Bracknell Data Centre

Energy Statement

-

Job No: 1027823

Doc Ref: 20305B-CUN-XX-XX-RP-E-9736

Revision: C

Revision Date: 02 March 2021

Project title	Bracknell Data Centre	Job Number
Report title	Energy Statement	1027823

Document Revision History

Revision Ref	Issue Date	Purpose of issue / description of revision
	19 January 2021	Draft for Comment
A	23 February 2021	Updated with Comments
B	01 March 2021	Updated with Comments
C	02 March 2021	Document Ref updated

Document Validation (latest issue)

02/03/2021
X Tom Sutherland
Principal author
Signed by: Sutherland, Tom

02/03/2021
X Jennifer Elias
Checked by
Signed by: Elias, Jennifer

02/03/2021
X [redacted]
Verified by
Signed by: Wyatt, Simon

Executive Summary

This Energy Statement has been prepared to support the planning application for the development of a data centre on land at Cain Road, Bracknell. It forms one of a suite of technical reports forming part of the application for the data centre and associated infrastructure.

The statement summaries the energy strategy devised for the development of the Bracknell Data Centre, and outlines the development's approach to energy efficiency and renewable energy strategies in order to meet the requirements of national policy as well as the local planning policy of Bracknell Forest Council.

Low environmental impact is central to the design of the building, with the following hierarchy of measures:

- Be Lean (Energy Saving Measures)
- Be Clean (Decentralised Energy)
- Be Green (Low and Zero Carbon Technologies)

The development incorporates a number of energy efficient and passive design measures to deliver significant savings on regulated energy use: U-values for all building fabric elements and openings have been specified to meet or exceed the levels required by Building Regulations. Heat losses from infiltration have been minimised and a low air permeability target has been set.

In addition, high efficiency evaporative cooling serves the building's data halls and the mechanical building services installation will be specified to achieve high annual energy efficiency in operation. All systems have efficiencies and controls which will meet or exceed the requirements of Part L of Building Regulations (2013). The inclusion of these will support the reduction in the CO2 emissions associated with the operation of the proposed development.

As part of the analysis, a feasibility study into Low or Zero Carbon Technologies (LZC) has been carried out, with photovoltaic panels and VRF (Air source heat pump) shown as the most appropriate for this development. Combined, PV and VRF (Air source heat pump) will deliver 24% of the energy used by the admin block component of the development.

The development is also targeting BREEAM credits under BREEAM Data Centres 2010, specifically:

- Ene 01 - Reduction of CO_2 Emissions (15 credits)
- Ene 05 – Low or Zero Carbon Technologies (1 credit)

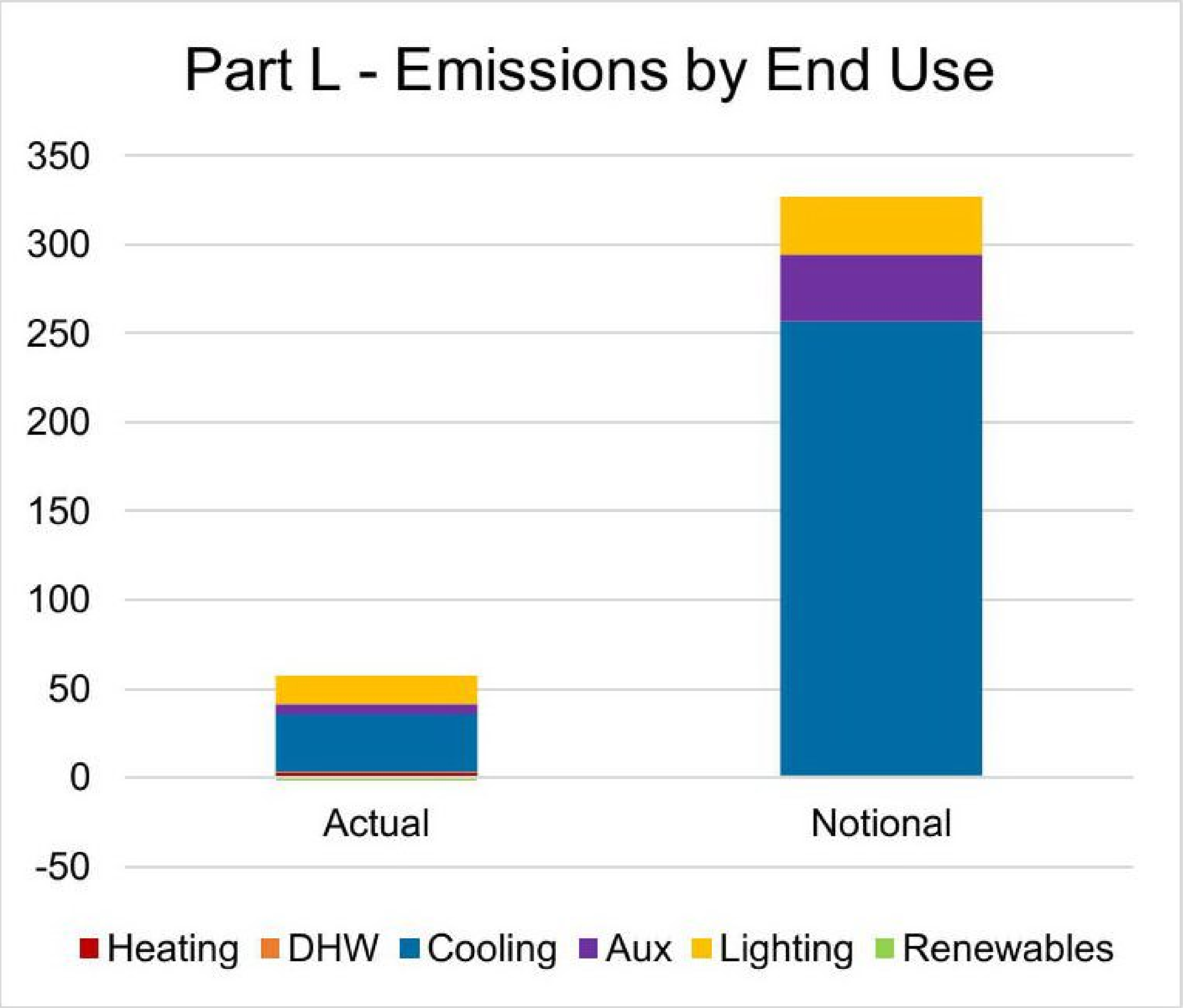
Results

The table and figure below give the CO_2 emissions of the site compared to that of the notional building, for each end use. The analysis indicates that the proposed development is achieving an 83% improvement over the Building Regulations Part L 2013 Target Emission Rate.

This level of performance would enable to building to achieve an EPC rating of A – the highest available.

kgCO2/m^2 yr	Actual	Notional
Heating	2.61	0.93
DHW	0.68	0.38
Cooling	32.37	255.34
Aux	5.81	37.72
Lighting	16.08	32.36
Renewables	-1.59	0
Total	**55.97**	**326.72**
Preliminary Compliance Pass Margin	83%	

kWh/m^2 yr	Actual	Notional
Heating	5.16	2.89
DHW	1.35	1.2
Cooling	63.97	504.6
Aux	11.48	74.54
Lighting	31.78	63.94
Renewables	-3.06	0
Total	**110.68**	**647.17**



Contents

1.0

Introduction

1.0 Introduction

1.1 Purpose of Document

This *Energy Statement* has been prepared to support a planning application for the development of land on Cain Road in Binfield, approximately 2km west of Bracknell.

This application seeks consent for a Data Centre building (containing data halls, associated electrical and AHU Plant Rooms, loading bay, maintenance and storage space, office administration areas and screened plant at roof level), emergency generators and emission stacks, diesel tanks and filling area, electrical switch room, a water sprinkler pump room and storage tank, a gate house, security building, site access, internal access roads, drainage infrastructure and hard and soft landscaping.

This report outlines the scheme and current planning context and assesses likely energy demands of the development prior to consideration of low and zero carbon technology options. The report concludes with the proposed energy strategy.

This Energy Report comprises:

- A scheme overview.
- A review of the planning context.
- A review of any applicable legislation or sustainability targets.
- An energy assessment of the project, following the energy hierarchy.
- A presentation of results and recommendations.

