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UNITS B AND C PIANO YARD, 30A HIGHGATE ROAD

Energy Statement – Revision A

UNITS B AND C PIANO YARD, 30A HIGHGATE ROAD, NW5 1NS

Energy Statement

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Revision	Amendment Details	Revision Prepared By	Revision Approved By
Rev A 20/06/2024	Updated as per the received comments	MB	SS

EXECUTIVE SUMMARY

This Energy Statement is submitted to support the planning application, which involves replacing one commercial gas absorption heat pump with three commercial air conditioning units at Units B and C, Piano Yard, 30A Highgate Road, NW5 1NS.

The strategy has been prepared in the context of the London Plan (2021) and Camden Local Plan, specifically Policy CC2, which states that development should adopt appropriate climate change adaptation measures, ensuring that development schemes demonstrate how adaptation measures and sustainable development principles have been incorporated into the design and proposed implementation.

Baseline: A baseline CO_2 emission has been created using the current building fabrics and building services. The development does not fall under major refurbishment, so it is not required to follow the energy hierarchy. With the building fabrics and gas absorption heat pump, the development achieves a 5% improvement in emissions over the baseline.

Low and Zero Carbon Technologies: The aim of the development is to replace the gas absorption heat pump with three air conditioning units with the goal of reducing CO_2 emissions over the baseline and complying with Policy CC2, ensuring that the proposed changes will have a positive impact by reducing CO_2 emissions. With the proposed ASHP- Samsung DVM S outdoor unit and 360 Cassette indoor units, the site achieves an overall 34% improvement over the baseline CO_2 emissions. The proposed changes not only comply with Policy CC2 but also achieve a 34% improvement over the baseline CO_2 emissions.

1.0 INTRODUCTION

1.1 Create Consulting Engineers Ltd has been commissioned by Wolfe Investments Ltd to carry out energy assessment and prepare an Energy Statement in support of the planning application for the proposed refurbishment of Units B and C, Piano Yard, 30A Highgate Road, NW5 1NS.

1.2 The objective of the Energy Statement is to assess the proposed development against the policy requirements of the Camden Local Plan and specifically Policy CC2: Adapting to Climate Change.

Site Location and Description

1.3 The proposal involves replacing one existing commercial Gas Absorption Heat Pump (GAHP) with three commercial air conditioning units for Commercial Units B and C at Piano Yard, 30A Highgate Road, NW5 1NS.

Figure 1.1: Site location plan

Objectives

1.4 The objectives of this report are to:

- Demonstrate how the proposed development has been assessed against the policy requirements of the Publication London Plan (2021) Camden Local Plan, specifically Policy CC2.
- To ensure that development schemes demonstrate how adaptation measures and sustainable development principles particularly in relation to energy efficiency, greenhouse gas emissions reduction and thermal comfort.

2.0 CURRENT AND FUTURE PLANNING POLICIES/GOOD PRACTICE REVIEW AND PROJECT REQUIREMENTS

National Planning Policy Framework (2023)

2.1 NPPF exerts additional responsibility on Local Planning Authorities (LPA) and sets out requirement for the Planning System to support transition to a low carbon future while taking into full account of changing climate, flood risk, water supply, biodiversity and landscape, risk of overheating etc. As part of Planning for climate change, plans should take proactive approach for mitigating and adapting to climate change. Policies should support appropriate measures to ensure the future resilience of communities and infrastructure to climate change impacts.

2.2 New development should be planning for in ways that; a) avoid increased vulnerability to the range of impacts arising from climate change. When new development is 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 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.

2.3 LPA should expect new development to comply with any development plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable; and b) take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.

2.4 In determining planning applications, local planning authorities should expect new development to: a) comply with any development plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable; and b) take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.

2.5 Chapter 2 of NPPF covers sustainable development. As per section 11, Plans and decisions should apply a presumption in favour of sustainable development.

2.6 For plan-making this means that:

a) all plans should promote a sustainable pattern of development that seeks to: meet the development needs of their area; align growth and infrastructure; improve the environment; mitigate climate change (including by making effective use of land in urban areas) and adapt to its effects;

b) strategic policies should, as a minimum, provide for objectively assessed needs for housing and other uses, as well as any needs that cannot be met within neighbouring areas, unless:
   i. the application of policies in this Framework that protect areas or assets of particular importance provides a strong reason for restricting the overall scale, type or distribution of development in the plan area; or
   ii. 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.

   For decision-taking this means:

c) approving development proposals that accord with an up-to-date development plan without delay; or

d) where there are no relevant development plan policies, or the policies which are most important for determining the application are out-of-date, granting permission unless:
   i. the application of policies in this Framework that protect areas or assets of particular importance provides a clear reason for refusing the development proposed; or
   ii. 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.

2.7 Chapter 9 details sustainable transport requirements to promote sustainable transport.

2.8 Chapter 14 addressed climate change issues. As per section 159, New development should be planned for in ways that: a) avoid increased vulnerability to the range of impacts arising from climate change. When new development is 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 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.

New London Plan (March 2021)

2.9 The London Plan 2021 is the Spatial Development Strategy for Greater London. It sets out a framework for how London will develop over the next 20-25 years and the Mayor's vision for Good Growth.

2.10 Policy SI 2 within the Chapter 9: Sustainable Infrastructure confirms the London principles for minimising greenhouse gas emissions.

> *"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. "

"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.

"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."

"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."

"Boroughs should ensure that all developments maximise opportunities for on-site electricity and heat production from solar technologies (photovoltaic and thermal) and use innovative building materials and smart technologies."

"To meet the zero-carbon target, an on-site reduction of at least 35 per cent beyond the baseline of Part L of the current Building Regulations is required."

Greater London Authority (GLA) guidance on preparing energy assessments as part of planning applications (June 2022)

2.11 The June 2022 revision to the GLA guidance on preparing energy statements explains how London Plan policies apply after Part L 2021 has taken effect. It introduces a percentage improvement benchmark for residential developments and the requirement to report the Energy Use Intensity (EUI) and space heating demand of the development.

2.12 It also further clarifies how to demonstrate carbon improvements from the 'be lean' stage of the energy hierarchy. The guidance has been updated considering the new Part O of building regulations and confirms that applicants should continue to report the results of dynamic overheating modelling as part of the energy strategy. This should use Chartered Institution of

Building Services Engineers (CIBSE) guidance and account for the limits that Part O 2021 places on choices when undertaking a CIBSE assessment.

2.13 More guidance is also given on design and reporting process for proposals involving ambient loop systems with heat pumps in individual units where there is potential to connect to a district heat network and where heat network is utilised.

2.14 The guidance confirms the London Plan energy efficiency targets which require new major developments to achieve:

- Residential – 10% improvement on 2021 Building Regulations from energy efficiency;
- Residential – minimum 35% improvement on 2021 Building regulations on-site with a strong encouragement to reach 50% on-site CO2 emissions reduction;
- Non-residential – 15% improvement on 2021 Building Regulations from energy efficiency and minimum 35% improvement on-site.

2.15 The documents clarify how the results should be presented in the report and requires the refurbishment and the new extension to separately demonstrate the carbon reductions achieved, as well as site wide.

Local Planning Policy

2.16 In addition to London Plan policies, Camden Local Plan Policy CC2 requires that development be resilient to climate change. The development should adopt appropriate climate change adaptation measures, ensuring that development schemes demonstrate how adaptation measures and sustainable development principles have been incorporated into the design and proposed implementation.

