

300 Brook Drive, Reading

Energy Statement

Client Mapletree UK Management Ltd
4th Floor – WestWorks
White City Place
195 Wood Lane
London
W12 7FQ

Date 29 October 2024
File Ref W.001478_300 Brook Drive_Energy Statement_R003
Revision R003
Classification ☒ Public | ☐ Internal | ☐ Restricted | ☐ Confidential

Revision

Revision	Revision details / Issue type	Page Nos	Document prepared by			Document checked by		
			Name	Signature	Date	Name	Signature	Date
R001	New Document	All	CDG	<i>Charles de Reggman</i>	15/02/2024	MC	<i>MC</i>	15/02/2024
R002	Main Building updates + addition of EOJ contents	All	CDG	<i>Charles de Reggman</i>	25/10/2024	OH	<i>Oliver Hobbs</i>	25/10/2024
R003	Appendix A Plans reference update	All	CDG	<i>Charles de Reggman</i>	29/10/2024	MC	<i>MC</i>	29/10/2024

This document and its contents are confidential and are intended solely for Mapletree’s information and use in relation to 300 Brook Drive.

Red Engineering Design Limited accepts no responsibility or liability to any other party (exception for death and personal injury) in respect of or arising out of or in connection with this document and/or its contents.

Copyright:

The copyright of this document is vested in Red Engineering Design Limited. This document may not be reproduced in whole or in part without their express written permission.

Executive Summary

RED Engineering design has been commissioned to advise on compliance of the designed scheme with the current planning policy as stipulated by Reading Borough Local Plan 2019.

The proposed development is a refurbishment of a TMT office located in Reading. This report relates specifically to the proposed to-be refurbished **300 Brook Drive**.

The planning policies as presented by the Reading Borough Council through its local plan require appropriate, efficient, responsible (taking account of the effects of climate change) and careful use and management of resources such as energy, water, minerals, materials, and other natural resources as addressed in Policy CC2: Sustainable Design and Construction. To ensure that these are met, the Reading Borough Local Plan of 2019 has incorporated the use of BREEAM standards, specifically requiring offices to achieve 'Excellent' ratings as possible.

This report shows that:

Steps have been taken to minimise the environmental impact of the proposed refurbishment of the **300 Brook Drive office**.

- There are no suitably feasible existing or proposed decentralised heat network to connect to at this site.
- Low carbon energy is provided in the form of Photovoltaic Panels and Air-Source Heat pumps which will exhibit the potential energy consumption and carbon emissions savings by incorporating these technologies.
- The proposed Low / Zero Carbon system provides **77.31%** reduction in Energy consumption and **82.56%** reduction in Carbon Dioxide emissions for the development.
- The proposed development achieves 11 of 15 possible credits for Ene 01 Part 1 – Whole building energy model (Option 1) and 2 credits under Ene 04 Parts Passive design analysis and Low and zero carbon feasibility study which will assist in achieving of the overall BREEAM 'Excellent' rating as required by the local plan.

A new **End of Journey facility** ancillary building of 77 m², adjacent to the main building is also proposed, thermal modelling shows it is predicted to achieve an EPC rating of A-7. For information, please see **Appendix A**.

CONTENTS

EXECUTIVE SUMMARY	3
1.0 INTRODUCTION	5
2.0 SITE CONTEXT	6
3.0 POLICY REVIEW	7
3.1 National Planning Policy Framework (February 2019)	7
3.2 Reading Borough Local Plan (Adopted November 2019)	9
4.0 DESCRIPTION OF CALCULATION METHODOLOGY AND SIMULATION SOFTWARE USED	11
4.1 Dynamic Simulation Modelling (DSM)	11
4.2 Building Model Isometric Views	13
5.0 STANDARD BUILDING – INPUT PARAMETERS, ENERGY CONSUMPTION AND CO₂ EMISSIONS	15
5.1 Standard Building input parameters	15
5.2 Standard building energy consumption	17
5.3 Standard building carbon dioxide emissions	18
6.0 DECENTRALISED LOW / ZERO CARBON GENERATION	19
6.1 District Heating	19
6.2 Combined Heat & Power	21
7.0 REVIEW OF LOW / ZERO CARBON TECHNOLOGIES	22
7.1 Site Energy Requirements	22
7.2 Biomass	22
7.3 Wind Turbines	22
7.4 Solar Domestic Hot Water	23
7.5 PV Solar panels	23
7.6 Ground Source Heat Pumps	23
7.7 Air Source Heat Pumps	24
8.0 ESTIMATIONS OF ENERGY SAVINGS AND REDUCTION OF CO₂ EMISSIONS OF THE PROPOSED BUILDING	25
8.1 Proposed Building with LZC Technology	25
8.2 Proposed building energy consumption	28
8.3 Standard building carbon dioxide emissions	29
9.0 CONCLUSION	30
APPENDIX A END OF JOURNEY FACILITY INFORMATION	31
A.1 Building Fabric Thermal Performance	31
A.2 Geometry model layout	31
A.3 MEP systems	32
A.4 Decentralised Low/Zero Carbon Generation	32
A.5 LZC Technology	32
APPENDIX B BRUKL OUTPUT DOCUMENT OF THE END OF JOURNEY FACILITY (DESIGN STAGE)	33
APPENDIX C PROVISIONAL ENERGY PERFORMANCE CERTIFICATE OF THE END OF JOURNEY FACILITY	38

1.0 Introduction

This report sets out developer's approach to energy efficiency at a national level as well as how energy efficient design measures will be integrated into the proposed 300 Brook Drive office.

1.1 Summary of energy statement requirements

The objective of this report is to define and outline how to incorporate low energy and renewable energy systems into the project at an early stage so that advice can be given early on the implications of compliance with Part L of the Building Regulations and the implications in relation to relevant planning policies.

In this document, the principles for developing an energy strategy are presented, where the main objective of the energy strategy is to reduce the CO₂ emissions from the proposed development.

The development of the energy strategy is based on the following principles:

- Reduce demand
- Meet end-use demand efficiently
- Supply from low/zero carbon technologies
- Enable effective energy management

1.2 Structure of the report

This report comprises a number of sections that together provide a full description of the evaluation criteria, input data, assumptions and modelling methodology used in order to provide recommendations for the project to reduce energy consumption and associated CO₂ emissions.

This comprises:

- Site Context
- Policy review
- Energy performance analysis
- Decentralised Energy
- Review of low/zero carbon technologies
- Energy performance of the proposed building
- Conclusion

2.0 Site Context

The proposed **to-be refurbished office** is located at **300 Brook Drive, Reading**.

As shown in **Figure 2**, **300 Brook Drive** is bounded by a bicycle pathway with trees to its north, a carpark to its east, offices and carpark to its south, and an open landscape and Foudry Brook to its west.

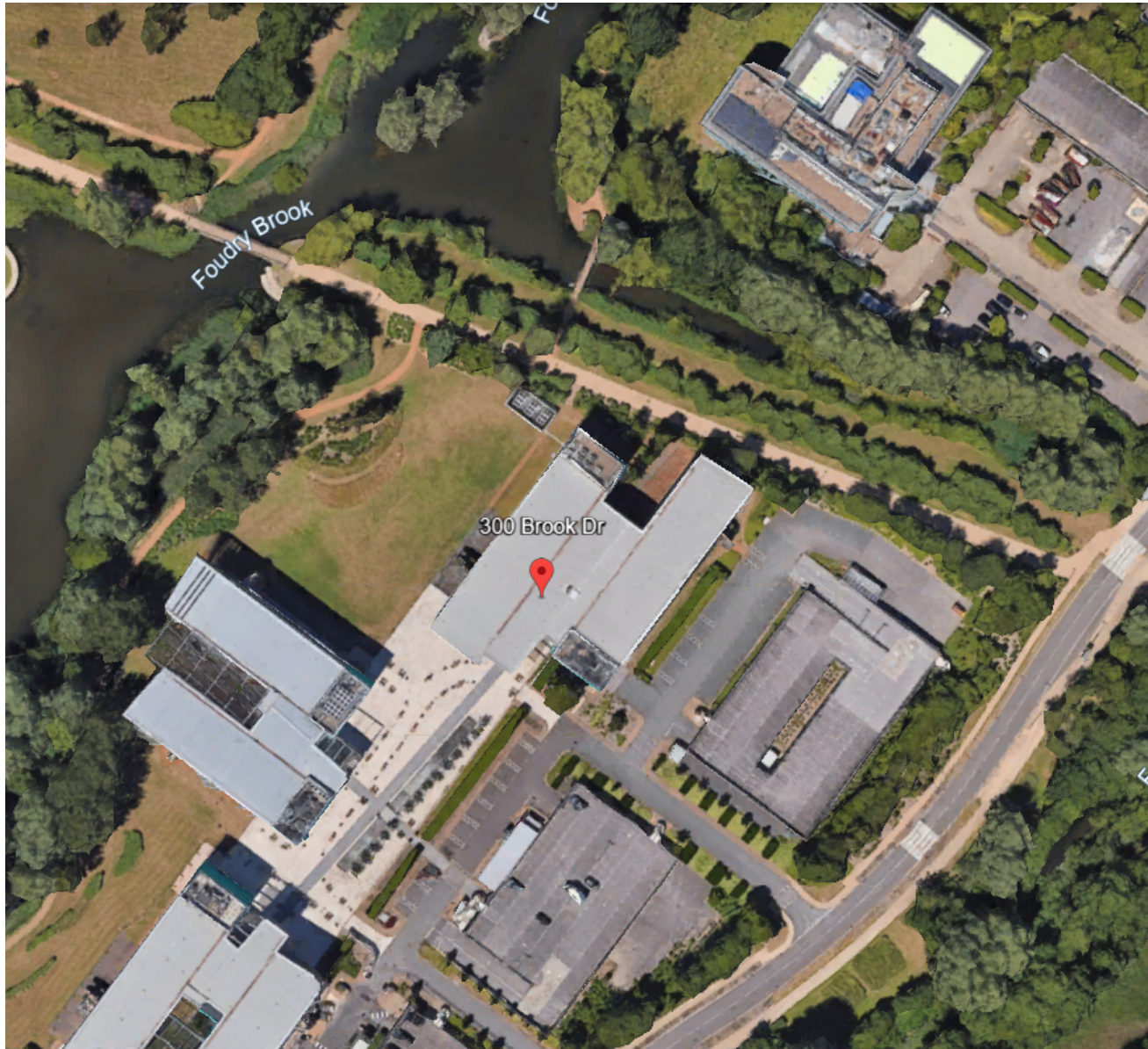


Figure 1 - Aerial view of the proposed site location of 300 Brook Drive in Reading

3.0 Policy Review

This section reviews the planning policies, energy and sustainability targets that are relevant to this development.

