



REPORT

VIRTUS Data Centres
LONDON7.5
Energy Strategy

CONFIDENTIAL | Revision: P03 – Final | Issued: 27 October 2022



London7.5 | Energy Strategy Report



1 EXECUTIVE SUMMARY

The VIRTUS Data Centre development is being designed with energy efficiency as a key driver to minimise the impact on the environment, while providing high quality resilient IT processing space, which will in turn provide significant energy savings through the use of ‘digital’ services when compared to current ‘manual’ processes.

The report outlines sustainability and renewable energy measures employed in order to deliver the design which achieves the greatest reduction in carbon dioxide emissions while remaining consistent with the objectives of the client and to satisfy the Mayor of London’s policy requirements provided within the Energy Hierarchy of the London Plan 2021. Measures considered are those ultimately recommended for incorporation within the development for energy savings are categorised under three broad headings as:

- Be Lean - energy-efficient design and construction.
- Be Clean - supply energy efficiently (low-carbon technology).
- Be Green - use of renewable energy systems (zero-carbon technology).
- Be Seen – verified monitoring of energy in use

Data Centres require large amounts of electrical energy to meet the process load, used to run the facility. The scale of the energy consumed by the process load, means that the building services system selection and efficiencies are key to reducing carbon dioxide emission rates, whilst renewable technologies offer limited scope for savings.

The Process load within Data Halls will be optimised using a combination of energy saving engineering technologies to reduce the electrical power consumption by approximately 24.2%, against a typical current Data Centre. Our evaluation has demonstrated that pursuing traditional LZC technologies such as wind, biomass, solar hot water and ground source heating/cooling would not make a practical contribution to meeting the targeted energy reduction limits. CHP was not deemed viable and the scheme has concentrated on reducing energy at the outset, and low carbon technologies that are practical to implement and specific to Data Centre applications.

The total estimated annual energy usage for LONDON7.5, when operating at notional full capacity is **19,710MWh** per year. The projected site operating load will increase on a staged basis over 2 years to a maximum estimated energy usage of 80% of the connected IT load.

Total **Process** load energy usage of **39,420MWh** are proposed, against a calculated total annual consumption of **52,034MWh** for a typical Data Centre (based on a PUE of 1.65).

A breakdown is provided for the un-regulated energy load for the data hall application within the energy strategy summary.

Table 1 Energy Saving Summary for London 7.5

Energy Consumption	Annual Energy Consumption (MWh)	Carbon Dioxide Emissions Per Annum Tonnes CO2
Process (un-regulated)	19,710	4,292
Building Envelope (regulated)	881.7	205.6

Energy Saving Technology	Investment Outlay (£) Extra Over	Annual energy savings (MWh)	Annual energy savings (£)	Annual carbon dioxide savings (TonnesCO ₂)
Data Centre (Process) – Energy/Carbon Reductions				
Free Cooling Chillers	244,444	7,088	708,814	1,496
Variable speed fan CRACs	21,083	1,761	176,123	372
Variable speed pumps	9,167	1,032	103,230	218
Hot aisle containment	N/A	1,823	182,293	385
Energy efficient lighting	N/A	62	6,234	13
Low Loss Transformers	10,185	79	7,884	17
IT UPS	59,074	631	63,072	133
Mech UPS	16,296	97	9,714	50
VRF Heat Pumps	22,000	50	5,000	11
Total Carbon Dioxide saving (TonnesCO ₂)				2,696

Note

The energy consumption and savings indicated in this report are in part a function of how the building is operated and the rate of fit out.

For the purpose of demonstration of compliance with Policy SI2 of the 2021 London Plan the following calculations have been undertaken, assuming that the data centre cooling loads form a part of the regulated loads of the building. The application of the energy hierarchy throughout the design of the additional capacity within DC7.5 has yielded significant savings over compliance with Part L2A of the Building Regulations.

The application of the following measures have led to a **72% saving through ‘be lean’ measures** (significant noting that energy consumption is dominated by data hall cooling).



Table 2: SAP 12 (GLA) Emission savings

SAP 10.2	Total regulated emissions (Tonnes CO ₂ / year)	CO ₂ savings (Tonnes CO ₂ / year)	Percentage savings (%)
Part L 2021 baseline	239.32		
Be lean	67.04	172.28	72%
Be clean	67.04	0.00	0%
Be green	67.04	0.00	0%
Total Savings		172.28	72%
		CO ₂ savings off-set (Tonnes CO ₂)	
Off-set		67.04	

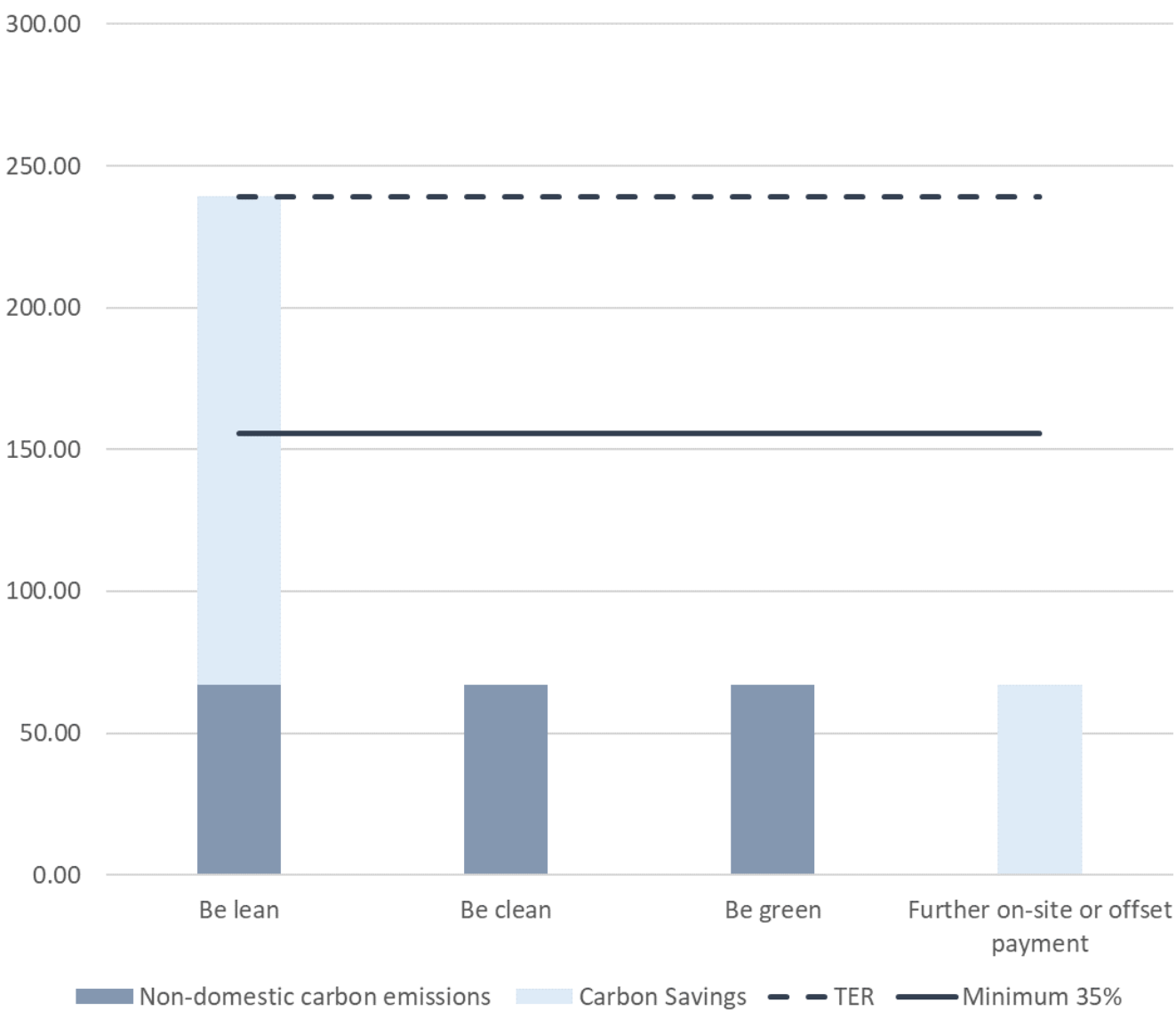


Figure 1: Non-domestic Carbon Emissions

In accordance with Policy SI2 of the 2021 London Plan, and the updated energy strategy guidance document (June 2022) a carbon contribution in lieu should be made to address the ‘regulated’ emissions down to ‘net zero’ for the development.

The table below demonstrates the valuation of that residual under the requirements of the London Borough of Hillingdon and GLA pricing of £95 per tonne of CO₂.

Based upon the power not being from certified renewable sources, the carbon contribution would be **£191,076.14**. However, for this development the power will be 100% renewable, so there are no carbon emissions which need to be offset, resulting in a zero payment.



Table 3: SAP 10 (GLA) Emission savings

	Regulated non-domestic carbon dioxide savings	
	(Tonnes CO ₂ per annum)	(%)
Be lean: savings from energy demand reduction	172.28	72%
Be clean: savings from heat network	0.00	0%
Be green: savings from renewable energy	0.00	0%
Total Cumulative Savings	172.28	72%
Annual savings from off-set payment	67.04	
	(Tonnes CO₂)	
Cumulative savings for off-set payment	2011.33	
Cash in-lieu contribution (£)*	£191,076.14	

Overheating - London Plan Policy SI4

Finally, the overheating risk analysis undertaken by the design team identified that due to the high internal heat gains associated with the data centre environment and the temperatures associated with the London DSY1 (weather data characterised by moderately warm summer), DSY2 (weather data characterised by short, intense warm spell) and DSY3 (weather data characterised by Long, less intense warm spell) weather files, comfort cooling was required for all office areas.

Table 4 Cooling demand reduction

	MJ/m ²	MJ/year
Actual Building	8,642	26,007,726
Notional Building (Part L)	9,266	27,885,486



2 DOCUMENT CONTROL

2.1 Revision History

Revision	Date of Issue	Reason for Issue
P01	25 th March 2022	Preliminary
P02	21 st June 2022	Planning Information
P03	27 th October 2022	Resubmission under Part L2 2021



3 INTRODUCTION

3.1 General

The project comprises the development of additional capacity to the power and cooling systems located between LONDON7 and LONDON8 buildings to support a 7.5 MW fit-out of additional capacity within LONDON7.

The new three-level gantry shall be constructed, in the car park/access area between LONDON7 and London 8, to accommodate additional power and cooling plant. Standby generators shall be located on the east side of this vacant area, being double stacked with the upper generators being supported, independently, by an approved steel framework system. The ground floor of the new gantry on the west side of the vacant area, between LONDON7 and LONDON8, shall house the main electrical intake rooms and associated transformers. The first floor of this gantry shall house the primary and secondary chilled water pipework headers, secondary pump system, buffer vessels and ancillary chilled water equipment, as required (e.g., pressurisation units, expansion vessels and dirt separators, etc).

Electrical rooms for additional IT UPS and mechanical UPS output switchboards, together with associated battery rooms, shall be located inside the building adjacent to the additional capacity within LONDON7. Chillers shall be located on the level 2 gantry.



