ENERGY MONITORING, RECORDING & REPORTING PLAN

LONDON 7.5

Virtus Data Centres

CONFIDENTIAL

Revision: 1.0 – REV2 | **Issued:** 19 July 2024

Document name: rp240613u0003

VERIFICATION

REVISION	DATE ISSUED	PREPARED BY	VERIFIED BY	AUTHORISED BY	COMMENT
1.0	21/06/2024	Ravi Woods	Andreas Alygizos	Steve Dickinson	Draft Issue
2.0	19/07/2024	Ravi Woods	Andreas Alygizos	Steve Dickinson	Updated based on manufacturer review

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1 EXECUTIVE SUMMARY

Norman Disney & Young (NDY) has been appointed by Virtus Data Centres to update the energy strategy for London 7.5 – a 4.5 MW fit-out of a new Data Hall within the LONDON7 Data Centre, in West Drayton, London – in order to reflect the latest Construction stage information.

An energy strategy was previously produced for the development in October 2022 (under Part L2 2021) in support of the planning application with reference number 77241/APP/2022/1407.

Within this report, two areas of the energy strategy have been updated, in order to meet the planning requirements for the development.

CO2 REDUCTION, FROM REGULATED ENERGY LOADS (PART L)

Within the planning application, the energy strategy previously demonstrated that the overall carbon emissions from regulated loads (i.e: at Be Green stage) has been calculated at **72%** lower than the AD L2 2021 Baseline.

The S106 agreement (dated 9th June 2023) includes relevant conditions to energy strategy updates:

"...demonstrate that Development will secure the 72% saving in CO2 emissions from the regulated energy load in accordance with the Energy Strategy Rev. P03 Dated 27th October 2022"

Based on updated energy modelling, using current design information, it has been calculated that the overall carbon emissions from regulated loads (i.e: at Be Green stage) achieve **76%** savings against the AD L2 2021 Baseline – an increase from the figure shown at planning stage.

"BE SEEN" OPERATIONAL ENERGY MODELLING

The "Be Seen" Stage is the latest stage of the Mayor's Energy Hierarchy as per Policy SI2 of the London Plan 2021. It requires 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.

The overall energy consumption (including unregulated and regulated loads) has been calculated for the proposed development has been. This is based on current design stage information, and the methodology from CIBSE TM54 "Evaluating Operational Energy use at the Design Stage" (2022 edition).

Based on this, the anticipated energy consumption of the proposed Development would be **52,402.8 kWh/m^2 GIA/year.**

99.2% of the reported energy consumption is related to process loads for the data centre (UPS and server loads).

The energy use intensity for the remaining end uses such as heating, cooling, ventilation, pumps, small power, lighting etc is estimated to be **420.6 kWh/m^2 GIA/year**.

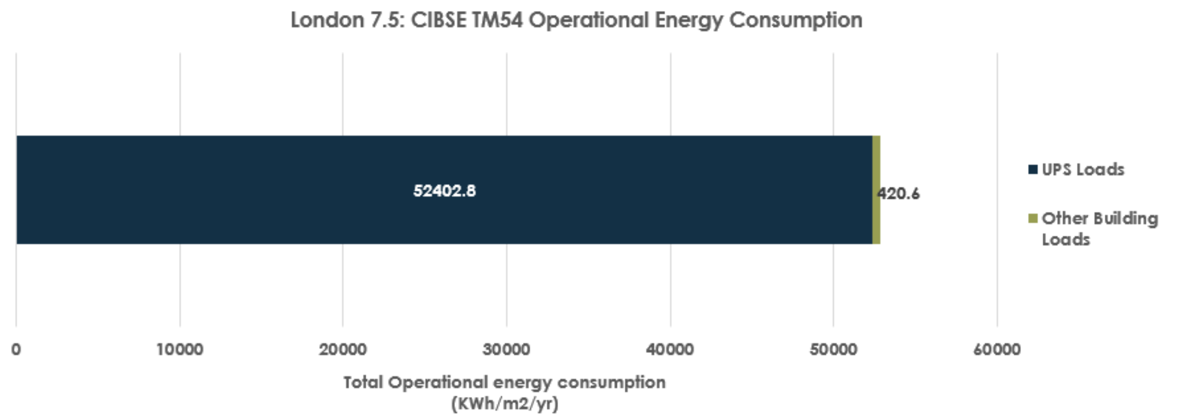


FIGURE 1: OPERATIONAL ENERGY, ESTIMATED BASED ON CIBSE TM 54 METHODOLOGY

2 ENERGY STRATEGY UPDATES

2.1 INTRODUCTION

Following the planning application of London 7.5, the S106 agreement (dated 9th June 2023) includes relevant conditions to the energy strategy:

"...demonstrate that Development will secure the 72% saving in CO2 emissions from the regulated energy load in accordance with the Energy Strategy Rev. P03 Dated 27th October 2022"

This section outlines how the development has changed - between planning stage and the current design - for the proposed design (i.e: Be Green stage), and shows that:

- At planning stage, the overall carbon emissions savings from regulated loads (i.e: at Be Green stage) have at **72%** against the AD L2 2021 Baseline.
- Based on the current Stage 5 information the savings have increased to **76%** against the Part L2 2021 Baseline.