3.1 National Planning Policy Framework (February 2019)

Planning law requires that applications for planning permission be determined in accordance with the development plan, unless material considerations indicate otherwise. The National Planning Policy Framework must be taken into account in preparing the development plan; and is a material consideration in planning decisions. Planning policies and decisions must also reflect relevant international obligations and statutory requirements.

Achieving sustainable development means that the planning system has three overarching objectives, which are interdependent and need to be pursued in mutually supportive ways (so that opportunities can be taken to secure net gains across each of the different objectives):

- **an economic objective** – to help build a strong, responsive and competitive economy, by ensuring that sufficient land of the right types is available in the right places and at the right time to support growth, innovation and improved productivity; and by identifying and coordinating the provision of infrastructure;
- **a social objective** – to support strong, vibrant and healthy communities, by ensuring that a sufficient number and range of homes can be provided to meet the needs of present and future generations; and by fostering a well-designed and safe built environment, with accessible services and open spaces that reflect current and future needs and support communities' health, social and cultural well-being; and
- **an environmental objective** – to contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy.

These objectives should be delivered through the preparation and implementation of plans and the application of the policies in this Framework; they are not criteria against which every decision can or should be judged. Planning policies and decisions should play an active role in guiding development towards sustainable solutions, but in doing so should take local circumstances into account, to reflect the character, needs and opportunities of each area.

Plans should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, coastal change, water supply, biodiversity and landscapes, and the risk of overheating from rising temperatures. Policies should support appropriate measures to ensure the future resilience of communities and infrastructure to climate change impacts, such as providing space for physical protection measures, or making provision for the possible future relocation of vulnerable development and infrastructure.

New development should be planned for in ways that:

- 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

- 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.

To help increase the use and supply of renewable and low carbon energy and heat, plans should:

- provide a positive strategy for energy from these sources, that maximises the potential for suitable development, while ensuring that adverse impacts are addressed satisfactorily (including cumulative landscape and visual impacts);
- consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development; and
- identify opportunities for development to draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co- locating potential heat customers and suppliers.

Local planning authorities should support community-led initiatives for renewable and low carbon energy, including developments outside areas identified in local plans or other strategic policies that are being taken forward through neighbourhood planning.

In determining planning applications, local planning authorities 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
- take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.

When determining planning applications for renewable and low carbon development, local planning authorities should:

- not require applicants to demonstrate the overall need for renewable or low carbon energy and recognise that even small-scale projects provide a valuable contribution to cutting greenhouse gas emissions; and approve the application if its impacts are (or can be made) acceptable. Once suitable areas for renewable and low carbon energy have been identified in plans, local planning authorities should expect subsequent applications for commercial scale projects outside these areas to demonstrate that the proposed location meets the criteria used in identifying suitable areas.

3.2 Reading Borough Local Plan (Adopted November 2019)

3.2.1 Policy CC1: Presumption in favour of Sustainable Development

A positive approach to considering development proposals will be taken that reflects the presumption in favour of sustainable development contained in the National Planning Policy Framework (NPPF). Where appropriate, the Council will work proactively with applicants to jointly find solutions which mean that proposals can be approved wherever possible.

Planning law requires that applications for planning permission must be determined in accordance with the development plan unless material considerations indicate otherwise. Planning applications that accord with the policies in the development plan (including, where relevant, with policies in neighbourhood plans) will be approved without delay, unless material considerations indicate otherwise. Proposed development that conflicts with the development plan will be refused, unless other material considerations indicate otherwise.

Where there are no policies relevant to the application or the policies which are most important to determining the application are out of date at the time of making the decision then permission will be granted unless material considerations indicate otherwise – taking into account whether:

- The application of policies in the NPPF that protect areas or assets of particular importance provides a clear reason for refusing the development proposed; or
- Any adverse impacts of doing so would significantly and demonstrably outweigh the benefits, when assessed against the policies in the NPPF taken as a whole.

3.2.2 Policy CC2: Sustainable Design and Construction

Proposal for new development, including the construction of new buildings and the redevelopment and refurbishment of existing building stock, will be acceptable where the design of buildings and site layouts use energy, water, minerals, and other natural resources appropriately, efficiently and with care and take account of the effects of climate change.

To meet these requirements:

- All major non-residential developments or conversions to residential are required to meet the most up-to-date BREEAM 'Excellent' standards, where possible;
- All minor non-residential developments or conversions to residential are required to meet the most up-to-date BREEAM 'Very Good' standard as a minimum;
- All non-residential development or conversions to residential should incorporate water conservation measures so that the predicted per capita consumption does not exceed the appropriate levels set out in the applicable BREEAM standard. Both the residential and non-residential development should include recycling greywater and rainwater harvesting where systems are energy and cost effective.

The future growth of Reading in terms of the amount of new development taking place has the potential to impose a large environmental footprint in terms of consumption of resources and materials, the use of energy and associated emission of greenhouse gases that contribute towards climate change. As such, the incorporation of sustainable design and construction techniques are essential in order to minimise this impact in the context of Reading. Reading's Climate Change Strategy (Reading Means Business on Climate Change 2013-2020) seeks to tackle the Borough's contribution to climate change by reducing Reading's carbon footprint by 34% by 2020 in comparison to 2005 levels. New development has a role to play in achieving these aims.

The general principle of this policy in terms of new development applies to both residential and non-residential uses. For non-residential uses (including non-C3 forms of accommodation) and for conversion to residential, this policy incorporates the use of BREEAM standards. These standards cover a wide range of

matters including building fabrics and materials, energy and water use, amenity areas and ecology, waste recycling, the location and accessibility of developments, daylighting, sound insulation etc. However, the current standards give high scores in urban areas to using previously developed land that is close to services, amenities, and public transport routes. Developments in Reading will therefore naturally score relatively highly before any consideration of the impact of development itself. Reading Borough Council believes that development should mitigate effects further by reducing greenhouse gas and other polluting emissions and providing higher energy conservation, hence the requirement for BREEAM 'Excellent' ratings.

For a number of uses, including offices, the requirement to achieve 'Excellent' ratings is unlikely to significantly affect viability. However, some types of development, such as industrial uses, warehouses, and schools might find it more difficult to meet these standards. In these cases, developments must demonstrate that the standard to be achieved is the highest possible for the development, and at a minimum meets the BREEAM 'Very Good' standard.

4.0 Description of Calculation Methodology and Simulation Software Used

In this section of the report, the calculation methodology for the development alongside the energy consumption and CO₂ emissions for the benchmark building will be presented.

4.1 Dynamic Simulation Modelling (DSM)

4.1.1 Description of Process

Dynamic Simulation Modelling (DSM), as used for Part L Building regulations compliance, has been conducted using the IES Virtual Environment (IES-VE) software package.

The Virtual Environment (VE) 2023 software package has been used for this project, as it allows a single model to be used for all the required analysis related to the building performance regarding passive and active strategies, energy efficient mechanical and electrical systems, and LZC technologies.

IES-VE is dynamic simulation modelling (DSM) software assists architects and engineers in developing a sustainable building design by offering a quantitative feedback as a response to different design options.

The software allows the user to create a “virtual environment” where building mass, form, climate, natural resource availability, occupancy, materials and services are taken into consideration in order to analyse different energy saving strategies.

4.1.2 Estimation of Annual Building Energy Profiles: VE-Compliance

It should be noted, both the initial and final calculations contained within this report are bespoke for this particular development using inputs and simulation models based on the latest architectural drawings and concept MEP services design.

Mechanical and Electrical services designs have been completed using the Dynamic Simulation Modelling (DSM) software described above. The thermal calculation and simulation engine Apache within IES was used in order to evaluate the energy consumption and carbon dioxide emissions of the development as the DSM software takes into account all energy efficient and passive design technologies we intend to incorporate some of which are not possible to include using SAP or SBEM.

National Calculation Methodology (NCM) profiles have been assigned to different rooms based on their activity as per Part L methodology.

4.1.3 External Weather Conditions

CIBSE Swindon TRY (Test Reference Year) weather file has been used in the modelling calculations, the dry bulb temperatures throughout the year are shown in the graph below.