Figure 2 Site location

The site will comprise of additional capacity on level 1 of London7. The site will be provided with a resilient power and cooling infrastructure A new power supply has been secured for the site and the scheme design has been completed to prove the viability of the development.

The data halls capacity enhancement will not include any additional personnel entrances, open plan offices, meeting areas or welfare facilities.

3.2 Objective

The objective of this report is to present the energy strategy that VIRTUS shall adopt to demonstrate an efficient use of energy used within the Data Centre.

London 7.5 has been defined as a single entity:

- Data Centre – comprising additional technical capacity plus supporting plant and equipment room.

The report outlines sustainability and renewable energy measures employed in order to deliver the design which achieves the greatest reduction in carbon dioxide emissions while remaining consistent with the objectives of the client and to satisfy the Mayor of London’s policy requirements provided within the Energy Hierarchy of the London Plan 2021. Measures considered are those ultimately recommended for incorporation within the development for energy savings are categorised under three broad headings as:

- Be Lean - energy-efficient design and construction
- Be Clean - supply energy efficiently (low-carbon technology)
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- Be Seen – verified monitoring of energy in use

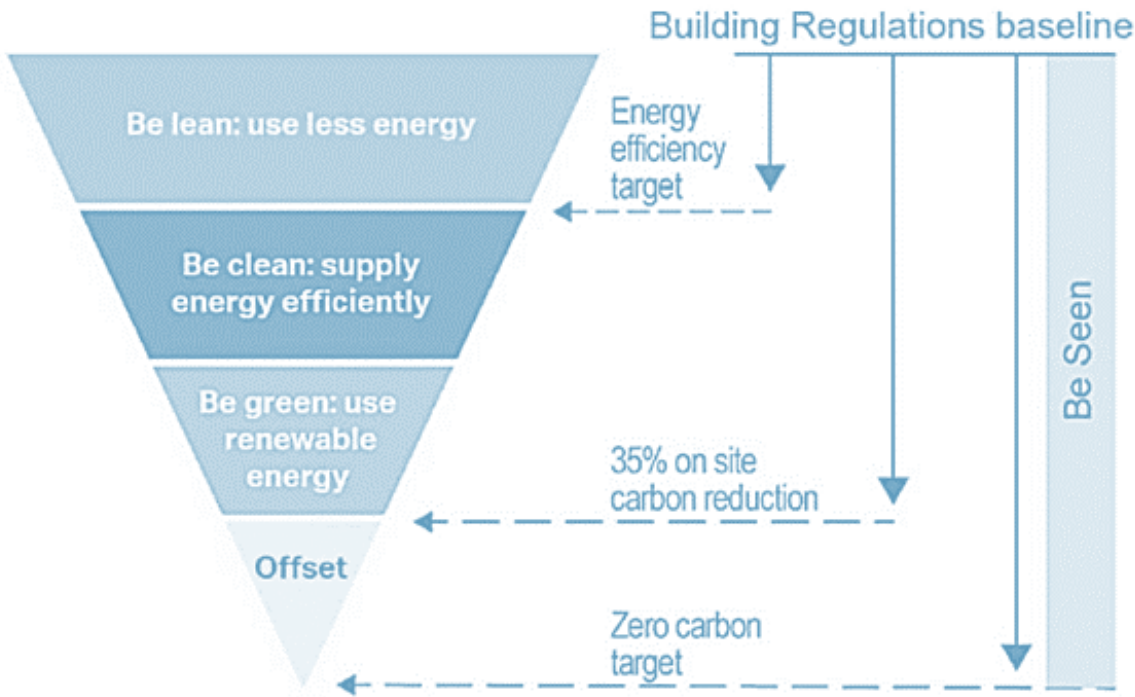


Figure 3: Energy Hierarchy

System sizing has been carried out for comparative purposes only in assessing the suitability of alternative renewable energy technologies for this development. Renewable energy technologies are assessed for their economic viability and the recommendation is based on the outcome of this assessment as well as the technical feasibility.

Consideration is given to providing energy via available community energy systems in the vicinity of the site.

Consideration is given to establishing a community energy system for the site which distributes energy (electrical and thermal) throughout the development, and the options for how these systems may be managed are presented, if viable.



4 DRIVERS & TARGETS

4.1 Current Planning Policy Framework

The planning policy documents which set out the energy and carbon performance targets for the proposed Development are outlined below:

- National Planning Policy Framework (NPPF), published in July 2021;
- The London Plan, published in March 2021;
- Sustainable design and construction supplementary planning guidance (SPG), published in April 2014;
- Greater London Authority (GLA) Energy Assessment Guidance, published in June 2022;
- GLA Guidance on Circular Economy Statements, version March 2022
- Whole Life-Cycle Carbon Assessments, published March 2022
- ‘Be seen’ energy monitoring guidance, published in September 2021;
- City of London Local Plan, published January 2015
- Draft City Plan 2036, published pre submission March 2021

4.2 National Planning Policy Framework

The National Planning Policy Framework-July 2021 (NPPF) sets out the Government’s planning policies for England and how these are expected to be applied. The NPPF informs the preparation of development plans and is a material consideration in planning decisions. It also sets objectives for sustainable development, which should be delivered through the preparation and implementation of local plans.

- Chapter 14-Meeting the challenge of climate change, flooding and coastal change mentions that the planning system should support the transition to a low carbon future in a changing climate. In particular:
 - 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
- Can help to reduce greenhouse gas emissions, such as through its location, orientation and design

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.

4.3 The London Plan, March 2021

The London Plan has been developed by the Mayor and the GLA to set out the development framework for London from 2019 to 2041. The Mayor has formally published the new London Plan in March 2021.

Key policies of the London Plan relating to energy and carbon emissions are outlined below:

- Policy SI1 Improving London’s air quality requires air quality to be significantly improved and exposure to poor air quality, especially for vulnerable people, to be reduced.

Development proposals should use design solutions to prevent or minimise increased exposure to existing air pollution and make provision to address local problems of air quality.

Major development proposals must be at least air quality neutral and be submitted with an Air Quality Assessment.

Development proposals must demonstrate how they reduce emissions from the demolition and construction of buildings following best practice guidance.
- Policy SI2 Minimising greenhouse gas emissions requires all major developments to be net zero-carbon, reducing greenhouse gas emissions and minimise both annual and peak energy demand in accordance with the energy hierarchy: (1) Be Lean, (2) Be Clean, (3) Be Green and (4) Be seen.

Major development proposals should include a detailed energy strategy to demonstrate how the zero-carbon target will be met within the framework of the energy hierarchy.

Major developments should achieve a minimum on-site reduction of at least 35% beyond Building Regulations. Non-residential development should aim to achieve 15% through energy efficiency measures. Where it is clearly demonstrated that the zero-carbon target cannot be fully achieved on-site, any shortfall should be provided, in agreement with the borough, either:

through a cash in lieu contribution to the borough’s carbon offset fund; or off-site provided that an alternative proposal is identified, and delivery is certain.

Major development proposals should calculate and minimise carbon emissions from any other part of the development, including plant or equipment, that are not covered by Building Regulations, i.e. unregulated emissions.
- Policy SI3 Energy infrastructure requires major development proposals within Heat Network Priority Areas to have a communal low-temperature heating system.

The heat source for the communal heating system should be selected in accordance with the following heating hierarchy:

 - connect to local existing or planned heat networks;
 - use available zero-emission or local secondary heat sources (in conjunction with heat pump, if required, and a lower temperature heating system);
 - use low-emission combined heat and power (CHP) (only where there is a case for CHP to enable the delivery of an area-wide heat network. In areas where legal air quality limits are exceeded all development proposals must provide evidence to show that any emissions related to energy generation will be equivalent or lower than those of an ultra-low NOx gas boiler);
 - use ultra-low NOx gas boilers.
 - Where a heat network is planned but not yet in existence the development should be designed for connection at a later date.
- ▶ Policy SI4 Managing heat risk requires that development proposals should minimise adverse impacts on of the urban heat island effect through design, layout, orientation, materials and the incorporation of green infrastructure. Major development proposals should demonstrate through an energy strategy



how they will reduce the potential for internal overheating and reliance on air conditioning systems in accordance with the following cooling hierarchy:

- Reduce the amount of heat entering a building through orientation, shading, high albedo materials, fenestration, insulation and the provision of green infrastructure;
- Minimise internal heat generation through energy efficient design;
- Manage the heat within the building through exposed internal thermal mass and high ceilings;
- Provide passive ventilation;
- Provide mechanical ventilation;
- Provide active cooling systems.

The London Plan includes additional policies related to environmental sustainability, which are detailed in the Sustainability Statement, which is submitted in support of this planning application as a standalone document.

4.4 Greater London Authority (GLA) Energy Planning Guidance, June 2022

The Greater London Authority's (GLA) Energy Planning Guidance, published in June 2022, has been updated to explain how London Plan policies should be applied following the introduction of the new Building Regulations Part-L 2021 in June 2022. The document provides guidance on preparing energy assessments for major development proposals. Each assessment is required to demonstrate compliance with the carbon reduction targets set out in Policy SI2 of the new London Plan.

The Energy Assessment Guidance requires major developments to:

- non-domestic developments to reduce CO2 emissions by at least 15% over the baseline building though energy efficiency measures alone;
- demonstrate at least a 35% on-site reduction beyond Part L 2021 for major, non-residential development;
- include information demonstrating that the risk of overheating has been mitigated through the incorporation of passive design measures;
- demonstrate that connection to existing or planned district heating networks has been prioritised and provide correspondence to support this;
- commit to a communal heat network to allow connection to existing or planned district heating networks identified in the area;
- commit to a single energy centre to supply the site-wide heat network;
- investigate suitable low carbon and/or renewable heating plant for installation within the energy centre if connection can't be made to an area wide network;
- investigate and commit to maximising the installation of low carbon and renewable technologies (including the potential for storage) on site;
- report the Energy Use Intensity (EUI) and the space heating demand of the development using the GLA's carbon emissions reporting spreadsheet;
- include information on how the building's actual energy performance will be monitored post-construction;
- align with related documents and assessments that are submitted as part of the planning application, e.g. Air Quality Assessments, Sustainability Statements.

4.5 Be Seen Energy Monitoring Guidance

The guidance document explains the process that needs to be followed to comply with the 'be seen' post-construction monitoring requirement of Policy SI 2 of the new London Plan.

The document sets the requirements outlined below for the planning stage:

- Contextual data: Provide contextual data relating to the development's reportable units (RUs). This includes non-energy information such as data on location and typology of buildings.
- Building energy use: Report on the energy and fuel imports into each RU of a development.
- Renewable energy: Report on the renewable energy generation within the development to identify how much energy is being generated on-site and where this is used.
- Energy storage equipment: Report on building energy storage equipment data.
- Plant parameters: Report on parameters that relate to the performance of heat or cooling generation plant within energy centres that form part of a development. This will include energy inputs and outputs of energy centres, energy use and contribution of heating and cooling technologies, and network efficiency data to monitor losses in district and communal energy networks.
- Carbon emissions: Report on the development's estimated carbon emissions at planning stage based on the appropriate carbon emission factors, as set out in the GLA's Energy Assessment Guidance. When on-site carbon reductions have been maximized, but a carbon shortfall still exists, applicants will be expected to report on and confirm the carbon offsetting contribution to the relevant local authority's fund in line with the net zero carbon target.