2.2 ASSESSMENT METHODOLOGY

The Energy Strategy follows the methodology set out in the GLA's Energy Assessment Guidance (published in June 2022) which the Local Plan also adopts. The proposed strategy has incorporated energy efficiency measures and renewable energy technologies, aiming to minimise CO_2 emissions associated with the building's operation utilising the principles of the Mayor's energy hierarchy.

The proposed Development has been modelled following the National Calculation Methodology (NCM) 2021. The IESVE Software version 2023.4.0.0 has been used to estimate the energy consumption and the associated CO_2 emissions from the proposed Development.

2.3 MODELLING INPUTS FOR THE ENERGY STRATEGY

The design of the proposed Development has prioritised the implementation of passive and active design measures to reduce the energy demand and hence the CO_2 emissions resulting from the building's operation.

The below sections outline the inputs within the dynamic thermal model, for both:

- Planning Stage, based on the concept design information (October 2022)
- Current (Stage 5) Design information, including 'Construction Stage' information and technical submittals (June 2024).

These are compared against the Part L2 2021 baseline, for reference.

2.3.1 BUILDING 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. Fabrics parameters are outlined in the table below

TABLE 1: FABRICS INFORMATION

	BASELINE	PLANNING STAGE	CURRENT DESIGN
External Wall U-value	0.26 W/m^{2}K	0.26 W/m^{2}K	0.26 W/m^{2}K
Ground floor U-value	N/A (Not Present)		
Roof U-value	0.18 W/m^{2}K	0.18 W/m^{2}K	0.18 W/m^{2}K
Glazing U-value	N/A (Not Present)		
Air Permeability	10 m^3/m^{2}hr @50 Pa	10 m^3/m^{2}hr @50 Pa	10 m^3/m^{2}hr @50 Pa

2.3.3 HEATING AND COOLING

Information regarding the heating and cooling systems of the design are outlined in the table below.

Calculation is provided below for the indicative SEER of the data hall cooling, which is the dominant load within the facility. The manufacturers data for this information is included in Appendix A.

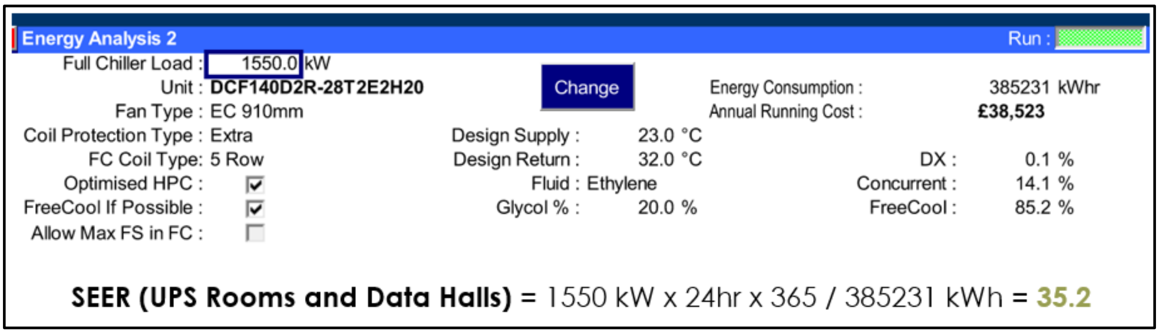


FIGURE 2: COOLING EFFICIENCY CALCULATION

TABLE 2: PROPOSED HEATING AND COOLING SYSTEMS FOR LONDON 7.5

	PART L BASELINE	PLANNING STAGE	CURRENT DESIGN
Data Halls			
System Type	CRAH Units		
Cooling Seasonal Efficiency (SEER)		28.54	35.2
Heating Seasonal Efficiency (SCOP)		-	-
UPS Rooms			
System Type	CRAH Units		
Cooling Seasonal Efficiency (SEER)	5.79	42.67	35.2
Heating Seasonal Efficiency (SCOP)	No Heating	-	-
Battery Rooms			
System Type	VRF		
Cooling Seasonal Efficiency (SEER)	5.79	6.90	9.94 (PUHY-M300YNW-A1)
Heating Seasonal Efficiency (SCOP)	No Heating	-	-
CRAC Corridors and Circulation Areas			
System Type	No Heating or Cooling		

Note: The Seasonal Energy Efficiency Ratio, or SEER rating, measures the air conditioning system's energy efficiency by calculating the cooling output divided by the amount of electric energy input. The higher the SEER rating, the greater energy efficiency of your air conditioning system. This measurement applies to a normal cooling season, which in the case of a data centre is 24 hours 7 days a week which is also operated at elevated operating temperature and attracts significant "free cooling" (cooling without the use of compressors). For a typical office development the SEER could be around 6. For this development, the SEER is over 30.