The results of the Part L simulation further identify that the proposed development will exceed the energy consumption targets set by 83% over the baseline building. This has been achieved by an energy efficient cooling solution utilising outside air as the cooling medium and limiting the requirement for mechanical cooling systems as far as possible.

1.2 Scheme Overview

The Application Site is located between Wokingham to the west and Bracknell to the east. To the north of the Site is the village of Binfield with Berkshire Way to the south. The area is in the outer edge of the urban area of Bracknell, the centre of which is 2km to the east.

The proposed development will consist of 1 no. single storey building (8,692 m^2), which is 12m in height at the main parapet level. The building includes:

- 1 no. data hall
- Administration areas (office space, meeting rooms, welfare facilities and associated circulation space etc.)
- Associated electrical and mechanical plant rooms to house the equipment required to maintain the temperature, humidity and power supply for the facility
- Mechanical plant at roof level
- 11 no. emergency back-up generators
- 1 no. single storey sprinkler pump house (71 m^2) and water storage tank
- 1 no. security hut building (27 m^2)
- 1 no. security kiosk (2.3m^2)
- 1 no. MV building (244 m^2)
- Underground foul and storm water drainage network, water supply and below/over ground storm water attenuation areas
- Internal access road network and site access; from Cain Road
- Emergency access of Beehive Road
- 1 no. diesel storage tanks
- Security fence, CCTV and lighting
- Hard and soft landscaping

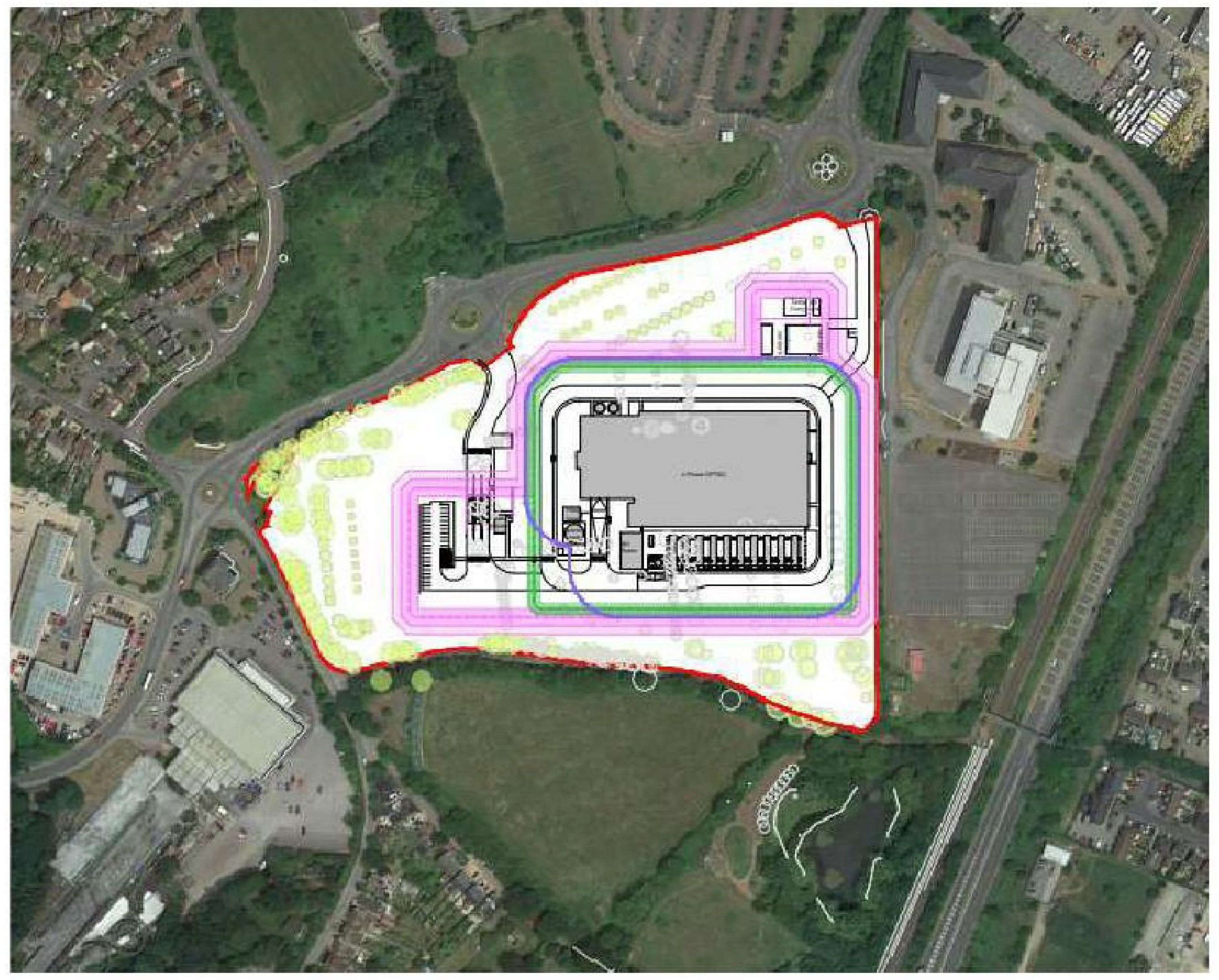


Figure 1 – Bracknell Data Centre Site Masterplan

2.0

Planning Context

2.0 Planning Context

The site lies within the administrative area of Bracknell Forest Council and the planning application takes into account the requirements of both national and local level policies.

2.1 National level policies

There are a number of national policies and regulations related to energy; those most relevant to the energy assessment of new developments are detailed below.

2.1.1 National Planning Policy Framework – NPPF (2019)

The National Planning Policy Framework (NPPF) was published in February 2019. The NPPF is designed to make the planning system less complex and more accessible; to protect the environment and promote sustainable growth. It provides a framework within which local people and their respective councils can produce their own distinctive local and neighbourhood plans, which reflect the needs and priorities of their communities.

At the heart of the National Planning Policy Framework is a presumption in favour of sustainable development. The three dimensions of sustainable development can be defined as the economic, social and environmental.

Within core planning principles, there is a strong support for the transition to a low carbon future in a climate change context, taking full account of a number of different factors. There is also an aim to contribute to conserving and enhancing the natural environment and reducing pollution.

The NPPF aims to strengthen local decision making, with the use of decision-taking in a positive way, as a means of fostering the delivery of sustainable development.

2.1.2 Climate Change Act 2008

The Government has introduced legislation and a number of policies during recent years focusing on the reduction of CO_2 emissions. The Climate Change Act (2008) sets a legally binding target for the reduction in UK carbon dioxide emissions. Upon ratification of the Kyoto Protocol, the UK committed to a reduction in its CO_2 emissions by 80% compared to 1990 levels (by 2050). In addition, under the Climate Change Act an interim target of a 34% reduction by 2020 was set. In June 2019, the Government amended the Climate Change Act CO_2 emissions target to a 100% (Net Zero Carbon) reduction compared to 1990 levels by 2050.

In order to enforce these targets, the Government is using the Building Regulations: Part L 2013 – (Conservation of fuel and power) which set the standards to which all new and existing buildings must comply.

2.1.3 Building Regulations 2013 Part L

Building Regulations are statutory instruments that seek to ensure that the policies set out within any relevant UK legislation are carried out. Building regulations approval is required for the majority of building work carried out in the United Kingdom.

Part L of these regulations covers the requirements with respect to the conservation of fuel and power in all building types. It controls the insulation values of building fabric elements and openings, the air permeability of the structure, the heating efficiency of heating, ventilation, and air conditioning systems together with hot water storage and lighting efficiency. It also sets out the requirements for calculating the carbon dioxide emissions and the Carbon Emission Targets for each building type. The unit needs to comply with Part L2A - New Buildings other than Dwellings.

2.2 Local level policies – Bracknell Forest Council

The Planning and Energy Act 2008 enables a local planning authority in England, through their development plan documents, to include policies imposing reasonable requirements for:

- A proportion of energy used in development in their area to be energy from renewable sources in the locality of the development.
- A proportion of energy used in development in their area to be low carbon energy from sources in the locality of the development.
- A development in their area to comply with energy efficiency standards that exceed the energy requirements of building regulations.