Local Policy – London Borough of Hillingdon

We have considered the requirements and specific inclusions of the London Borough of Hillingdon Local Plan; Part 1 2012. This has been used as the basis for determining minimum energy renewable targets for the proposed scheme. The following key policies have been highlighted:

- Policy BE1: Built Environment
- Policy EM8: Land, Water, Air and Noise
- Policy EM1: Climate Change Adaption and Mitigation



5 BACKGROUND

5.1 What is a Data Centre?

Data centres are split into the following areas:

- Data halls (technical spaces)
- Plant rooms and corridors (circulation and plant access)
- External plant rooms
- Circulation space including loading bay, refuse collection and de-box points and lifts
- Storage areas
- Data halls have a large electrical load (>1,000W/m²) and are defined as a process load.
- Ancillary areas have a load of approximately 25W/m²

5.2 Benefits of Data Centres

Data Centres such as the VIRTUS LD7.5 scheme are an essential part of modern day life in the UK today.

Data centres are recognised as consuming a great deal of energy. As their source of power is typically electrical energy, they also by nature produce large quantities of carbon dioxide.

The aim for both developers and end users of these high technology facilities is to deliver power and cooling to the Information Technology (IT) equipment as efficiently as possible. The energy optimisation of IT processing has been proven to save vast quantities of energy and carbon dioxide through the following methods:

- Reducing postal deliveries; saving truck, rail and multiple plane journeys over the operational life.
- Reducing the quantity of tree felling, paper manufactured, transported, and disposed of over time.
- On-line banking for example, the IT equipment of financial institutions housed in Data Centres benefits the commercial sector and society in general; it immediately reduces the production of paper statements and minimises the need for the public to personally visit retail branches.
- By reducing energy consumed through printing magazines, advertising and the consumables used for printing.
- Optimising business processes, enabling information storage and recovery in a 'real time' continuous manner.
- Facilitating energy saving initiatives such as providing video conferencing platforms and document sharing facilities to optimise everyday working for millions of people on a daily basis.
- Improving the security of electronic data / records across a range of industries. Private sector to high security government departments, thereby benefiting both personal, corporate and Home Security sectors.
- By reducing the need for physical document storage and archiving systems, which are now predominately electronic and must meet stringent security and retrieval legislation as required by the Public Records and Official Information Acts.

Unfortunately, very little work has been carried out to date within the industry to quantify this saving, to enable it to be offset against energy consumption.

5.3 Typical Data Centre Benchmarking Statement

IT equipment needs to be housed in an environment that is secure, clean and has very reliable power. There is always a pressure to reduce the footprint of IT equipment while maintaining its processing power.

This has resulted in data hall IT equipment power densities of between 1 kW/m² and 2.5 kW/m², (typically 1.5–2.0 kW/m²). These load densities need to be cooled and this parasitic energy is the principle target for saving energy addressed in this report.

Data Centre energy consumption is over fifteen times that of a commercial office space. The power consumption of the Data Centre can be split into several component parts, with a data hall IT load (the actual computer equipment) being the largest component. Of the other parasitic loads, the cooling system is a major contributor, and this will be a focal point for energy savings against a typical Data Centre facility.

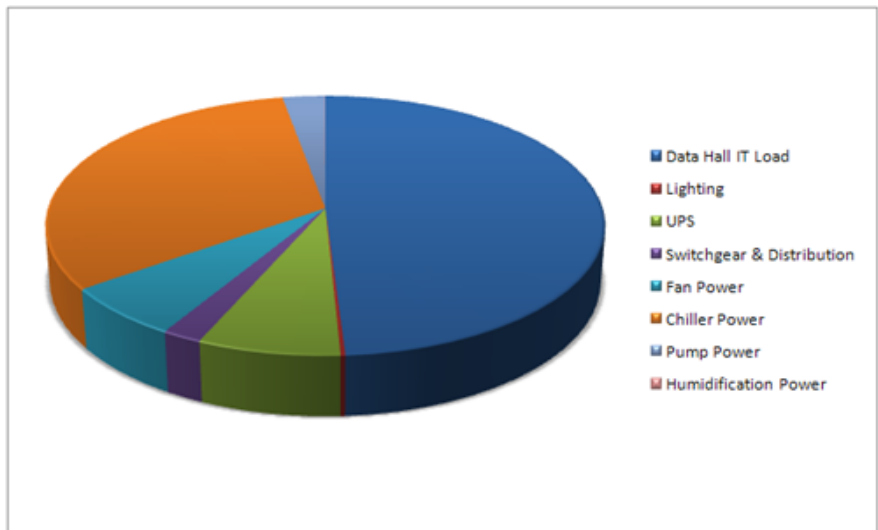


Figure 4: Power usage distribution pie chart

The efficiency/effectiveness of the data centre is measured by a metric called Power Usage Effectiveness (PUE).

$$PUE = \frac{\text{Power to Site}}{\text{Power to IT Equipment}}$$

A typical Data Centre would have a PUE of 1.6-1.7, mainly based on the efficiency of the cooling system, which would rely solely of mechanical cooling with low temperature chilled water circulation (6-12°C) and fixed speed pumps and fans.

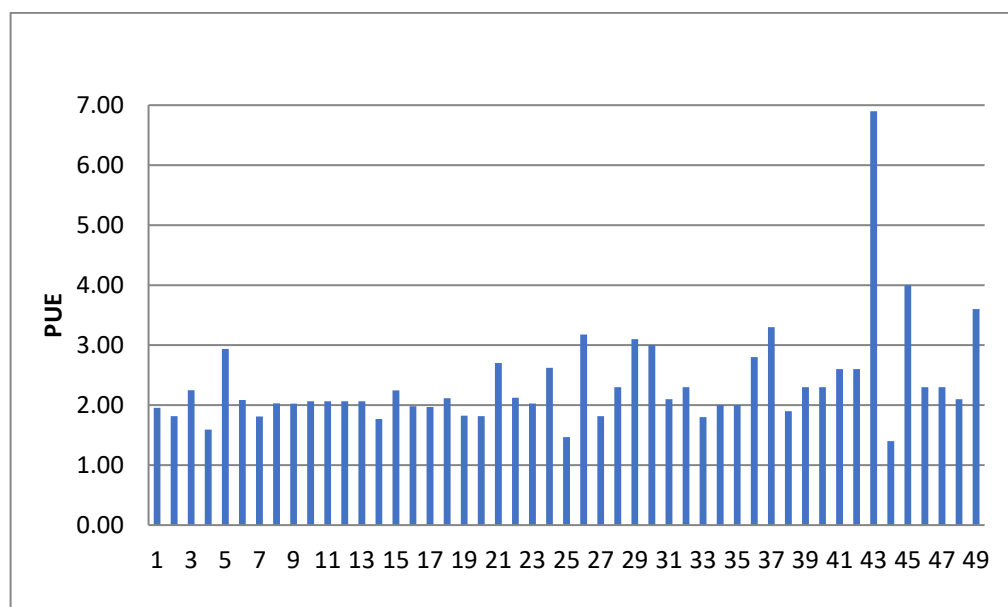


Figure 5: Sample PUE from recent benchmarking audit of data and telecommunication sites

5.4 Key Design Criteria

The design has considered and incorporates the following key elements:

- Scalable and modular.
- Resilience to suit business requirements.
- Maximise part load efficiencies.
- Air flow management.
- Free cooling.
- High efficiency equipment
- Energy monitoring.

Note: As the offices and associated support areas for the unit has already undergone an energy performance assessment, NDY have omitted these zones from the energy calculations. The EPC produced for the unit is based on the current design fit out specification as used for compliance with planning and the Building Regulations. Any subsequent fit out will need to comply with Building Regulations and be of the same spec as the current 'as installed' plant or more energy efficient. The current Energy Performance Rating for both sites is A (13) (2016) and well within the CO₂ index rating for a dwelling of that type.



6 DATA CENTRE ENERGY USE ASSESSMENT FOR LONDON 7.5

6.1 Methodology

This energy strategy has been produced in conjunction with a concept services design. Our assessment presents practical measures for lowering the energy impact from the proposed development, these measures form the basis of our energy reduction recommendations and will require validation through appropriate calculations as the subsequent stages of engineering design progress.

As such, the figures presented for energy and carbon reduction for the range of technologies considered represents best endeavours at this stage of the planning process, as well as reinforcing the Applicant's commitment to integrating energy reduction measures into the development proposals.

For the purposes of this energy strategy, and to form the benchmark for our energy assessment, the building has been treated as a:

- Data Centre Process

The energy strategy for the development will follow the energy hierarchy set out under Policy SI 2 of the London Plan 2021.

Lean Measures

Improvements to the building fabric and building services, as detailed in section 7.

Clean Measures

The technical and economic feasibility of the following heating and cooling systems are then considered sequentially:

- Connection to existing CCHP/CHP distribution networks
- Site-wide CCHP/CHP or hydrogen fuel cells
- Communal heating and cooling
- The highest-ranking feasible option is selected, where viable.

Green Measures

The technical and economic feasibility of the following renewable energy technologies listed in the London Plan is then considered:

- Wind turbines
- Photovoltaic cells
- Solar water heating
- Biomass heating
- Ground-coupled heating and cooling
- Hydrogen fuel cells
- Air Source Heat Pumps.

The scheme will invest significantly in energy saving technologies to reduce the energy and carbon dioxide impact of the process environment, the one aspect in particular within the overall development that the Applicant has very little end control over.

6.2 Energy Use

6.2.1 Process Load

The load deployment, and subsequent energy consumption will be staged over the first 2 years of operation and aligned to the demand lead Data Hall fit out program.

Due to the anticipated phasing the projected maximum energy trend will increase from approximately 20,341 MWh in Year 1 to 40,681 MWh at the end of year 2.

The load projections have been estimated based on market tested data and the design teams' expert knowledge of IT equipment take up in Data Centres in the UK marketplace today. The anticipated power consumption and associated carbon dioxide emissions are estimated to be in the order of 4,292 Tonnes per annum. This is calculated on the maximum permissible, fully engineered, fully operational Data Centre development as proposed, assuming that all data (process) halls are equally loaded and all running on a 24/7/365 continuous basis. The realities will be quite different – IT equipment load is dynamic and will changes significantly over time, over each day, week and subsequent month.

6.2.2 Data Hall Load

Table 5: Energy Load Profile (Year 1 to Year 2)

Stage (Years)	Load Deployment	Benchmark PUE @1.65 Annual Energy Use MWh	Estimated Annual Energy Use PUE 1.29 MWh	Estimated Carbon Dioxide Emission Per Annum Tonnes CO ²
1	1 Data Hall @ 40%	26,017	19,710	6,307
2	1 Data Hall @ 80%	52,034	39,420	12,614

The actual timing of each stage will be very dependent on the letting and subsequent construction fit-out of the Data Hall and incoming tenant's requirements.