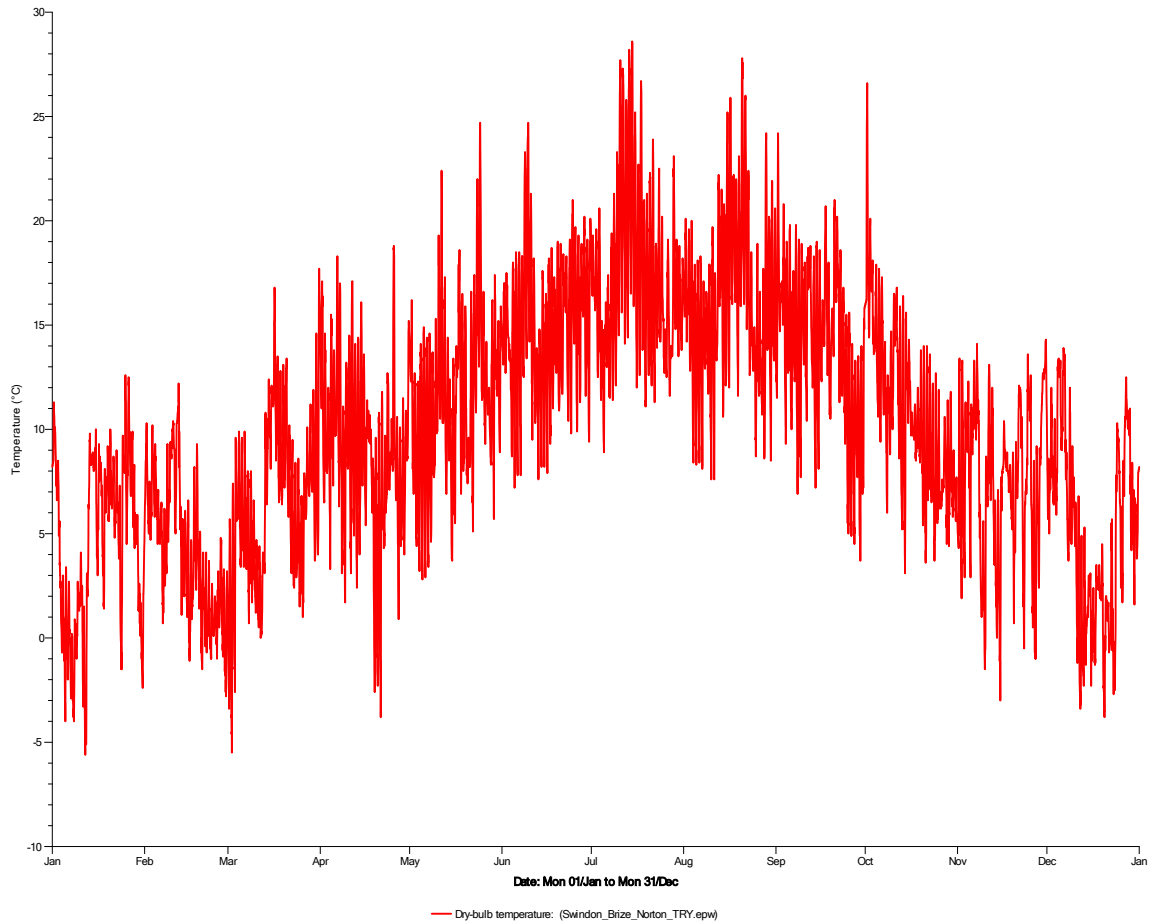


Figure 2 - Dry-bulb temperature graph for Swindon

4.2 Building Model Isometric Views

The presented model below captures the office's geometry, constructions, usage, climate, and equipment through the Integrated Data Model (IDM) within IES-VE. The following isometric views show the proposed building created based on the drawings provided by **Stride Treglown**.