Camden Local Plan 2017

2.17 The Camden Local Plan is the key strategic document in Camden's development plan. It sets out the vision for shaping the future of the borough and contains policies for guiding planning decisions. The following policies have been identified as appropriate for assessing the sustainable performance of new developments:

Policy CC2 Adapting to Climate change

"The Council will require development to be resilient to climate change. All development should adopt appropriate climate change adaptation measures such as:

a. *the protection of existing green spaces and promoting new appropriate green infrastructure;*
b. *not increasing, and wherever possible reducing, surface water runoff through increasing permeable surfaces and use of Sustainable Drainage Systems;*
c. *incorporating bio-diverse roofs, combination green and blue roofs and green walls where appropriate; and*
d. *measures to reduce the impact of urban and dwelling overheating, including application of the cooling hierarchy.*

Any development involving 5 or more residential units or 500 sqm or more of any additional floorspace is required to demonstrate the above in a Sustainability Statement.

Sustainable design and construction measures

The Council will promote and measure sustainable design and construction by:

e. *ensuring development schemes demonstrate how adaptation measures and sustainable development principles have been incorporated into the design and proposed implementation;*
f. *encourage new build residential development to use the Home Quality Mark and Passivhaus design standards;*
g. *encouraging conversions and extensions of 500 sqm of residential floorspace or above or five or more dwellings to achieve "excellent" in BREEAM domestic refurbishment; and*
h. *expecting non-domestic developments of 500 sqm of floorspace or above to achieve "excellent" in BREEAM assessments and encouraging zero carbon in new development from 2019."*

Building Regulations Approved Document Part L

2.18 Part L of the current Building Regulations (2021) considers the reduction of carbon emissions in new and existing buildings. As the proposals consist of the creation of new domestic spaces, they fall under Part L1A of the Regulations.

2.19 The overall structure of compliance with the 2021 Building Regulations for new buildings includes five criteria to comply with:

- **Criterion 1** – The Dwelling/Building Emission Rate (DER/BER) should be better than the Target Emission Rate (TER) and Dwelling/Building Primary Energy Rate should not exceed the Target Primary Energy Rate.
- **Criterion 2** – Limit on design flexibility;
- **Criterion 3** – Limiting effects of heat gain in summer;
- **Criterion 4** – Commissioning and air-tightness;
- **Criterion 5** – Efficient operation of buildings.

2.20 The detailed energy strategy for the scheme will be developed to ensure the scheme meets the relevant requirements of the Building Regulations.

3.0 BASELINE

Energy Efficiency Features

Building Envelope Specification and Thermal Performance

3.1 The heat losses of the spaces will be reduced by optimising the thermal performance of the building fabric and limiting the air permeability through a very high standard of construction. This strategy will lead to a steady but extremely low space heating load for all of the spaces of the scheme.

3.2 Table 3.1 below detail the designed U-values for the development.

Building Element/Characteristic	Designed values
External Wall – U value (W/m²K)	**0.15**
Ground Floor – U value (W/m²K)	**0.15**
Roof – U value (W/m²K)	**0.13**
Windows - U value (W/m²K)	**1.60**
Doors - U value (W/m²K)	**1.60**
Design Air Permeability (m³/hr/m² @50Pa)	**3**

Table 3.1: Proposed building fabric for the development

Air Tightness and Ventilation Strategy/Scope for Natural Ventilation

3.3 Air permeability is a measure of infiltration. It indicates how often the entire air quantity in a building is exchanged with outside air within 1 hour without any ventilation in place. Any air exchange with outside air is carrying heat energy away from the building, resulting in a higher heating load. Lower air permeability levels are desirable for conserving heat energy and in the case of mechanical ventilation systems for reducing fan power consumption. Infiltration is different from ventilation. Infiltration is essentially unwanted air exchanges through imperfections in the building fabric while ventilation is the air exchanges intended by the designer.

3.4 As detailed in Tables 3.1 it is envisaged that the air permeability of the Commercial units will be in the region of 3 m³/m²@50PA/hr.

3.5 The ventilation system for the commercial units will be predominantly naturally ventilated. Extract fans will be used for wet rooms (kitchens, bathrooms, WCs).

Overheating (with Natural Ventilation)

3.6 The overheating assessment was conducted to determine the efficiency of single-sided natural ventilation in maintaining thermal comfort. Results indicate that Unit B and Unit C fail to comply with the overheating criteria under this ventilation strategy. Refer to Appendix D for results.

3.7 Due to the inability of single-sided natural ventilation to prevent overheating, mechanical cooling is deemed necessary. Mechanical cooling is required to achieve and maintain thermal comfort in Units B and C.

Cooling Issues with GAHP System

3.8 The Gas Absorption Heat Pump (GAHP) provided only 'notional' cooling. The cooling effect of the GAHP was minimal, reducing ambient temperatures by only a couple of degrees. This performance was inadequate for ensuring thermal comfort during hotter periods.

Lighting and Appliances

3.9 Within the commercial units, high-frequency, dimmable, and high-efficiency lighting will be fitted. Furthermore, both the internal and external lighting will be controlled using PIR and daylight switching where appropriate. Lighting will be zoned to suit needs and daylight provision.

3.10 Unnecessary light spill will be reduced by avoiding the use of external decorative lighting; providing fittings only where they are required for security and maintenance purposes. External luminaires have been chosen to minimise sky glow and overspill and located to ensure that only the level of lighting that is required is achieved.

3.11 All appliances, if fitted, will be very energy efficient (A to A+++ rated). Information on the EU Energy Efficiency Labelling Scheme will be provided.

Building Systems and Plant

3.12 The heating system for the commercial units is powered by a highly efficient gas absorption heat pump located on the roof of the building. This system will supply fan coil units within the ceiling of each commercial unit. Gas absorption heat pumps have a seasonal efficiency of up to 149% for the provision of space heating.

3.13 The gas absorption heat pumps will be reversible, capable of providing some cooling to mitigate any overheating during the hottest periods of the year.

3.14 Since the domestic hot water demand for the commercial units is anticipated to be very low, the most efficient means of meeting this demand is by using local water heaters that will heat water according to the demand.

3.15 Please refer to Section 4 of this report for a feasibility study of community and district heating for the site and to Section 5 for detailed calculation for the site with ASHP proposed ('Be Green' stage).

Energy requirement and CO_2 emissions of the development

Simplified Building Energy Model (SBEM)

3.16 IES VE uses the National Calculation Methodology (NCM) and SBEM platform to demonstrate building compliance for non-residential buildings with Part L2 of the Building Regulations 2021. It can also be used to determine the building's regulated energy demand, consumption and carbon dioxide emissions.

3.17 The calculations determine a Building Emissions Rate or 'BER'. This value is compared to the energy requirements and emissions of a notional building of the same shape and dimensions which determines a compliant building (the Target Emission Rate or 'TER'). The BER must be equal to or less than the TER.

Spaces Modelled

3.18 A sample of representative model have been modelled for the scheme based on the latest set of architectural drawings from Chassay Studio, 11 November 2013.

Results of the Energy Simulation

3.19 The energy modelling has been carried out using the current building fabric and building services to determine the baseline.

3.20 Total carbon dioxide emissions for the building have been derived from the Building Emission Rate, and are as detailed in Appendix A

Carbon Dioxide Emissions	Carbon Dioxide Emissions [tonnes/year]	
	Regulated	**Unregulated**
Baseline: Part L 2021 of the Building Regulations Compliant Development	1.6	-
Be Lean - After energy demand reduction	1.5	-
Improvement over Part LA: 2021	**0.1**	**Tonnes CO_2 per annum**
	5	**%**

Table 3.2: CO_2 emissions from the Baseline development and Be Lean case

3.21 In the above table 3.2, the commercial units achieve a 5% improvement in emissions over the baseline, with the building fabric and ASHP powered by gas. To reduce the development's total energy demand and maximize carbon emission reduction, the proposed scheme will utilize low carbon and renewable energy technology. The study of feasible systems for the development at 30A Highgate Road has been summarized in Section 4 of this report.