2.3 Bracknell Forest Core Strategy

The Core Strategy sets out the Council's long-term aspirations for the borough and policies to guide and manage development in Bracknell Forest until 2026. It was adopted by the council on 7 February 2008.

2.3.1 Policy CS12: Renewable Energy

Development proposals for five or more net additional dwellings, or for 500 square metres (GEA) or more of floorspace for other development, will be accompanied by an energy demand assessment demonstrating how (potential) carbon dioxide emissions will be reduced by at least 10% and will provide at least 20% of their energy requirements from on-site renewable energy generation.

2.3.2 Sustainable Resource Management SPD

The Sustainable Resource Management supplementary planning document provides guidance to ensure new development delivers Core Strategy objectives, it provides guidance on how new developments should be constructed in a sustainable way to meet or exceed current best practice standards. The SPD identifies the parameters against which planning statements will be assessed; those most relevant to this energy statement are:

1. Assessment of the energy demand and predicted CO_2 emissions
2. Demonstrate how the energy demand has reduced CO_2 emissions by at least 10%
3. Demonstrate the % of energy provided from on site renewable generation
4. Show how adaptation to microclimate is considered through design principles and the use of shading.

2.4 Draft Bracknell Forest Local Plan (2019)

A Draft Local Plan was consulted on in 2019; the document has not been through examination in public so less weight can be given to any of the policies. However, it does give a clear direction as to future policies.

2.4.1 Policy LP46 'Sustainable Construction'

New development proposals (excluding extensions) will be required to meet climate change objectives and achieve a high standard of environmental sustainability. This will be achieved by the following:

iv. Non-residential development shall meet at least BREEAM 'excellent' or equivalent standard.

2.4.2 Policy LP47 'Renewable and low carbon energy'

Development involving the generation of energy from low carbon and renewable sources will be permitted where it can be demonstrated that there will be no significant adverse impact on:

i. amenity
ii. the built or historic environment; and,
iii. natural environment, including individual and cumulative landscape and visual impacts

2.5 BREEAM Data Centres 2010

This development is targeting credits under:

- Ene 01 – Reduction of CO_2 Emissions
  - Based on the developments Power Usage Effectiveness (PUE) and the CO_2 index (EPC Rating), targeting 15 credits
- Ene 05 – Low or Zero Carbon Technologies
  - One credit based on the fulfilment of a feasibility study into the use of LZC technologies

2.5.1 Policy summary

In conclusion, compliance with a number of national, regional and local policy standards is required for the proposed non-domestic building. These are presented in Table 1 below:

Policy Level	Standard
National Policies	National Policy Framework
	Climate Change Act
	Building Regulations Part L2A
Local Policies	Bracknell Forest Council ▪ Policy CS12: Renewable Energy ▪ Policy LP46 & LP47 (emerging policy)

Table 1: Planning Policy Overview

3.0

Energy Modelling

3.0 Energy Modelling

3.1 Building Regulations Part L2A

There are three key elements associated with Part L2A that can be assessed using building simulation software at the design stage:

- Criterion 1 - Confirmation that the proposed building design achieves a lower Building Emission Rating (BER) compared to a Target Emission Rating (TER) determined for a "notional building", as per Part L2A 2013 paragraphs 2.7 to 2.36.
- Criterion 2 - Confirmation that building fabric and the fixed building services meet or improve upon minimum standards of energy efficiency, as outlined in paragraphs 2.37 to 2.49 of Part L2A 2013.
- Criterion 3 - Confirmation that the building has incorporated appropriate passive control measures to limit solar gains, as per Part L2A 2013 paragraphs 2.50 to 2.53.

Compliance with the three criteria detailed above are demonstrated by provision of a BRUKL compliance report: a design stage BRUKL must be provided prior to commencement of works on site, and must be updated to reflect the 'As Built' building upon completion.

Additionally, an As-Built Energy Performance Certificate (EPC) must be lodged by an accredited assessor upon completion of works.

Compliance with two additional criteria must be demonstrated by the contractor:

- Criterion 4 - The performance of the building, as built, should be consistent with the Building Emissions Rate (BER). This requires that the contractor demonstrate the building construction is of a standard that it consistent with the model and to provide documentation to support the achieved air permeability, ductwork leakage, and commissioned fan performance.
- Criterion 5 - The necessary provisions for enabling energy-efficient operation of the building should be put in place. The owner of the building should be provided with sufficient information about the building, the fixed building services and their maintenance requirements so that the building can be operated in such a manner as to use no more fuel and power than is reasonable in the circumstances (for example, a building log book).

3.2 Energy Simulation

To assess the compliance of the development with the Part L requirements, a model was created in IES in accordance with the NCM. Energy modelling was then carried out on this model, shown below in figures 2 and 3.

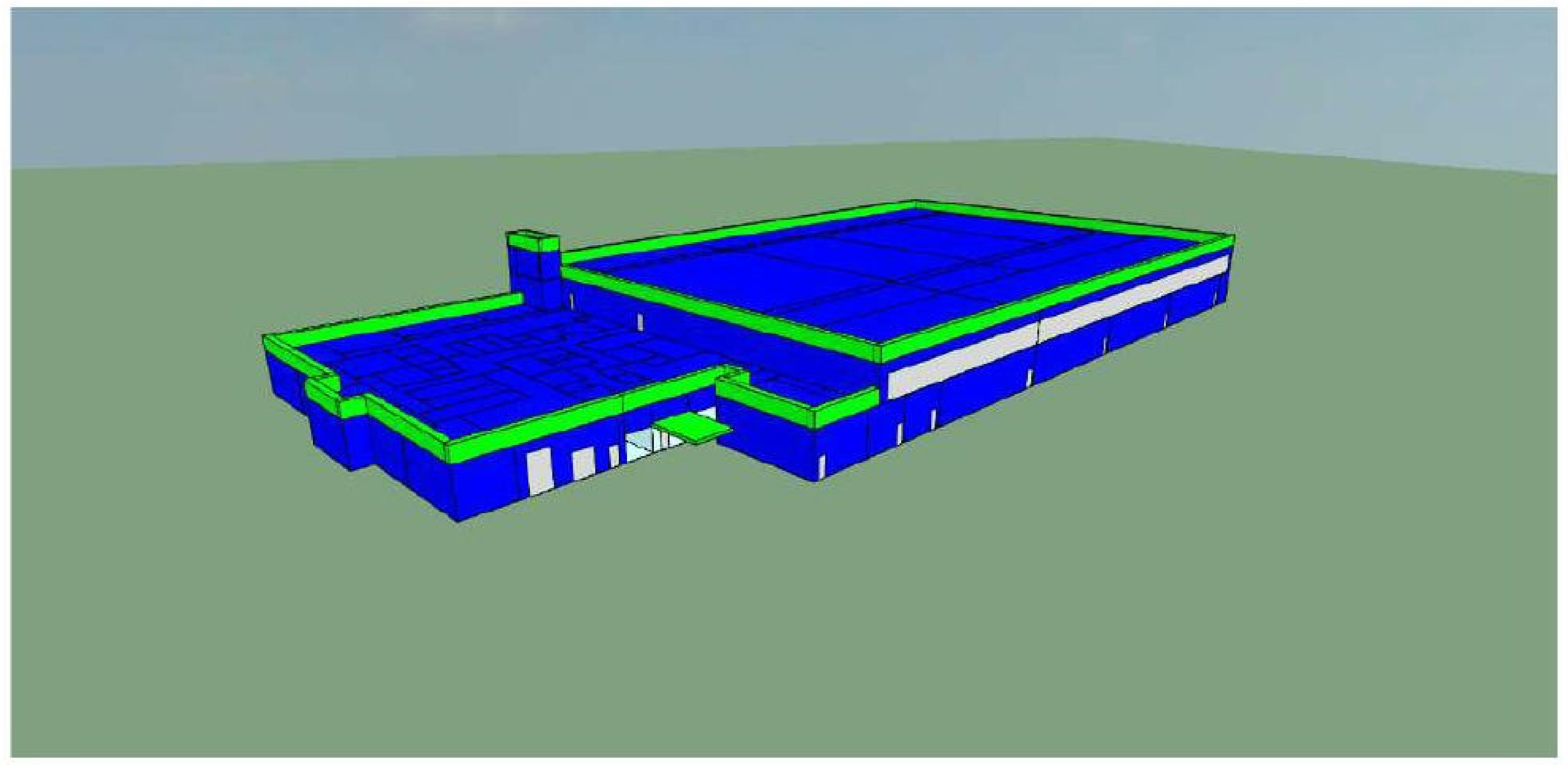


Figure 2 - Model used for energy simulation (View from the south-west)