There is however no control over the energy loading within each hall which is dynamic and likely to sit at a lower energy draw than estimated – the developer of the facility has no control over this aspect of the building operation; the energy efficiency of IT equipment is also the responsibility of the end user tenant, hence carbon assessment is recognised in industry as only being effectively quantifiable, through accurate and granular energy measurement.

7 BE LEAN – ENERGY EFFICIENT DESIGN AND TECHNOLOGIES

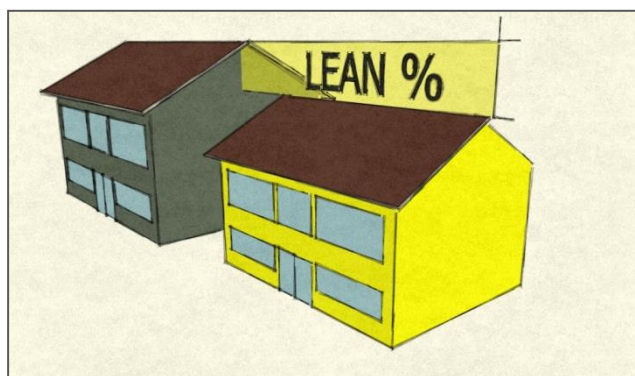


Figure 6: Be Lean Phase CO2 Emission reductions

7.1 Introduction

There are several established low carbon and new energy saving technologies, which can be applied to the engineering systems of a data centre to significantly reduce the energy consumption of the parasitic load.

- High temperature chilled water system with free cooling chillers and variable speed fans in CRAC units
- Hot aisle containment - maximising the delivery of cool air to the IT cabinets
- Elevated room temperatures – higher data room temperatures provide more efficient heat exchange at the cooling equipment and increase the threshold for free cooling
- Energy efficient lighting and controls – high frequency ballasts in fluorescent light fittings, with presence detection control in all the data halls
- Low loss transformers – reduce the electrical losses between HV and LV conversion.

The benefits of each of these have been assessed at 80% of the full design load, which is the estimated full operating load.

7.2 Chilled Water CRAC units and Free Cooling Chillers

It is intended to cool all circa 1,693 m² data hall white space plus supporting plant and equipment rooms using elevated temperature chilled water, variable speed pumps and CRAC units fan to maintain a supply air temperature of 24°C. Adopting this high temperature provide significant opportunities for energy savings, while still maintaining an acceptable environment for the computer equipment.

The plant area temperature will only be maintained at 25°C.

Chillers are a common source of heat rejection for cooling systems and the main energy consumption component is the compressors. These require an electrical input in a ratio of approximately 1kW to reject approximately 3kW of thermal heat. Where chillers operate continuously throughout the year, there is an opportunity to utilise cool ambient air (below 16°C) to provide partial or full free cooling, with heat being rejected with reduced or no compressor power input. To achieve this additional heat rejection, coils and controls components are required, and the overall size of the chiller increases.

Based upon the facility operating at approximately 80% full load, which is the projected peak, the entire site will have a total of 38 CRAC units (N+4) and 4 no. (N+1) free cooling chillers. Note: N+X refers to the additional plant provide for resilience/standby.

Variable speed pumps and drives for the fans and within the CRAC units have been included within the calculation for the energy consumption as they are fitted as standard. The use of variable speed drives in

conjunction with energy saving control strategies allows the quantity of air being circulated to match the heat load in the room.

The electrical energy savings are magnified due to the fact that power is proportional to speed. Hence, a 10% reduction in speed results in a 27% reduction in power.

Our assessment of energy savings from CRAC unit and hybrid cooler solution has been based on the nominal 80% cooling capacity and quantity of units required by the data hall in comparison with a standard chilled water and air cooled chiller solution.



Figure 7: Free Cooling Chiller & CHW CRAC Unit

Based on the scheme proposed:

- Order of cost £244,444 (per free cooling chiller)
- Total Annual chiller energy savings 7,088 MWh
- Total Annual energy savings £708,814 (based on electricity cost of 10p/kWh)
- Total Annual carbon dioxide savings 1,496 Tonnes
- Order of cost £21,083 (per variable fan speed CRAC units)
- Total Annual variable speed fan CRACs energy savings 1,761 MWh
- Total Annual energy savings £176,123
- Total Annual carbon dioxide savings 372 Tonnes
- Order of cost £9,167 (per variable speed secondary pump)
- Total Annual variable speed pumps energy savings 1,032 MWh
- Total Annual energy savings £103,230
- Total Annual carbon dioxide savings 218 Tonnes

Conclusion – high capital outlay, but high energy savings and good return on investment.



7.3 Hot Aisle Containment

Historically the layout of the IT racks within a data hall has been under the control of the IT designers, and racks were cooled from bottom to top. Modern data centres are now generally arranged in a hot aisle/cold aisle configuration, with air being drawn through the front of each rack and discharged at the rear. This arrangement allows for air to be supplied at a higher temperature and improves the efficiency of the cooling system. One step beyond this is to provide containment of the hot aisle. Doing this affords more efficient use of the cooling by both minimising mixing of hot and cold air and greatly reducing the air that bypasses the IT racks. The implementation of hot aisle containment is an integral part of the data hall cooling design and will provide a significant benefit by reducing the bypass (wasted) circulation of cooling air. Reducing the amount of air that bypasses the IT racks can drastically improve the cooling efficiency in the region of 25%.

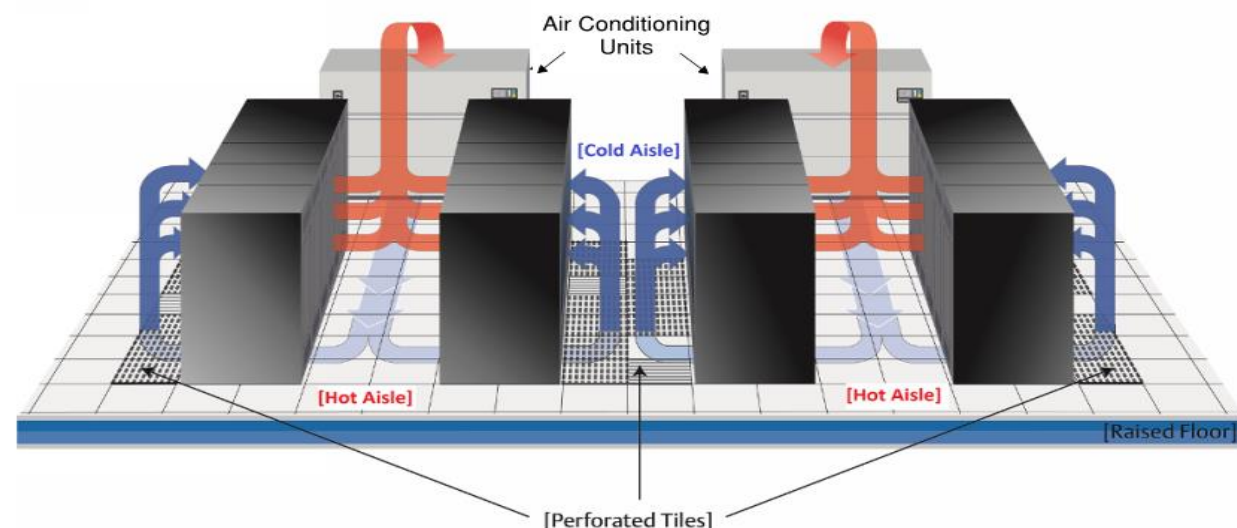


Figure 8: Standard Hot Aisle / Cold Aisle Arrangement

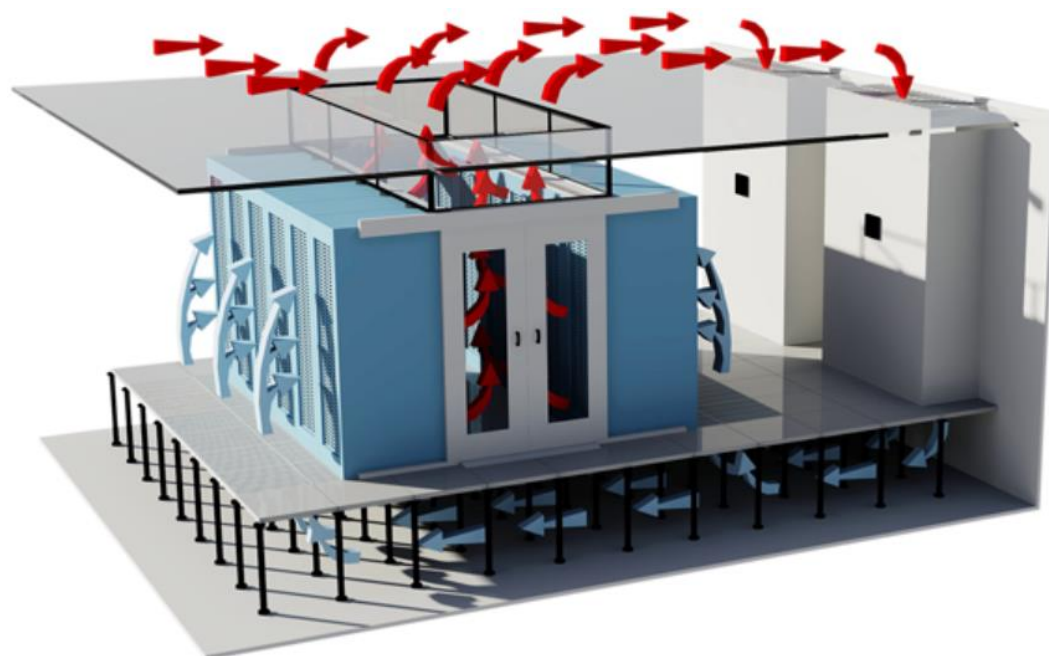


Figure 9: CRAC units with Hot Aisle Containment maximises effective air delivery

7.4 Elevated Room Temperatures

The recommended air inlet temperatures for IT racks has increased significantly over the last 10 years in conjunction with the use of the hot aisle cold aisle arrangement describe above and amendments to the ASHRAE 2011 Guidelines.

Many legacy data rooms still operate with supply air temperatures of 14°C and return temperatures of 24°C. The proposed data centre has been designed to supply air at 24°C, which is in line with the most energy efficient commercial data centres currently being developed. At the elevated temperatures free cooling becomes far more significant for both the fresh air solutions and the water-based chiller system. Savings associated with this technology have been calculated as part of the cooling system energy assessment.

- Order of cost £N/A (over standard solution)
- Annual energy savings 1,823 MWh
- Annual energy savings £182,293
- Annual carbon dioxide savings 385 Tonnes
- Simple payback N/A years (as a measure of effectiveness)

Conclusion –increased capital outlay, but high energy savings and good return on investment.

7.5 Energy Efficient Lighting and Controls

The normal lighting energy consumption for a data centre equates to approximately 15W/m². High efficiency lighting LED can provide a 50% energy saving, and a further gain can be achieved via the good use of passive infrared sensors (PIR).

The data hall will be unoccupied for the majority of its operational life (typically referred to as ‘lights out’ operation), and PIR controls can be used to only provide lighting when and where it is required. This works particularly well in conjunction with the IT rack aisles, with lights only being activated in single rows, as needed and triggered by persons entering the space, not across larger areas.