4.0 LOW AND ZERO CARBON TECHNOLOGIES – 'BE GREEN'

Overview

4.1 The final step in the energy hierarchy requires that the clean generation of energy by renewable energy technologies be examined.

4.2 A feasibility study has been undertaken to establish the most technically and economically viable renewable technology which provides the highest overall reduction in carbon dioxide emissions for the proposed development to help achieve the planning policy target. The renewable technologies reviewed in this study and their feasibility for the proposed development are summarised in Table 5.1 below.

Low and Zero Carbon Technology	Suitability for the proposed development
Heat Pumps	**YES**
Photovoltaic Panels	**YES**
Solar thermal panels	**NO**
Biomass boilers	**NO**
Wind turbines	**NO**

Table 4.1: Review of suitability of LZC technology for the site.

4.3 Key parameters which have been considered when selecting appropriate combinations of technologies include:

- Opportunities of the site and energy demand of the development;
- Visual impact of the system;
- Practical implementation considerations;
- Maintenance requirements;
- Implications for internal arrangement and space allocation, infrastructure and site layout;
- Public acceptability;
- Deliverability;
- Management options;
- Interactions of the technologies with one another;
- Planning constraints;
- Client's preference.

Proposed Renewable Technology – ASHP

4.4 ASHPs are considered the most suitable option for providing low carbon heating to the development. The choice of air source heat pumps was dictated by a number of restrictions and constraints posed by the development, such as:

- Limited roof areas to accommodate sufficient number of PV panels to offset carbon dioxide emissions; CO_2 emissions reduction smaller due to lower emissions factor for electricity (0.136 kg/kWh for SAP 10.2 carbon emission factors comparing with 0.519 kg/kWh for SAP 2012);
- The development is proposed on a site fully covered by a building footprint; horizontal loops not feasible and spacing required between the vertical boreholes under the building would be technically challenging and economically not feasible;
- Location of the development in an urban area – no space for a wind turbine and a large biomass fuel store.

4.5 For these reasons the Client's preferred option for reducing carbon dioxide emissions is through the application air source heat pumps (ASHPs).

4.6 The following characteristics of the system will give it an advantage over other renewable technologies:

- High efficiency heating;
- Low impact on air quality;
- Low levels of noise when suitable location is chosen;
- Lower emissions when calculated using SAP 10 fuel carbon factors;
- Use of fuel that is becoming 'green' due to the grid decarbonisation.

4.7 ASHPs will be used to provide all of the space heating and cooling demand for the commercial units. The space conditioning will be via a VRF system composed of a Samsung DVM S outdoor unit and 360 Cassette indoor units, designed for efficient and flexible heating and cooling in commercial environments. The efficiency metrics from the received product data sheet, with a Heating COP of 3.5 and Cooling EER of 2.7 for Unit B, and a Heating COP of 3.75 and Cooling EER of 3.1 for Unit C, were considered for modelling purposes. This specific unit was suggested by the M&E consultant from the design team.

4.8 ASHPs extract energy from the air and therefore require space for external units. A roof space above the 2nd floor has been considered for the location of the external units serving Commercial Units.

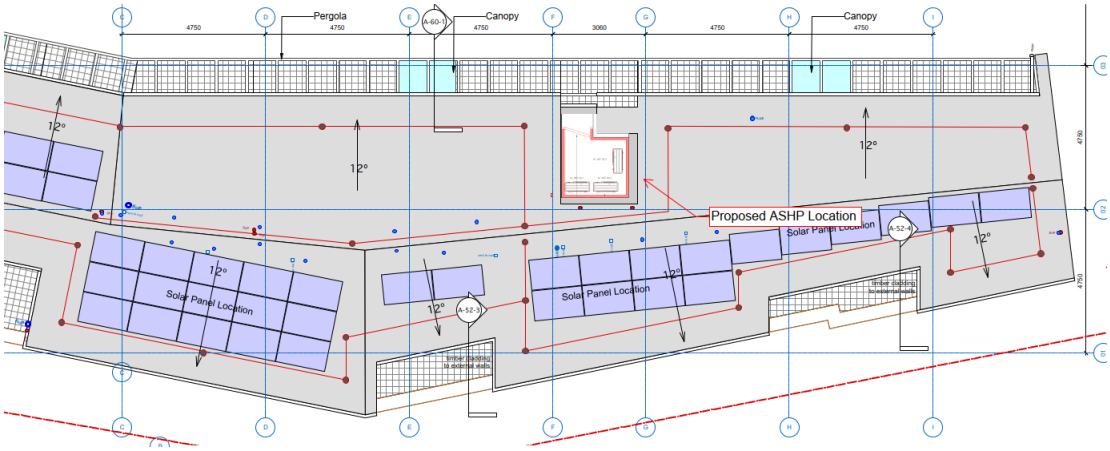


Figure 4.1: Roof area for ASHP location.

4.9 Carbon emissions savings achieved by the proposed ASHPs have been calculated in line with the GLA guidance on preparing energy statements (June 2022).

4.10 Please refer to table 5.2 for a summary of the savings achieved by the proposed ASHPs, Appendix C for BRUKL and Appendix A for carbon emissions calculations for revised (SAP 10) carbon factors.

4.11 Total CO_2 emissions reduction over the GLA Base Case scenario, achieved through incorporation of ASHPs are estimated to be 34% for the development, exceeding the requirements of Part L of the Building Regulations.

4.12 These results provide a robust case for supporting the proposed heating strategy incorporating air source heat pumps for commercial units. This aligns with the London Plan policy strategy supporting clean, low emission fuels.

	Total regulated emissions (Tonnes CO_2 / year)	CO_2 savings (Tonnes CO_2 / year)	Percentage savings (%)
Part L 2021 baseline	1.6		
Be lean	1.5	0.1	5%
Be clean	1.5	0.0	0%
Be green	1.1	0.5	28%
Total Savings	-	**0.6**	**34%**

Table 4.2: Energy hierarchy reductions (SAP 10 fuel emission factors)

Photovoltaic Panels –Supplementing Technology

4.13 Photovoltaic cells directly convert sunlight into electrical current using semiconductors. The output of a cell is directly proportional to the intensity of the light received by the active surface of the cell. The location and positioning of PV cells is therefore critical to achieving acceptable performance.

4.14 Photovoltaics are generally technically suitable for residential developments, however the carbon reduction achieved by the system is quite low due to decarbonisation of the grid and revised carbon factors for electricity. 1 kWp of PV in a horizontal position generates approximately 760 kWh of electricity per year, which translates to 177 kg of CO_2 savings per year, using SAP 10 carbon factors, and only 103 kg of CO_2 savings per year, when calculated using SAP 10.2 carbon factor for electricity.

4.15 Areas of PV modules vary between manufacturers, however on average 1 PV module covers an area of approximately 1.6m^2. PV panels are produced in various sizes with power outputs ranging from 0.165 kWp to 1kWp per module. The most commonly used generate approximately 0.3-0.4 kW of electricity.

4.16 The estimated carbon emissions reduction from the development, after incorporation of ASHP, is 34% as shown in Table 4.2 above. However, due to insufficient available space on the roof, additional PVs have not been proposed.

Selection of Refrigerant for Proposed AC units

4.17 The refrigerant R410A of the proposed 3 AC units has a high global warming potential, over 2,000 times that of CO2. The environmental impact of refrigerants is a valid concern, and alternative refrigerants with lower GWP should be considered. For instance, refrigerants such as R32 or R454B, which have significantly lower GWPs, could be considered as potential alternatives. These refrigerants will not impact the energy assessment results. GWP is defined as the potential for global warming that a chemical has relative to 1 unit of carbon dioxide, the primary greenhouse gas. In determining the GWP of the refrigerant, the Intergovernmental Panel on Climate Change methodology using a 100-year integrated time horizon should be applied. Table below lists some of the refrigerant types with low GWP.

