Euston Tower

Predictive Energy Assessment

Contents

1. Executive Summary

This Predictive Energy Assessment is a supplemental report to the Energy Statement. This report describes the methodology used during the predicted energy assessment of the Proposed Development of Euston Tower, in line with the requirements of GLA 'Be Seen' guidance. For further details on policy and requirements, please refer to the main body of the Energy Statement.

The results from this assessment have formed the basis of the Whole Life Carbon Assessment submitted for planning, as well as the 'Be Seen' energy consumption that is reported in the main body of the Energy Statement.

2. Model Construction

2.1 Choice of modelling tool and approach

For this project, the DSM tool IES <Virtual Environment> was used to estimate the operational energy consumption of the building under expected conditions, using an hourly resolution over a year.

DSM tools provide a holistic estimate of energy use as they consider the variation of energy consumption over time by simulating the dynamic relationship between the building form, fabric, external weather, occupants, usage patterns. The HVAC plant can also be developed either as part of an existing dynamic simulation template (simple HVAC Modelling) or through separate HVAC modules specified at a component level (Detailed HVAC Modelling).

Since this project is at RIBA Stage 2, an initial operational energy model has been set up using the simple HVAC modelling approach. As the design progresses to stages 3 and onwards, a more detailed HVAC modelling methodology will be developed to inform the design process.

Dynamic simulation models require a range of different input parameters to be able to provide detailed outputs and accurate insights into building performance. Further information about the input data can be found in following sections.

2.2 Weather File

The Proposed Development is located on Euston Road, in the London Borough of Camden, therefore the London Test Reference Year (TRY05) weather data was used as a reference for the external ambient conditions the building will experience.

In this development cooling is anticipated to be the dominant load, therefore the overall energy use will be highly dependent on external conditions. The impact of the weather is included in the sensitivity analysis.

2.3 Model geometry

The building geometry and the context of the Proposed Development was modelled within IES using Stage 2 design drawings – snapshots of the 3D model geometry are shown in Figure 1

The entire Office Building was modelled to allow detailed energy analysis throughout the building. The Part L modelling described within the main body of the Energy Statement was based on a full building model.

Internal layouts were generated for different areas of the buildings according to their function as well as their different loads, solar gains, and usage patterns. The main office floor plate is divided into four perimeter zones (North East, North West, South East and South West) and two internal zones (North and South).

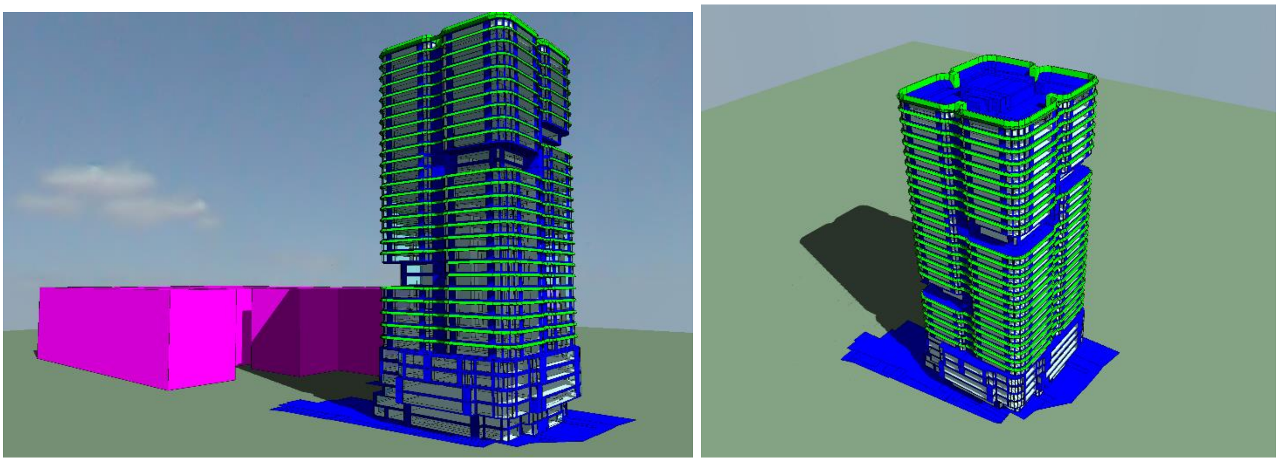

Figure 1 – Snapshots from 3D energy model

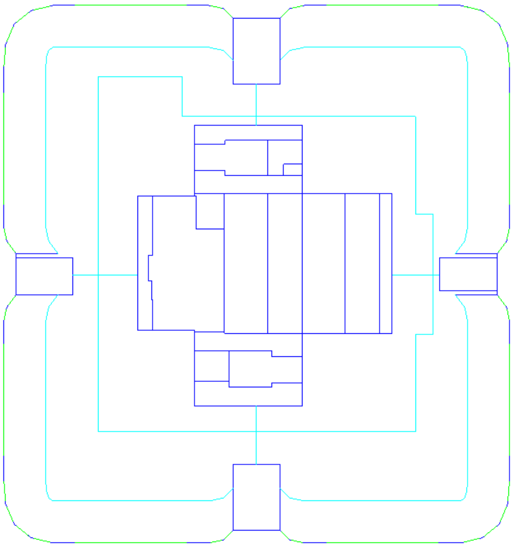

Figure 2 – Internal zones on a typical upper level in the office tower

2.4 Façade thermal performance

Façade performance is as described within the Be Lean chapter of the Energy Statement.

