110	-	-
Corridor	110	-	-
Bedroom	110	-	-
Bedroom	110	-	-
En-suite	110	-	-
En-suite	110	-	-
Bedroom	110	-	-
En-suite	110	-	-
Bedroom	110	-	-
Bedroom	110	-	-
En-suite	110	-	-
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En-suite	110	-	-
Bedroom	110	-	-
En-suite	110	-	-
En-suite	110	-	-
Bedroom	110	-	-
Bedroom	110	-	-
En-suite	110	-	-
En-suite	110	-	-
Bedroom	110	-	-

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
Bedroom	110	-	-
En-suite	110	-	-
En-suite	110	-	-
Bedroom	110	-	-
Bedroom	110	-	-
En-suite	110	-	-
En-suite	110	-	-
Bedroom	110	-	-
En-suite	110	-	-
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En-suite	110	-	-
Bedroom	110	-	-
Bedroom	110	-	-
En-suite	110	-	-
En-suite	110	-	-
Bedroom	110	-	-
Bedroom	110	-	-

General lighting and display lighting	General luminaire	Display light source	
Zone name	**Efficacy [lm/W]**	**Efficacy [lm/W]**	**Power density [W/m²]**
Standard value	95	80	0.3
En-suite	110	-	-
En-suite	110	-	-
Bedroom	110	-	-
Bedroom	110	-	-
En-suite	110	-	-
Bedroom	110	-	-
En-suite	110	-	-
Bedroom	110	-	-
En-suite	110	-	-
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Bedroom	110	-	-
Bedroom	110	-	-
En-suite	110	-	-
Bedroom	110	-	-
En-suite	110	-	-
Bedroom	110	-	-
En-suite	110	-	-
Reception	110	80	1.688
Reception Lobby	110	-	-

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

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
ENTRANCE	NO (-38.9%)	NO
Bedroom	N/A	N/A
BAR & SEATING AREA	N/A	N/A
Bedroom	N/A	N/A
Bedroom	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Bedroom	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
En suite	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
Bedroom	N/A	N/A
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En-suite	N/A	N/A
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En-suite	N/A	N/A
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En-suite	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Bedroom	N/A	N/A
En-suite	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
Reception	N/A	N/A
Reception Lobby	N/A	N/A

Regulation 25A: Consideration of high efficiency alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m^2]	2012.9	2012.9
External area [m^2]	1166.7	1166.7
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	3	3
Average conductance [W/K]	250.35	362.63
Average U-value [W/m^{2}K]	0.21	0.31
Alpha value* [%]	25	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
	Offices and Workshop Businesses
	General Industrial and Special Industrial Groups
	Storage or Distribution
100	**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/m^2]

	Actual	Notional
Heating	4.55	8.1
Cooling	0.82	1.42
Auxiliary	0.83	7.12
Lighting	9.75	9.99
Hot water	42.71	46.08
Equipment*	21.88	21.88
TOTAL**	**58.66**	**72.71**

* 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/m^2]

	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/m^2]	60.92	104.71
Primary energy [kWh$_{PE}$/m^2]	88.05	107.62
Total emissions [kg/m^2]	8.11	9.93

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	50.6	0.3	5.3	0	1.7	2.64	5.8	2.64	8
	Notional	87.1	7.2	8.7	0.4	13.3	2.78	4.63	----	----
[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	32.4	42.5	3.4	2	0	2.64	5.98	2.64	8
	Notional	63	57.5	6.3	3.5	0	2.78	4.63	----	----
[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	187.1	63.8	19.7	3	0	2.64	5.98	2.64	8
	Notional	178.5	47	17.8	2.8	0	2.78	4.63	----	----
[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	76.8	71.4	8.1	3.3	0	2.64	5.98	2.64	8
	Notional	206.2	70.8	20.6	4.2	0	2.78	4.63	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	0	0	0	----	----

Key to terms

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

Appendix B Energy Model Data – Be Green, Incorporating Renewable Technologies

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

Travelodge Covent Garden Extension

As built

Date: Tue Sep 03 13:44:03 2024

Administrative information

Building Details

Address: Travelodge London Covent Garden, London, WC2B 5RE

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

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]: 548.09

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

Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	9.93	
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	6.04	
Target primary energy rate (TPER), $kWh_{PE}/m^2.annum$	107.62	
Building primary energy rate (BPER), $kWh_{PE}/m^2.annum$	65.8	
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	0.22	0.22	LF000003:Surf[2]
Floors	0.18	0.18	0.18	NW000013:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.16	0.16	LF000003:Surf[1]
Windows** and roof windows	1.6	1.6	1.6	NW000043:Surf[1]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	1.6	1.6	NW000043:Surf[2]
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