R-Number	Chemical Name	GW 100-yr
R30	Dichloromethane	9
R-170	Ethane	3
R-290	Propane	3
R-600	Butane	3

R-Number	Chemical Name	GW 100-yr
R-600a	Isobutane	3
R-702	Hydrogen	5.8
R-717	Ammonia	0
R-718	Water	0.2
R-729	Air (nitrogen, oxygen, argon)	1
R-744	Carbon Dioxide	1
R-1150	Ethylene	3
R-1234yf	2,3,3,3-Tetrafluropropene	4
R-1270	Propylene	3

Table 4.3: List of some common refrigerant types with low GWP (Source: The United Nations Environment Programme '2010 Report of the Refrigeration, Air-conditioning and Heat Pumps Technical Options Committee'

4.18 Hermetically sealed system can be considered to reduce the risk of refrigerant leaks.

Justification to increase in Cooling Capacity

4.19 The proposed increase from 1 to 3 AC units is necessitated by the need to effectively address the cooling deficiencies of the original GAHP system.

4.20 The increase in cooling demand is due to the failure in achieving thermal comfort for Unit B and Unit C through passive ventilation. The single-sided natural ventilation through the windows failed to comply with the overheating check for both units. Furthermore, with GAHP, it is unlikely that the set point temperature will be reached and desired thermal comfort level will be achieved. GAHP provided 'notional' cooling, which is not effective and would only reduce the ambient temperature by a couple of degrees. The proposed three AC units constitute a comfort cooling system that would maintain indoor temperatures at a set point up to the design temperature.

4.21 The proposed 3 AC units form a comfort cooling system which is designed to maintain indoor temperatures at a set point up to the design temperature, proportionally rising thereafter to ensure thermal comfort. This significant improvement in cooling capacity inherently increases energy consumption; however, the proposal includes measures to offset and minimize this

impact. These measures involve the use of energy-efficient AC units, optimized operational schedules, and integration with smart control systems to ensure the cooling load is managed efficiently, thereby reducing unnecessary energy usage while maintaining the required indoor climate.

Cooling Hierarchy

4.22 The cooling hierarchy has been thoroughly considered to justify the proposal. The strategies mentioned below for the cooling hierarchy are in line with the Energy Efficiency CPG (2021).

a. Internal heat generation has been minimized through energy-efficient design. To further enhance this, it is recommended that the pipe network be insulated to reduce internal heat gain and heat loss through the pipes.
b. The cooling hierarchy suggest reducing external heat gain i.e. amount of heat entering the building in summer through orientation, shading, light-coloured roofs, fenestration, insulation, green roofs, and walls. Due to limitations, not all these measures can be implemented; however, shading has been considered in the modelling.
c. Managing heat within the building through exposed internal thermal mass and high ceilings is limited by constraints and, therefore, not recommended.
d. Passive ventilation has been utilized where possible in the modelling. Where passive ventilation fails to achieve an appropriate thermal comfort level, mechanical cooling has been proposed as a mitigation measure for overheating risks.
e. The proposed active cooling system is a low carbon option, as detailed in the Table 4.3.

<u>Overheating</u>

4.23 The primary justification for the installation of the new AC systems is to address spatial overheating. Given the failure of natural ventilation and the original GAHP system to control indoor temperatures, the proposed AC systems are essential for maintaining a comfortable and habitable indoor environment.

4.24 Overheating is reduced through the inclusion of openable windows to enable effective purge ventilation. Additionally, it is proposed that the commercial units be supplied with mechanical cooling.

4.25 The proposed 3 AC systems are designed to maintain indoor temperatures at a set point up to the design outdoor temperature. The system is capable of proportional temperature control, meaning it will rise in response to increasing outdoor temperatures but still maintain a comfortable indoor environment. This is a significant improvement over the original GAHP system, which lacked the capacity for effective temperature control.

4.26 The proposed AC systems offer a more reliable and consistent method of cooling compared to the GAHP system. The original GAHP system was not effective in addressing spatial overheating issues. The new AC systems ensure thermal comfort by adequately managing indoor temperatures even during peak heat periods, refer to Appendix E for detailed results for Overheating.

4.27 The commercial units have the majority of their glazing on the northwest façade, providing more diffuse light without excessive glare. The glazing on the southeast façade is reduced, which has the effect of reducing solar gains and therefore reducing overheating.

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 This report has been developed to detail the energy efficient features of the development and assess how they relate to the relevant planning policy, including the Local Plan and its Policy CC2. This policy requires ensuring that development should adopt appropriate climate change adaptation measures, ensuring that development schemes demonstrate how adaptation measures and sustainable development principles have been incorporated into the design and proposed implementation.

5.2 The new AC systems will provide effective and reliable cooling, ensuring thermal comfort by maintaining indoor temperatures within a comfortable range even during high outdoor temperatures.

5.3 This proposal aims to replace a single commercial gas absorption heat pump with three commercial air-conditioning units to achieve a significant reduction in overall site CO_2 emissions. Utilizing the existing building fabric and services, a baseline was established. Currently, with the building's U-values and the gas-powered heat pump, the site achieves a 5% improvement in CO_2 emissions over the baseline. However, by installing the proposed air-conditioning units, the scheme is projected to achieve a 34% improvement over the baseline scenario.

6.0 DISCLAIMER

6.1 Create Consulting disclaims any responsibility to the Client, Wolfe Investments Ltd and others in respect of any matters outside the scope of this report.

6.2 The copyright of this report is vested in Create Consulting Engineers Ltd and Wolfe Investments Ltd. The Client, or his appointed representatives, may copy the report for purposes in connection with the development described herein. It shall not be copied by any other party or used for any other purposes without the written consent of Create Consulting Engineers Ltd or Wolfe Investments Ltd.

6.3 Create Consulting Engineers Ltd accepts no responsibility whatsoever to other parties to whom this report, or any part thereof, is made known. Any such other parties rely upon the report at their own risk.

APPENDICES

APPENDIX A

GLA Carbon Emissions Reporting Spreadsheet

BACKGROUND AND PURPOSE

From **January 2023** planning applicants for new and refurbishments schemes are required to use this spreadsheet to report the anticipated carbon performance of a development. It should be used for both domestic and non-domestic uses. This spreadsheet ensures a consistent and transparent process for presenting Part L 2021 CO_2 emission performance. The GLA will not accept the use of alternative methodologies or tools. This is to ensure consistency and to minimise the need for clarifications during the planning application determination period.

Planning applicants should use Part L 2021 BRUKL and SAP outputs to fill in this spreadsheet which serves as a the final step in reporting the carbon emission performance of the proposed energy strategy. **It is solely for the purpose of reporting compliance with the London Plan to the GLA and does not replace Part L calculations submitted for Building Regulations approval.**

The spreadsheet has been developed to fit as wide a range of policy compliant approaches for schemes as possible. Any planning applicants with a policy compliant approach that the spreadsheet does not serve should contact the GLA at: **ZeroCarbonPlanning@london.gov.uk**. Applicants must not amend or alter the spreadsheet to suit non-policy compliant strategies. Any unauthorised amendment to the spreadsheet will invalidate the CO_2 emission calculations.

Applicants should note that we will update the spreadsheet from time to time to ensure it remains fit for purpose. Applicants are expected to use the latest version at the time of the planning submission.