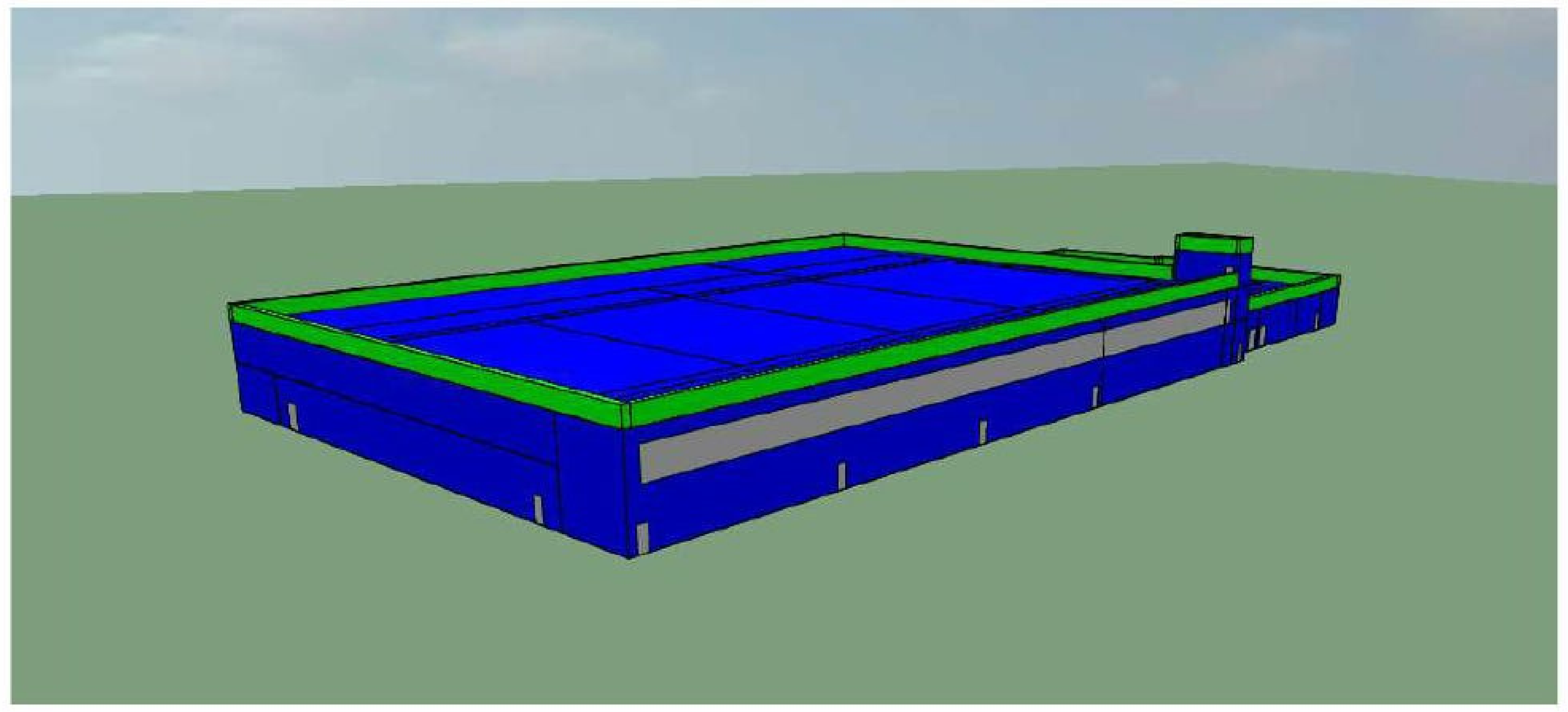


Figure 3 - Model used for energy simulation (View from the north-east)

4.0

Energy Saving Measures (Be Lean)

4.0 Energy Saving Measures (Be Lean)

Energy demand reduction within the building can be utilised to improve compliance with Part L2A 2013. This development has been reviewed to maximise both passive and active design measures to reduce the energy demand within the building.

4.1 Building Fabric

Considering the project's microclimate, the key to passive design for the project is reduction of CO_2 emissions of the development through minimising the heat losses through the building fabric. In order to achieve this, U-values for all building fabric elements and openings have been specified to meet or exceed the levels required by Building Regulations. The glazed facades have deliberately been oriented to maximise shading from the building itself, avoiding overheating. In addition, heat losses from infiltration have been minimised and a low air permeability target has been set. The details of these measures are summarised in the Table 2 below.

Fabric details	Unit	Data Hall	Admin Block	Part L2A Minimum
Ground floor average area weighted thermal conductivity (U-value)	W/m².K	0.22	0.22	0.25
External wall average area weighted thermal conductivity (U-value)	W/m².K	0.23	0.23	0.35
Roof average area weighted thermal conductivity (U-value)	W/m².K	0.18	0.18	0.25
High usage pedestrian entrance doors thermal conductivity (U-value)	W/m².K	2.20	3.8	2.20
Loading bay access doors thermal conductivity (U-value)	W/m².K	1.50	4.00	2.20
Spandrel elements thermal conductivity (U-value)	W/m².K	N/A	4.00	2.20
Windows thermal conductivity (U-value) (inc. frame)	W/m².K	N/A	1.40	2.20
Windows glazing total solar transmission (G-value)	%	N/A	0.35	N/A
Windows glazing visible light transmission (VLT)	%	N/A	71	N/A
Windows frame factor	%	N/A	10	N/A
Air permeability @ 50 Pascals	m³/(h.m²)	10	10*	10

Table 2: Passive Design Energy Saving Measures

* In reality the admin block will target an air permeability closer to 3 m³/h.m².

4.2 Building Services (Regulated Energy)

In addition to upgrading the insulation standards, it is important that the energy used within the building is efficient. Therefore, the building systems have been designed to optimise the efficiency of the systems by matching installed capacity to anticipated building demand. Items of equipment, which make up the building's mechanical building services installation, will be specified to achieve high annual energy efficiency in operation and will be regularly serviced to maintain their performance. All systems have efficiencies and controls which will meet or exceed the requirements of Part L2A:2013 Non-Domestic Building Services Compliance Guide.

4.2.1 Data Halls Mechanical System

Direct evaporative Air Handling Units (AHU's) with variable air volume conditioning will provide cooling and ventilation air to the data processing areas and equipment rooms. Cooling will be based on ambient wet bulb (WB) temperature and additional cooling will be provided by evaporative pads utilising water as cooling media. This system is designed to offer the highest efficiency (over other cooling technologies) on an annual basis.

4.2.2 Administration Block Mechanical Systems

The office air conditioning shall be served by a VRF (Air source heat pump) system. High efficiency units will be used to minimise electrical power demand. Typically, the energy efficiency of a VRF (Air source heat pump) system will exceed that of traditional air-cooled chillers by 15-25%.

4.2.3 Ventilation Systems

The fresh air ventilation system for the office area will be served using energy efficient Heat Recovery Units which will recover waste heat from the office spaces and re-use to pre-heat the air with the HRU. This will reduce the overall energy consumption for this system.

The toilet areas shall be mechanically ventilated and automatically controlled by occupancy sensors to set back the ventilation rate during periods of non-use.

4.2.4 Lighting

Internal lighting shall be provided by high efficiency, low energy LED luminaires combined with presence detection controls or local switching where appropriate.