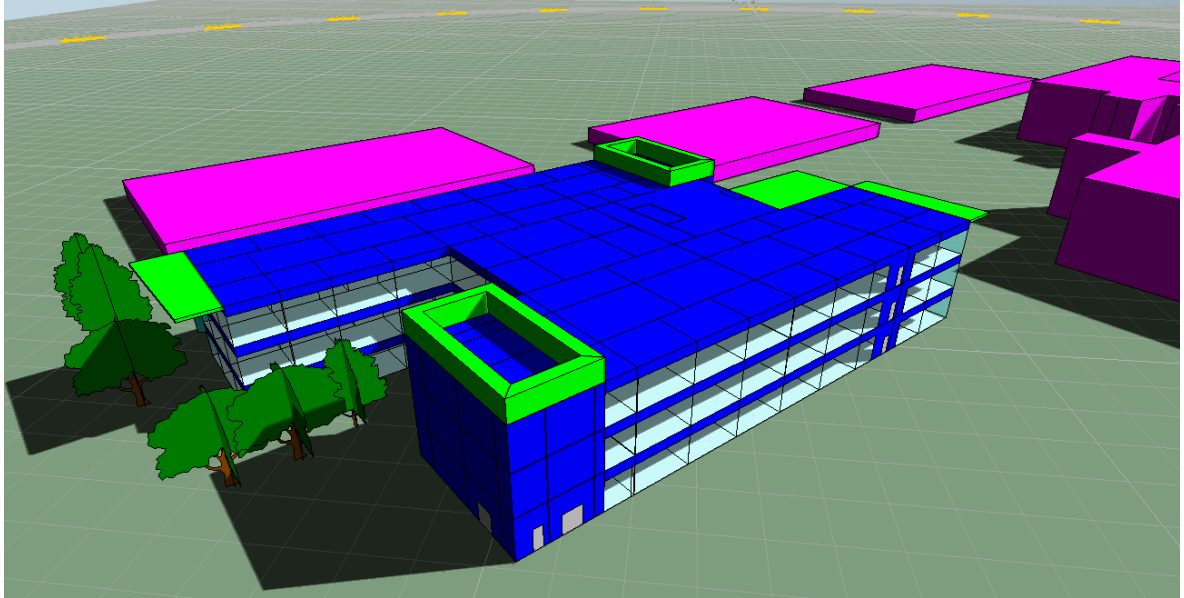


Figure 3 - 300 Brook Drive North view

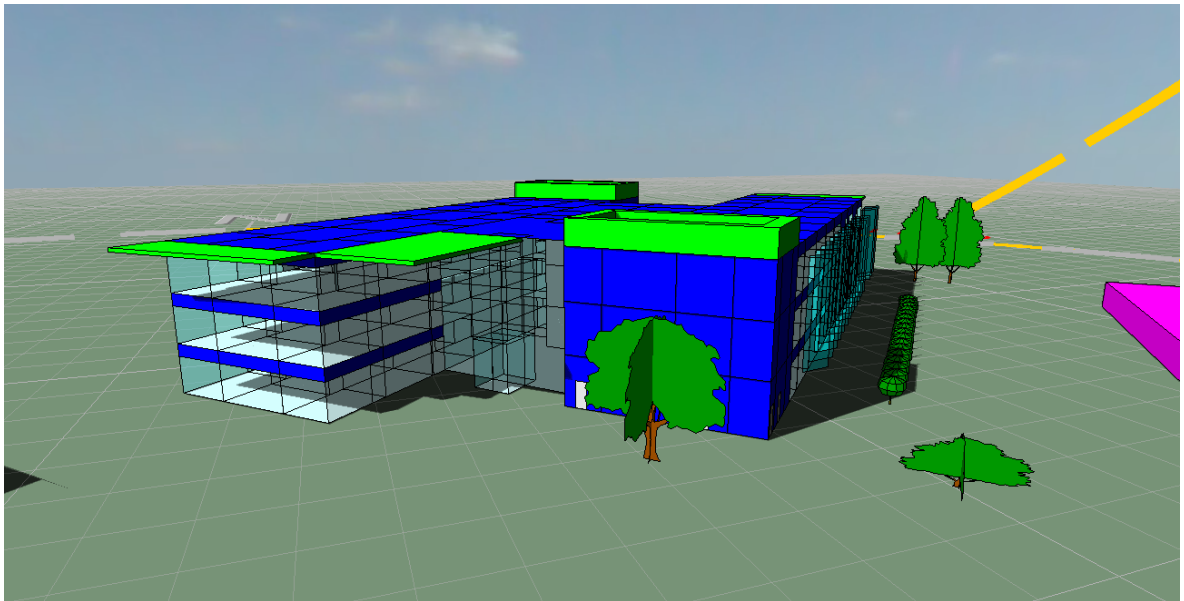


Figure 4 300 Brook Drive South View

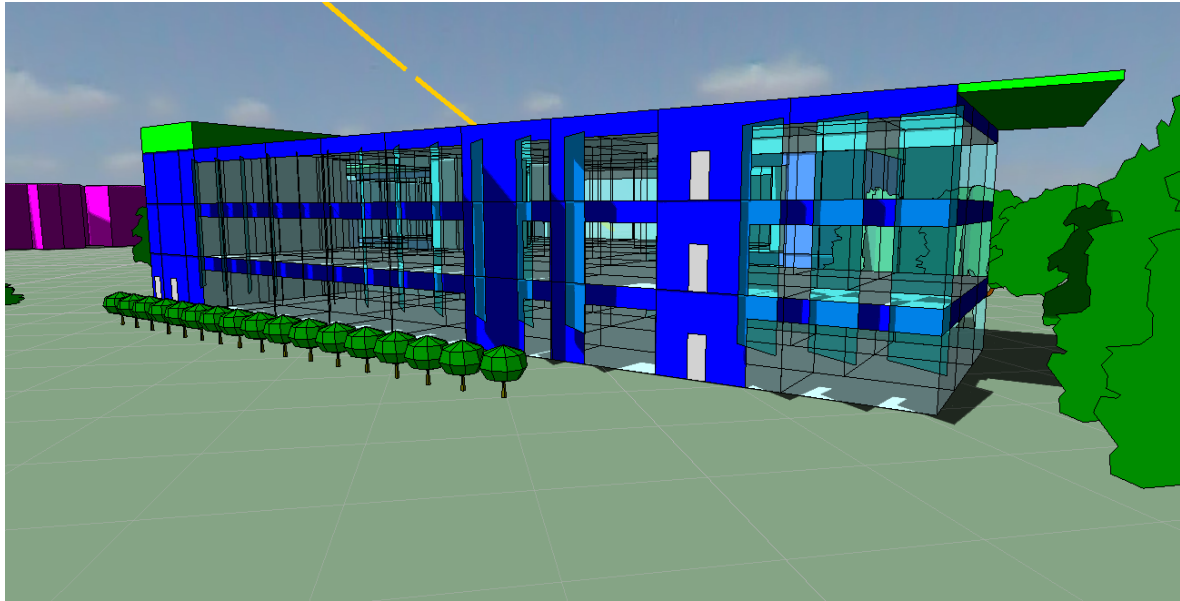


Figure 5 300 Brook Drive East View

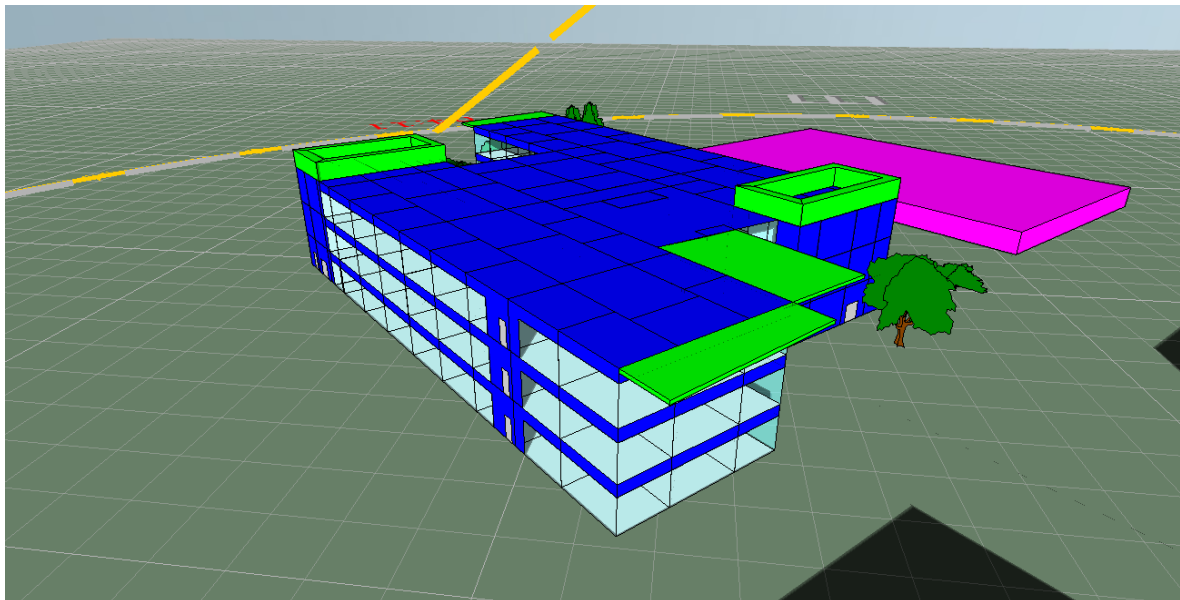


Figure 6 300 Brook Drive West View

5.0 Standard Building – input parameters, energy consumption and CO₂ emissions

5.1 Standard Building input parameters

This section of the report provides reference values for the parameters used in the IES building model in order to establish the energy consumption and CO₂ emissions of the proposed development. To enable a baseline for performance comparison to be established, a 'standard' building was modelled in accordance with BREEAM UK Refurbishment and Fit-out 2014 requirements. Input parameters are presented below.

- Location: **the proposed to-be refurbished office** is located in **Reading**.
- **TRY weather** data for **Swindon** has been used for calculations, based on NCM recommendations.
- Orientation: the façade faces various orientations.
- External shading devices: as per existing building.
- U-values: the opaque and glazing values used in the calculations were based existing values due to its building age, Part L 1995 regulations were referenced.
- Air permeability: as per existing value due to its building age based on EPC Conventions Issue 7.1.

Building Fabric Thermal Performance

EXPOSED ELEMENT	EXISTING U-VALUES (W/m ² .K)	STANDARD U-VALUE (W/m ² .K)
Wall	0.45	0.45
Floor	0.27	0.27
Roof	0.25	0.25
External Glazing	2.60	2.60
Pedestrian/Personnel doors	3.30	3.30

Table 1 - Standard Building U-values

Air Permeability

AIR PERMEABILITY	EXISTING U-VALUES	STANDARD BUILDING
m ³ /(h.m ²) at 50 Pa	15	15

Table 2 - Building Air Permeability

HVAC systems

HVAC systems used in the calculations were based on building age, information from RED MEP Feasibility Report, IES defaults and on available data from 2013 Non-Domestic Building Services Compliance Guide.

HVAC SYSTEM	EFFICIENCIES
Office areas	Heating (Assumed Nat. Gas) and Cooling via FCU LTHW Boiler/CHW System SCoP – 0.84 SEER – 2.65
Core, toilet, and reception areas	Heating (Assumed Nat. Gas) and Cooling via FCU LTHW Boiler/CHW System SCoP – 0.84 SEER – 2.65
Stairs	Heating only (Assumed Natural Gas) via Radiators fed by LTHW Boiler SCoP – 0.84

Table 3 - Standard Building Heating/Cooling Systems

The table below present Specific Fan Powers (SFP) for the ventilation systems used for the thermal model of the standard building:

VENTILATION SYSTEM	SPECIFICATIONS
Office areas	Mechanical Ventilation Heat Recovery System (Centralised Balanced) System level SFP = 2.90 W/l/s (IES default value) Terminal level SFP = 0.50 W/l/s (2013 NDBSCG) HR efficiency = 65.00% (IES default value)
Core, toilet, and reception areas	Mechanical Ventilation Heat Recovery System (Centralised Balanced) System level SFP = 2.90 W/l/s (IES default value) Terminal level SFP = 0.50 W/l/s (2013 NDBSCG) HR efficiency = 65.00% (IES default value)

Table 4 - Standard Building Ventilation Systems

DHW

DHW is assumed to be provided by Electric water heaters for the standard building.

DHW	EFFICIENCY
Elec. Water Heater	SCoP – 3.69

Table 5 - Standard Building DHW

Lighting

General lighting specifications for all areas are assumed based on building age and 2013 Non-Domestic Building Services Compliance Guide. Occupancy and Daylighting controls are as per existing building.

GENERAL LIGHTING	SPECIFICATION
All Areas	60 lm/W

Table 6 - Standard Building General Lighting Specifications

5.2 Standard building energy consumption

The following is a breakdown of the energy consumption of the standard building by the type of fuel and type of use:

DATE	TOTAL NAT. GAS (MWh)	TOTAL ELECTRICITY ENERGY (MWh)	TOTAL ENERGY (MWh)	TOTAL REGULATED ENERGY (MWh)
January	88.277	42.387	130.663	105.575
February	79.299	37.112	116.412	93.630
March	64.217	39.108	103.325	78.237
April	36.217	33.448	69.665	47.543
May	22.974	37.444	60.417	36.271
June	10.123	40.430	50.553	26.547
July	6.424	48.813	55.237	30.149
August	9.259	46.462	55.721	30.633
September	13.812	37.667	51.479	28.415
October	34.043	43.084	77.127	51.097
November	57.583	41.840	99.423	74.476
December	80.108	37.674	117.782	95.519
Summed total	502.335	485.469	987.804	698.094

Table 7 - Standard building monthly energy consumption by type of fuel

Total estimated gas energy consumption for the standard building is **502,335 kWh per annum**;

Total estimated electrical energy consumption for the standard building is **485,469 kWh per annum**;

The total energy consumption for the standard building is **987,804 kWh per annum**.

The total regulated energy consumption for the standard building is **698,094 kWh per annum**.

5.3 Standard building carbon dioxide emissions

The following is a breakdown of the energy consumption of the standard building by the type of fuel and type of use:

DATE	TOTAL NAT.GAS CE (KG CO ₂)	TOTAL ELECTRICITY CE (KG CO ₂)	TOTAL CE (KG CO ₂)	TOTAL REGULATED CE (KG CO ₂)
January	18551	6914	25465	21372
February	16665	5942	22607	18960
March	13495	5988	19483	15642
April	7611	4786	12397	9231
May	4828	4946	9774	6584
June	2127	4855	6982	4100
July	1350	5422	6772	3985
August	1946	5207	7153	4342
September	2903	4599	7501	4687
October	7154	5864	13018	9475
November	12101	6322	18423	14654
December	16835	6145	22980	19349
Summed total	105566	66991	172556	132380

Table 8 - Standard building monthly carbon dioxide emissions by type of fuel

Total estimated CO₂ emissions from gas energy consumption is **105,566 kg CO₂ per annum**;

Total estimated CO₂ emissions from electricity energy consumption is **66,991 kg CO₂ per annum**;

Total estimated CO₂ emissions for the standard building are **172,556 kg CO₂ per annum**. This figure includes unregulated equipment loads.