Any feedback on this spreadsheet should be sent to: ZeroCarbonPlanning@london.gov.uk.

METHODOLOGY

Applicants are required to complete **all** light blue input cells in the applicable tabs prior to submission ('Development Information', 'Part L Outputs', 'EUI & space heating demand' and 'GLA Summary Tables').

Input Data
For all applications, the input data required includes:
'Development information' tab
- Table 1. Application Completeness Check
- Table 2. Development Details
- Table 3. Bespoke District Heating Carbon Factors (if applicable)
- Table 4. Distribution loss factor (if applicable)
- Table 5. SCoP Calculation Methodology (if applicable)

'Part L Output' tab
- Type of units modelled
- Area of units modelled (m²)
- Number of units modelled
- Total area represented by model (m²)
- TER, DER and BER figures ($kgCO_2/m^2$ p.a.)
- Notional building Energy saving/generation technologies (-) for residential ($kgCO_2$ p.a.)
- Notional building Displaced electricity (-) for non-residential (kWh//m² p.a.)
- TFEE and DFEE figures for residential (kWh//m² p.a.)

'GLA Summary tables' tab
- Unregulated figures (tCO_2 p.a.)
- Actual and notional building cooling demand (MJ/m²)

Note: The total carbon emissions figures in the 'GLA Summary tables' tab are now calculated based on the area input for 'Total area represented by model (m²)'. This input requirement has been added to ensure that the carbon emission figures align with the development area schedule (included within the DAS) rather than the number of representative models.

'EUI & Space Heating Demand' tab
- Confirmation of building type
- Gross Internal Area (GIA) in m^2
- Energy Use Intensity (EUI) per fuel type (kWh p.a.)
- Space heating demand (kWh p.a.)
- Confirmation that both regulated and unregulated energy use has been included
- Confirmation of predicted energy use methodology, including modelling software
- Notes on the assessment, including justification if expected performance differs from Table 4

Note: Applicants can use the ‘be seen’ methodology or an alternative predictive energy modelling methodology to fill in the required EUI & space heating demand information.
Where ‘be seen’ reporting is used the reported EUI and space heating demand should align with energy consumption data reported in the planning stage submission for the ‘be seen’ policy, submitted via the online webform.

Required Part L Outputs for the GLA spreadsheet
Domestic Part L Outputs:
For the domestic conversion applicants are required to use the outputs from the SAP TER and DER worksheets. To assist in the process the required SAP worksheet rows have been referenced in each input cell. Note: The SAP worksheet rows are based on a communal heating system in line with GLA policy and guidance. Applicants proposing individual systems must first seek confirmation from the GLA as to whether the approach will be acceptable.

Non-domestic Part L Outputs:

Regarding the non-domestic uses, the applicant can determine whether each individual unit will be modelled independently and apportioned to the entire scheme or whether a single model will be generated for the entire development. The applicant should, however, include the results from all BRUKL outputs generated for the proposed development under the "NON-RESIDENTIAL CO_2 ANALYSIS" sections. Applicants are generally encouraged to model each individual typology independently.

Validation Check
Applicants must ensure that the calculated TER/DER/BER in this spreadsheet matches the actual values from the Part L 2021 BRUKL and SAP worksheets. The Part L 2021 BRUKL and SAP sheet must accompany the energy assessment so that results can be validated.

TABLE 1. APPLICATION COMPLETENESS CHECK	
Development information tab (Tables 1-4) completed and included in appendix of energy strategy?	
Part L outputs tab completed	
EUI & space heating demand completed	
Confirmation that the planning stage webform will be completed at planning application submission and that the Be Seen process and reporting responsibilities are fully understood, including the requirement for as-built and in-use stage reporting to be undertaken (or where the legal owner changes from one reporting stage to another that the responsible party will be notified).	

TABLE 2. DEVELOPMENT DETAILS		Further notes	Response	Supporting comments (or signpost sections in the energy assessment)
Application details	Date of Application	Please provide the date the application was submitted to the Local Planning Authority.		
	Local Planning Authority	Please indicate the Local Planning Authority determining the application.	*Camden*	
	Confirmed carbon offset price (£/tonne of carbon dioxide)	Please confirm the agreed carbon offset price for the Local Planning Authority. If no value is entered then the GLA's recommend price of £95 per tonne of carbon dioxide will be used.		
	Evidence of communication on the carbon offset price included in the energy assessment (Y/N).			
	Residential units number (Part L1)			
	Non-residential floor area in m^2 (Part L2)		*393.10*	
Heat risk	CIBSE TM59 undertaken for residential development (Y/N)			
	CIBSE TM52 undertaken for non-residential development (Y/N)			
	All sample units meet CIBSE criteria with DSY1 weather file (Y/N)			
	DSY2 and DSY3 included in overheating assessments (Y/N)			
	Residential g-value			
	% Glazing Ratio over façade			
	External shading proposed (Y/N)			
Energy efficiency measures	Target Fabric Energy Efficiency met (Y/N)			
	Mechanical Ventilation with Heat Recovery included (Y/N)			
	Waste Water Heat Recovery (Y/N)			
	Low energy lighting (Y/N)			
District heating connection	Development in a Heat Network Priority Area (HNPA) (Y/N)			
	District Heating Network connection (Y/N)			
	Name of District Heating Network			
	Carbon factor ($kgCO_2$/ kWh)			
	Borough energy officer and Heat Network Operator contacted and evidence of correspondence included in the energy strategy (Y/N)	Applicable to all applications.		
Site heating distribution configuration	Development future proofed for DHN connection (Y/N)	Note that individual heating systems would not be appropriate for developments in HNPAs.		
	Drawings of communal system provided (Y/N)	Applicants should provide a drawings of the energy centre, on-site communal network with all building uses connected and future proofing arrangements detailed, including single point of connection.		
	Distribution type			
	Flow temperature (°C)			
	Return temperature (°C)			
	Distribution losses modelled (%)	See table 4 below for details.		
Heating system performance	Heat Pump (Y/N)			
	Heat Pump source			
	Centralised Heat Pump capacity (kWth)			
	Heat Pump Seasonal Heating Efficiency (SCoP)			
	Heat Pump SCoP calculation includes heat source and heat distribution temperature and seasonal performance factor (Y/N)	See table 5 below for details.		
	Fraction of heat supplied by heat pump (only for hybrid systems with boilers) (%)			
	Low-emission on-site CHP enabling an area-wide heat network (Y/N)	Only low-emission CHP is suitable and only where it is facilitating an area-wide heat network. Therefore, new gas engine CHP is not suitable for any other purpose for new developments.		
	CHP (kWe)			
	Estimated end user cost (pence/kWh)			
	Energy assessment includes consideration of occupant running costs (Y/N)	Applicants should consider the estimated costs to occupants of the energy assessment and outline how they are committed to protecting the consumer from high prices.		
Solar technologies	Solar PV included (Y/N)			
	Roof layout demonstrating solar PV technologies have been maximised included in energy strategy (Y/N)			
	kWh generated			
	kWp			
	Total PV panel area (m^2) installed			
	Solar Thermal included (Y/N)			
	Solar Thermal panel area (m^2) installed			
Flexibility and peak energy demand	Site-wide peak demand, capacity and flexibility potential included in energy assessment (Y/N)	Table 9 in the energy assessment guidance to be completed.		
	Interventions for achieving flexibility included in energy assessment (Y/N)	Table 10 in the energy assessment guidance to be completed.		
	Estimated peak demand (MW)			
	Electrical energy storage (kWh) capacity			
	Heat energy storage (kWh) capacity			
Other technologies	System type (e.g. wind turbine)			
	Capacity (kW)			
Cooling	Cooling proposed - Residential (Y/N)	It is not expected that 'active cooling' will be proposed for any residential developments. It will be expected that applicants can fully demonstrate that all passive design measures have been thoroughly investigated before considering 'active cooling'.		
	Cooling proposed - Non-residential (Y/N)			
	Residential Cooling consumption (kWh p.a.)	See note in cell C60.		
	Commercial Cooling consumption (MJ p.a.)			