		Data Hall	Admin Block (Office Areas)	Admin Block (Back of House)
Systems				
Central AHU Specific Fan Power (SFP)	W/l/s	1.03 (per DAHU)	1.6 W/l/s	
Terminal Unit Specific Fan Power (SFP) (where relevant)	W/l/s	N/A	0.25	
Heat recovery efficiency	%	0 Mixing Box Only	75%	
Extract fan SFP	W/l/s	0.56 (per EF)		1.5 W/L/s (assumed) Toilets
Cooling/Heating				
Cooling Source		Evaporative cooler in DAHU	Refrigerant	no cooling in stairs, plant and store rooms
Heating Source		No Heating	Refrigerant	Stairs, plant and store rooms electric unit heaters
Chiller/VRF/DX system Heating Seasonal Coefficient of Performance	SCOP	N/A	5.5	
Chiller/VRF/DX system Cooling Seasonal Energy Efficiency Ratio	SEER	35.12	4.83	
Chiller/VRF/DX Cooling Energy Efficiency Ratio	EER	N/A	6.8	
Other units (e.g. panel heaters) efficiency	%	N/A		100% (Electric)
DHW				
Hot water system type		N/A	Electric with 10L of storage per unit	
Hot water system efficiency	%		100%	
Lighting				
Lighting efficacy	lm/cw	110	90	90

Table 3: Summary of equipment energy efficiency

4.3 Building Services (Unregulated Energy)

Optimisation of the design parameters of the regulated energy within the building is important to deliver energy savings, but even more important in the context of data centres is considering the unregulated energy uses, and identifying ways to save energy that go beyond the requirements of Part L.

4.3.1 Utility Supply

The power requirements for the proposed development will be provided via a Utility connection at 33kV. The on-site substation will then provide a stepdown transformer to 11kV for electrical power distribution at medium voltage throughout the site. The site distribution system supplies all electrical rooms where stepdown transformers are deployed to provide 415V electricity to all loads. This configuration minimises distribution losses.

4.3.2 Transformers

To reduce electrical losses between HV/MV/LV conversions, the applicant will install low loss transformers which comply with the Eco design directive 2009/125/EC as a minimum.

4.3.3 External Lighting

A site lighting report has been prepared to accompany the planning application. The external lighting will make use of high efficiency, low energy LED luminaires. The lighting design has been optimised to reduce glare, spillage or other light nuisance to adjacent sites and/or public roads.

Secondary external lighting in areas such as the generator compound will be operated via presence and daylight detection to minimise hours of operation and thus keep energy usage to a minimum.

4.3.4 Data Storage Room Environmental Conditions

As part of the environmental design considerations, the data storage rooms' temperature is maintained as high as possible given technical and operational requirements. This has the following benefits:

- The air flow rate required to meet the environmental conditions is minimised, thereby reducing electrical power required for the ventilation fans.
- The requirement for adiabatic cooling / water demand is minimised.

4.4 Water Saving Measures

In addition to saving energy, saving water has been a key consideration for the project. Refer to the sustainability statement 20305B-RPS-ZZ-XX-RP-P-9726 which details water efficiency measures that will be incorporated to reduce water consumption and demand including the specification of water efficient appliances which will be in line with BREEAM Data Centres 2010 requirements.

5.0

Decentralised Energy (Be Clean)

5.0 Decentralised Energy (Be Clean)

Connection to a decentralised energy network and the use of Combined Heat and Power (CHP) is a recognised method of generating energy more efficiently. Where an existing decentralised energy network is not present, an assessment of the feasibility of establishing a decentralised energy system for the proposed development should be undertaken; including an assessment of the feasibility of a CHP communal heating system.

5.1 Combined Heat & Power (CHP)

CHP is the on-site generation of electricity and the recovery of the normally wasted heat produced during this process.

- The operation of CHP plant can offer significant CO_2 emission rates when compared to conventional methods of energy generation and use.
- Most large conventional power stations currently generate electricity at 30-50% efficiency (due to waste heat and transmission losses).
- 'Good quality' CHP schemes achieve overall efficiencies of 70-85% by making use of waste heat and eliminating transmission losses.

The efficient use of CHP typically depends on finding a use for the heat generated by the process. Issues to consider include:

- If heat is not used, then the system is effectively just an electricity generator and electricity will be greener and cheaper if sourced from the national grid.
- If excess electricity is generated on site this can be exported (sold) back to the grid whereas excess heat needs to be rejected (wasted).
- Exported electricity will typically not be financially attractive as exports tend to coincide with low demand periods on the national grid. The cost of producing the electricity on site can be less than the prices received for the exported electricity.

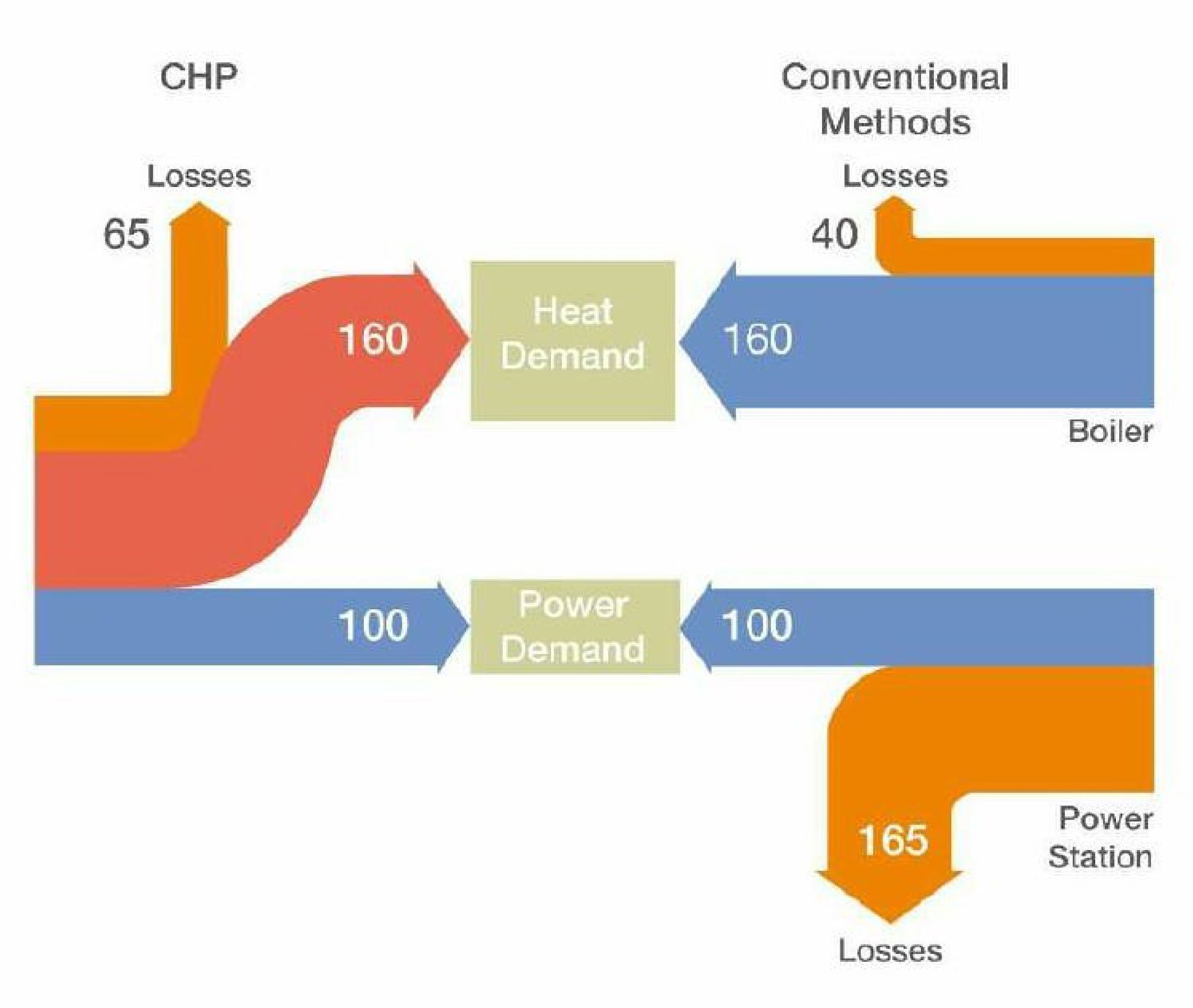


Figure 4: Combined Heat & Power

As there is minimal demand for heat within the data centre, finding a use for the generated heat will not be feasible. As such, CHP is not proposed for the project.

Additionally, as the electricity grid continues to decarbonise, with renewable energy coming online, incorporation of CHP would not result in reduction in terms of carbon emissions.