Building services

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

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	0.9 to 0.95

1- Lobby - Heating via Split Heat Pump

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	5.49	8	0	-	0.7
Standard value	2.5*	5	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system	YES				

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

2- Bedrooms - Heating & Cooling via HVRF System

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	5.49	8	0	0.4	0.7
Standard value	2.5*	N/A	N/A	2^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system	YES				

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

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

3- Restaurant - Casette type split heat system heat pump

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	5.49	8	0	-	0.7
Standard value	2.5*	5	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system	YES				

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

4- Reception - Heating via Split Heat Pump with Heat Recovery

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	5.49	8	0	-	0.7
Standard value	2.5*	5	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system	YES				

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

1- Hot Water System - Hot Water

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	4.03	-
Standard value	2*	N/A

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

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

General lighting and display lighting	**General luminaire**	**Display light source**	
Zone name	**Efficacy [lm/W]**	**Efficacy [lm/W]**	**Power density [W/m²]**
Standard value	95	80	0.3
LINEN	110	-	-

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
ENTRANCE	110	-	-
KITCHEN EXTENSION	110	-	-
LINEN	110	-	-
CORRIDOR	110	-	-
CORRIDOR	110	-	-
LINEN	110	-	-
Bedroom	110	-	-
BAR & SEATING AREA	110	80	1.875
LINEN	110	-	-
FIRE ESCAPE	110	-	-
Bedroom	110	-	-
Corridor	110	-	-
Bedroom	110	-	-
Bedroom	110	-	-
En-suite	110	-	-
En-suite	110	-	-
Bedroom	110	-	-
En-suite	110	-	-
Bedroom	110	-	-
Bedroom	110	-	-
En-suite	110	-	-
En-suite	110	-	-
Bedroom	110	-	-
Bedroom	110	-	-
En-suite	110	-	-
En-suite	110	-	-
Bedroom	110	-	-
Bedroom	110	-	-
En-suite	110	-	-
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Bedroom	110	-	-
En-suite	110	-	-
Bedroom	110	-	-
Bedroom	110	-	-
En-suite	110	-	-
Bedroom	110	-	-
En-suite	110	-	-
En-suite	110	-	-
Bedroom	110	-	-
Bedroom	110	-	-
En-suite	110	-	-
En-suite	110	-	-
Bedroom	110	-	-

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
Bedroom	110	-	-
En-suite	110	-	-
En-suite	110	-	-
Bedroom	110	-	-
Bedroom	110	-	-
En-suite	110	-	-
En-suite	110	-	-
Bedroom	110	-	-
En-suite	110	-	-
Bedroom	110	-	-
Bedroom	110	-	-
En-suite	110	-	-
Bedroom	110	-	-
En-suite	110	-	-
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En-suite	110	-	-
Bedroom	110	-	-
En-suite	110	-	-
En suite	110	-	-
Bedroom	110	-	-
En-suite	110	-	-
Bedroom	110	-	-
Bedroom	110	-	-
En-suite	110	-	-
En-suite	110	-	-
Bedroom	110	-	-
Bedroom	110	-	-
En-suite	110	-	-
En-suite	110	-	-
Bedroom	110	-	-
Bedroom	110	-	-
En-suite	110	-	-
En-suite	110	-	-
Bedroom	110	-	-
Bedroom	110	-	-
En-suite	110	-	-
En-suite	110	-	-
Bedroom	110	-	-
Bedroom	110	-	-

General lighting and display lighting	General luminaire	Display light source	
Zone name	Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m²]
Standard value	95	80	0.3
En-suite	110	-	-
En-suite	110	-	-
Bedroom	110	-	-
Bedroom	110	-	-
En-suite	110	-	-
Bedroom	110	-	-
En-suite	110	-	-
Bedroom	110	-	-
En-suite	110	-	-
En-suite	110	-	-
Bedroom	110	-	-
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En-suite	110	-	-
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En-suite	110	-	-
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En-suite	110	-	-
En-suite	110	-	-
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Bedroom	110	-	-
En-suite	110	-	-
En-suite	110	-	-
Bedroom	110	-	-
Bedroom	110	-	-
En-suite	110	-	-
Bedroom	110	-	-
En-suite	110	-	-
Bedroom	110	-	-
En-suite	110	-	-
Reception	110	80	1.688
Reception Lobby	110	-	-

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

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
ENTRANCE	NO (-38.9%)	NO
Bedroom	N/A	N/A
BAR & SEATING AREA	N/A	N/A
Bedroom	N/A	N/A
Bedroom	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Bedroom	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
En suite	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Bedroom	N/A	N/A
En-suite	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
Bedroom	N/A	N/A
En-suite	N/A	N/A
Reception	N/A	N/A
Reception Lobby	N/A	N/A