2.3.4 VENTILATION

Information regarding the ventilation of the design is outlined in the table below.

TABLE 3: PROPOSED VENTILATION SYSTEMS FOR LONDON 7.5

	BASELINE	PLANNING STAGE	CURRENT DESIGN
Data Halls			
Mechanism	Supply Only AHU		
AHU SFP (W/l/s)	1.8	1.6	1.51
Heat Recovery	No Heating	None	None
UPS Rooms			
Mechanism	Supply only AHU		
AHU SFP (W/l/s)	1.8	1.6	1.51
Heat Recovery	No Heating	None	None
Battery Rooms			
Mechanism	Supply only AHU		
AHU SFP (W/l/s)	1.8	1.6	1.51
Heat Recovery	No Heating	None	None
CRAC Corridors and Circulation Areas			
System Type	Infiltration Only		

2.3.5 LIGHTING

Information regarding the luminaire efficiencies of the design is outlined in the table below,

TABLE 4: PROPOSED LIGHTING EFFICIENCES FOR LONDON 7.5

	BASELINE	PLANNING STAGE	CURRENT DESIGN
Data Halls	95lm/W	140 lm/W	142lm/W (WPZ/5/12600/4)
UPS Rooms	95lm/W	110 lm/W	142lm/W (WPZ/5/12600/4)
Battery Rooms	95lm/W	120 lm/W	142lm/W (WPZ/5/12600/4)
CRAC Corridors	95lm/W	110 lm/W	142lm/W (WPZ/5/12600/4)
Circulation	95lm/W	110 lm/W	142lm/W (WPZ/5/12600/4)

2.4 REGULATED ENERGY STRATEGY SUMMARY

The application of the energy hierarchy throughout the design of the London 7.5 has yielded significant savings over compliance with Part L2A of the Building Regulations.

The results of the assessment are shown in the table below. These results show that:

- At planning stage, the overall carbon emissions savings from regulated loads (i.e: at Be Green stage) have at **72%** against the AD L2 2021 Baseline.
- Based on the current Stage 5 information the savings have increased to **76%** against the Part L2 2021 Baseline.

TABLE 5: GLA CARBON EMISSION SAVINGS

	PLANNING STAGE			CURRENT DESIGN		
	TOTAL REGULATED EMISSIONS (TCO_2/YEAR)	CO_2 SAVINGS (TCO_2/YEAR)	% SAVINGS	TOTAL REGULATED EMISSIONS (TCO_2/YEAR)	CO_2 SAVINGS (TCO_2/YEAR)	% SAVINGS
Part L 2021 Baseline	239.32			229.80		
Be Lean	67.04	172.28	72%	54.76	175.03	76%
Be Clean	67.04	0.00	0%	54.76	0.00	0%
Be Green	67.04	0.00	0%	54.76	0.00	0%
Total Savings		172.28	72%		175.03	76%

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 CO_2.

Based on this. the carbon offset contribution would be **£156,077.** This is lower than the figure of **£191,076** shown at planning stage (as outlined in the table below), so no additional carbon offset payments need to be made.

TABLE 6: GLA CARBON OFFSET CALCULATION

	PLANNING STAGE	CURRENT DESIGN
Annual Shortfall (tonnes of CO_2/year)	67.04	54.76
Cumulative Shortfall (tonnes of CO_2 for a 30-year period)	2,011	1,643
Cash-in-lieu contribution	£191,076	£156,077

3 "BE SEEN" OPERATIONAL ENERGY MODELLING

3.1 INTRODUCTION

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

It has been widely recognised that there are significant discrepancies between the energy consumption estimated at design stage and the actual energy consumption of buildings during operation, which is known as the 'performance gap'. Common practice in the UK with regards to energy modelling at design stage primarily aims to assess compliance with Building Regulations and estimate regulated CO_2 emissions. However, compliance-based energy models are not intended to predict energy use, as they include a number of simplifications and standardisations to allow compliance calculations to be carried out.

The 'Be Seen' stage 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 of London'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 energy performance data that will be collected will provide an evidence base which could help inform future industry-wide benchmarks or performance ratings for major building typologies based on in-use performance.