Total estimated CO₂ emissions for the building from regulated energy consumption are **132,380 kg CO₂ per annum**.

6.0 Decentralised Low / Zero Carbon Generation

The purpose of this section is to analyse feasibility of decentralised energy sources for the site. Two options for decentralised energy will be investigated in this section of the report:

- Option 1: District heating
- Option 2: Combined heat and power (CHP)

6.1 District Heating

The UK CHP Development Map was commissioned by the Department of Business, Energy and Industrial Strategy. The Map is designed to geographically represent the heat demand across various sectors in the United Kingdom.

Sections of the map above show the total heat load in relation to the proposed with Figure 7 showing that the expected heat load is between 2,000 – 10,000 MWh/km².

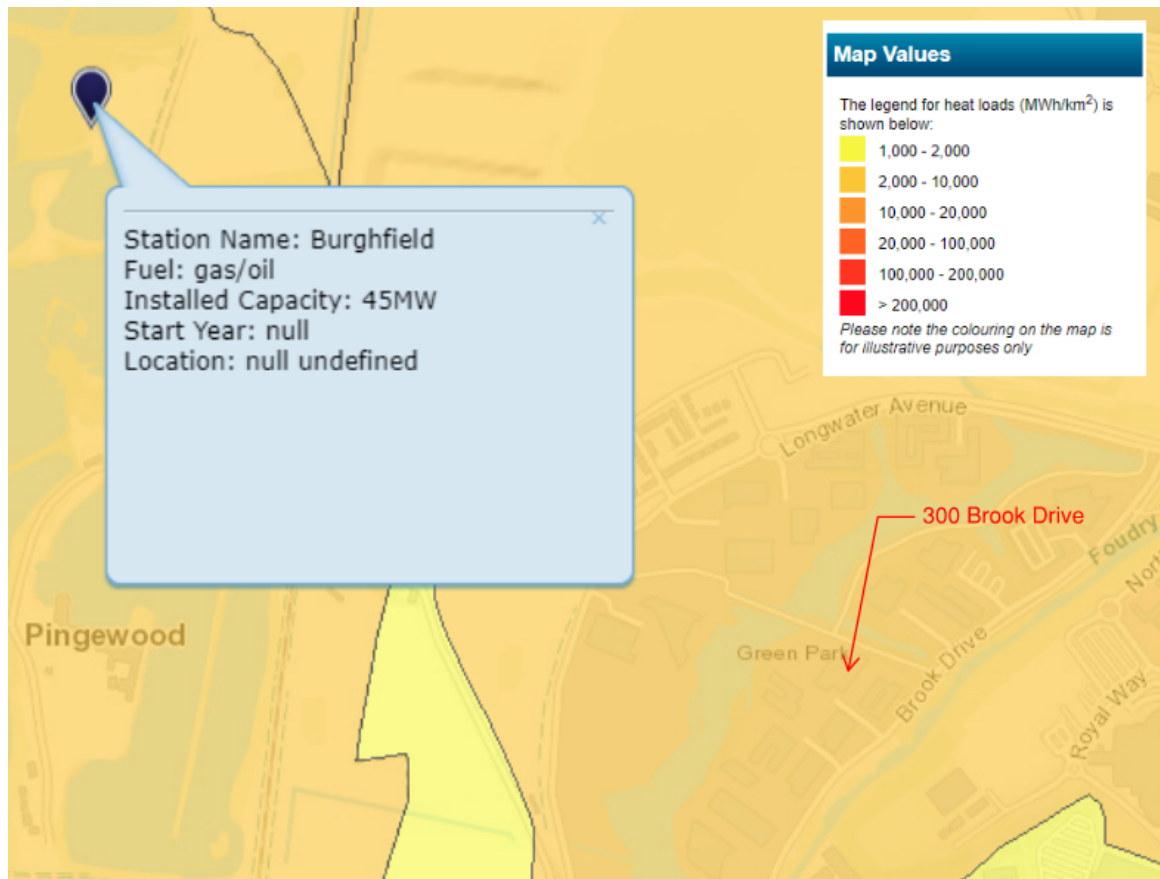


Figure 7 - UK CHP Development Map in Reading

Sector Totals

Large Heat Load Sites (4)

The table below shows the sector totals within your search area.

Sector Name	Share	Total MWh
Communications and Transport	0.29%	15,455 MWh
Commercial Offices	2.16%	114,832 MWh
Domestic	81.97%	4,358,755 MWh
Education	2.87%	152,358 MWh
Government Buildings	1.21%	64,486 MWh
Hotels	0.56%	29,878 MWh
Large Industrial	4.35%	231,084 MWh
Health	0.45%	23,865 MWh
Other	0.15%	8,162 MWh
Small Industrial	4.39%	233,649 MWh
Prisons	0%	0 MWh
Retail	0.91%	48,395 MWh
Sport and Leisure	0.37%	19,511 MWh
Warehouses	0.32%	16,781 MWh
District Heating	0%	0 MWh
Total heat load in Area		5,317,211 MWh

The results for this area are shown below as a pie chart. The colours used in the pie chart, correspond to the colour shown next to each sector in the table above.

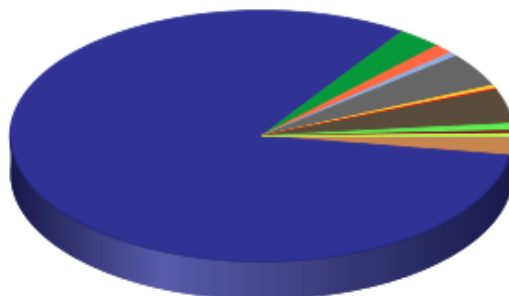


Figure 8 - UK CHP Development Map heat density report and heat demand pie chart for the proposed site and surrounding areas (1 km radius)

There is a power station (Burghfield Power Station) in proximity (2km) of the site, with heat provided by gas turbines, however connecting into it is not cost effective, and as it is fossil fuelled with no immediate plans to decarbonise the network. The carbon emissions associated with the heat from the heat network are still significantly higher than the chosen heat source, namely air source heat pumps. Therefore, district heating is not deemed feasible.

6.2 Combined Heat & Power

As an alternative to Option 1 (District Heating), the development could incorporate Combined Heat and Power (CHP) engines as part of a decentralised energy concept.

The use of CHP results in the highly efficient use of fuel, with primary energy savings of 30-45% compared with the conventional separate generation to achieve the same quantity of heat and power. Due to the efficiency of CHP, emissions to the environment are approximately 30% less than in separate generation of electricity and heat.

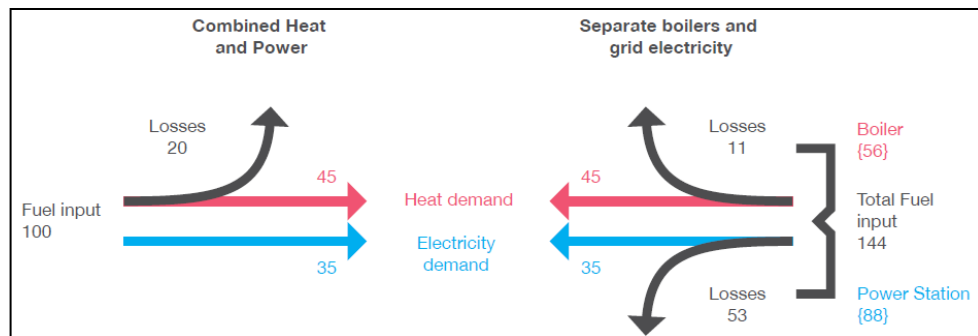


Figure 9 - The Benefits of Combined Heat and Power

CHP cannot be used as a stand-alone system; it requires effective integration with other energy systems on site. It is unlikely that all the power and heat requirements will be supplied by the CHP plant, additional heat and/or power from conventional sources will be required.

By introducing a CHP unit the running costs and carbon dioxide emissions are significantly reduced when compared to running a separate generator and boiler. However, the CHP plant should always operate as the lead heat source to maximise savings.

CHP systems require predictable and relatively constant loads all year round for best performance, which is normally found in applications with high domestic hot water loads such as hotels. Offices have a lower hot water demand and therefore a CHP plant would not be deemed viable due to the lengthy amount of the year where the CHP engine would be sitting idle due to lack of thermal demand.

7.0 Review of Low / Zero Carbon Technologies

The purpose of this section is to estimate site energy requirements and to analyse feasibility of each of different renewable or low/zero carbon technologies for the site. Not all of these technologies will be appropriate however and the most suitable ones should be applied in order to meet required energy and CO₂ reduction.

7.1 Site Energy Requirements

The regulated annual energy consumption for the standard building is predicted to be **698,094 kWh** and emissions are **132,380 kgCO₂** per annum excluding unregulated loads as demonstrated in Section 5.

With these figures in mind, the sections below analyse different passive design strategies to be implemented for this site.