5.2 Decentralised Energy Network

The feasibility of connecting to an existing or proposed district network has been investigated for the site. The development is not located adjacent to major heat users, nor is there any known heat networks within the vicinity of the development. Accordingly, connection to any heat network is not considered applicable.

6.0

Low and Zero Carbon Technologies (Be Green)

6.0 Low and Zero Carbon Technologies (Be Green)

6.1 Site-Specific Low and Zero Carbon Technologies feasibility assessment

This section discusses the feasibility of using Low and Zero Carbon (LZC) technologies for the proposed scheme. To address the planning requirement for the integration of LZC technologies onsite, the installation of solar thermal panels, photovoltaics, wind turbines, biomass and heat pumps were investigated. Appendix B contains the full appraisal matrix.

6.1.1 Air Source Heat Pumps (ASHP)

Air source heat pumps exchange heat between the outside air and a building to provide space heating in winter and cooling in the summer months. The efficiency of these systems is inherently linked to the ambient air temperatures.

Heat pumps supply more energy than they consume by extracting heat from their surroundings. Heat pumps can supply as much as 4kW of heat output for just 1kW of electrical energy input.

Typically, there are two main types of air sourced heat pump systems, one which is refrigerant-based system (VRF) and one which is water-based system (air to water heat pumps). VRF systems transfer heat from one location to another using refrigerant. The volume or flow rate of refrigerant is accurately matched to the required heating or cooling loads thereby saving energy and providing more accurate control.

All the occupied rooms within the admin block are well suited to supply from VRF (Air source heat pump). It presents a viable option due to the heating and cooling demand present in these spaces and will therefore be used in the development.

6.1.2 Ground Source Heat Pumps (GSHP)

GSHP systems require either horizontal trenches or vertical boreholes to be excavated in order to accommodate piles or loops. Heat and cooling are recovered from the earth's crust and transferred to the building using a water to air or water to refrigerant heat exchanger.

Typically, GSHP systems are well suited to low rise (1-2 storey) buildings with a large site area available from which to recover heat. Although GSHP systems work best where there is a constant heating demand, they can also be an efficient solution where demand is more intermittent, depending on the loads involved; buildings with a substantially higher heating load than cooling load can lead to cooling of the ground, reducing the system's effectiveness over time. Space and site restrictions do not allow this system to be viable for this project due to the large area requirement for the ground collector or boreholes.

6.1.3 Wind Turbines

Wind turbines are not considered for analysis due to the negative impact they would have on the visuals of the local area.

6.1.4 Photovoltaic (PV) Panels

Photovoltaic solar cells convert solar energy directly into electricity. The cells consist of two layers of silicon, one with additives that create additional electrons the other with additives that create holes where electrons are missing. The incoming solar energy charges the layer with additional electrons. The energised electrons move through the cell into a wire creating an electrical current.

Provision for an amount of PV, 200 m^2, has been made in the building design to reduce the operational energy of the development.

The 200m^2 of PV will provide 21% of the energy used by the administration block of the data centre, as shown in the following table:

Energy Use in Administration block	$kWh/m^2.yr$
Heating	22.47
DHW	6.84
Cooling	3.67
Aux	15.14
Lighting	26.3
Renewables	-15.53
Total	**58.89**
PV Area (m2 of PV panel)	200
PV Contribution	21%

6.1.5 Solar Thermal

Solar thermal collectors utilise solar radiation to heat water for use in buildings. The optimum orientation for a solar collector in the UK is a south facing surface, tilted at an angle of 30º from the horizontal. Solar collectors are typically designed to meet a development's base heat load, associated with its domestic hot water (DHW) requirements. The DHW demand of the building is a very small proportion of the total energy demand.

Moreover, solar thermal collectors would compete with PV for limited roof space on the project: the preferred approach is to install solar PV. For these reasons solar thermal collectors are not suitable for the development.

6.1.6 Biomass Heating

Biomass-fired boilers could be incorporated into the project to meet the space heating and domestic hot water heating. Biomass boilers require significant space for storage and delivery of fuel, as well as bringing air quality concerns. The restricted spatial nature of the site and regional policies regarding air quality mean a biomass boiler is not suitable for this development.

6.2 Project LZC technologies incorporated

In supplying energy from Low Zero Carbon and Renewable Energy Sources (Be Green), based on the considerations detailed in the preceding subsections, including local authority requirements, land use, potential noise impacts and available space within the development, it was concluded that the best energy strategy for the different building types is the following:

- VRF (air source heat pump) heating
- 200m^2 of solar photovoltaic

The table below summarises the CO_2 savings of the proposed technologies:

Carbon Intensity without renewables ($kgCO_2/m^2.yr$)	Carbon Intensity with Renewables ($kgCO_2/m^2.yr$)	Carbon Saving ($kgCO_2/m^2.yr$)
57.6	56.0	1.6

We have calculated the contribution from renewables to the office aspect as 24% of the total energy demand of the offices, demonstrating compliance with Bracknell Forest Council policy CS12.

Emerging policy focusses on carbon reduction and renewables– this is achieved through the 83% reduction in CO2 emissions compared with a 2013 Building Regulations compliant building, the inclusion of passive design features including improved insulation and reduced glazing g-value and the inclusion of VRF (air source heat pump) heating and solar photovoltaic energy.

6.3 Operator Energy Commitments

The Operator has a strong focus on sustainability and has programs in place to reduce its carbon footprint, with a commitment to achieve net zero carbon by 2040. To work towards achieving this ambitious goal, the Operator focuses on energy efficiency and reducing power consumption across its operations. The Operator's facilities are already far more efficient than traditional enterprise or on-premises servers. The Operator has commissioned studies to estimate the efficiency of its infrastructure in comparison to traditional computing and found it to be more than three times as efficient, due to efficient servers and higher utilisation rates.

The Operator's efforts on energy efficiency are never complete and it continuously seeks out additional opportunities to reduce energy usage from every aspect of its business. The operator custom builds its own hardware, which is designed to run workloads with high level of resource utilization to increase efficiency.

Beyond efficiency, the Operator is working to decarbonise the electricity that powers its facilities. The Operator purchases renewable energy by enabling new wind and solar projects, across Europe. To date, the Operator has announced renewable energy projects in eight European countries, including the United Kingdom. The UK projects will generate enough new clean energy to power the equivalent of over 165,000 average UK homes annually. The Operator is on a path to meet its global energy consumption with 100 percent renewable energy by 2025.

The Operator is also committed to water conservation at its data centres. The Operator prioritizes the use of outside air cooling, which means that water is rarely used to cool servers. Utilising this highly efficient cooling solution, the proposed data centre will use the equivalent annual water usage of just eight average UK households – less than 1000m^3.

7.0

Results and Conclusion

7.0 Results and Conclusion

7.1.1 Criterion 1

To pass Criterion 1, the building must achieve a lower Building Emission Rating (BER) compared to a Target Emission Rating (TER) determined for a "notional building". The results for Criterion 1 for the proposed Bracknell data centre as based on the assumptions summarised above, are shown in the table below:

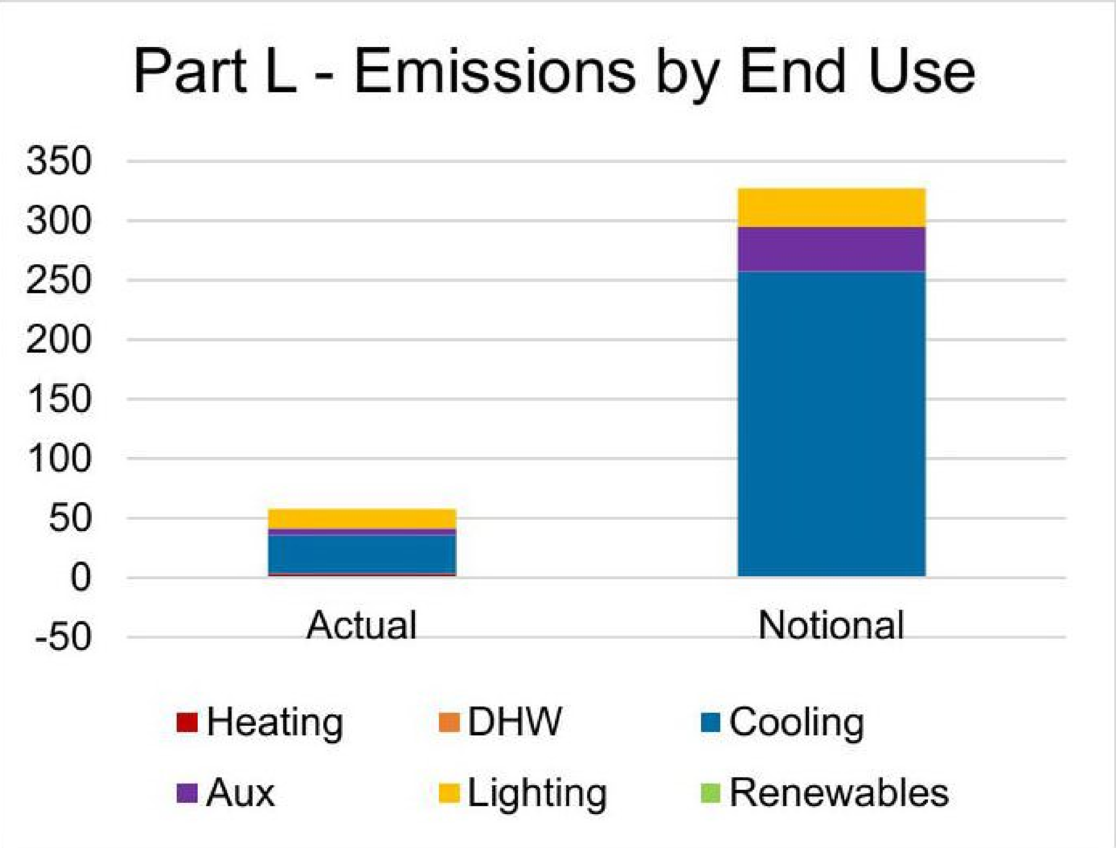
$kgCO_2/m^2.yr$	Actual	Notional
Heating	2.61	0.93
DHW	0.68	0.38
Cooling	32.37	255.34
Aux	5.81	37.72
Lighting	16.08	32.36
Renewables	-1.59	0
Total	**55.97**	**326.72**
Preliminary Compliance Pass Margin	83%	

Table 4: Part Calculation: carbon emissions reduction

$kWh/m^2.yr$	Actual	Notional
Heating	5.16	2.89
DHW	1.35	1.2
Cooling	63.97	504.6
Aux	11.48	74.54
Lighting	31.78	63.94
Renewables	-3.06	0
Total	110.68	647.17

Table 5: Part L calculation results: energy demand reduction

Cooling demand is the predominant energy use within the building, as expected for a building of this type. The chart below summarises the breakdown of emissions by end use:



The contribution from renewables to the office aspect has been calculated at 24% of the total energy demand of the offices.

	kWh/m^2
PV Generation	15.53
VRF (Air source heat pump) heating Contribution	2.6
Total Renewables Contribution	18.13
Total office energy demand (excl. renewables)	74.42
Renewable Contribution	**24%**

Table 6: Renewable energy contribution

7.1.2 Criterion 2

All fabric and building services elements have been designed to meet or exceed the minimum requirements of Part L2A as required to comply with Criterion 2.

7.1.3 Criterion 3

All zones within the building have been demonstrated to pass the requirement of Part L2A – Criterion 3.

7.2 Planning Requirements

The results of the Part L simulation identify that the proposed development will exceed the energy consumption targets set by 83% over the baseline building. This has been achieved by an energy efficient cooling solution utilising outside air as the cooling medium and limiting the requirement for mechanical cooling systems as far as possible.

In line with local policy guidance this meets the requirements of Bracknell Forest Council Policy CS12: Renewable energy by demonstrating:

- at least a 10% reduction in carbon dioxide emissions; and
- at least 20% of the energy requirements of the development provided by on-site renewable energy.

The results also demonstrate compliance with the emerging policy LP46 & 47 'Addressing Climate Change through Renewable Energy and 'Sustainable Construction' & 'Renewable and low carbon energy'; although the emerging policy can be given limited weight, it does demonstrate the future direction of climate change and renewable requirements, including carbon reduction.

7.3 BREEAM Requirements

7.3.1 Energy Performance Certificate (EPC) rating

Based on this level of performance, the building would be eligible for an EPC A rating: the highest available. This contributes to achievement of the full 15 points under the BREEAM ENE-01 credit.

The preliminary BRUKL certificates and illustrative EPC are shown in Appendix A.

7.3.2 LZC Feasibility Study

The project is eligible for one credit for credit ENE-05 based on the fulfilment of a feasibility study into the use of LZC technologies. Based on the findings of the LZC technologies appraisal, the following low and zero carbon technologies incorporated in the project are:

- VRF (air source heat pump) heating
- $200m^2$ of solar photovoltaic

The table below summarises the CO_2 savings of the proposed technologies:

Carbon Intensity without renewables ($kgCO_2/m^2.yr$)	Carbon Intensity with Renewables ($kgCO_2/m^2.yr$)	Carbon Saving ($kgCO_2/m^2.yr$)
57.6	56.0	1.6

Table 7: LZC feasibility study results

Appendices

Appendix A - BRUKL and EPC

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Bracknell Data Centre — As designed

Date: Sat Dec 12 01:43:06 2020

Administrative information

Building Details

Address: Bracknell, RG12 1HN

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.13

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.13

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: Tom Sutherland

Telephone number: +442039726889

Address: One Carter Lane, London, EC4V 5ER

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2$.annum	326.7
Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	326.7
Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	56
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a-Limit}$	U_{a-Calc}	U_{i-Calc}	Surface where the maximum value occurs*
Wall**	0.35	0.23	0.23	M_00000B:Surf[1]
Floor	0.25	0.22	0.22	GF000073:Surf[0]
Roof	0.25	0.18	0.18	M_00000B:Surf[7]
Windows***, roof windows, and rooflights	2.2	3.84	4	M_00000B:Surf[0]
Personnel doors	2.2	3.8	3.8	M_00000B:Surf[2]
Vehicle access & similar large doors	1.5	4	4	GF000002:Surf[3]
High usage entrance doors	3.5	-	-	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)]

* There might be more than one surface where the maximum U-value occurs.
** 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.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m³/(h.m²) at 50 Pa	10	10

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	10087.8	10087.8
External area [m²]	20592.1	20592.1
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	10	3
Average conductance [W/K]	6715.9	5133.08
Average U-value [W/m²K]	0.33	0.25
Alpha value* [%]	10.05	10

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

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
22	**B2 to B7 General Industrial and Special Industrial Groups**
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
78	**Others: Miscellaneous 24hr activities**
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	5.16	2.89
Cooling	63.97	504.6
Auxiliary	11.48	74.54
Lighting	31.78	63.94
Hot water	1.35	1.2
Equipment*	1977.28	1977.28
TOTAL**	**113.75**	**647.17**

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

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	3.06	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	6552.9	6892.88
Primary energy* [kWh/m²]	340.47	1929.44
Total emissions [kg/m²]	56	326.7