TABLE 3. BESPOKE DH CARBON FACTOR CALCULATION METHODOLOGY
Please provide below details of the calculation methodology followed to establish the bespoke carbon factor, if applicable.

TABLE 4. DISTRIBUTION LOSSES				COMMENTS
Primary network (buried pipe)	Total pipe length (m)			
	Average heat loss rate (W/m)			
Secondary network (buried pipe)	Total pipe length (m)			
	Average heat loss rate (W/m)			
Total losses (MWh/year)				
Total heat supplied (MWh/year)				
Distribution Loss Factor (DLF)				
Calculation included in energy statement (yes/no)				

TABLE 5. SEASONAL COEFFICIENT OF PERFORMANCE (SCOP) CALCULATION METHODOLOGY
Details of the Seasonal Coefficient of Performance (SCOP), the Seasonal Performance Factor (SFP) and Seasonal Energy Efficiency ratio (SEER), which should be used in the energy modelling. This should be based on a dynamic calculation of the system boundaries over the course of a year i.e. incorporating variations in source temperatures and the design sink temperatures (for space heat and hot water). Details of the assumptions should be included in the energy assessment, including manufacturer datasheets showing performance under test conditions for the specific source and sink temperatures of the proposed development and assumptions for hours spent under changing source temperatures.

The applicant should complete all the light blue cells including information on the modelled units, the area per unit, the number of units, the TER/DER/BER and the TFEE/DFEE.

RESIDENTIAL CO_2 ANALYSIS (PART L1)

				Baseline		'Be Lean'	'Be Clean'	'Be Green'	Fabric Energy Efficiency (FEE)		Baseline		'Be Lean'			'Be Clean'			'Be Green'	
Unit identifier (e.g. plot number, dwelling type etc.)	Model total floor area	Number of units	Total area represented by model	TER	Energy saving/generation technologies (-)	DER	DER	DER	Target Fabric Energy Efficiency	Dwelling Fabric Energy Efficiency	Part L 2021 CO_2 emissions	Energy saving/generation technologies	Part L 2021 CO_2 emissions	Part L 2021 CO_2 emissions with Notional PV savings included	'Be Lean' savings	Part L 2021 CO_2 emissions	Part L 2021 CO_2 emissions with Notional PV savings included	'Be Clean' savings	Part L 2021 CO_2 emissions	'Be Green' savings
	(m^2) (Row 4)		(m^2)	($kgCO_2$ / m^2) (Row 273)	($kgCO_2$ p.a.) (Row 269)	($kgCO_2$ / m^2) (Row 273 or 384)	($kgCO_2$ / m^2) (Row 273 or 384)	($kgCO_2$ / m^2) (Row 273 or 384)	(kWh/m^2)	(kWh/m^2)	($kgCO_2$ p.a.)	($kgCO_2$ p.a.)	($kgCO_2$ p.a.)	($kgCO_2$ p.a.)	($kgCO_2$ p.a.)	($kgCO_2$ p.a.)	($kgCO_2$ p.a.)	($kgCO_2$ p.a.)	($kgCO_2$ p.a.)	($kgCO_2$ p.a.)
Sum		0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*

NON-RESIDENTIAL CO_2 ANALYSIS (PART L2)

				Baseline		'Be Lean'	'Be Clean'	'Be Green'			Baseline		'Be Lean'			'Be Clean'			'Be Green'	
Building Use	Model Area	Number of units	Total area represented by model	BRUKL TER	BRUKL Displaced electricity (-)	BRUKL BER	BRUKL BER	BRUKL BER			Part L 2021 CO_2 emissions	Energy saving/generation technologies	Part L 2021 CO_2 emissions	Part L 2021 CO_2 emissions with Notional PV savings included	'Be Lean' savings	Part L 2021 CO_2 emissions	Part L 2021 CO_2 emissions with Notional PV savings included	'Be Clean' savings	Part L 2021 CO_2 emissions	'Be Green' savings
	(m^2)		(m^2)	($kgCO_2$ / m^2)	(kWh / m^2)	($kgCO_2$ / m^2)	($kgCO_2$ / m^2)	($kgCO_2$ / m^2)			($kgCO_2$ p.a.)	($kgCO_2$ p.a.)	($kgCO_2$ p.a.)	($kgCO_2$ p.a.)	($kgCO_2$ p.a.)	($kgCO_2$ p.a.)	($kgCO_2$ p.a.)	($kgCO_2$ p.a.)	($kgCO_2$ p.a.)	($kgCO_2$ p.a.)
Commercial	*393.1*	*1*	*393.1*	4.07	0.00	3.85	3.85	2.70			1,600	0.00	1,513.44	1,513	86	1,513	1,513	0	1,061	452
Sum		1	393	4.1	0.0	3.9	3.9	2.7			*1,600*	*0*	*1,513*	*1,513*	*86*	*1,513*	*1,513*	*0*	*1,061*	*452*
SITE-WIDE ENERGY CONSUMPTION AND CO_2 ANALYSIS																				
Total Sum			393	-	-	-	-	-			*1,600*	*0*	*1,513*	*1,513*	*86*	*1,513*	*1,513*	*0*	*1,061*	*452*

Applicants can use the 'be seen' methodology or an alternative predictive energy modelling methodology to fill in this tab.
Where 'be seen' reporting is used the reported EUI and space heating demand should align with energy consumption data reported in the planning stage submission for the 'be seen' policy, submitted via the online webform.

Residential predicted energy use

Building type	GIA (m^2)	EUI & space heating demand (kWh/year)									Has the following energy use been included?		Results		Table 4 of the guidance comparison		Methodology used		
		Space heating demand	Annual Electricity Use	Annual Gas Use	Annual Oil Use	Annual Biomass Use	Annual District Htg Use	Annual District Clg Use	Elec Generation, Gross	Solar Thermal Generation	Regulated	Unregulated	EUI (kWh/m^2/year) (excluding renewable energy)	Space heating demand (kWh/m^2/year) (excluding renewable energy)	EUI value from Table 4 of the guidance (kWh/m^2/year) (excluding renewable energy)	Space heating demand from Table 4 of the guidance (kWh/m^2/year) (excluding renewable energy)	Software	Operational energy use assessment	notes (if expected performance differs from the Table 4 values in the guidance or other software used)
					if applicable	if applicable	if applicable	if applicable	if applicable	if applicable									
Residential use (total)				0	0	0	0	0	0	0									
Landlord Circulation (in Residential Blocks)																			
Total	0	0	0	0	0	0	0	0	0	0									

Non-residential predicted energy use

Building type	GIA (m^2)	EUI & space heating demand (kWh/year)									Has the following energy use been included?		Results		Table 4 of the guidance comparison		Methodology used		
		Space heating demand	Annual Electricity Use	Annual Gas Use	Annual Oil Use	Annual Biomass Use	Annual District Htg Use	Annual District Clg Use	Elec Generation, Gross	Solar Thermal Generation	Regulated	Unregulated	EUI (kWh/m^2/year) (excluding renewable energy)	Space heating demand (kWh/m^2/year) (excluding renewable energy)	EUI value from Table 4 of the guidance (kWh/m^2/year) (excluding renewable energy)	Space heating demand from Table 4 of the guidance (kWh/m^2/year) (excluding renewable energy)	Software	Operational energy use assessment	notes (if expected performance differs from the Table 4 values in the guidance or other software used)
					if applicable	if applicable	if applicable	if applicable	if applicable	if applicable									
Total	0	0	0	0	0	0	0	0	0	0									