Regulation 25A: Consideration of high efficiency alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m^2]	2012.9	2012.9
External area [m^2]	1166.7	1166.7
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	3	3
Average conductance [W/K]	250.35	362.63
Average U-value [W/m^2K]	0.21	0.31
Alpha value* [%]	25	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
	Offices and Workshop Businesses
	General Industrial and Special Industrial Groups
	Storage or Distribution
100	**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/m^2]

	Actual	Notional
Heating	2.19	8.1
Cooling	0.82	1.42
Auxiliary	0.83	7.12
Lighting	9.75	9.99
Hot water	30.31	46.08
Equipment*	21.88	21.88
TOTAL**	**43.89**	**72.71**

* 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/m^2]

	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/m^2]	60.92	104.71
Primary energy [kWh_{PE}/m^2]	65.8	107.62
Total emissions [kg/m^2]	6.04	9.93

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	50.6	0.3	2.6	0	1.7	5.49	5.8	5.49	8
	Notional	87.1	7.2	8.7	0.4	13.3	2.78	4.63	----	----
[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	32.4	42.5	1.6	2	0	5.49	5.98	5.49	8
	Notional	63	57.5	6.3	3.5	0	2.78	4.63	----	----
[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	187.1	63.8	9.5	3	0	5.49	5.98	5.49	8
	Notional	178.5	47	17.8	2.8	0	2.78	4.63	----	----
[ST] Split or multi-split system, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	76.8	71.4	3.9	3.3	0	5.49	5.98	5.49	8
	Notional	206.2	70.8	20.6	4.2	0	2.78	4.63	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	0	0	0	----	----

Key to terms

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

Appendix C GLA Carbon Spreadsheet

Part L 2021 Performance

Residential

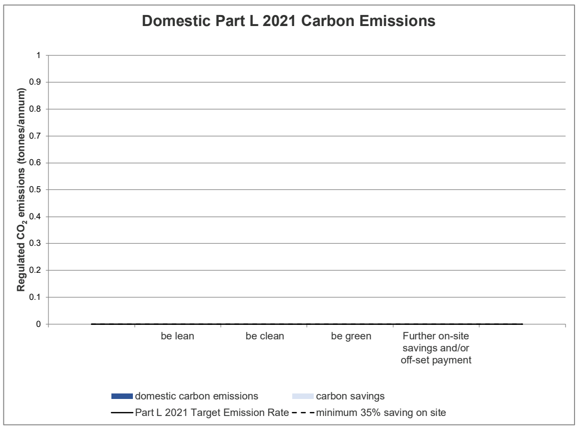
Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for residential buildings

	Carbon Dioxide Emissions for residential buildings (Tonnes CO_2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2021 of the Building Regulations Compliant Development	0.0	
After energy demand reduction (be lean)	0.0	
After heat network connection (be clean)	0.0	
After renewable energy (be green)	0.0	

Table 2: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for residential buildings

	Regulated residential carbon dioxide savings	
	(Tonnes CO_2 per annum)	(%)
Be lean: savings from energy demand reduction	0.0	0%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	0.0	0%
Cumulative on site savings	**0.0**	**0%**
Annual savings from off-set payment	0.0	-
	(Tonnes CO_2)	
Cumulative savings for off-set payment	**0**	-
Cash in-lieu contribution (£)	**0**	

*carbon price is based on GLA recommended price of £95 per tonne of carbon dioxide unless Local Planning Authority price is inputted in the 'Development Information' tab



Non-residential

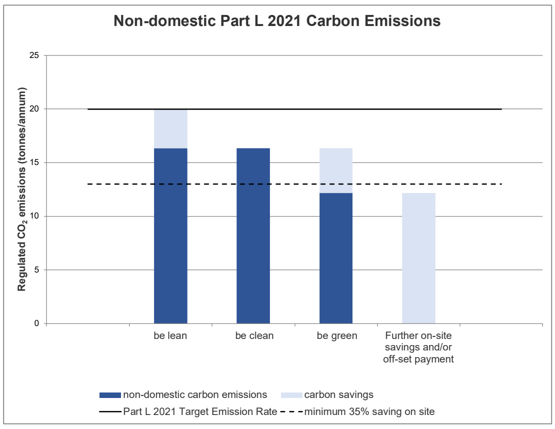
Table 3: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for non-residential buildings

	Carbon Dioxide Emissions for non-residential buildings (Tonnes CO_2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2021 of the Building Regulations Compliant Development	20.0	7.9
After energy demand reduction (be lean)	16.3	7.9
After heat network connection (be clean)	16.3	7.9
After renewable energy (be green)	12.2	7.9

Table 4: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for non-residential buildings

	Regulated non-residential carbon dioxide savings	
	(Tonnes CO_2 per annum)	(%)
Be lean: savings from energy demand reduction	3.7	18%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	4.2	21%
Total Cumulative Savings	**7.8**	**39%**
Annual savings from off-set payment	12.2	-
	(Tonnes CO_2)	
Cumulative savings for off-set payment	**365**	-
Cash in-lieu contribution (£)	**34,652**	