3. Scenario Methodology

3.1 Scenario testing: low-end, mid-range and high-end

Different low-end, high-end and mid-range scenarios were tested alongside the baseline cases, representing the design intent of the Proposed Development at this stage. Each was tested to give an indication of the range of variation in a building's performance due to various uncertainties.

- Baseline cases: these scenarios represent the current design intent most accurately. A scenario where the building is fully occupied by office tenants was chosen to compare against the current design intent where the building is also partially occupied by lab tenants. These scenarios use the current design estimates and allowances.
- Medium Office/Lab: the best estimate of the energy use based on the occupancy estimates from the prospective occupants using more less energy intensive assumptions for the building's power allowances.
- High-end and low-end scenarios: generated by considering the uncertainties on opposing ends from the baseline for key parameters.

The scenarios in Table 1 were to represent ranges in the variables that are least certain or have a have a high influence on performance.

Table 1 – Summary of test scenario inputs

	Low-end	Medium Office/Lab	Baseline Office	Baseline Office/Lab
Tenancy	All office	Office + Lab	All office	Office + Lab
Office occupancy density (m^2 per person)	1: 10	1:8	1:8	1:8
Lab occupancy density (m^2 per person)	-	1:20	-	1:12
Plant operation hours	Refer to Table 3 *Low*	Refer to Table 3 *Medium (Baseline)*	Refer to Table 3 *Medium (Baseline)*	Refer to Table 3 *Medium (Baseline)*
Office small power*	13.5 W/m^2 (BCO 2023)	13.5 W/m^2 (BCO 2023)	20 W/m^2 (BCO 2019)	20 W/m^2 (BCO 2019)
Lab small power	-	90 W/m^2	-	90 W/m^2
Lift energy controls	Incorporating ECO controls and regenerative braking	Standard	Standard	Standard
Weather file	London_TRY	London_TRY	London_TRY	London_TRY

*Includes tenant tea point allowances

4. Model Assumptions

4.1 Internal gains and associated energy uses

Internal heat gains are generated by the activity of occupants as metabolic heat, by electrical devices, or by thermal emission of artificial lighting.

The internal heat gains from occupants, equipment and processes within the building were included in the model to accurately calculate the energy use associated with heating, cooling and distribution systems.

4.1.1 Occupancy Factors

The occupancy density and pattern can have a significant impact on the building's energy use. Future occupiers are not known at this design stage, therefore different occupancy scenarios where defined and tested.

In different tested scenarios the design occupant densities were combined with the workstation density and real diversity or utilisation factors (the average proportion of staff that are in the office at any one time) as shown in Table 2.

Table 2 – Modelled occupancy factors

Parameters	Low	Medium (Baseline)
Design Occupant Density	10 m^2/person	8 m^2/person
Workstation Diversity	70%*	70%*
Occupant Diversity	70%*	70%*

*Based on NABERS DfP as referenced within CIBSE TM54 Guidance

4.1.2 Operating Hours

The building's operating profile is defined both by its operating hours and by the extent of the out-of-hours activity. The intended hours of operation of the plant and equipment are also needed to accurately calculate the energy performance of the building. Table 3 shows the operating hours assumptions that were tested.

Table 3 – Modelled operating hours

	Low	Medium (Baseline)
Occupancy, small power & lighting	**Mon – Fri:** 8am to 6pm **Sat:** 9am to 12pm **Sun:** None	**Mon – Fri:** 8am to 6pm **Sat:** 9am to 12pm **Sun:** None
Reception Plant, Basement Plant and Servers	**Mon-Fri:** 24/7 **Sat:** 24/7 **Sun:** 24/7	**Mon-Fri:** 24/7 **Sat:** 24/7 **Sun:** 24/7
Plant Operating Hours	**Mon – Fri:** 7am to 7pm **Sat:** 11am to 1pm **Sun:** None	**Mon – Fri:** 7am to 7pm **Sat:** 9am to 1pm **Sun:** None

4.2 Internal lighting gains and controls

The internal lighting and their control strategies have been modelled for all spaces within the building to estimate an accurate lighting energy use. Table (9) shows the lighting power breakdown that was implemented in each of the different building zones. For landlord areas, it has been assumed that the lighting operates on a time switch profile from 08.00 to 20.00.