Figure 3 summarises the process and responsibilities for the 'Be Seen' process.

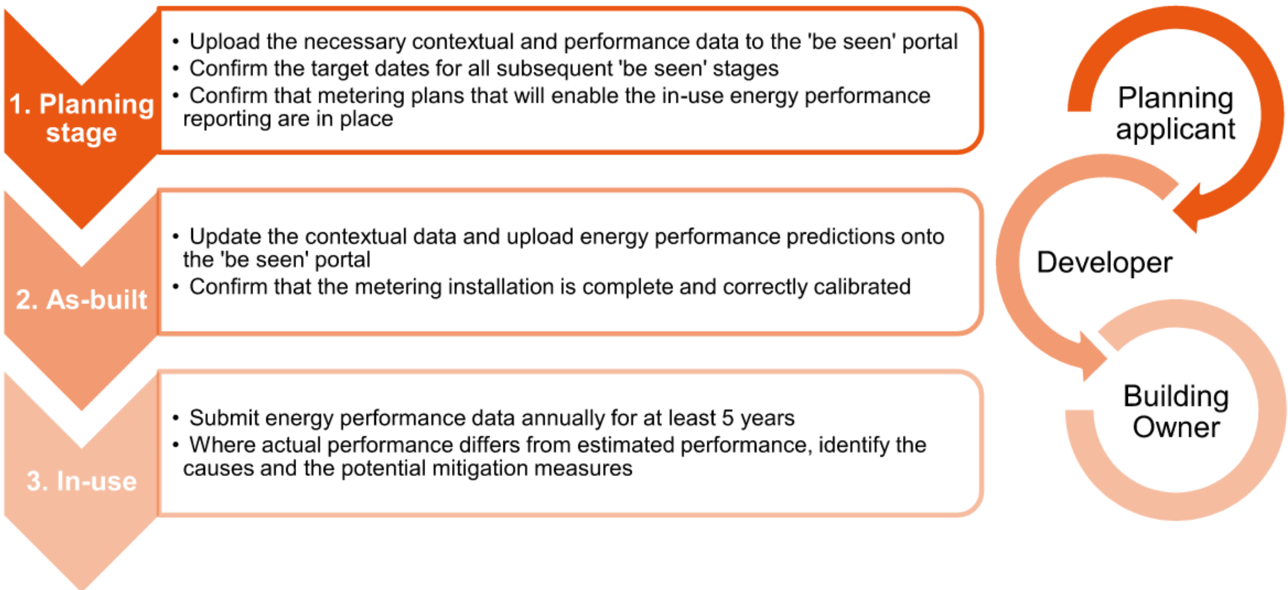


FIGURE 3 'BE SEEN' PROCESS AND RESPONSIBILITIES. IMAGE COURTESY OF BE SEEN ENERGY MONITORING GUIDANCE (SEPTEMBER 2021)

The Be Seen Energy Monitoring Guidance document, published in September 2021, explains the process that needs to be followed to comply with the 'Be Seen' post-construction monitoring requirement of Policy SI 2 of the London Plan. The 'Be Seen' energy monitoring guidance requires the reporting of energy performance data as a scheme is planned, built out and in use. The responsibility for providing the data at each reporting stage lies with the legal owner of the development at that reporting stage.

The document sets the requirements outlined below for the planning stage. This includes:

- 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.
- 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 maximised, 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.

Developments can be made up of a mix of uses, phases and tenures. At the planning stage reporting is done for the entire development as a whole. However, to allow for more comprehensive reporting at the as-built and in-use stages, a development is split into a number of 'reportable units' (RUs) which applicants will need to report against individually:

- The energy centre RUs
- The residential RUs
- The non-residential Rus

London 7.5 is a non-residential RU as it is an individual building/facility with a single non-residential occupier/tenant.

3.2 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.