- Order of cost £N/A (over standard solution)
- Annual energy savings 62 MWh
- Annual energy savings £6,234
- Annual carbon dioxide savings 13 Tonnes
- Simple payback N/A years (as a measure of effectiveness)

Conclusion –increased capital outlay, reasonable energy savings.



Figure 10: PIR Detector

7.6 Low Loss Transformers

Transformers typically operate at about half load under normal operation. If efficiency of this load can be improved by selecting energy efficient transformers, energy savings can be made as estimated:

- Order of cost £10,185 (over standard solution)

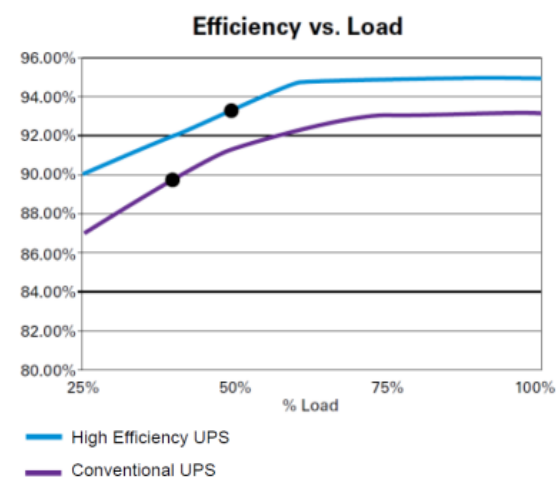


- Annual energy savings 79 MWh
- Annual energy savings £7,884
- Annual carbon dioxide savings 17 Tonnes
- Simple payback 1.5 years (as a measure of effectiveness)

Conclusion –increased capital outlay, reasonable energy savings, excellent payback.

7.7 Modular UPS System

Modular UPS can provide efficiency benefits by both its design and by closely matching the unit operating capacity to the load. The high efficiency UPS has an approximate improvement of 2% less losses, which is achieved across the full load range.



- Order of cost £59,074 (over standard solution)
- Annual energy savings 631 MWh
- Annual energy savings £63,072
- Annual carbon dioxide savings 133 Tonnes
- Simple payback 1.5 years (as a measure of effectiveness)
- Conclusion –increased capital outlay, high energy savings, excellent payback.

7.8 Mechanical Services UPS

The mechanical services plant is not as susceptible to damage from unconditioned power supplies and can there be fed from an off-line UPS system. In offline mode the normal losses of a UPS system (6-8%) are reduced to 1%.

- Order of cost £16,296
- Annual energy savings 97 MWh
- Annual energy savings £9,714
- Annual carbon dioxide savings 50 Tonnes
- Simple payback 1 year (as a measure of effectiveness);

Conclusion –increased capital outlay, high energy savings, excellent payback.

7.9 Cooling Towers

The use of cooling towers for heat rejection improves cooling efficiencies, but is seldom deployed due to public fears over Legionnaires disease. Cooling towers have therefore not been considered.

Conclusion – not to be considered.

Be Lean SummaryError! Not a valid link.

Table 6: Be Lean carbon dioxide emission rates

Name	tCO ₂ /annum
Benchmark building (tCO ₂ /annum)	52,034
Reduction due to Lean design measures	12,578
LEAN building (tCO ₂ /annum)	39,456

7.10 Dynamic Thermal Model Inputs

The following inputs have been included in the dynamic thermal model in terms of energy efficiency measures, reflective of the concept design of the data centre systems outlined in this report.

It should be noted that these inputs are likely to change as the design develops and are representative of a point in time in the design process.

Table 7: Thermal Model Inputs

Heating		
Data Centre (24hr)		
Data halls		
NCM system type	No Heating	No Heating
Battery room		
NCM system type	Split/multi-split (VRV)-New unit	Split/multi-split (VRV)-New unit
Heat Source	Boiler	ASHP
Heating seasonal efficiency (SCOP)	91%	2.60
Pump Type	N/A	N/A
Telco rooms		
NCM system type	Split/multi-split (VRV)-New unit	Split/multi-split (VRV)-New unit
Heat Source	Boiler	ASHP
Heating seasonal efficiency (SCOP)	91%	2.60
Pump Type	N/A	N/A
Corridors (Datahall) / Storage rooms		
NCM system type	No Heating	No Heating
Cooling		
Data Centre (24hr)		



Data Halls		
NCM Cooling System Type	CRAC Units connected to Air Cooled Chiller	CRAC Units connected to Air Cooled Chiller
Type	IAC	IAC
EER	4.03	4.03
System Seasonal efficiency SEER	28.5400	28.5400
Battery rooms		
NCM Cooling System Type	Fan Coil Units - VRF	Fan Coil Units - VRF
Type	ASHP	ASHP
EER	3.88	3.88
System Seasonal efficiency SEER	6.90	6.90
UPS ROoms rooms		
NCM Cooling System Type	CRAC units	Single Room Cooling
Type	ASHP	ASHP
EER	3.88	3.88
System Seasonal efficiency SEER	42.67	42.67
Datahall corridors		
NCM system type	No Cooling	No Cooling
Ventilation		
Data Centre (24hr)		
Data Halls		
Ventilation mechanism	Supply Only (see room level)	Supply Only (see room level)
Demand control	None	None
Heat recovery	None	None
heat recovery efficiency	N/A	N/A
FCU terminal SFP (W/l/s)	0.5	0.5
Centralised AHU SFP (W/l/s)	1.6	1.6
Toilets (in offices)		
Ventilation mechanism	Extract (fan remote)	Extract (fan remote)
Extract SFP (W/l/s)	0.8 (from the main office AHU)	0.8 (from the main office AHU)
Heavy Plant Rooms		
Ventilation mechanism	Extract Only	Supply Only
Demand control	None	None
Heat recovery	None	None
heat recovery efficiency	None	None
FCU terminal SFP (W/l/s)	None	None
Centralised AHU SFP (W/l/s)	0.5	0.5

7.11 Un-regulated Be Lean Summary

Table 8: Energy Saving Technology Assessment Summary

Energy Saving Technology	Investment Outlay (£) Extra Over	Annual energy savings (MWh)	Annual energy savings (£)	Annual carbon dioxide savings (TonnesCO ₂)
Data Centre (Process) – Energy/Carbon Reductions				
Free Cooling Chillers	244,444	7,088	708,814	1,496
Variable speed fan CRAC	21,083	1,761	176,123	372
Variable speed pumps	9,167	1,032	103,230	218
Hot aisle containment	N/A	1,823	182,293	385
Energy efficient lighting	N/A	62	6,234	13
Low Loss Transformers	10,185	79	7,884	17
IT UPS	59,074	631	63,072	133
Mech UPS	16,296	97	9,714	50
Total Carbon Dioxide saving (TonnesCO ₂)				2,685

Table 9: Be Lean carbon dioxide emission rates

Name	tCO ₂ /annum
Benchmark building (tCO ₂ /annum)	52,034
Reduction due to Lean design measures	12,578
LEAN building (tCO ₂ /annum)	39,456

7.12 Energy Efficient Fabric

The majority of the energy efficiency of a data centre will be in the efficiency of the cooling system to the data halls, however the control of heat losses and gains are still of some significance, particularly as the form factor of the proposed data centre has a high wall to floor area ratio. As such the following fabric improvements are proposed for the building.



Table 10: Fabric inputs

	Baseline (Notional Building)	Proposed Design Be Lean/ Clean	Proposed Design Be Green
Building fabric			
External Walls	0.26	1.5	1.5
Roof	0.18	1.5	1.5
Ground floor	N/A	N/A	N/A
Air Tightness			
Air permeability (Throughout)	25m3/m2hr @50 Pa	25m3/m2hr @50 Pa	25m3/m2hr @50 Pa

Application of these measures to the dynamic thermal model yielded the following savings for the ‘be lean’ contribution.

Table 11: Be Lean carbon dioxide emission rates

SAP 10.2 (GLA)	Total regulated emissions (Tonnes CO ₂ / year)	CO ₂ savings (Tonnes CO ₂ / year)	Percentage savings (%)
Part L 2021 baseline	239.32		
Be Lean	67.04	172.28	72%

7.13 Regulated Energy Be LEAN Summary

The majority of the savings associated with the reduction of carbon emissions under GLA Policy SI2 are achieved through the specification of energy efficiency space conditioning systems for the Data Hall areas. It should be noted that the calculations provided in Section 11 of this report are more typically reflective of the energy saving analysis performed on data centres during the design process, however the Part L calculation figures are presented here as required by the London Plan.

Table 12: SAP 10 (GLA) Emission savings

SAP 10.2 (GLA)	Total regulated emissions (Tonnes CO ₂ / year)	CO ₂ savings (Tonnes CO ₂ / year)	Percentage savings (%)
Part L 2021 baseline	239.32		
Be lean	67.04	172.28	72%
Be clean	67.04	0.00	0%
Be green	67.04	0.00	0%
Total Savings		172.28	72%
		CO ₂ savings off-set (Tonnes CO ₂)	
Off-set		67.04	



8 BE CLEAN - COMBINED HEAT & POWER FESABILITY



Figure 11: Be Clean Phase CO₂ Emission reductions

In compliance with the existing and draft London Plans, the development will have to address the feasibility of connection to district CCHP schemes, as referenced in the London Plan policy SI 3.

8.1 District CHP Viability

There is no available space for CHP infrastructure to be installed in this capacity expansion project so this option has not been considered further.

8.2 Be Clean Summary

At this stage no measures have been included under 'be clean' though use of district heating schemes may be re-explored as the design develops. As such the results for this element of the GLA hierarchy are presented below:

Table 13: SAP 10 (GLA) Emission savings from Be Lean and Be Clean measures

SAP 10 (GLA)	Total regulated emissions (Tonnes CO ₂ / year)	CO ₂ savings (Tonnes CO ₂ / year)	Percentage savings (%)
Part L 2021 baseline	239.32		
Be lean	67.04	172.28	72%
Be clean	67.04	0.00	0%



9 BE GREEN - RENEWABLE ENERGY TECHNOLOGIES



Figure 12 Be Green Phase CO₂ Emission reductions

9.1 Introduction

The following section indicates the viability and the extent of renewable energy systems that could be incorporated into the development. Technologies that are feasible are assessed using the methodologies outlined in the GLA Toolkit.

System sizing suggested is suitable only to provide an early indication of energy contribution and carbon-dioxide emissions reduction. Feasibility studies of each of the technologies are on the basis of stand-alone systems. **Thus, the carbon dioxide emissions achieved may not be considered to be cumulative if the technologies are combined.**

As an example, if biomass technology is used to meet the entire heating requirement then any solar hot water system installed would not provide any further carbon dioxide reduction.

The table below highlights the viability of the different Low and Zero Carbon Technologies that have been investigated for Data Centre development.

Table 14: Low & Zero Carbon technologies

Technologies	Viability
Combines Cooling Heating and Power (CCHP)	NO
Photovoltaics	NO
Solar Thermal	NO
Wind Turbines	NO
Biomass	NO
Ground Source Heating	NO
Air Source Heat Pumps	YES

In order to show the effectiveness of these technologies when considering a large process load such as a data centre, these technologies have been analysed for carbon dioxide savings and economic feasibility. Because the process loads are so large when compared to a typical office building, the impact of the LZC technologies is typically very small. The whole site is going to be run off of electricity which will distort some of the benefit of the renewable technologies, most notably solar thermal panels and biomass.