7.2 Biomass

Biomass boilers provide heat with a very low resulting net carbon emission taken over the life cycle of the fuel; CO₂ emitted in the combustion process is nearly balanced by the CO₂ absorbed by photosynthesis during the growth of the biomass vegetation.

Embedded CO₂ emissions result from the processing and transportation of the fuel. Therefore, as part of a carbon reduction strategy a wood pellet or wood fuelled boiler would have a significant positive impact on CO₂ reductions.

Biomass fuel is generally regarded as a zero-carbon emission fuel over the lifetime of the plant material although there will be a residual carbon footprint relating to collecting, processing and transporting the fuel. This figure is in the order of 5% in most cases.

However, an overriding reason against using this type of unit is the space restrictions on this particular site and the lack of available space for the storage and delivery of the fuel. Furthermore, the high NO_x emissions and particle content of the exhaust gases from typical small scale biomass units may raise objections from the Environmental Agency and planning department.

In light of the above considerations, biomass boilers are considered not to be a viable option for the proposed development.

7.3 Wind Turbines

The Department of Energy & Climate Change (DECC) wind speed database estimated average wind speed at this location in the UK is:

HEIGHT ABOVE GROUND, m	WIND SPEED, m/s
10	4.7
25	5.5
45	6.0

Table 9 - Estimated average wind speed

A typical horizontal axis turbine with a **10 m** diameter rotor would generate approximately 49,210 kWh of energy per year at a wind speed of 6.2 m/s (hub height), which would offset 21,160kg of CO₂ by displacement of grid electricity. It means, at least 1 wind turbine is required to produce 10% of savings in Carbon Dioxide emissions.

However, the wind speed database does not take into account local topographical features such as buildings. Being a suburban environment there are numerous buildings in close proximity to the site and these will cause turbulent air flow resulting in significantly reduced output. This is likely to result in the wind turbines under performing and not delivering the required energy or carbon savings.

The size / number of wind turbines required to generate significant energy for the site could not be realistically accommodated on this site.

7.4 Solar Domestic Hot Water

The application of solar panels is for the heating of domestic hot water and due to the low demand of hot water services in this building, there would be insufficient throughput to achieve a significant reduction in CO₂ emissions on this site.

7.5 PV Solar panels

Photovoltaic modules convert sunlight directly to DC electricity. They can be integrated into buildings in numerous ways including sloping and flat roofs, building façades, glass roof structures, and solar shading devices. There are mainly three types of PV cells: polycrystalline silicon, amorphous silicon, and monocrystalline silicon with the latter being the most efficient.

In order to generate energy from renewable sources, photovoltaic panels may be installed on the roofs of the proposed development. PV panels are proposed on the roof (100 m²) with the exception of the roof mounted plant areas.

Given the available space in the roof area, Photovoltaic solar panels will provide LZC energy source for the office.

7.6 Ground Source Heat Pumps

A Ground Source Heat Pump (GSHP) is a central heating and/or cooling system that pumps heat to or from the ground. During the winter season it uses the earth as a heat source, whereas during the summer season it can use the earth as a heat sink. The design increases the efficiency and reduces the operational costs of the heating and cooling systems by taking advantage of the moderate constant temperature in the ground.

Below a certain depth, the ground maintains a constant temperature of 10-12°C winter and summer. A heat pump extracts some of this energy and increases it to a temperature suitable for space heating; this is achieved by circulating water or glycol through either a horizontal matrix of PVC pipework or via a series of boreholes.

The ground source heat pump performance could be higher than the equivalent air source heat pump and, providing the flow and return water temperatures in the heating/cooling circuit can be kept relatively low, seasonal coefficients of performance (COP's) of 3.5 to 4.0 can be achieved.

Ground source heat pumps offer the best carbon savings and return on investment on sites without access to mains gas. On sites with mains gas the carbon savings in comparison to a gas fired boiler are relatively modest as heat pumps generally use grid supplied carbon intensive electricity.

For this development, there is access to gas and alternative LZC technologies are feasible, in light of these considerations, ground source heat pumps are considered not to be a viable option for the proposed development.

7.7 Air Source Heat Pumps

Liquid through the evaporator side of the Air Source Heat Pumps (ASHP) absorbs heat from the outside air which is then passed through a compressor where its temperature is increased. The higher temperature heat is then transferred at the condenser side of the ASHP to the heating and hot water circuits of the development.

There are two main types of air source heat pump systems:

- An air to water system which distributes the heat via a wet central heating system
- An air to air system which circulates the heat by fans to heat the development

A further variation to the main types of ASHP presented above is VRF (Variable Refrigerant Flow) units. The main difference between the systems presented above and the VRF units is that the VRF units make use of a refrigerant as a cooling and heating medium.

In a VRF scheme, a large outdoor unit serves multiple indoor units. Each indoor unit uses an electronic liquid expansion valve to control its refrigerant supply to match the communal demand of the space it serves.

The efficiency of a VRF system is usually defined by the Coefficient of Performance (COP) which is the ratio of the electrical energy input versus the thermal (heating or cooling) energy output.

This office building will use a four-pipe fan coil unit system which will be sourced from an ASHP with piped low temperature hot water (LTHW) and chilled water (CHW) medium for transferring this energy to the occupied spaces and ventilation plant.

The use of Air Source Heat Pumps as source for heating for the office areas is feasible for this site.

8.0 Estimations of Energy Savings and reduction of CO₂ emissions of the Proposed building

8.1 Proposed Building with LZC Technology

The Proposed building represents the anticipated energy consumption for the development with the incorporation of the Low/Zero Carbon technologies.

- Location: **the proposed to-be refurbished office** is located in **Reading**.
- **TRY weather** data for **Swindon** has been used for calculations, based on NCM recommendations.
- Orientation: the façade faces various orientations.
- External shading devices: as per existing building.
- U-values: the opaque and glazing values used in the calculations were based existing values due to its building age, Part L 1995 regulations were referenced. Roof u-value for cores is the only building fabric parameter that will undergo change.
- Air permeability: as per existing value due to its building age based on EPC Conventions Issue 7.1.

Building Fabric Thermal Performance

EXPOSED ELEMENT	EXISTING U-VALUES (W/m ² .K)	PROPOSED U-VALUE (W/m ² .K)
Wall	0.45	0.45
Floor	0.27	0.27
Roof (Areas excluding core areas)	0.25	0.25
Roof (Core areas)	0.25	0.18
External Glazing	2.60	2.60
Pedestrian/Personnel doors	3.30	3.30

Table 10 - Proposed Building U-values

Air Permeability

AIR PERMEABILITY	EXISTING U-VALUES	PROPOSED BUILDING
m ³ /(h.m ²) at 50 Pa	15	15

Table 11 - Building Air Permeability

HVAC systems

HVAC systems used in the calculations were based on building age, information from RED MEP Feasibility Report, IES defaults and on available data from 2013 Non-Domestic Building Services Compliance Guide.

HVAC SYSTEM	EFFICIENCIES
Office areas	Heating and Cooling (Electric) via ASHP SCoP – 3.95 SEER – 2.51
Core, toilet, and reception areas	Heating and Cooling (Electric) via ASHP SCoP – 3.69 SEER – 2.69
Stairs	Heating only (Electric) via ASHP SCoP – 3.69

Table 12 - Proposed Building Heating/Cooling Systems

The table below present Specific Fan Powers (SFP) for the ventilation systems used for the thermal model of the standard building:

VENTILATION SYSTEM	SPECIFICATIONS
Office areas	Mechanical Ventilation Heat Recovery System (Centralised Balanced) System level SFP = 1.69 W/l/s Terminal level SFP = 0.24 W/l/s HR efficiency = 83.20%
Core, toilet, and reception areas	Mechanical Ventilation Heat Recovery System (Centralised Balanced) System level SFP = 1.39 W/l/s Terminal level SFP = 0.24 W/l/s HR efficiency = 71.90%

Table 13 - Proposed Building Ventilation Systems

DHW

DHW is assumed to be provided by Electric water heaters for the standard building.

DHW	EFFICIENCY
Elec. Water Heater	SCOP – 3.69

Table 14 - Proposed Building DHW

Lighting

General lighting specifications are based on design criteria.

GENERAL LIGHTING	SPECIFICATION
All areas	8 W/m ²

Table 15 - Proposed Building General Lighting Specifications

LZC Technology – ASHP

Air Source Heat Pumps shall be used to heat and cool the office in an efficient manner defined by the ratio of the electrical energy input versus the thermal energy output. This energy saving technology will be employed to reduce the amount of fossil fuel supplied energy use throughout the building. In turn this will reduce the carbon emissions. Please see Table 12 in the previous page for ASHP specs used in the simulation.