Part L 2021 Performance

Residential

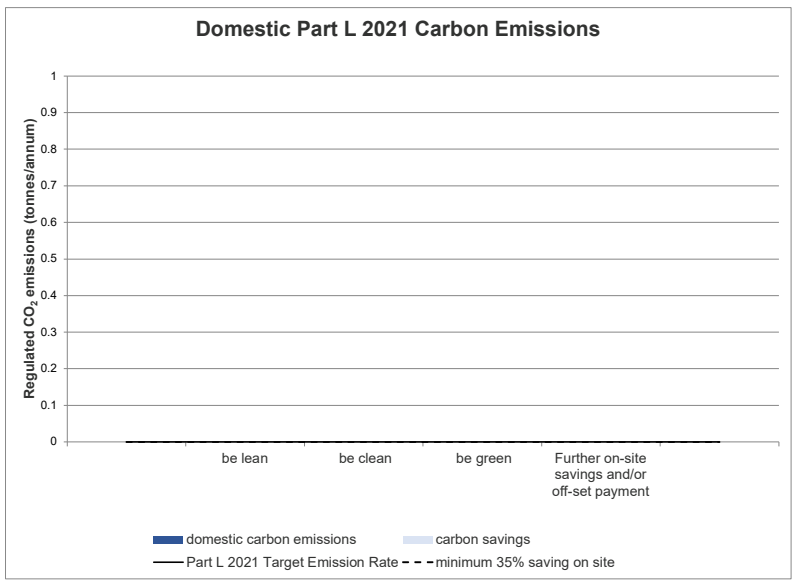
Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for residential buildings

	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	10.3
After energy demand reduction (be lean)	0.0	10.3
After heat network connection (be clean)	0.0	10.3
After renewable energy (be green)	0.0	10.3

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

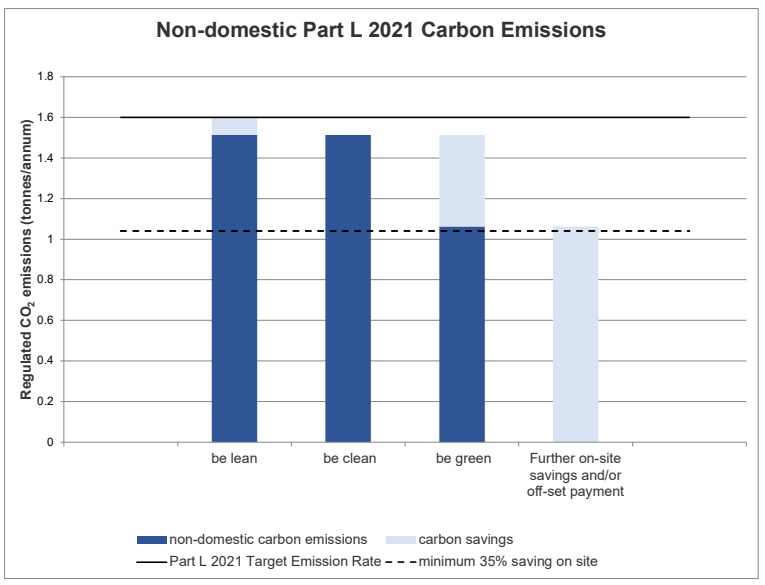
Table 3: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for non-residential buildings

	Carbon Dioxide Emissions for non-residential buildings (Tonnes CO_2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2021 of the Building Regulations Compliant Development	1.6	
After energy demand reduction (be lean)	1.5	
After heat network connection (be clean)	1.5	
After renewable energy (be green)	1.1	

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	0.1	5%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	0.5	28%
Total Cumulative Savings	**0.5**	**34%**
Annual savings from off-set payment	1.1	-
	(Tonnes CO_2)	
Cumulative savings for off-set payment	**32**	-
Cash in-lieu contribution (£)	**3,025**	

*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



SITE-WIDE

	Total regulated emissions (Tonnes CO_2 / year)	CO_2 savings (Tonnes CO_2 / year)	Percentage savings (%)
Part L 2021 baseline	1.6		
Be lean	1.5	0.1	5%
Be clean	1.5	0.0	0%
Be green	1.1	0.5	28%
Total Savings	-	0.5	34%
	-	**CO_2 savings off-set (Tonnes CO_2)**	-
Off-set	-	**31.8**	-

	Target Fabric Energy Efficiency (kWh/m²)	Dwelling Fabric Energy Efficiency (kWh/m²)	Improvement (%)
Development total	0.00	0.00	

	Area weighted non-residential cooling demand (MJ/m^2)	Total non-residential cooling demand (MJ/year)
Actual		
Notional		

EUI & space heating demand (predicted energy use)

Residential

Building type	EUI (kWh/m^2/year) (excluding renewable energy)	Space heating demand (kWh/m^2/year) (excluding renewable energy)	EUI value from Table 4 of the guidance (kWh/m^2/year) (excluding renewable energy)	Space heating demand from Table 4 of the guidance(kWh/m^2/year) (excluding renewable energy)	Methodology used (e.g. 'be seen' methodology or an alternative predictive energy modelling methodology)	Explanatory notes (if expected performance differs from the Table 4 values in the guidance)

Non-residential

Building type	EUI (kWh/m^2/year) (excluding renewable energy)	Space heating demand (kWh/m^2/year) (excluding renewable energy)	EUI value from Table 4 of the guidance (kWh/m^2/year) (excluding renewable energy)	Space heating demand from Table 4 of the guidance(kWh/m^2/year) (excluding renewable energy)	Methodology used (e.g. 'be seen' methodology or an alternative predictive energy modelling methodology)	Explanatory notes (if expected performance differs from the Table 4 values in the guidance)

APPENDIX B

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

30a Highgate Road- Baseline

As designed

Date: Tue Jun 04 19:01:02 2024

Administrative information

Building Details

Address: London, NW5 1NS

Certifier details

Name: Create Consulting Engineers Ltd

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]: 372.63

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

Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	4.07	
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	3.85	
Target primary energy rate (TPER), $kWh_{PE}/m^2.annum$	37.23	
Building primary energy rate (BPER), $kWh_{PE}/m^2.annum$	37.19	
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	NT000007:Surf[0]
Floors	0.18	-	-	UNKNOWN
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	-	-	No flat roofs in building
Windows** and roof windows	1.6	1.64	1.64	NT000007:Surf[3]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	1.61	1.61	NT000007:Surf[20]
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)] $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m²K)]

$U_{a\text{-}Calc}$ = Calculated area-weighted average 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	>0.95

1- Gas ASHP+FCU

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1.5	2.6	0	1.2	0.65
Standard value	1	1.6	N/A	2^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
^ Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.					