9.2 Wind Turbines

There is no available space for wind turbines to be installed in this capacity expansion project so this option has not been considered further.

9.3 Photovoltaic Cells (PV)

There is no available space for PVs to be installed in this capacity expansion project so this option has not been considered further.

9.4 Solar Water Heating

There are no office areas requiring solar water heating in this capacity expansion project so this option has not been considered further.

9.5 Biomass

There is no available space for Biomass infrastructure to be installed in this capacity expansion project so this option has not been considered further.

9.6 Ground Source Heating/Cooling

There is no available space for ground source infrastructure to be installed in this capacity expansion project so this option has not been considered further.

9.7 Hydrogen Fuel Cells

There is no available space for hydrogen fuel infrastructure to be installed in this capacity expansion project so this option has not been considered further.

9.8 Air Source Heat Pumps (Variable Refrigerant Flow)

Air source heat pumps strip heat stored in the air typically above 0°C. The air is run through coils and refrigerant is used to take the heat or coolth out of the air. The refrigerant is then used to heat or cool the building. The carbon benefits of the heat pump are only taken into account when the system is in heating mode.

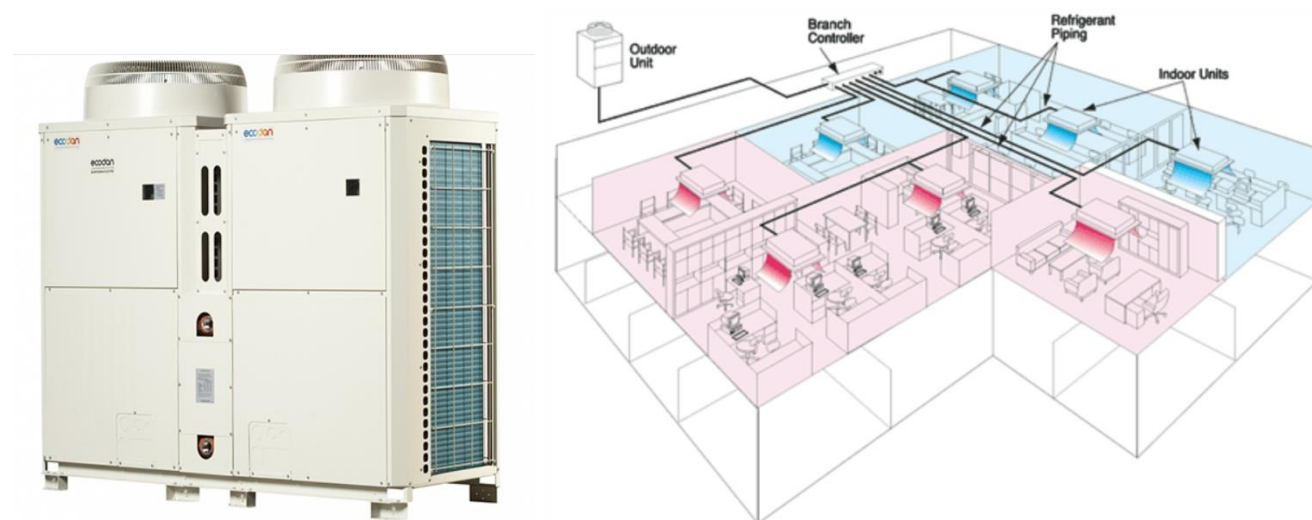


Figure 13 Air Source Heat Pumps and Variable Refrigerant Flow in Operation

9.8.1 Air Source Heat Pumps Viability Appraisal

Air source heat pumps have been installed to serve the new battery rooms.

- Order of cost £22,000 (over standard solution)
- Annual energy savings 50 MWh
- Annual energy savings £5,000
- Annual carbon dioxide savings 11 Tonnes
- Simple payback 4.5 years (as a measure of effectiveness)

Conclusion –increased capital outlay, reasonable energy savings.

9.9 Un-regulated Be Green Summary

Table 15: Be Green carbon dioxide emission rates

Name	tCO ₂ /annum
CLEAN building (tCO ₂ /annum)	39,456
Reduction due to GREEN design measures	50
GREEN building (tCO ₂ /annum)	39,406

9.10 Regulated Be Green Summary

The application of the energy hierarchy throughout the design of the Global Switch London South has yielded significant savings over compliance with Part L2A of the Building Regulations.

The application of the following measures have led to a **72% saving through ‘be lean’ measures** (significant noting that energy consumption is dominated by data hall cooling).

Table 16: SAP 12 (GLA) Emission savings

SAP 10.2	Total regulated emissions (Tonnes CO ₂ / year)	CO ₂ savings (Tonnes CO ₂ / year)	Percentage savings (%)
Part L 2021 baseline	239.32		
Be lean	67.04	172.28	72%
Be clean	67.04	0.00	0%
Be green	67.04	0.00	0%
Total Savings		172.28	72%
		CO₂ savings off-set (Tonnes CO₂)	
Off-set		67.04	

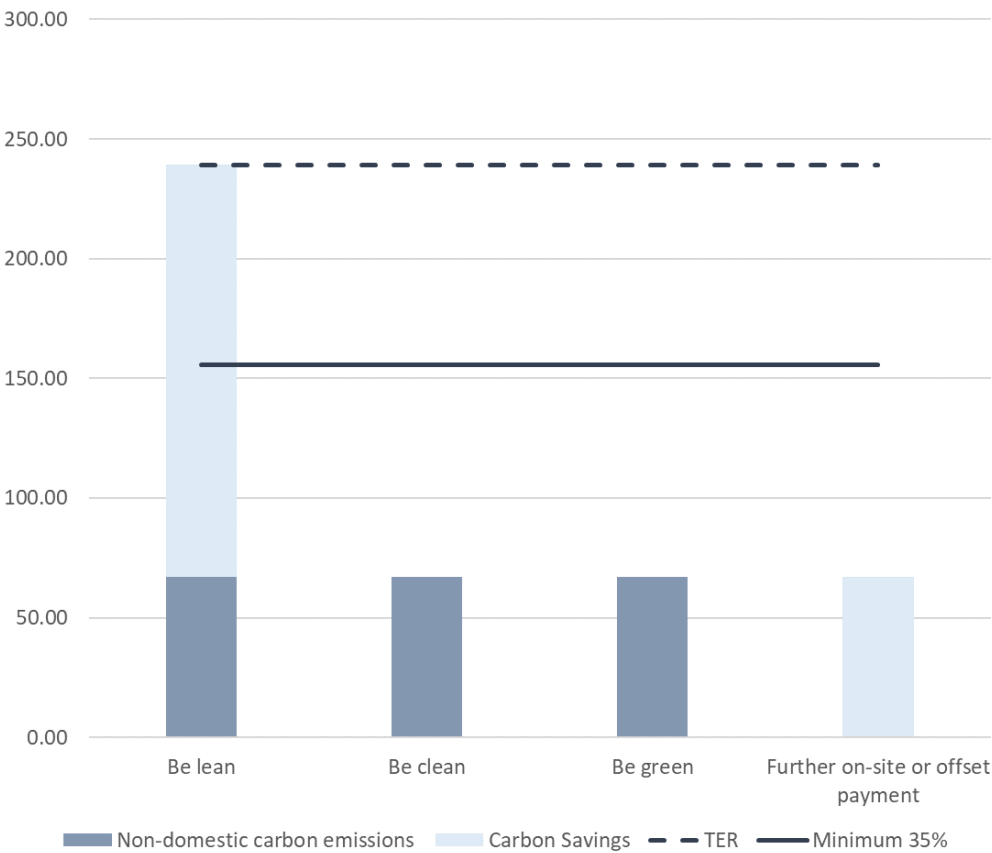


Figure 14: Non-domestic Carbon Emissions



10 BE SEEN – MONITORING AND REPORTING OF THE ACTUAL OPERATIONAL ENERGY PERFORMANCE

10.1 General

The London Plan 2021 has developed the Be Seen stage on top of the Be Lean, Be Clean, Be Green categories.

Be Seen aims to address the gap between the building theoretical energy performance and the measured reality by.

- Monitoring and reporting of the actual operational energy performance of major developments for at least five years via the Mayor's be seen monitoring portal.
- Establishing post-construction monitoring as good practice, enabling developers and building owners to better understand their buildings and identify methods for improving energy performance from the project inception stage and throughout the building's lifetime.
- Ensuring that the actual energy and carbon performance of buildings is aligned with the estimated energy and carbon performance will also be a key factor in achieving a zero-carbon London.

The Be seen energy monitoring guidance requires the reporting of energy performance data as a scheme is planned, built out and in use. The following image summarises the process and responsibilities:

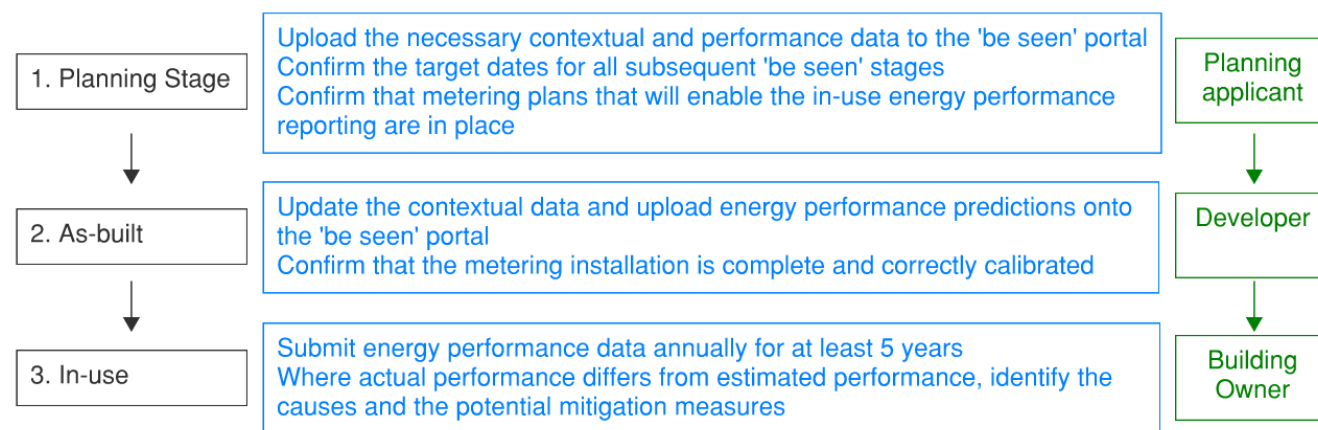


Figure 15: Be Seen Summary

The be seen stage is mentioned for information purposes within this energy report whilst its detailed treatise doesn't constitute part of this document.

10.2 Automatic Metering and Monitoring

The proposed data centre will be provided with a Power Monitoring System (PMS) covering 100% of the energy usage across the site. The PMS will allow monthly energy usage will be analysed and energy reductions targeted. The Power Usage Effectiveness (PUE) will also be automatically calculated and displayed on the monitoring screen.