LZC Technology – PV

Table below presents the proposed renewable energy generation system properties used for the thermal model of the proposed building:

ITEM	
PV cell type	Monocrystalline
PV panel efficiency, %	20.1%
Inverter efficiency,	96%
PV array area, m2	100 m ²

Table 16 - Renewable energy generation system for the Proposed Building

8.2 Proposed building energy consumption

The following is a breakdown of the energy consumption of the proposed building by the type of fuel and type of use:

DATE	TOTAL NAT. GAS (MWh)	TOTAL ELECTRICITY (MWh)	TOTAL GRID DISPLACED ELECTRICITY VIA PV (MWh)	NET TOTAL ENERGY (MWh)	REGULATED ENERGY WITH PROPOSED ASHP (MWh)	REGULATED ENERGY WITH PROPOSED ASHP + 100 M ² PV (MWh)
January	0.000	48.101	-0.651	47.450	23.013	22.362
February	0.000	43.213	-0.857	42.356	20.432	19.575
March	0.000	41.790	-1.457	40.333	16.702	15.245
April	0.000	31.981	-2.011	29.970	9.859	7.847
May	0.000	31.849	-2.219	29.630	7.702	5.483
June	0.000	30.398	-2.660	27.738	6.392	3.732
July	0.000	36.617	-2.455	34.161	11.529	9.073
August	0.000	34.651	-1.977	32.674	9.563	7.586
September	0.000	28.796	-1.505	27.291	5.732	4.227
October	0.000	36.668	-1.068	35.600	10.639	9.571
November	0.000	40.846	-0.720	40.126	15.899	15.179
December	0.000	43.182	-0.514	42.668	20.919	20.405
Summed total	0.000	448.090	-18.094	429.995	158.379	140.285

Table 17 - Proposed building monthly energy consumption by type of fuel

Total estimated gas energy consumption for the site is **0 kWh** per annum.

Total estimated electrical energy consumption for the site is **448,090 kWh** per annum.

Total grid displaced electricity via 100 m² PV for the site is **-18,094 kWh** per annum.

Therefore:

Net total energy consumption with ASHP and 100 m² PV utilized for the site is **429,995 kWh** per annum.

Regulated energy consumption with ASHP utilized for the site is **158,379 kWh**.

Regulated energy consumption with ASHP and 100 m² PV utilized for the site is **140,285 kWh**.

8.3 Standard building carbon dioxide emissions

The following is a breakdown of the energy consumption of the proposed building by the type of fuel and type of use:

DATE	TOTAL NAT.GAS CE (KG CO2)	TOTAL ELECTRICITY CE (KG CO2)	TOTAL GRID DISPLACED CE FROM PV (KG CO2)	NET ACTUAL CE EMISSIONS (KG CO2)	TOTAL CE EXCL EQUIPMENT UTILIZING ASHP (KG CO2)	CE EXCL EQUIPMENT + UTILIZING ASHP AND 100 M ² PV
January	0	7846	-128	7718	3754	3626
February	0	6919	-163	6756	3272	3109
March	0	6398	-255	6143	2558	2303
April	0	4577	-308	4269	1410	1102
May	0	4207	-286	3921	1016	730
June	0	3650	-282	3368	769	487
July	0	4067	-226	3841	1280	1054
August	0	3884	-184	3700	1071	887
September	0	3516	-166	3350	701	535
October	0	4990	-147	4843	1448	1301
November	0	6172	-122	6050	2402	2280
December	0	7044	-101	6942	3412	3311
Summed total	0	63270	-2369	60901	23092	20723

Table 18 - Proposed building monthly carbon dioxide emissions by type of fuel

Total estimated CO₂ emissions for natural gas fired equipment is **0 kg CO₂** per annum;

Total estimated CO₂ emissions for electricity is **63,270 kg CO₂** per annum. This figure includes unregulated equipment loads;

Total grid displaced CO₂ emissions by 100 m² PV system is **-2,369 kg CO₂**.

Therefore:

Net total estimated CO₂ emissions with ASHP and 100 m² PV utilized for the site is **60,901 kg CO₂** per annum.

The estimated **regulated** CO₂ emissions for the actual building with ASHP utilized is **23,092 kg CO₂** per annum.

The estimated **regulated** CO₂ emissions for the actual building with ASHP and 100 m² PV utilized is **20,723 kg CO₂** per annum.

9.0 Conclusion

In Section 3.0, the relevant planning policies were addressed where it was determined that in order to comply with the Reading Borough Local Plan (Adopted November 2019), it is required that:

- All major non-residential developments or conversions to residential are required to meet the most up-to-date BREEAM 'Excellent' standards, where possible.

In Section 5.0, a baseline building was established for the development using Part L (2021). The following annual energy consumption and carbon dioxide emissions were estimated for the standard building:

- Annual regulated Energy Consumption: **698,094 kWh**
- Annual regulated Carbon Dioxide Emissions: **132,380 kg CO₂**

In Section 6.0, the possibility of connecting the development to a decentralised energy scheme has been assessed. Two options were put forward, in Option 1 the possibility of connecting the proposed development to a potential or existing district heating scheme was investigated. However, at the time of preparing this statement, while there was a heat network present in the vicinity of the development, connecting to it is not cost effective and does not reduce carbon emissions effectively compared to the proposed solution (using ASHP and PV), thus Option 1 was not deemed feasible. In Option 2, the possibility of installing a CHP plant on-site was discussed. However, due to the low base load thermal demand and the non-continuous nature of the base load, Option 2 was also not deemed viable.

In Section 7.0, on-site Low / Zero Carbon (LZC) technologies were assessed in order to investigate how the required BREEAM 'Excellent' rating can be achieved. The recommended LZC technology were utilizing ASHP and PV panels.

In Section 8.0, energy consumption and Carbon Dioxide emissions were estimated for the proposed building with LZC energy generation under Part L 2021 as follows:

- Annual regulated Energy Consumption utilizing ASHP only: **158,379 kWh**
- Annual regulated Carbon Dioxide Emissions utilizing ASHP only: **23,092 kg CO₂**
- Annual PV Energy savings: **18,094 kWh**
- Annual PV CO₂ savings: **2,369 kg CO₂**
- Annual regulated Energy Consumption utilizing ASHP and PV: **140,285 kWh**
- Annual regulated Carbon Dioxide Emissions utilizing ASHP and PV: **20,723 kg CO₂**

The proposed development saves **77.31%** of the total annual regulated energy consumption and **82.56%** of the total annual regulated carbon emissions with the utilization of the LZC technologies – ASHP and PV panels.

The proposed development **achieves 11 of the 15 possible credits and an EPRndr of 0.67** which is within the 'Outstanding' threshold for Ene 01 Reduction of energy use and carbon – Whole building energy model (Option 1) and **2 credits** under Ene 04 Low carbon design for parts Passive design analysis (when Hea 04 Thermal comfort is achieved) and Low and zero carbon feasibility study. These credits will assist with the achievement of the overall BREEAM 'Excellent' rating.

Appendix A End of Journey Facility Information

Below is a high level summary of the End of Journey facility parameters as per Design Stage Part L modelling. The End of Journey facility achieved an EPC rating of A-7 based upon the following design information.

A.1 Building Fabric Thermal Performance

The following is a list of modelling assumptions that have been used for the inputs to the IES VE software.

Important, where parameters used for the building fabric and the building services are better than the Part L limits, if the final design does not achieve these values, then there is a risk that the as built SBEM/IES-VE DSM will show that the building is non-compliant.

- The following U-values have been supplied by the architect, calculated or are default values and have been used for the IES VE calculations:

BUILDING ELEMENT	PART L 2021 U-VALUES, W/m ² K	U-VALUES, W/m ² K	NOTES
External Wall	0.26	0.26	Provided by the architect (Part L 2021 Limiting values)
Floor	0.18	0.18	Provided by the architect (Part L 2021 Limiting values)
Roof	0.16 – Pitched Roof 0.18 – Flat Roof	0.18	Provided by the architect (Part L 2021 Limiting values)
Door	1.3– Vehicle Access 3.0 – High Usage 1.6 - Pedestrian	1.6	Provided by the architect (Part L 2021 Limiting values)
Glazing	1.6	1.6	Provided by the architect (Part L 2021 Limiting values)

- Building air permeability is 5 m³/h/m² – Provided by the architect

Building Fabric parameters in the design stage achieves compliance with the limiting values as set-out in the Part L 2021 guidance.

A.2 Geometry model layout

The IES model was built based upon the following architectural drawings by **Stride Treglown Ltd**.

- EOJF – Proposed GA Plan (156210-STL-XX-00-DR-A-XXXX-10000 Rev PL_022) Floor Plan
- EOJF – Proposed Site Plan (156210-STL-XX-00-DR-A-XXXX-100002 Rev PL_024) Site Plan
- EOJF – Proposed Elevations (156210-STL-XX-XX-DR-A-XXXX-20003 Rev PL-P22) Elevations

A.3 MEP systems

The following notes on the methodology used in and by the IES VE software apply to this project and should be taken into consideration when reading this report. Best fit descriptions within the IES VE software have been used in the model.

A.3.1 Heating and ventilation systems

The End of Journey facility is heated using an Air Source Heat Pump (ASHP) serving a Low Temperature Hot Water (LTHW) underfloor heating system. The ASHP has a Seasonal Coefficient of Performance (SCOP) of 3.26. The building is ventilated using a Mechanical Ventilation Heat Recovery (MVHR) system incorporating a cross-flow plate heat exchanger with an efficiency of 84%.

Efficiencies and flow rates are based on the product data sheets while fan powers are based on Part L 2021 Limiting Values.

A.3.2 Domestic hot water system

Domestic Hot Water (DHW) is generated by the same ASHP via a 300 litre calorifier.

A.3.3 Lighting system

The End of Journey Facility is provided with lighting system with excellent lighting efficacy figures compliant with the Part L 2021 Limiting value. Occupancy control is incorporated within the End of Journey Facility.

A.4 Decentralised Heat Network

As detailed in Section 6.0, there is no opportunity for connection to a heat network at this site.