*carbon price is based on GLA recommended price of £95 per tonne of carbon dioxide unless Local Planning Authority price is inputted in the 'Development Information' tab



Appendix D ASHP Datasheet

2. Specification

Premium Compact

Type				DVM S	DVM S	DVM S
Model Name				AM080JXVHGR/EU	AM100JXVHGR/EU	AM120JXVHGR/EU
	Outdoor unit module 1			-	-	-
	Outdoor unit module 2			-	-	-
	Outdoor unit module 3			-	-	-
	Outdoor unit module 4			-	-	-
Power Supply			Ø, #, V, Hz	3, 4, 380-415, 50	3, 4, 380-415, 50	3, 4, 380-415, 50
Mode			-	HEAT RECOVERY	HEAT RECOVERY	HEAT RECOVERY
Performance	HP		HP	8	10	12
	Capacity	Cooling	kW	22.4 / 22.4※	28.0 / 28.0※	33.6 / 33.6※
		Heating	kW	25.2 / 22.4※	31.5 / 28.0※	37.8 / 33.6※
Maximum number of connectable indoor units			EA	14	18	21
Total capacity of the connected Indoor Units		Min.	kW	11.2	14.0	16.8
Total capacity of the connected Indoor Units		Max.	kW	29.1	36.4	43.7
Power	Power Input	Cooling	kW	4.59 / 4.59※	6.22 / 6.22※	7.57 / 7.57※
		Heating	kW	4.59 / 4.08※	5.89 / 5.23※	7.56 / 6.72※
	Current Input	Cooling	A	7.40	10.00	12.10
		Heating	A	7.40	9.40	12.10
	Current	Minimum Ssc	MVA	3.1	4.5	5.3
		MCA	A	18.0	21.1	25.0
		MFA	A	25	32	32
Efficiency	EER	Cooling	W/W	4.88 / 4.88※	4.50 / 4.50※	4.44 / 4.44※
	COP	Heating	W/W	5.49 / 5.49※	5.35 / 5.35※	5.00 / 5.00※
	ESEER		W/W	8.00	7.43	7.23
Casing	Material	Body	-	EGI Steel Plate	EGI Steel Plate	EGI Steel Plate
		Base	-	EGI Steel Plate	EGI Steel Plate	EGI Steel Plate
Heat Exchanger	Type		-	Fin & Tube	Fin & Tube	Fin & Tube
	Material	Fin	-	Al	Al	Al
		Tube	-	Cu	Cu	Cu
	Fin Treatment		-	Anti-corrosion	Anti-corrosion	Anti-corrosion
Compressor	Output		kW x n	5.18 x 1	6.39 x 1	6.39 x 1
	Model Name		-	DS-GB052FAV* x 1	DS-GB066FAV* x 1	DS-GB066FAV* x 1
	Oil	Type	-	PVE	PVE	PVE
		Initial charge	cc x n	1,100 x 1	1,100 x 1	1,100 x 1
Fan	Type		-	Propeller	Propeller	Propeller
	Discharge direction		-	Top	Top	Top
	Quantity		EA	1	1	1
	Air Flow Rate		m^3/min	170	170	200
			l/s	2,833	2,833	3,333
	External Static Pressure	Max.	mmAq	8	8	8
			Pa	78.45	78.45	78.45
Fan Motor	Type		-	BLDC Motor	BLDC Motor	BLDC Motor
	Output		W x n	830 x 1	830 x 1	830 x 1
Piping Connections	Liquid Pipe		Type	Braze connection	Braze connection	Braze connection
			Φ, mm (inch)	9.52 (3/8)	9.52 (3/8)	12.70 (1/2)
	Gas Pipe		Type	Braze connection	Braze connection	Braze connection
			Φ, mm (inch)	19.05 (3/4)	22.22 (7/8)	28.58 (1-1/8)
	High pressure Gas Pipe(HR Only)		Type	Braze connection	Braze connection	Braze connection
			Φ, mm (inch)	15.88 (5/8)	19.05 (3/4)	19.05 (3/4)
	Heat Insulation		-	All liquid and gas pipes	All liquid and gas pipes	All liquid and gas pipes
	Piping length (ODU-IDU)	Max. [Equiv.]	m	200[220]	200[220]	200[220]
	Piping length (1st Branch-IDU)	Max.	m	90	90	90
	Total piping length (System)	Max.	m	1,000	1,000	1,000
	Level difference (ODU in highest position)	Max.	m	110	110	110
	Level difference (IDU in highest position)	Max.	m	110	110	110
	Level difference (IDU-IDU)	Max.	m	40	40	40