Table 4 – Modelled lighting power

Building Zones	Lighting Power Density (W/m²)	Control Type
Office	5.5	PIR Sensor
Lab enabled	5.5	PIR Sensor
Public Facing	6	PIR Sensor
Circulation	6	PIR Sensor
Retail	6	PIR Sensor
Showers/ Changing	6	PIR Sensor
Cycle Store	6	PIR Sensor
Plantrooms	6	PIR Sensor
WC	6	PIR Sensor

4.3 Lifts and escalators

Estimation of the annual lift energy consumption is shown in Table 5 and has been based on the *BS EN ISO 25745-2:2015: Energy Performance of lifts, escalators and moving walks. Energy Calculations and classifications for lifts (elevators).*

Table 5 – Calculated lift energy consumption

Type	Number	Annual Energy Consumption (kWh)
General Lifts	13	282,985
Goods Lifts	5	147,117
Other Lifts -	4	53,405
Escalators	5	105,040

4.4 Catering

Estimation of catering consumption is shown in Table 5 and has been based on the *Restaurants, Clubs and Bars: Planning, Design and Investment for Food Service Facilities (Lawson 1995)* as references within *CIBSE TM50: Energy efficiency in commercial kitchens (2021)*

Table 6 – Calculated catering energy consumption

Catering Type	Meals Per Year	Annual Energy Consumption (kWh)
Coffee Shop/ Restaurant	198,616	170,810

4.5 Small power gains and profiles

Benchmarks from the British Council for Offices (BCO) guide to specification, key design criteria (BCO, 2023) and NABERS UK guidance (2020) among others were used to extract a range of small power loads.

The energy use from other equipment such as communal small power (e.g., printers), small catering equipment (e.g., fridges), local kitchen areas and tea points (e.g., microwaves) were also considered in the calculations and are accounted for within the values stated in Table 7. Lab enabled equipment loads have been derived from industry best practice guidance (BCO Science Guide 202 /BL Guide 2022).

It should be noted that out of hours consumption was allowed for, with equipment operating at 25% out of main office hours.

Table 7 – Modelled small power load

Small Power Load (W/m^2)	Low-end	Medium Office/Lab	Baseline Office	Baseline Office/Lab
Office Equipment Load	13.5	13.5	20	20
Lab Enabled Equipment Load	-	90	-	90

4.6 Server rooms

The building includes 10no. satellite equipment rooms containing servers with a rated power of **3.2 kW** on upper levels of the building. These rooms are equipped with local cooling, therefore their energy consumption was considered in the energy model.

IT and server rooms were assumed to run **24/7.**

4.7 Domestic hot water usage

The domestic hot water (DHW) demand and profile was established using benchmarks from CIBSE Guide G (2014) as shown in Table 8.

Table 8 – Modelled domestic hot water consumption

Building Zone	Daily demand (l/person)	Storage per 24-hour demand (l)	Recovery Period (hour)
Office (Open Plan)	4	4.5	2.0
Lab Enabled	4	4.5	2.0
Changing/Showers	3	3	2.0
Retail	Considered within general power allowance to retail spaces		

4.8 Mechanical ventilation

The majority of the building zones will be mechanically ventilated with a mechanical ventilation system providing the required fresh air to maintain adequate indoor air quality and thermal comfort. The following air-flow rates were used, in line with the proposed building specification.

Table 9 –Modelled ventilation rates

Building Zone	Air Supply Rate (L/s/person)
Office	3.65 ($l/s/m^2$)
Lab enabled	6 ACH
Public Facing	12

Circulation	0
Retail	12
Showers/ Changing	10 ACH
Cycle Store	0
Plantrooms	1 ACH
WC	5 ACH

4.9 Space heating: Setpoints, controls, generation, and distribution

The setpoint and setback temperatures for space heating shown in Table 10 are set consistently across the building zones with a sufficient dead band to avoid simultaneous heating and cooling. Figure 3 shows the annual heating load profile.

Table 10 – Modelled internal temperatures (winter)

Building Zone	Setpoint Temperature	Setback Temperature
Office (Open Plan)	20 ºC ± 2 ºC	16 ºC ± 2 ºC
Lab enabled	20 ºC ± 2 ºC	16 ºC ± 2 ºC
Circulation	18 ºC ± 2 ºC	N/A