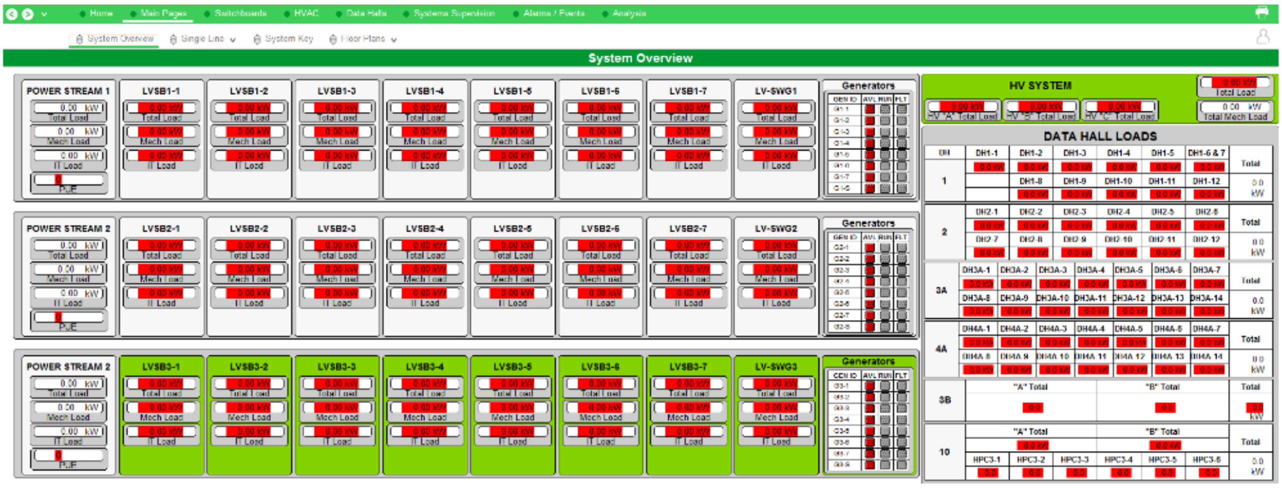


FIGURE 4 SAMPLE PMS GRAPHIC

3.3 MODELLING METHDOLOGY

This section presents the operational energy modelling that has been carried out for the proposed Development in line with CIBSE TM 54.

The operational energy consumption of the proposed Development has been estimated following the methodology stipulated by the GLA's 'Be Seen' Energy Monitoring Guidance.

The anticipated energy consumption (kWh/m^2) and carbon emissions (tonnes CO_2/m^2) of the proposed Development have been estimated based on CIBSE TM54 methodology.

The section covers the following performance indicators:

- Modelling Assumptions: Non-energy information about the location, typology, and usage of the Development.
- Building Energy Use: Grid electricity and gas consumption, energy generation.
- Carbon emissions: Carbon emissions estimates (tonnes CO_2/m^2), estimated carbon offset amount).

Additional performance indicators, including renewable energy generation, energy storage equipment and plant parameters are required to be reported at the as-built and in-use stage.

3.3.1 MODELLING ASSUMPTIONS

Operational energy modelling was carried out using Dynamic Simulation Modelling (DSM) and energy consumption calculations following the prescriptive methodology outlined in CIBSE TM 54.

DSM was carried out using the IESVE software version 2023.4.0.0. The following table presents calculation method for each end use.

TABLE 7: ENERGY CONSUMPTION CALCULATION METHOD FOR EACH END-USE

DSM	ENERGY CONSUMPTION CALCULATIONS
Heating	Power Loads from Data Halls*
Cooling	Other UPS Loads*
Lighting	
Auxiliary (Fans and Pumps)	
Misc Equipment	

*These loads have been calculated outside the DSM but have been included within the DSM to accurately assess the data centre cooling loads.

3.3.2 ENERGY MODELLING INPUTS

A number of inputs have been used, to build the Operational Energy model. These are generally based on Stage 4 design information and are outlined in the subsections below.

BUILDING FABRIC

The fabric information has been previously outlined, within the Energy Strategy (Section 2.3)

HEATING AND COOLING

Information on the heating and cooling plant has been previously outlined, within the Energy Strategy (Section 2.3.

In addition to this, the "Be Seen" model uses design setpoints for each space. These setpoints are outlined for each space type in the table below.

TABLE 8: HEATING AND COOLING SETPOINTS PER SPACE TYPE

	HEATING	COOLING
Data Halls	-	24°C ± 2°C
UPS Rooms	-	25°C ± 3°C
Battery Rooms	-	20°C ± 1°C

VENTILATION

Information on the ventilation plant has been previously outlined, within the Energy Strategy (Section 2.3.

In addition to this, the "Be Seen" model uses design ventilation rates for each space. These setpoints are outlined for each space type in the table below.

TABLE 9: PROPOSED VENTILATION RATE FOR EACH SPACE TYPE

SPACE TYPE	VENTILATION RATE
Data Halls	0.47 l/s/m²
UPS Rooms	0.47 l/s/m²
Battery Rooms	0.47 l/s/m²
CRAC Corridors	-
Corridors	-

INTERNAL GAINS (OCCUPANCY, LIGHTING AND SMALL POWER)

The internal gains (occupancy, lighting and small power) for each space type is outlined in the table below, based on indicative Stage 4 design assumptions.