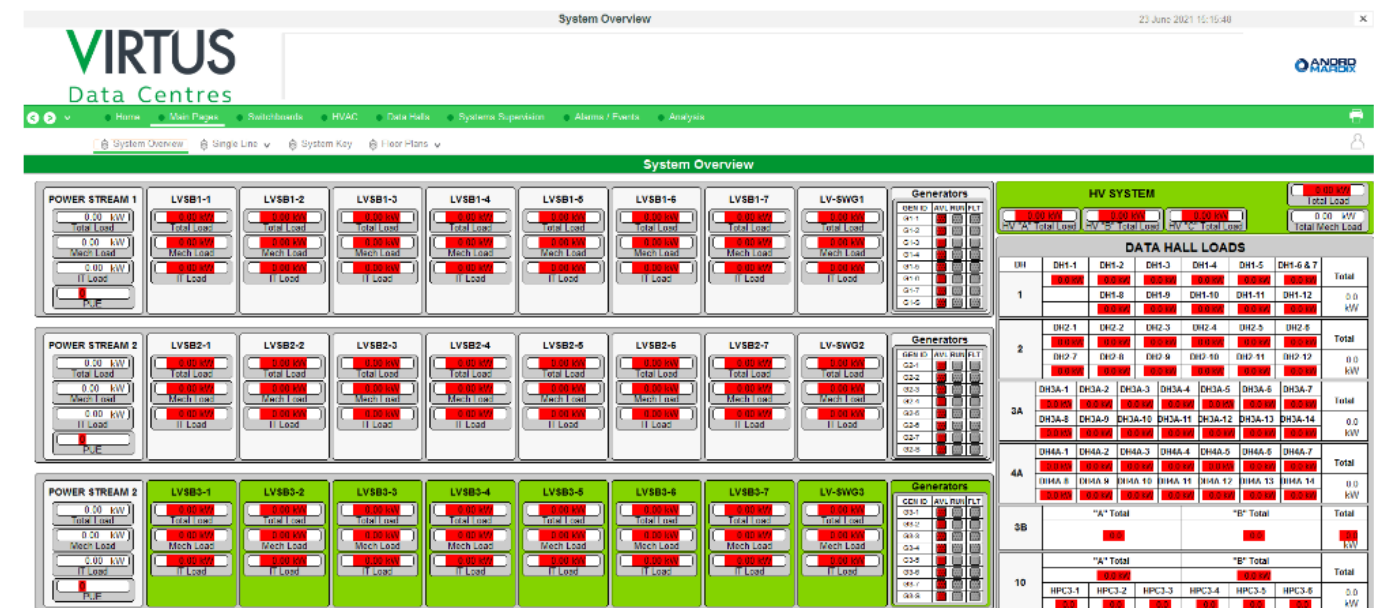


Figure 16: Sample PMS graphic

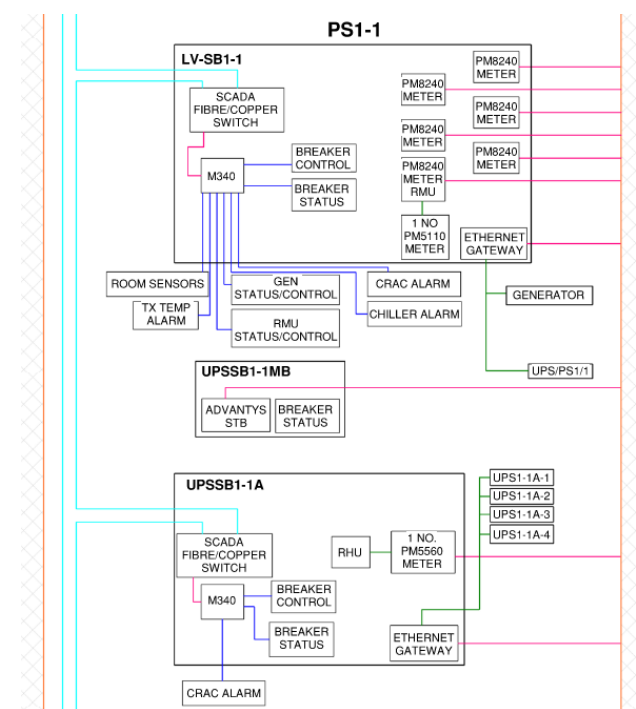


Figure 17: PMS schematic of typical power stream



11 UNREGULATED (PROCESS) ENERGY STRATEGY SUMMARY

11.1 General

The proposed Data Centre scheme plans to invest heavily to ensure practical, maintainable and technologically viable energy conservation measures are put in place as part of the data centre Development.

After consideration of the suitability of a number of Low and Zero Carbon technologies it was concluded that meeting the 20% on-site renewable energy target for a 'Non-Housing Development' is not feasible or viable in this instance, specifically due to the large scale energy consumption of a Data Centre.

The use of energy saving technologies for the process load are by far the most effective means of reducing carbon emissions and provide an estimated 24.2% saving on the total energy usage for a typical building of this type. With this saving the Power Usage Effectiveness (PUE) is estimated at 1.25 meeting the estimated annual energy use for stage 4 of the development.

The maximum anticipated carbon emissions for the overall development are estimated to be 40,649 Tonnes per annum. This is calculated on the maximum permissible, fully engineered, fully operational Data Centre development, assuming that all data (process) halls are equally loaded and all running on a 24/7/365 continuous basis. The realities will be quite different – IT equipment load is dynamic and will change significantly over time, over each day, week and subsequent month.

That is why the theoretical prediction of total carbon emissions is quantitative only and the prescriptive approach to calculating the carbon offsetting contribution is likely to adversely impact the scheme viability – there is no guarantee of reaching the estimated maximum carbon emissions and the total number of data halls may alternatively never be built, hence the estimation of future emissions on this basis is unrealistic.

The Government CRC scheme changes as announced during the recent Comprehensive Spending Review will be based on payment in arrears. This is a sensible approach that we bring to your attention for consultation.

11.2 Process Areas (Data Halls)

The energy assessment submitted presents practical measures for lowering the energy impact from the proposed development. The energy strategy follows the energy hierarchy set out under policy SI2 of the London plan 2021 and will adopt a number of low carbon and new energy saving technologies to minimise the calculated energy demand and overall annual CO2 emissions.

The calculated energy demand for the proposed development will be assessed against a data hall with the same IT capacity but with a benchmark Power Usage Effectiveness (PUE) of 1.65.

Energy saving technologies will be applied to the process engineering systems of the Data Centre to significantly reduce the energy consumption of the parasitic (non- IT equipment).

- Free cooling air cooled chillers and CHW CRAC units equipped with variable speed pumps and fans will serve all of the data halls, with N+4 units operating at a reduced capacity to further improve energy efficiency
- The plant room associated with the data halls would be cooled by the same CHW CRAC units, with N+1 resilience operating at a reduced capacity to further improve energy efficiency.
- Elevated room temperature operation by design – higher data room temperatures provide more efficient heat exchange at the cooling equipment and increase the threshold for free cooling
- Energy efficient lighting and controls – high frequency ballasts in fluorescent light fittings, with presence detection control in all the data halls
- Low loss transformers – reduce the electrical losses between HV and LV conversion.
- High efficiency and offline UPS

11.2.1 Un-Regulated Process Energy

Table 10 lists the un-regulated process energy and carbon reduction savings offered by the proposed scheme:

Table 17: Un-regulated process energy/carbon reduction savings for DC 7.5

Energy Saving Technology	Annual energy savings (MWh)	Annual carbon dioxide savings (TonnesCO ₂)
Data Centre (Process) – Energy/Carbon Reductions		
Free Cooling Chillers	7,088	1,496
Variable speed fan CRAC	1,761	372
Variable speed pumps	1,032	218
Hot aisle containment	1,823	385
Energy efficient lighting	62	13
Low Loss Transformers	79	17
IT UPS	631	133
Mech UPS	97	50
VRF Heat Pumps	50	11
Total Energy Saving	12,628	2,696

11.3 Site Summary

Table 18: Process Energy / Carbon Reduction Savings offered by the Scheme for DC 7.5

Energy Saving Technology	Investment Outlay (£) Extra Over	Annual energy savings (MWh)	Annual energy savings (£)	Annual carbon dioxide savings (TonnesCO ₂)
Data Centre (Process) – Energy/Carbon Reductions				
Free Cooling Chillers	244,444	7,088	708,814	1,496
Variable speed fan CRACs	21,083	1,761	176,123	372
Variable speed pumps	9,167	1,032	103,230	218



Energy Saving Technology	Investment Outlay (£) Extra Over	Annual energy savings (MWh)	Annual energy savings (£)	Annual carbon dioxide savings (TonnesCO ₂)
Hot aisle containment	N/A	1,823	182,293	385
Energy efficient lighting	N/A	62	6,234	13
Low Loss Transformers	10,185	79	7,884	17
IT UPS	59,074	631	63,072	133
Mech UPS	16,296	97	9,714	50
VRF Heat Pumps	22,000	50	5,000	11
Total Carbon Dioxide saving (TonnesCO ₂)				2,696

Based on the energy profile at Year 2 (assuming the site is fully occupied)

11.4 Commitment to Sustainable Design

It is clear at national and regional level that there is considerable weight behind requiring new development to contribute towards reducing carbon dioxide emissions. The onus is on buildings to be energy efficient and wherever practical, utilise renewable energy regeneration technologies to offset a degree of the carbon impact.

The data centre development as a whole is committed to sustainable design and construction practises and to implementing practical, cost effective measures to assist the overall reduction of carbon emissions.

We have assessed the London Borough of Hillingdon's Unitary Development Plan, 2007 and as per Council Policy, our assessment has taken into consideration the following factors and provided justification of:

- Economic viability depending on site specific conditions.
- Implementation of other sustainable measures. We have presented for consideration our recommended approach for installing a wide range of sustainable measures.
- Due to the specialised nature of the development and the high process loads, the facility overall is not able to meet the renewable target of 20% across the whole development.
- We believe we have explored all available options and presented the most effective energy strategy for the development in line with the Council's policies.



12 REGULATED ENERGY STRATEGY SUMMARY

The application of the energy hierarchy throughout the design of the Global Switch London South has yielded significant savings over compliance with Part L2A of the Building Regulations.

The application of the following measures have led to a **72% saving through ‘be lean’ measures** (significant noting that energy consumption is dominated by data hall cooling).