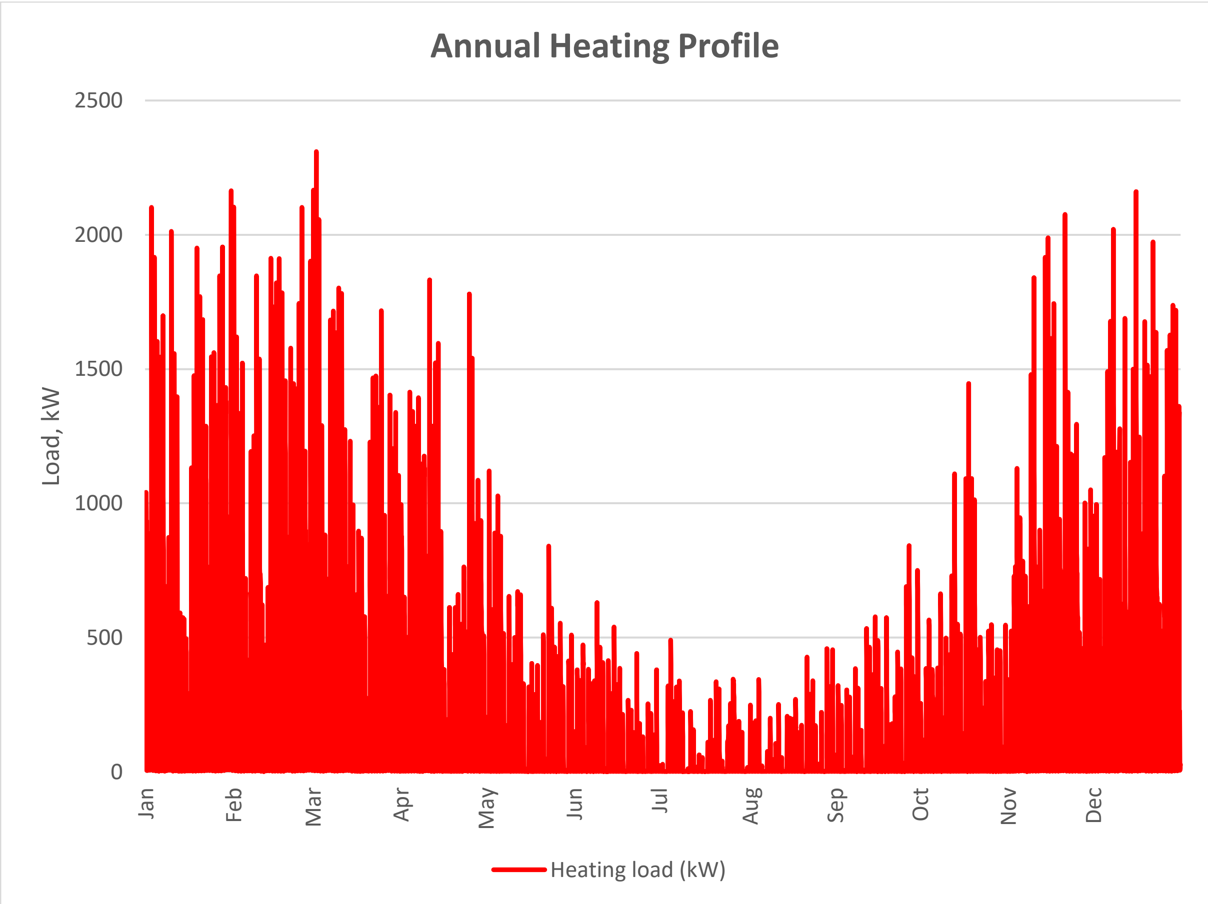

Figure 3 – Heating demand across the year

4.10 Space cooling: Setpoints, controls, generation, and distribution

The setpoint and setback temperatures for space cooling shown in Table 11 are set consistently across the building zones with a sufficient dead band to avoid simultaneous heating and cooling. Figure 4 shows the annual cooling load profile.

Table 11 – Modelled internal temperatures (summer)

Building Zone	Setpoint Temperature	Setback Temperature
Office (Open Plan)	24ºC ± 2 ºC	26ºC ± 2 ºC
Lab enabled	24 ºC ± 2 ºC	26ºC ± 2 ºC
Circulation	26 ºC ± 2 ºC	N/A