Note: Power loads for Data Halls, Battery Rooms and UPS Rooms are not included here, since these were calculated separated. These are outlined in Section 3.3.3

TABLE 10: PROPOSED INTERNAL GAINS PER SPACE TYPE

SPACE TYPE	OCCUPANCY	LIGHTING (W/M²)	SMALL POWER (W/M²)
Data Halls	None	6.92	5
Battery Rooms	None	6.92	5
UPS Rooms	None	6.92	5
Circulation	None	6.92	5

3.3.3 ENERGY USE CALCULATIONS

The CIBSE TM54 methodology requires the calculation of the energy consumption of various end-uses that are out of scope of DSM. As such it provides specific methodologies for estimating the energy consumption from these end-uses as shown below:

POWER LOADS FOR DATA HALLS, BATTERY ROOMS AND UPS ROOMS

Since the proposed development is a data centre, a significant amount of the overall energy loads will come from power loads for the Data Halls, as well as the Battery Rooms & UPS Rooms. The loads for these have been calculated separately, based on the equipment contained within each room. These loads are outlined in the table below, and are calculated based 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.

TABLE 11: POWER LOADS FOR DATA HALLS, BATTERY ROOMS AND UPS ROOMS

ROOM NAME	POWER LOAD PER ROOM (KW)
Data Halls	4500
Battery Rooms	6
UPS Rooms	66

3.3.4 CONTEXTUAL INFORMATION

Contextual data, including the site location and proposed land-use, have been provided in the Energy Statement, which was previously submitted as part of this planning application. The GIA of the proposed development is 3,009m² (based on the area of the DSM model).

3.4 MODELLING RESULTS

3.4.1 BUILDING ENERGY USE

The below graph illustrates the outcome of the CIBSE TM54 operational energy modelling, which demonstrates that the anticipated energy consumption of the proposed Development would be **52,823 kWh/m² GIA/year**

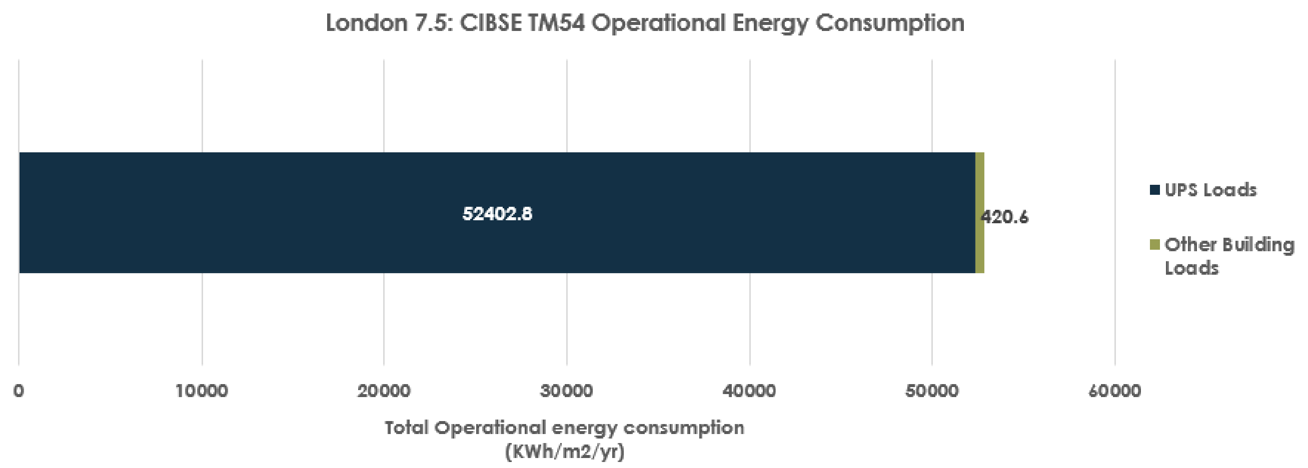


FIGURE 5: OPERATIONAL ENERGY, ESTIMATED BASED ON CIBSE TM 54 METHODOLOGY

Table 12 presents the breakdown of the operational energy consumption for the development. This is calculated based on the GIA of 3,009m² (taken from DSM model).

TABLE 12: CALCULATED OPERATIONAL ENERGY CONSUMPTION BASED ON CIBSE TM54, BY GIA

	CIBSE TM54 RESULTS MWH	CIBSE TM54 RESULTS KWH/M²
Auxiliary	130.6	43.4
Cooling	663.2	220.4
Small Power	289.5	96.2
Heating	0.0	0.0
Lighting	182.3	60.6
UPS	157680.0	52402.8
Total	**158945.6**	**52823.4**

Since the development is a data centre, unregulated (process) loads account for the vast majority of operational energy of the development. This is due to the significant number of UPS within the proposed design. This is outlined in the chart below.