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

Energy Performance Certificate

HM Government

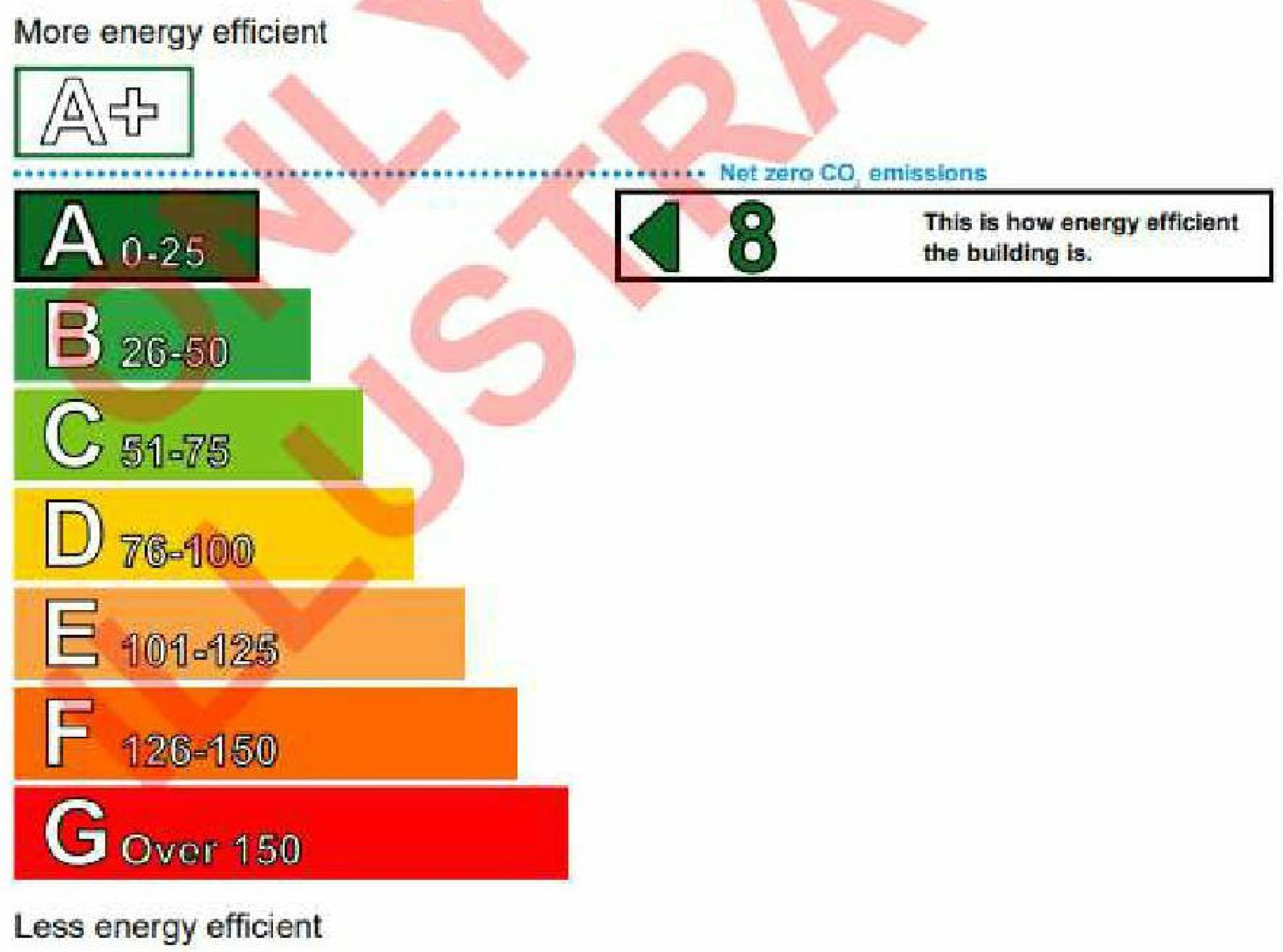
Non-Domestic Building

Bracknell
RG12 1HN

Certificate Reference Number:
2619-4029-7180-7843-4582

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



Technical information

Main heating fuel: Grid Supplied Electricity
Building environment: Air Conditioning
Total useful floor area (m²): 10087.774
Building complexity: Level 5
Building emission rate ($kgCO_2/m^2$ per year): 55.97
Primary energy use (kWh/m² per year): 340.47

Benchmarks

Buildings similar to this one could have ratings as follows:

45 — If newly built

120 — If typical of the existing stock

Appendix B – LZC Technologies Appraisal Matrix

LZC technology	Basic Technical Information	Technical, Environmental and Economic implications/considerations	Suited Application	Site specific comment	Considered for detailed analysis
Solar thermal	Solar collectors (flat plate or tube) transfer energy into transfer liquid to a closed loop twin coil hot water cylinder	✓ Can meet a significant proportion of the DHW demand ✓ No adverse noise impacts ✓ No adverse land use impacts - Efficiency effected by site factors shading, orientation and roof/ground space - Requires considerable hot water demand all year round to be financially beneficial - No nearby users with significant heat demand, making export of excess heat unfeasible - Government Renewable Heat Incentives (RHIs) no longer available	Domestic and commercial applications with high annual hot water load; leisure centres, canteens, washrooms	The DHW demand is a very small proportion of the total demand, because of this the lifecycle payback time for the system will be very long.	No
Wind turbine	Turbine/generator converts wind energy to electrical power.	✓ Excess electricity generation can be exported to the grid - Can create structural, vibrations and noise implications - Not suited for urban environments - Costs can be high in relation to the actual amount of electricity generated, making payback times longer than for other technologies - Generally payback over 20 years - Government bonus Feed in Tariffs (FiTs) no longer available	Large sized turbines in non- urban or offshore locations will be more effective	Wind turbines are not suited to the local environment	No
Solar Photovoltaic	Photovoltaic solar cells convert solar energy directly into electricity. The incoming solar energy charges the excess electrons doped within one of the cells' layers. The energised electrons move through the cell into a wire creating an electrical current.	✓ Allows on site generation of renewable electricity ✓ Excess electricity generation can be exported to the grid ✓ Generally payback between 7- 12 years ✓ Low maintenance requirements, contributing to short payback periods when life cycle costs are considered ✓ No adverse noise impacts ✓ No adverse land use impacts - Efficiency affected by site factors – shading, orientation and roof/ground space - Government bonus Feed in Tariffs (FiTs) no longer available	Wide range of building types particularly buildings with limited solar shading and south facing roof	The large roof area has the potential to accommodate a PV array.	Yes
Air source heat pump	Air Source Heat Pumps (ASHP) capture heat from the outside air and transfer the heat directly to the air inside the building or transferring the heat to a liquid medium that can be pumped around the building	✓ Lower installation cost than ground source heat pump ✓ Can provide heating and cooling ✓ Life cycle costs and payback times are comparable to non-renewable alternatives ✓ No adverse noise impacts ✓ No adverse land use impacts - COP is not as good during the heating season when the outside air temperature is often less than the ground temperature - Government Renewable Heat Incentives (RHIs) no longer available - No nearby users with significant heat demand, making export of excess heat unfeasible	Suits a wide range of building types particularly buildings with office areas which tend to have high heating demands when the outdoor temperature is mild.	Within the simulation, demand for heating and cooling by ASHP presents a viable option for the development.	Yes

LZC technology	Basic Technical Information	Technical, Environmental and Economic implications/considerations	Suited Application	Site specific comment	Considered for detailed analysis
Ground source heat pump	Ground Source Heat Pumps (GSHP) capture heat from the ground and transfer the heat to a liquid medium that can be pumped around the building	✓ More heat is supplied to the building than energy is consumed by the heat pump ✓ COP is much better than air source heat pumps ✓ No adverse noise impacts once constructed - Requires area for ground collector or borehole - No nearby users with sufficiently high heat demand to justify export - High initial capital cost, with substantially longer life cycle payback time than air source heat pumps. - For sites without balanced heating and cooling loads, the local ground temperature depletes over time, reducing efficacy of the system - Government Renewable Heat Incentives (RHIs) no longer available	Suited to projects with a balanced heating and cooling load, and space for the necessary ground works.	Space and site restrictions do not allow this system to be viable for this project. Unbalanced cooling and heating loads mean the system efficacy will reduce over time.	No
Biomass	Uses biomass as a fuel source for space heating and hot water	✓ Renewable source of heating ✓ No adverse noise impacts - Government Renewable Heat Incentives (RHIs) no longer available - No nearby users with sufficiently high heat demand to justify export - Requires large fuel storage capacity - Significant areas of arable land must be used for fuel production - Generally a large capital cost with ongoing fuel and maintenance costs that mean life cycle payback times are long - Contributes to poor air quality	Building/site with sufficient access and storage facilities and a capable maintenance team/ infrastructure in place. Best suited to projects with large heating loads.	The project has very small heating loads: the potential energy savings would not justify the large additional space required. Regional policies regarding air quality mean a biomass boiler is not suitable for the project.	No

Cundall Johnston & Partners LLP
One Carter Lane London EC4V 5ER United Kingdom Tel:+44 (0)20 7438 1600
Asia Australia Europe MENA UK and Ireland
www.cundall.com

ONE PLANET LIVING

An initiative by Bioregional