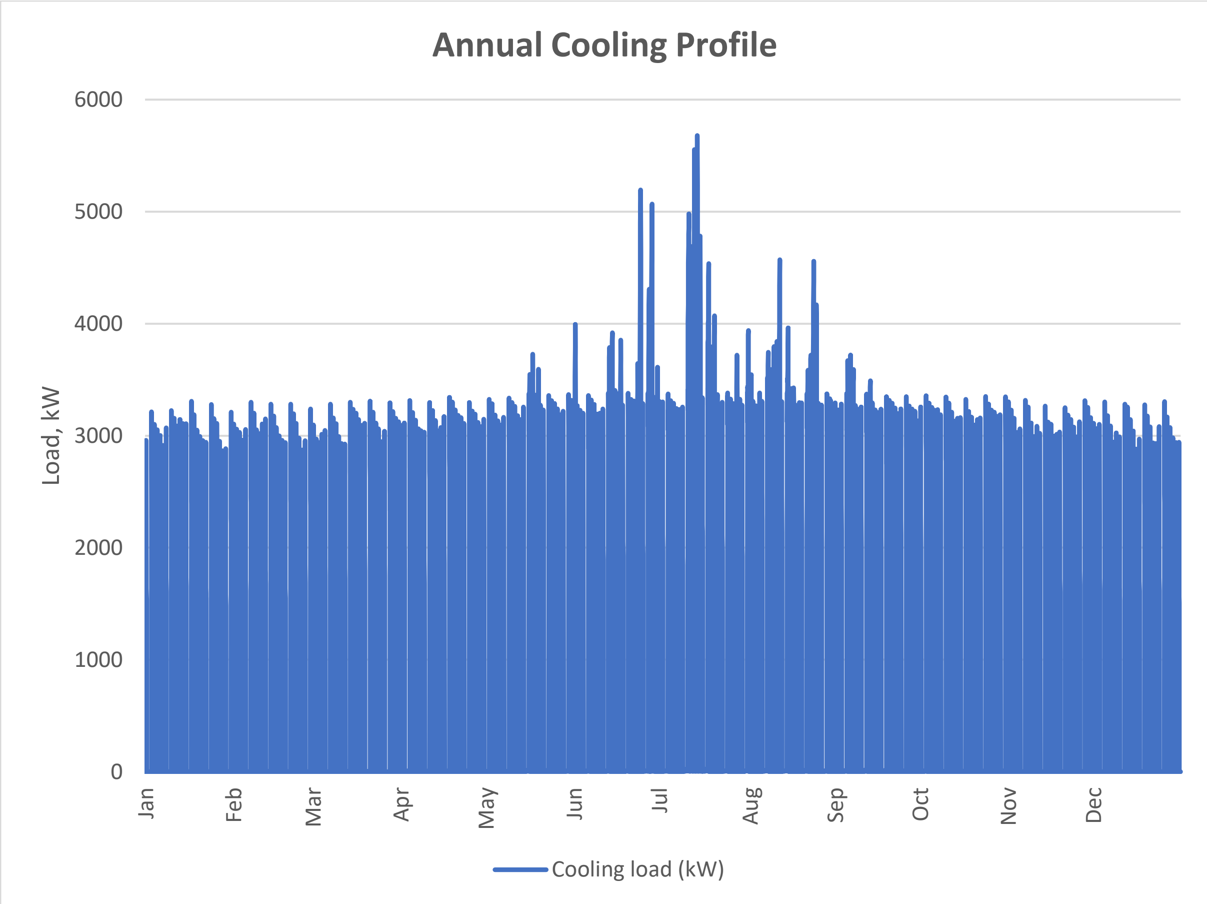

Figure 4 – Cooling profile across the year

5. Results and Conclusion

5.1 Baseline results

The results show that the most energy consumption is associated with ‘unregulated loads’ of equipment/ small power and therefore cooling, along with lifts and escalators (other). In this case, the equipment energy consumption is particularly high due to the requirement of the lab enabled spaces.