1- HWS (BeLean)

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
Standard value	1	N/A

"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
Unit B	125	-	-
Toilet	125	-	-
Plant	125	-	-
Lobby	125	-	-
Unit C	125	-	-

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?
Unit B	NO (-75.9%)	NO
Unit C	NO (-88.6%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m^2]	393.1	393.1
External area [m^2]	372.5	372.5
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	3	3
Average conductance [W/K]	142.48	245.52
Average U-value [W/m^2K]	0.38	0.66
Alpha value* [%]	25.19	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
100	**Offices and Workshop Businesses**
	General Industrial and Special Industrial Groups
	Storage or Distribution
	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	5.09	6.5
Cooling	9.52	4.88
Auxiliary	3.94	7.43
Lighting	5.55	5.5
Hot water	2.74	2.6
Equipment*	42.7	42.7
TOTAL**	**26.85**	**26.93**

* 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]	86.84	112.5
Primary energy [kWh_{PE}/m^2]	37.19	37.23
Total emissions [kg/m^2]	3.85	4.07

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] Natural Gas, [CFT] Electricity										
	Actual	28	63.6	5.4	10	3.9	1.45	1.76	1.5	2.6
	Notional	32.8	85.9	6.9	5.2	7.6	1.33	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

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name

30a Highgate Road- BeGreen

As designed

Date: Thu Jun 06 11:25:00 2024

Administrative information

Building Details

Address: London, NW5 1NS

Certifier details

Name: Create Consulting Engineers Ltd

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]: 372.63

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

Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	3.18	
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	2.7	
Target primary energy rate (TPER), $kWh_{PE}/m^2.annum$	34.69	
Building primary energy rate (BPER), $kWh_{PE}/m^2.annum$	30.04	
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	NT000007:Surf[0]
Floors	0.18	-	-	UNKNOWN
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	-	-	No flat roofs in building
Windows** and roof windows	1.6	1.64	1.64	NT000007:Surf[3]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	1.61	1.61	NT000007:Surf[20]
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)]

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

$U_{a\text{-}Calc}$ = Calculated area-weighted average 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	>0.95

1- Unit B- ASHP +VRF

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.5	2.7	0	0.15	0.65
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.

2- Unit C- ASHP+VRF

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.75	3.1	0	0.11	-
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.

1- HWS

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
Standard value	1	N/A

"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
Unit B	125	-	-
Toilet	125	-	-
Plant	125	-	-
Lobby	125	-	-
Unit C	125	-	-

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?
Unit B	NO (-75.9%)	NO
Unit C	NO (-88.6%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m^2]	393.1	393.1
External area [m^2]	372.5	372.5
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	3	3
Average conductance [W/K]	142.48	245.52
Average U-value [W/m^2K]	0.38	0.66
Alpha value* [%]	25.19	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
100	**Offices and Workshop Businesses**
	General Industrial and Special Industrial Groups
	Storage or Distribution
	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	3.29	3.1
Cooling	8.28	4.88
Auxiliary	0.73	7.43
Lighting	5.55	5.5
Hot water	2.74	2.6
Equipment*	42.7	42.7
TOTAL**	**20.59**	**23.53**

* 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]	97.15	112.5
Primary energy [kWh_{PE}/m^2]	30.04	34.69
Total emissions [kg/m^2]	2.7	3.18

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	92	43.7	7.4	5.6	0.4	3.45	2.18	3.75	3.1
	Notional	46.1	89.7	4.6	5.4	8.3	2.78	4.63	----	----
[ST] Variable refrigerant flow, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	27.3	65.7	2.4	9.6	0.5	3.22	1.9	3.5	2.7
	Notional	29	84.9	2.9	5.1	7.3	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 D

App D – Overheating Results with Nat Vent

Weather file: London_LWC_DSY1_2020High50.epw

Passed: 0 rooms:

Room Name	Room ID	Occupied days (%)	Criteria 1 (%Hrs Top-Tmax>=1K)	Criteria 2 (Max. Daily Deg.Hrs)	Criteria 3 (Max. DeltaT)	Criteria failing

Failed: 2 rooms:

Room Name	Room ID	Occupied days (%)	Criteria 1 (%Hrs Top-Tmax>=1K)	Criteria 2 (Max. Daily Deg.Hrs)	Criteria 3 (Max. DeltaT)	Criteria failing
Unit B	NT000007	71.2	12.2	33	5	1 & 2 & 3
Unit C	NT00000C	71.2	15.9	28	5	1 & 2 & 3

Unoccupied: 4 rooms:

Room Name	Room ID	Occupied days (%)	Criteria 1 (%Hrs Top-Tmax>=1K)	Criteria 2 (Max. Daily Deg.Hrs)	Criteria 3 (Max. DeltaT)	Criteria failing
Toilet	NT000008	0	0	0	0	-
Plant	NT000009	0	0	0	0	-
Lift	NT00000A	0	0	0	0	-
Lobby	NT00000B	0	0	0	0	-

APPENDIX E

App E – Overheating Results with AC unit

Weather file: London_LWC_DSY1_2020High50.epw

Passed: 2 rooms:

Room Name	Room ID	Occupied days (%)	Criteria 1 (%Hrs Top-Tmax>=1K)	Criteria 2 (Max. Daily Deg.Hrs)	Criteria 3 (Max. DeltaT)	Criteria failing
Unit B	NT000007	71.2	0	0	0	-
Unit C	NT00000C	71.2	0	0	0	-

Failed: 0 rooms:

Room Name	Room ID	Occupied days (%)	Criteria 1 (%Hrs Top-Tmax>=1K)	Criteria 2 (Max. Daily Deg.Hrs)	Criteria 3 (Max. DeltaT)	Criteria failing

Unoccupied: 4 rooms:

Room Name	Room ID	Occupied days (%)	Criteria 1 (%Hrs Top-Tmax>=1K)	Criteria 2 (Max. Daily Deg.Hrs)	Criteria 3 (Max. DeltaT)	Criteria failing
Toilet	NT000008	0	0	0	0	-
Plant	NT000009	0	0	0	0	-
Lift	NT00000A	0	0	0	0	-
Lobby	NT00000B	0	0	0	0	-

App E – Overheating Results with AC unit

Weather file: London_LWC_DSY2.epw

Passed: 2 rooms:

Room Name	Room ID	Occupied days (%)	Criteria 1 (%Hrs Top-Tmax>=1K)	Criteria 2 (Max. Daily Deg.Hrs)	Criteria 3 (Max. DeltaT)	Criteria failing
Unit B	NT000007	71.2	0	0	0	-
Unit C	NT00000C	71.2	0	0	0	-

Failed: 0 rooms:

Room Name	Room ID	Occupied days (%)	Criteria 1 (%Hrs Top-Tmax>=1K)	Criteria 2 (Max. Daily Deg.Hrs)	Criteria 3 (Max. DeltaT)	Criteria failing

Unoccupied: 4 rooms:

Room Name	Room ID	Occupied days (%)	Criteria 1 (%Hrs Top-Tmax>=1K)	Criteria 2 (Max. Daily Deg.Hrs)	Criteria 3 (Max. DeltaT)	Criteria failing
Toilet	NT000008	0	0	0	0	-
Plant	NT000009	0	0	0	0	-
Lift	NT00000A	0	0	0	0	-
Lobby	NT00000B	0	0	0	0	-

App E – Overheating Results with AC unit

Weather file: London_LWC_DSY3.epw

Passed: 2 rooms:

Room Name	Room ID	Occupied days (%)	Criteria 1 (%Hrs Top-Tmax>=1K)	Criteria 2 (Max. Daily Deg.Hrs)	Criteria 3 (Max. DeltaT)	Criteria failing
Unit B	NT000007	71.2	0	0	0	-
Unit C	NT00000C	71.2	0	0	0	-

Failed: 0 rooms:

Room Name	Room ID	Occupied days (%)	Criteria 1 (%Hrs Top-Tmax>=1K)	Criteria 2 (Max. Daily Deg.Hrs)	Criteria 3 (Max. DeltaT)	Criteria failing

Unoccupied: 4 rooms:

Room Name	Room ID	Occupied days (%)	Criteria 1 (%Hrs Top-Tmax>=1K)	Criteria 2 (Max. Daily Deg.Hrs)	Criteria 3 (Max. DeltaT)	Criteria failing
Toilet	NT000008	0	0	0	0	-
Plant	NT000009	0	0	0	0	-
Lift	NT00000A	0	0	0	0	-
Lobby	NT00000B	0	0	0	0	-