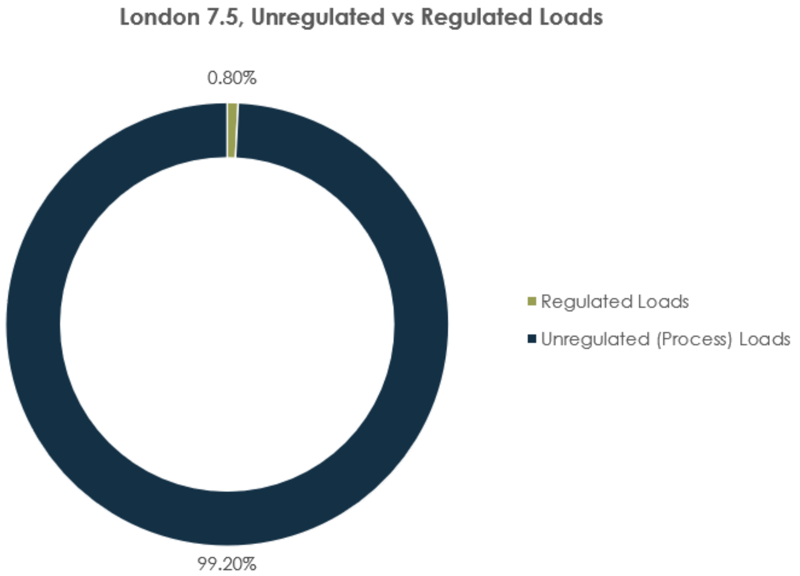


FIGURE 6: SPLIT OF UNREGULATED VS REGULATED LOADS

If UPS loads are removed (as shown in the figure below), we can see a clearer split between the other end uses. This shows that cooling is the next most significant (since server cooling is significant for the development). Following this, small power and lighting loads are the next most significant.

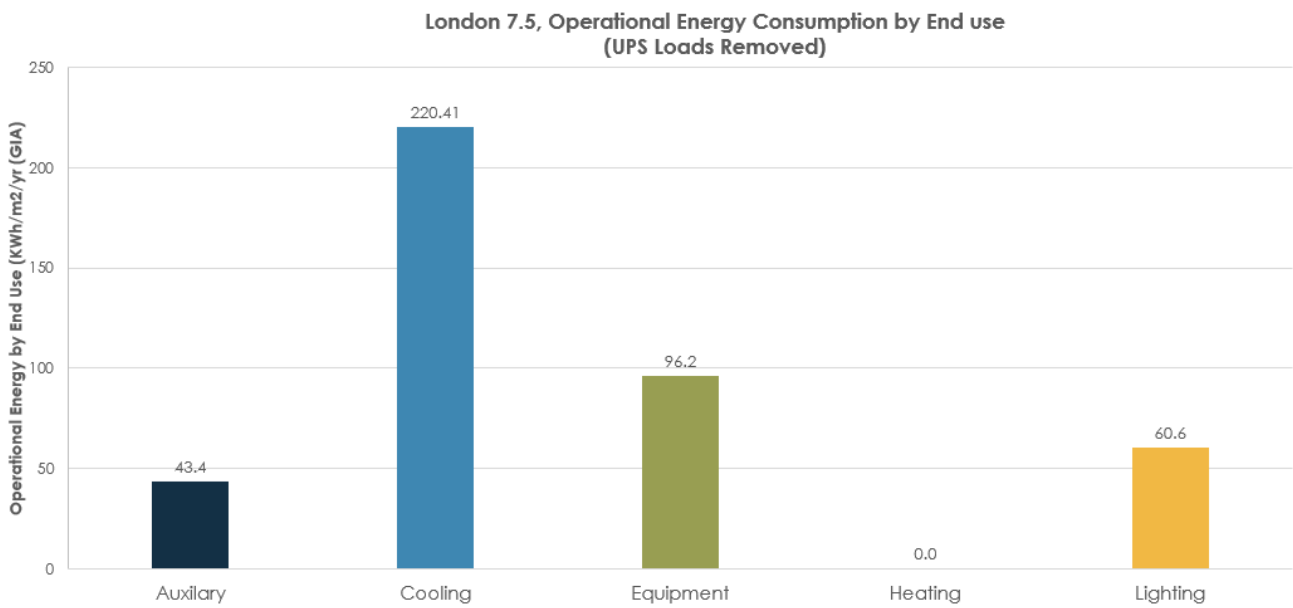


FIGURE 7: OPERATIONAL ENERGY BY END USE, WITH UPS LOADS REMOVED

3.4.2 BUILDING CARBON EMISSIONS

Following the calculation of the operational energy consumption of the proposed Development in accordance with CIBSE TM54, the total operational carbon emissions have been estimated as shown in the table below.