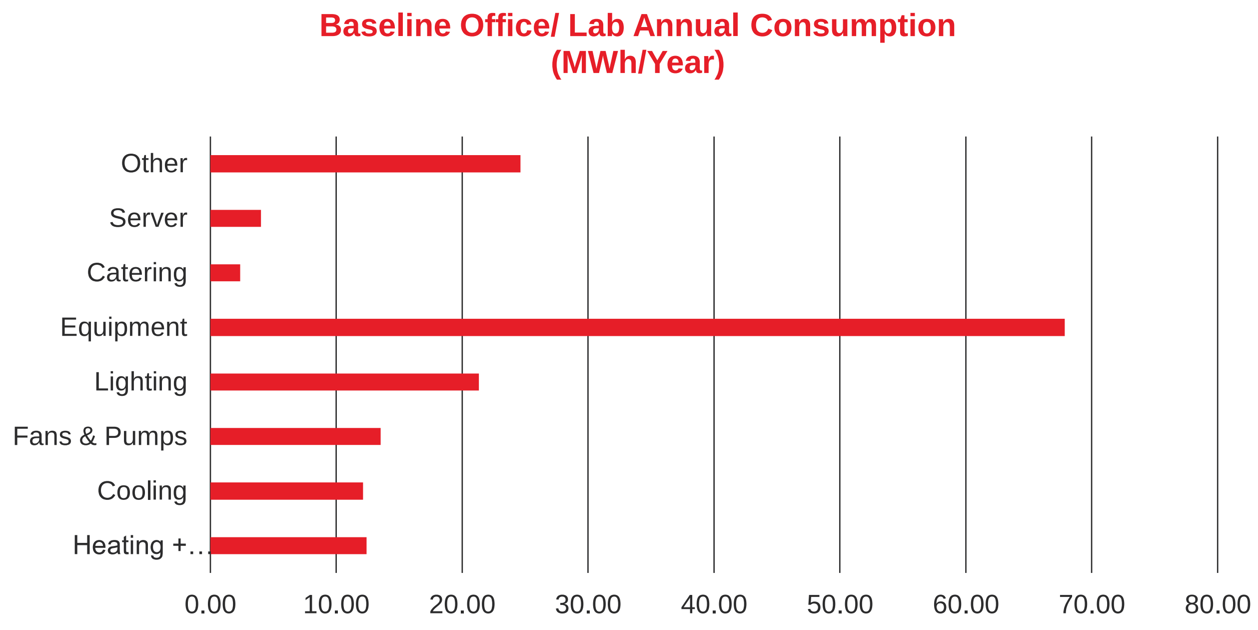

Figure 5 - Baseline energy consumption

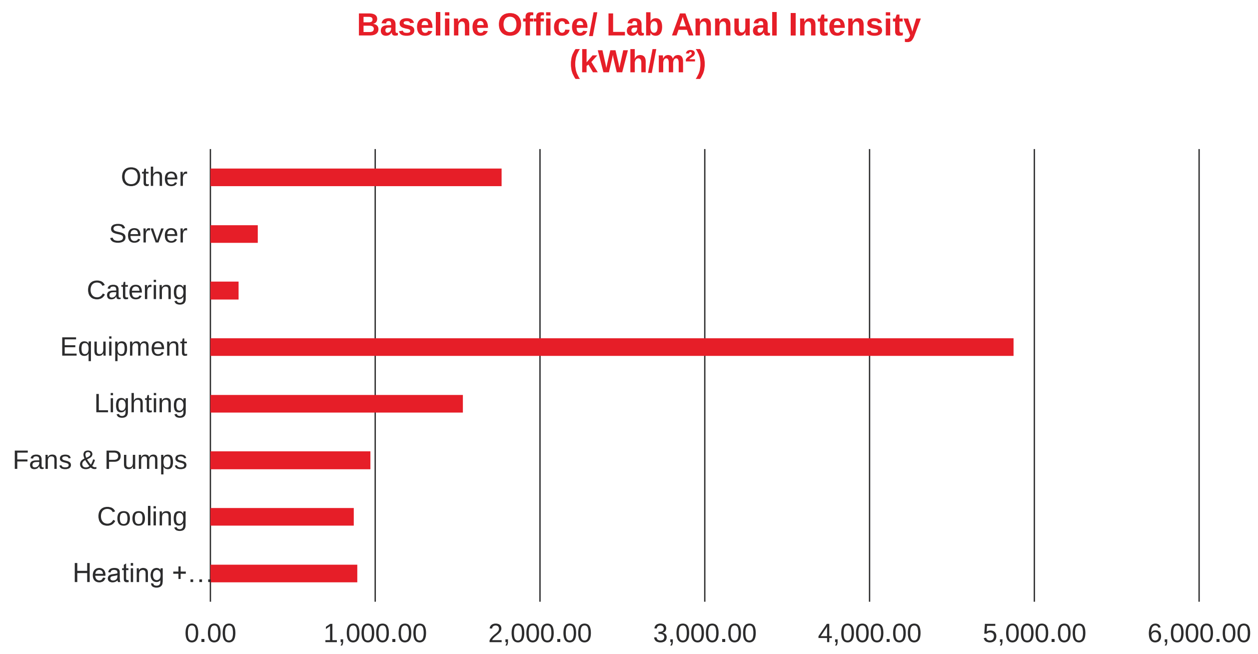

Figure 6 - Baseline energy intensity

Table 12 provides the split of regulated and unregulated energy use inline with the GLA requirement to provide consumption separately, which has been provided as an input into the Whole Life Carbon Assessment.

Table 12 - Regulated and Unregulated Energy Use

Baseline Office/Lab	Predicted Energy Consumption (MWh/yr)		
	Base Build	**Tenant**	**Total**
	6,002	5,364	11,366

5.2 Scenario testing results

The change from a lab-enabled spaces to all office scenario has the greatest reduction in energy consumption, mainly due to negating the heat loads associated with the lab equipment and therefore decreasing the cooling consumption. The medium scenario, which includes lab enabled spaces, also shows a significant reduction in energy consumption from equipment and cooling, due to reduced small power allowances. The changes in occupancy rates resulted in changes in lift energy. It is clear that the equipment is the leading energy consumer and therefore has the greatest impact on these scenarios.