Table 19: SAP 12 (GLA) Emission savings

SAP 10.2	Total regulated emissions (Tonnes CO ₂ / year)	CO ₂ savings (Tonnes CO ₂ / year)	Percentage savings (%)
Part L 2021 baseline	239.32		
Be lean	67.04	172.28	72%
Be clean	67.04	0.00	0%
Be green	67.04	0.00	0%
Total Savings		172.28	72%
		CO ₂ savings off-set (Tonnes CO ₂)	
Off-set		67.04	

Table 20: SAP 10 (GLA) Emission savings

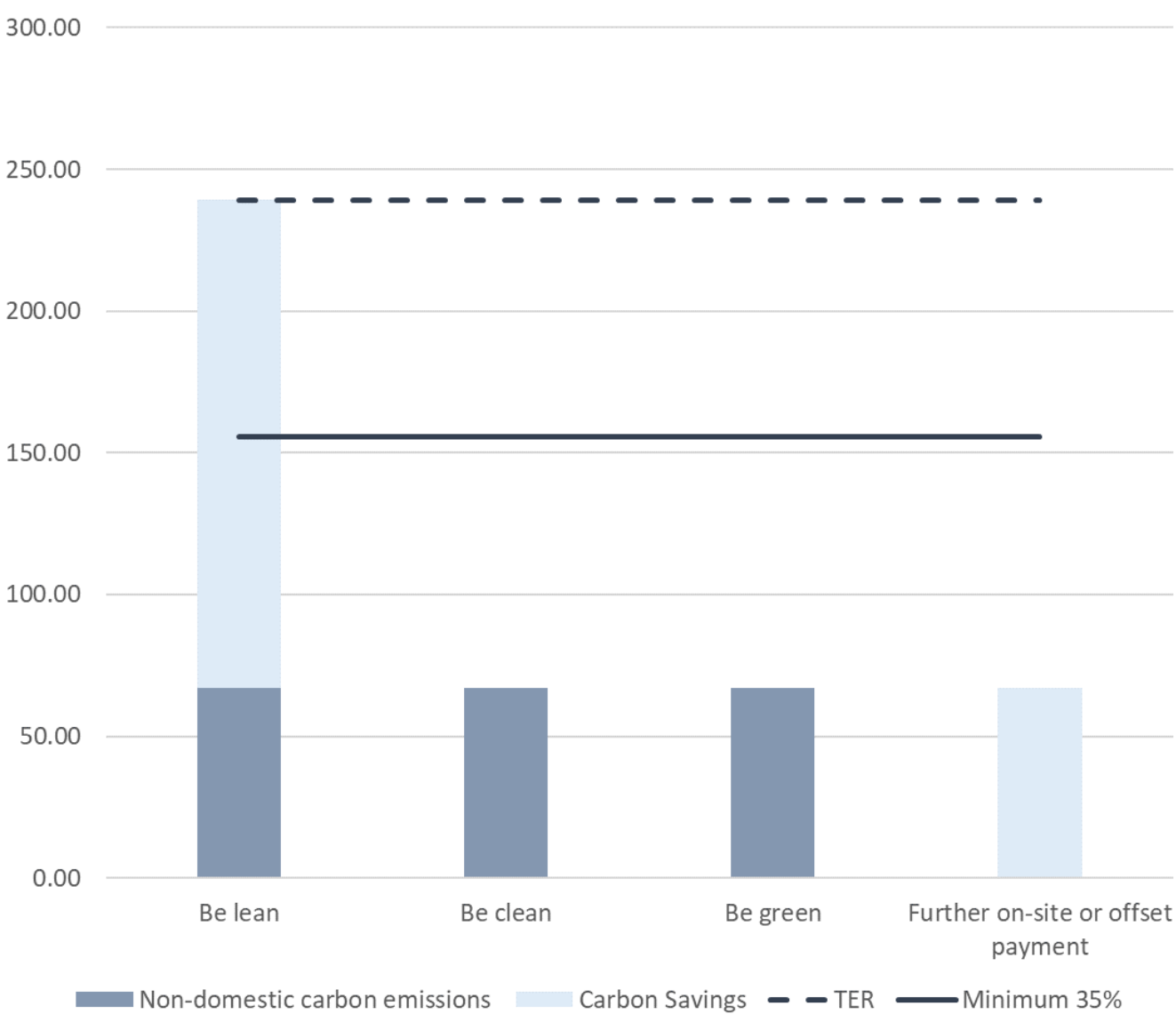


Figure 18: Non-domestic Carbon Emissions

In accordance with Policy SI2 of the 2021 London Plan, and the updated energy strategy guidance document (June 2022) a carbon contribution in lieu should be made to address the ‘regulated’ emissions down to ‘net zero’ for the development.

The table below demonstrates the valuation of that residual under the requirements of the London Borough of Hillingdon and GLA pricing of £95 per tonne of CO₂.

Based upon the power not being from certified renewable sources, the carbon contribution would be **£191,076.14**. However, for this development the power will be 100% renewable, so there are no carbon emissions which need to be offset, resulting in a zero payment.



Table 21: SAP 10 (GLA) Emission savings

	Regulated non-domestic carbon dioxide savings	
	(Tonnes CO ₂ per annum)	(%)
Be lean: savings from energy demand reduction	172.28	72%
Be clean: savings from heat network	0.00	0%
Be green: savings from renewable energy	0.00	0%
Total Cumulative Savings	172.28	72%
Annual savings from off-set payment	67.04	
	(Tonnes CO₂)	
Cumulative savings for off-set payment	2011.33	
Cash in-lieu contribution (£)*	£191,076.14	

Overheating - London Plan Policy SI4

Finally, the overheating risk analysis undertaken by the design team identified that due to the high internal heat gains associated with the data centre environment and the temperatures associated with the London DSY1 (weather data characterised by moderately warm summer), DSY2 (weather data characterised by short, intense warm spell) and DSY3 (weather data characterised by Long, less intense warm spell) weather files, comfort cooling was required for all office areas.

Table 22 Cooling demand reduction

	MJ/m ²	MJ/year
Actual Building	8,642	26,007,726
Notional Building (Part L)	9,266	27,885,486



13 CONCLUSION

The energy strategy for the proposed VIRTUS DC 7.5 Data Centre development in Prologis Park West London is extremely bespoke to the process use of the buildings. The focus of the strategy is to minimise energy use by utilising energy saving engineering technologies, while ensuring the resilience and capacity demands of the process are maintained.

Be Lean	Base building including small power (tCO ₂ /annum)	52,034
	Energy efficient building (tCO ₂ /annum)	39,456
	Reductions due to fabric measures and M&E services	24.2%
Be Clean	Energy efficient building (tCO ₂ /annum)	39,456
	Energy efficient building (tCO ₂ /annum)	39,456
	Reductions due to CHP	0%
Be Green	Energy efficient building with CHP (tCO ₂ /annum)	39,456
	Energy efficient building with renewable technologies (tCO ₂ /annum)	39,406
	Reduction due to renewable technologies	0.01%
TOTAL	Base building including small power (tCO ₂ /annum)	52,034
	Proposed building (tCO ₂ /annum)	39,406
	Reduction due to Lean, Clean and Green measures	24.21%



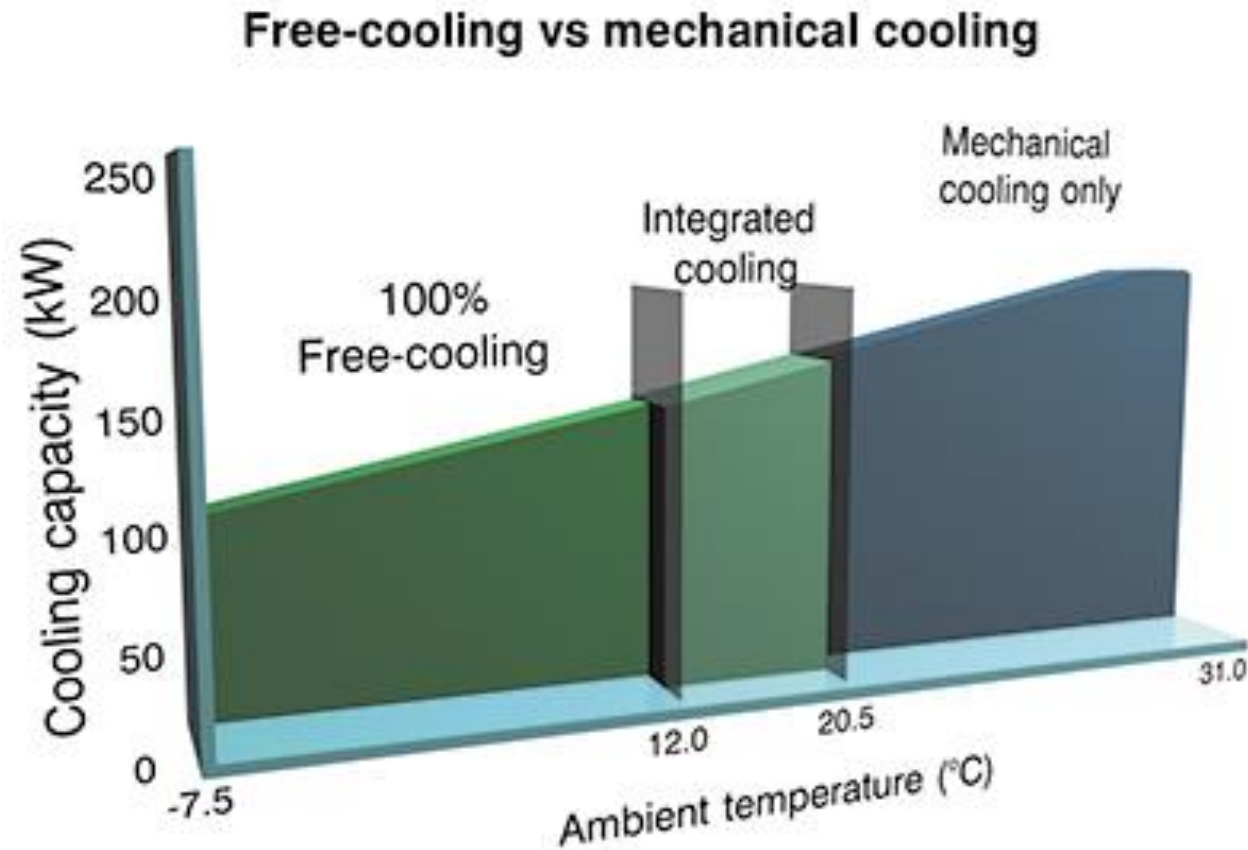
APPENDIX A – TECHNICAL FACT SHEET (FREE COOLING)

A considerable proportion of the data centre parasitic load is related to cooling. In the drive to reduce energy consumption in data centres, operators and equipment vendors have generally accepted that they can operate computer equipment at higher operating temperatures. These recommended operating temperatures as advised by ASHRAE, typically 18 to 27°C rather than the traditional 14-18°C, enable the direct fresh air handling units to be utilised very effectively.

Free cooling can be achieved in a number of ways. Where site constraints allow, one of the most effective methods of providing free cooling is via direct fresh air handling units with mechanical cooling required only when external ambient temperatures are above a certain threshold.

In low ambient conditions, the units operate in an indirect mode, using a run-around coil to provide coolth to recirculated air from the data hall and reject heat to cool external air which is then discharged to atmosphere. For the majority of the year the unit will operate in a direct fresh air mode, mixing recirculated data hall air and fresh air to obtain the required supply air temperatures. When the external ambient temperatures are high (typically 4°C below the server cabinet supply air temperature to allow for gains), the units operate in a mechanical cooling mode to achieve the desired supply air temperatures. Given higher operating temperature, the hours per year that the units are required to operate in this mode are significantly reduced, leading to reduced energy consumption for the system.

The following graph shows the temperature frequency distribution for Heathrow, London and the periods when partial and total free cooling are achievable. The point at which total free is available will depend on the system load and whether the standby module is available.





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