A.5 L&ZC Technology

A.5.1 ASHP

Similar to the main building, Air Source Heat Pumps shall be used to heat the End of Journey facility in an efficient manner defined by the ratio of the electrical energy input versus the thermal energy output. Please see Appendix section A.3.1 for high level details of the ASHP proposed in the facility

A.5.2 Photo-Voltaic Panels

No PV system is included. The roof is not ideal for a PV installation as it is significantly overshadowed by the 3 storey offices to the south.

Appendix B BRUKL Output Document of the End of Journey Facility (Design Stage)

BRUKL Output Document

 HM Government

Compliance with England Building Regulations Part L 2021

Project name

300 Brook Drive

As designed

Date: Tue Oct 22 17:18:35 2024

Administrative information

Building Details

Address: 300 Brook Drive, Berkshire, RG2 6UA

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

Certifier details

Name: Oliver Hanson

Telephone number: 01869 254389

Address: 1 Lower Farm Barns, Bainton Road, Bucknell, Bicester, OX27 7LT

Foundation area [m²]: 67.9

The CO₂ emission and primary energy rates of the building must not exceed the targets

Target CO ₂ emission rate (TER), kgCO ₂ /m²·annum	16.66
Building CO ₂ emission rate (BER), kgCO ₂ /m²·annum	16.5
Target primary energy rate (TPER), kWh _{ep} /m²·annum	180.5
Building primary energy rate (BPER), kWh _{ep} /m²·annum	178.77
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	0.26	0.26	JF000002:Surf[2]
Floors	0.18	0.18	0.18	JF000002:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.18	0.18	JF00000E:Surf[0]
Windows** and roof windows	1.6	1.6	1.6	JF000003:Surf[1]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	1.6	1.6	JF000002:Surf[1]
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	5

Page 1 of 5

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	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- HVAC_01_underfloor heating

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.26	-	0	-	0.84
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types > 12 kW output, except absorption and gas engine heat pumps.					

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

Zone-level mechanical ventilation, exhaust, and terminal units

ID	System type in the Approved Documents
A	Local supply or extract ventilation units
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal balanced supply and extract ventilation system
E	Local balanced supply and extract ventilation units
F	Other local ventilation units
G	Fan assisted terminal variable air volume units
H	Fan coil units
I	Kitchen extract with the fan remote from the zone and a grease filter
NB: Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.	

Zone name	SFP [W/(l/s)]										HR efficiency	
	ID of system type	A	B	C	D	E	F	G	H	I	Zone	Standard
Standard value		0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1		
EOJF_Lobby-Rear		-	-	-	2.2	-	-	-	-	-	-	N/A
EOJF_Corridor		-	-	-	2.2	-	-	-	-	-	-	N/A
EOJF_Access Shower WC		-	-	-	2.2	-	-	-	-	-	-	N/A
EOJF_Lobby - Front		-	-	-	2.2	-	-	-	-	-	-	N/A
EOJF_Corridor		-	-	-	2.2	-	-	-	-	-	-	N/A
EOJF_Corridor		-	-	-	2.2	-	-	-	-	-	-	N/A
EOJF_Cleaners CPD		-	-	-	2.2	-	-	-	-	-	-	N/A
EOJF_Plant		-	-	-	2.2	-	-	-	-	-	-	N/A
EOJF_Shower 2		-	-	-	2.2	-	-	-	-	-	-	N/A
EOJF_Shower 1		-	-	-	2.2	-	-	-	-	-	-	N/A
EOJF_Shower 4		-	-	-	2.2	-	-	-	-	-	-	N/A
EOJF_Shower 3		-	-	-	2.2	-	-	-	-	-	-	N/A

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
EOJF_Lobby-Rear		113	80	1.688

General lighting and display lighting		General luminaire	Display light source	
Zone name		Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m ²]
	Standard value	95	80	0.3
EOJF_Corridor		113	-	-
EOJF_Access Shower WC		101	-	-
EOJF_Lobby - Front		113	80	1.688
EOJF_Corridor		146	-	-
EOJF_Corridor		146	-	-
EOJF_Cleaners CPD		98	-	-
EOJF_Plant		101	-	-
EOJF_Shower 2		98	-	-
EOJF_Shower 1		98	-	-
EOJF_Shower 4		98	-	-
EOJF_Shower 3		98	-	-
EOJF_Plant Room		154	-	-

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?
EOJF_Lobby-Rear	N/A	N/A
EOJF_Lobby - Front	NO (-92.1%)	NO

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]	77.3	77.3
External area [m ²]	293.6	293.6
Weather	SWI	SWI
Infiltration [m ³ /hm ² @ 50Pa]	5	3
Average conductance [W/K]	77.29	77.48
Average U-value [W/m ² K]	0.26	0.26
Alpha value* [%]	27.82	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/m²]

	Actual	Notional
Heating	14.6	11.01
Cooling	0	0
Auxiliary	9.39	11.98
Lighting	9.6	9.36
Hot water	84.15	89.62
Equipment*	39.9	39.9
TOTAL**	117.75	121.97

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

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
<i>Displaced electricity</i>	<i>0</i>	<i>0</i>

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	152.84	110.14
Primary energy [kWh _{PE} /m ²]	178.77	180.5
Total emissions [kg/m ²]	16.5	16.66

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 SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Central heating using water: floor heating, [HS] ASHP, [HFT] Electricity, [CFT] Electricity									
Actual	173.9	0	16.6	0	10.7	2.91	0	3.26	0
Notional	125.3	0	12.5	0	2.3	2.78	0	---	---
[ST] No Heating or Cooling									
Actual	0	0	0	0	0	0	0	0	0
Notional	0	0	0	0	0	0	0	---	---

Key to terms

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

Appendix C Provisional Energy Performance Certificate of the End of Journey Facility

Energy Performance Certificate
Non-Domestic Building

 HM Government

300 Brook Drive
Reading
Berkshire
RG2 6UA

Certificate Reference Number:
7144-6683-5978-4159-8441

This certificate shows the energy rating of this building. It indicates the energy efficiency of the building fabric and the heating, ventilation, cooling and lighting systems. The rating is compared to two benchmarks for this type of building: one appropriate for new buildings and one appropriate for existing buildings. There is more advice on how to interpret this information in the guidance document *Energy Performance Certificates for the construction, sale and let of non-dwellings* available on the Government's website at www.gov.uk/government/collections/energy-performance-certificates.

Energy Performance Asset Rating

More energy efficient

A+

..... Net zero CO₂ emissions

A 0-25

7

This is how energy efficient the building is.

B 26-50

C 51-75

D 76-100

E 101-125

F 126-150

G Over 150

Less energy efficient

Technical information

Main heating fuel:	Grid Supplied Electricity
Building environment:	Heating and Mechanical Ventilation
Total useful floor area (m ²):	77.250
Building complexity:	Level 5
Building emission rate (kgCO ₂ /m ² per year):	16.5
Primary energy use (kWh _e /m ² per year):	178.77

Benchmarks

Buildings similar to this one could have ratings as follows:

7

If newly built

30

If typical of the existing stock

Administrative information

This is an Energy Performance Certificate as defined in the Energy Performance of Buildings Regulations 2012 as amended.

Assessment Software:	Virtual Environment v7.0.26 using calculation engine ApacheSim v7.0.26
Property Reference:	UPRN-000000000000
Assessor Name:	Oliver Hanson
Assessor Number:	LCEA121088
Accreditation Scheme:	CIBSE Certification Limited
Assessor Qualifications:	NOS5
Employer/Trading Name:	Red Engineering Ltd
Employer/Trading Address:	1 Lower Farm Barns, Bainton Road, Bucknell, Bicester, OX27 7LT
Issue Date:	22 Oct 2024
Valid Until:	21 Oct 2034 (unless superseded by a later certificate)
Related Party Disclosure:	Not related to the owner

Recommendations for improving the energy performance of the building are contained in the associated Recommendation Report: 5438-5731-4502-2776-6412

About this document and the data in it

This document has been produced following an energy assessment undertaken by a qualified Energy Assessor, accredited by CIBSE Certification Limited. You can obtain contact details of the Accreditation Scheme at www.cibsecertification.com.

A copy of this certificate has been lodged on a national register as a requirement under the Energy Performance of Buildings Regulations 2012 as amended. It will be made available via the online search function at www.ndepcregister.com. The certificate (including the building address) and other data about the building collected during the energy assessment but not shown on the certificate, for instance heating system data, will be made publicly available at www.opendatacommunities.org.

This certificate and other data about the building may be shared with other bodies (including government departments and enforcement agencies) for research, statistical and enforcement purposes. For further information about how data about the property are used, please visit www.ndepcregister.com. To opt out of having information about your building made publicly available, please visit www.ndepcregister.com/optout.

There is more information in the guidance document *Energy Performance Certificates for the construction, sale and let of non-dwellings* available on the Government website at: www.gov.uk/government/collections/energy-performance-certificates. It explains the content and use of this document and advises on how to identify the authenticity of a certificate and how to make a complaint.

Opportunity to benefit from a Green Deal on this property

The Green Deal can help you cut your energy bills by making energy efficiency improvements at no upfront costs. Use the Green Deal to find trusted advisors who will come to your property, recommend measures that are right for you and help you access a range of accredited installers. Responsibility for repayments stays with the property - whoever pays the energy bills benefits so they are responsible for the payments.

To find out how you could use Green Deal finance to improve your property please call 0300 123 1234.