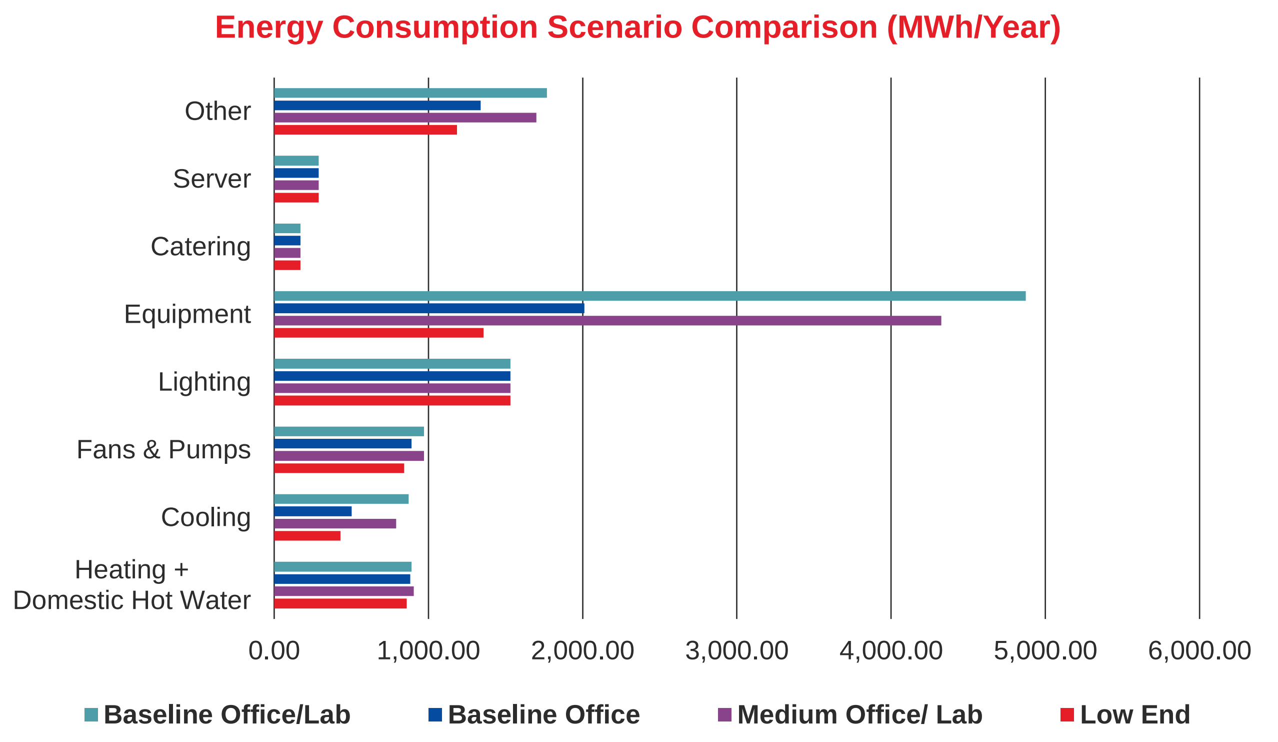

Figure 7 Total energy consumption by scenario

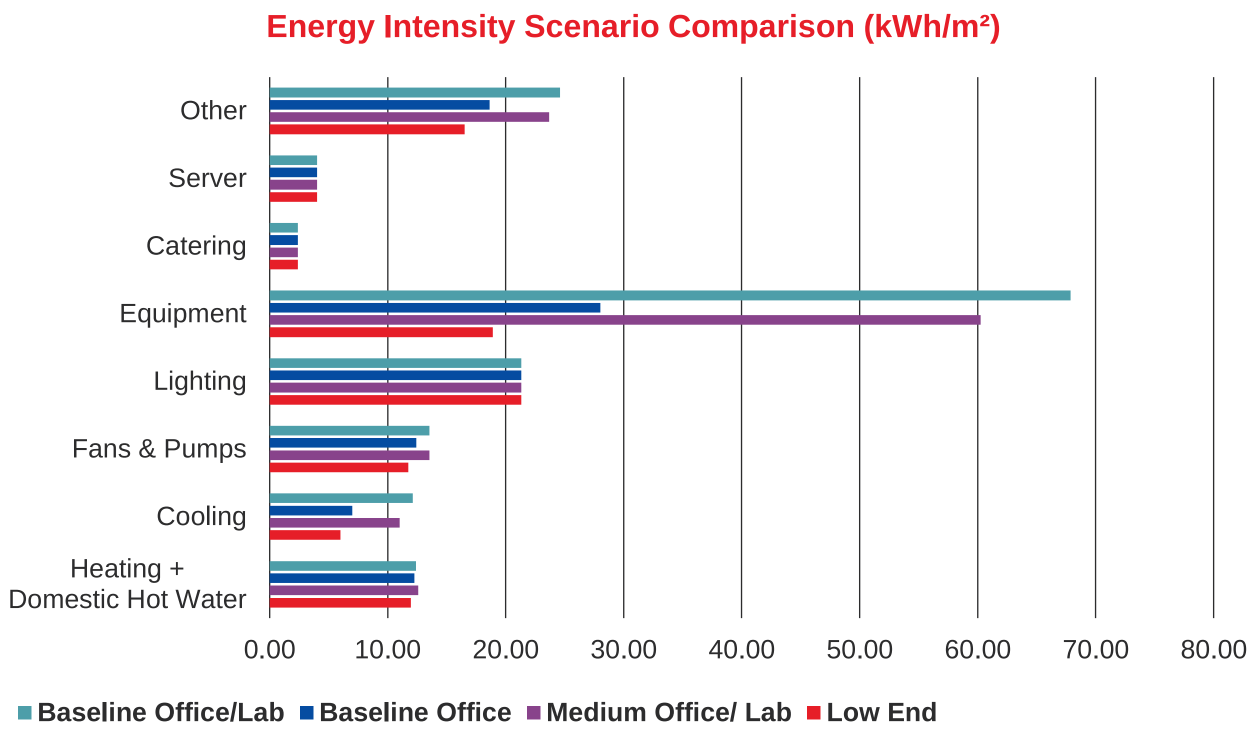

Figure 8 Total energy intensity by scenario

5.3 Be Seen results

The below figures show the absolute energy consumption of each scenario assessed for the Proposed Development as well as the relative energy use intensity.