Grid-supplied electricity is the only fuel used in the proposed Development. As such, the carbon emissions have been calculated based on the current carbon factors (shown for reference below).

TABLE 13: CURRENT CARBON FACTORS, FROM PART L 2021

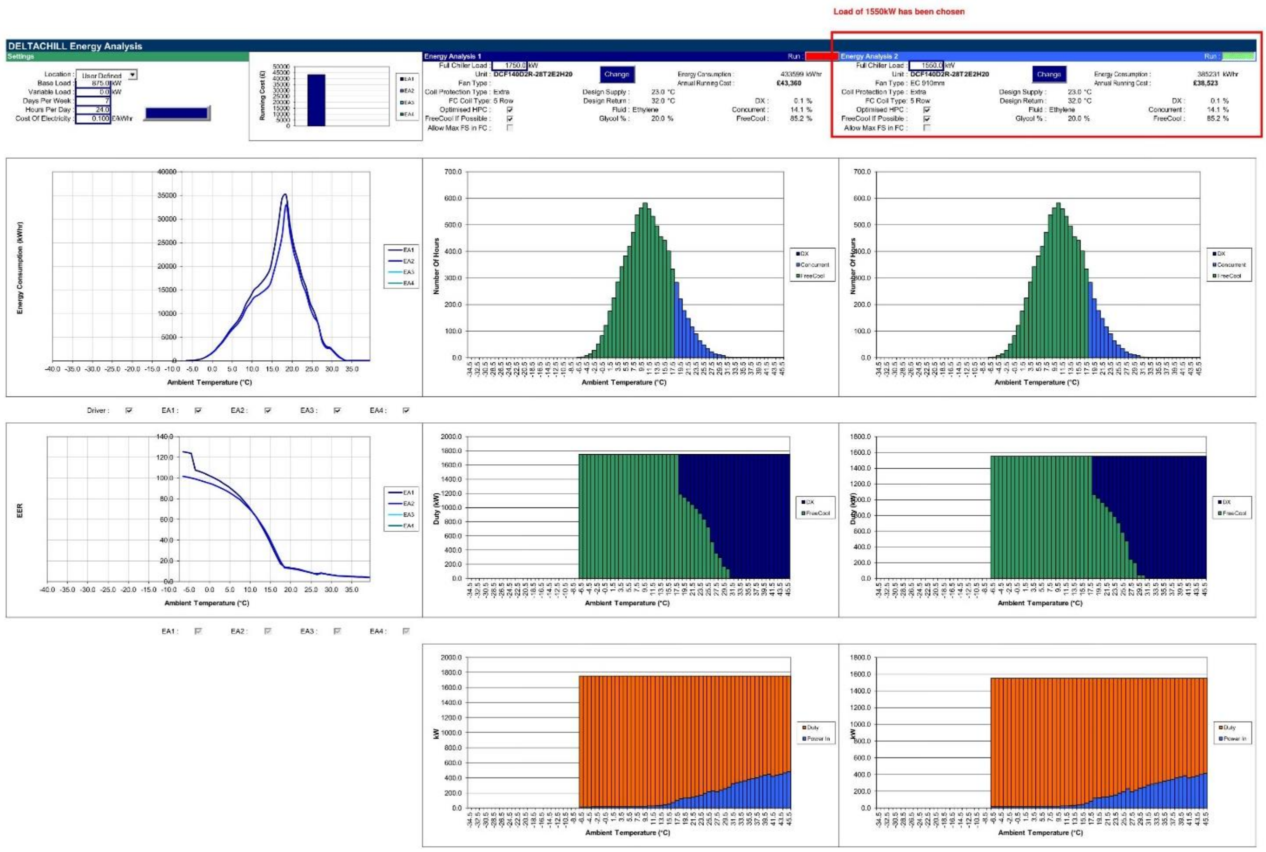
CO_2 emission and primary energy factors for grid-displaced electricity, except that generated by PV Systems												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
$KgCO_2$/ kWh	0.163	0.160	0.153	0.143	0.132	0.120	0.111	0.112	0.122	0.136	0.151	0.163
CO2 emission and primary energy factors for grid-displaced electricity by generation from PV systems												
$KgCO_2$/ kWh	0.196	0.190	0.175	0.153	0.129	0.106	0.092	0.093	0.110	0.138	0.169	0.197

This carbon factor gives the following CO_2 emissions:

TABLE 14: CALCULATED CO_2 EMISSIONS BASED ON CIBSE TM54

	CIBSE TM54 CO_2 EMISSIONS
Total CO_2 emissions during operation (tonnes/year)	22,066

APPENDIX A: COOLING CALCULATION FROM AIREDALE



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