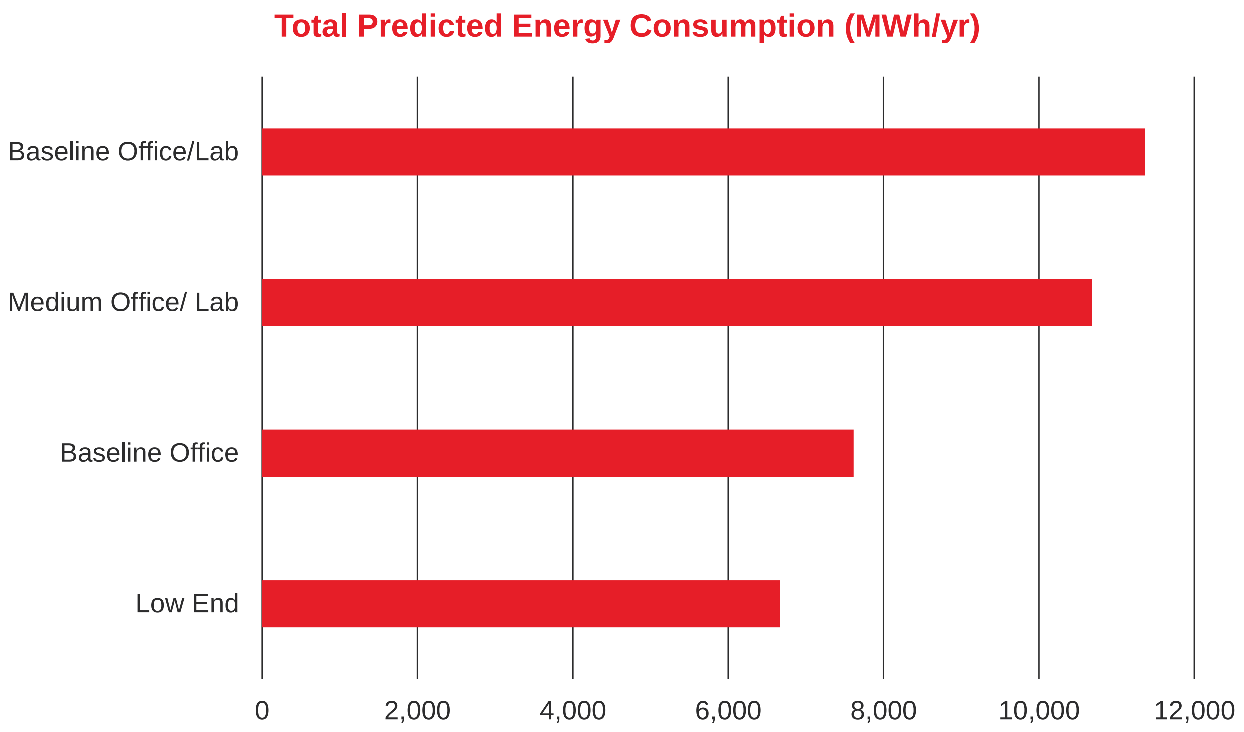

Figure 9 Predicted annual energy consumption per scenario for the Proposed Development

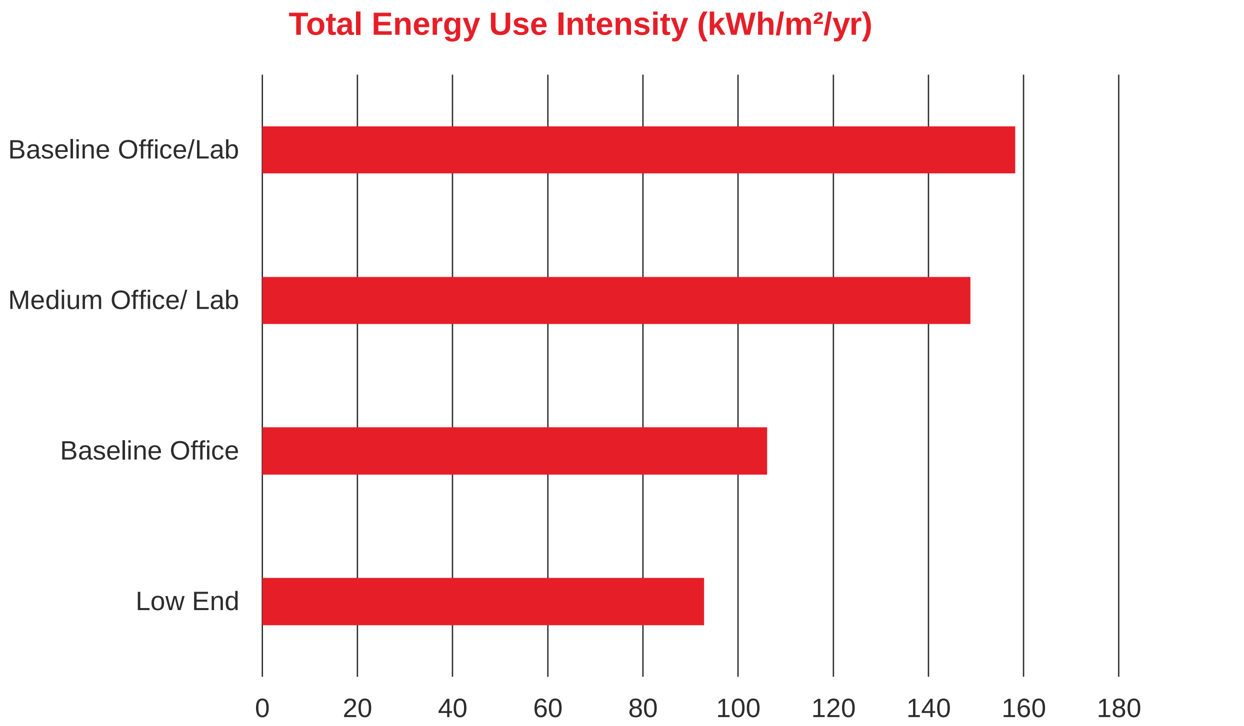

Figure 10 Energy Use Intensity per scenario for the Proposed Development

5.4 Next steps

5.4.1 Sensitivity analysis

Sensitivity analysis will be undertaken during Stage 3 design using the NABERS methodology. Several optioneering studies have been pre-selected to inform the design development.

- Simultaneous vs. reversable ASHP to determine greatest level of efficiency for the overall system.
- Assessment of 24 hour cooling circuit serving server rooms
- Analysis into the benefits of free cooling through natural ventilation and AHUs.

This list will be supplemented with additional sensitivity studies where appropriate, based on initial modelling results.