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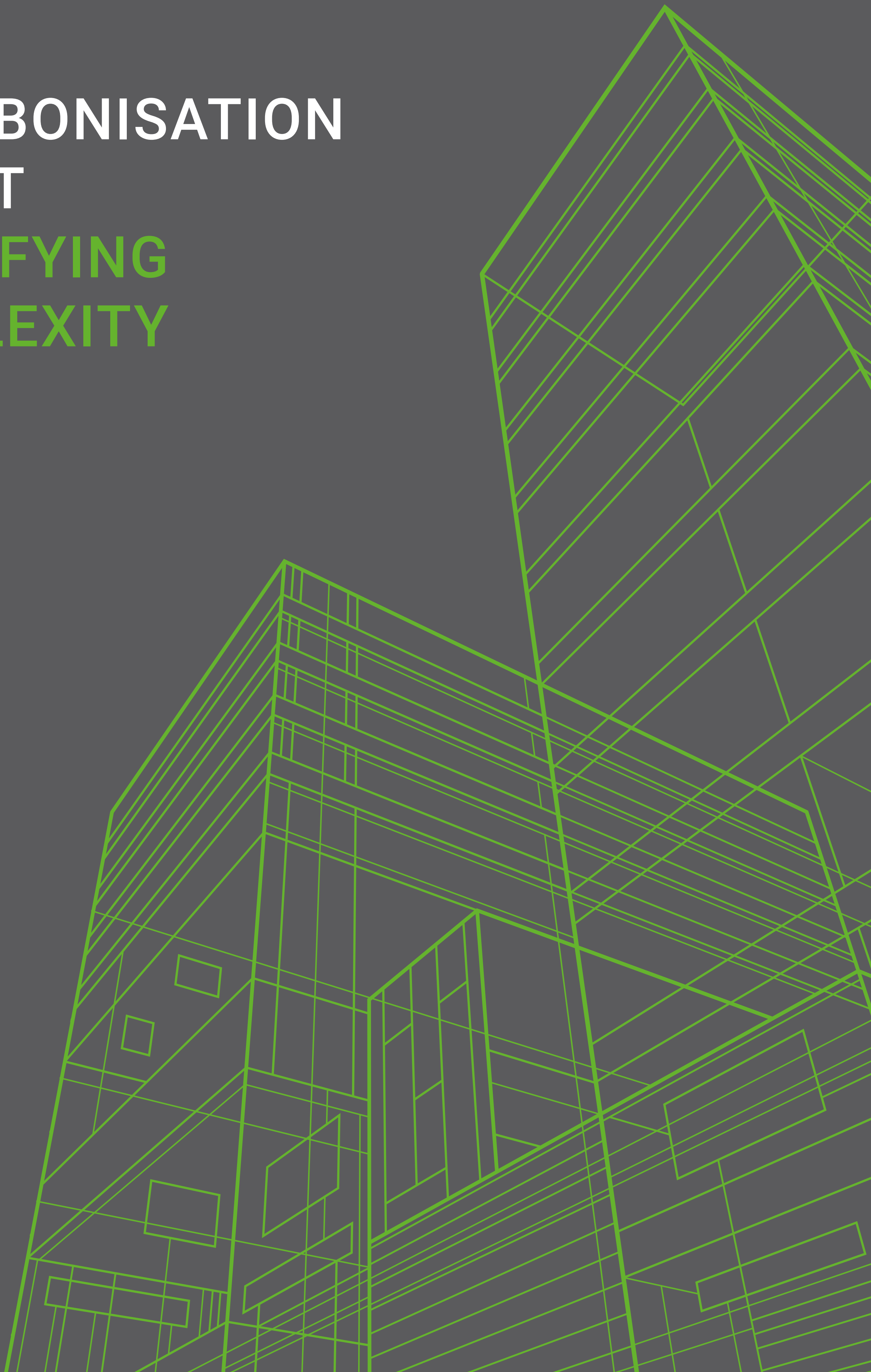
ESG, Environmental & Sustainability Consultants

ASSET DECARBONISATION REPORT

SIMPLIFYING COMPLEXITY



The way in which we define and govern Net Zero in respect of the UK's built assets is becoming clearer, with the well-established *UKGBC Net Zero Carbon Buildings: A Framework Definition* soon to be augmented by the development of the UK's first cross-industry *Net Zero Carbon Buildings Standard* that brings together Net-Zero Carbon requirements for all major building types.

The release of the revised *RICS Whole life carbon assessment for the built environment,* effective from July 2024 also brings a much-welcomed framework around the carbon impacts over the entire life cycle of a built asset, from its construction through to its end of life.

At Jones Hargreaves, we recognise the need to evolve and refine our approaches to the assessment of buildings and with this make the most of our multi-disciplinary approach.

We adopt a unique, integrated approach with energy consultants and sustainability professionals working hand in hand with our building services engineering and building surveying teams on every assessment. Our aim is to remove as many barriers and uncertainties associated with decarbonising commercial real estate assets as possible. Our approach is tailored to every building, ensuring each assessment and roadmap is focused on delivering real, verifiable outcomes.

With experience delivering projects of all scales and sizes we are able to simultaneously develop a roadmap for implementation, knowing that we have already assessed and validated likely constraints and barriers.

Above all we want our Clients to pick-up our reports and know exactly where they stand and what actions are required.

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In summary, our reports deliver the following:

- Establishing a baseline of both modelled and actual utilities consumption for the asset. This includes analysing the Primary Energy Demand (PED) and Energy Usage Intensity (EUI).
- Modelling not only focussed on energy consumption, but also performance of building fabric and balancing of heating and cooling loads in different climatic conditions.
- Using the data to baseline operational emissions with the CRREM Risk Assessment Tool to determine the assets current decarbonisation pathway and relative 'stranding' date.
- Undertaking an optioneering and feasibility assessment to determine appropriate measures to improve efficiency, reduce energy demand and decarbonise utilities consumption. All options are benchmarked according to impact on energy & carbon reduction, and cost.
- Payback periods are also calculated to determine ROI against effective lifespan and impact.
- Feasibility of integration of renewable energy will be assessed and modelled to provide recommendations for most suitable (and cost effective) solutions.
- Integration of certification such as BREEAM, NABERS (UK) and Energy Performance Certificates (EPCs).

With a vast amount of experience in project design and implementation, we can chart a clear path for implementing the most effective strategy for decarbonising an asset.

We appreciate the nuances and common constraints that are presented with respect to occupied operational assets, and therefore tailor our approach to minimise disruption and coordinate works in line with asset management priorities.

Example Report

For and on behalf of:

16-17 Little Portland Street, London
W1W 8BP

Jones Hargreaves

16-17 Little Portland Street
LONDON
W1W 8BP

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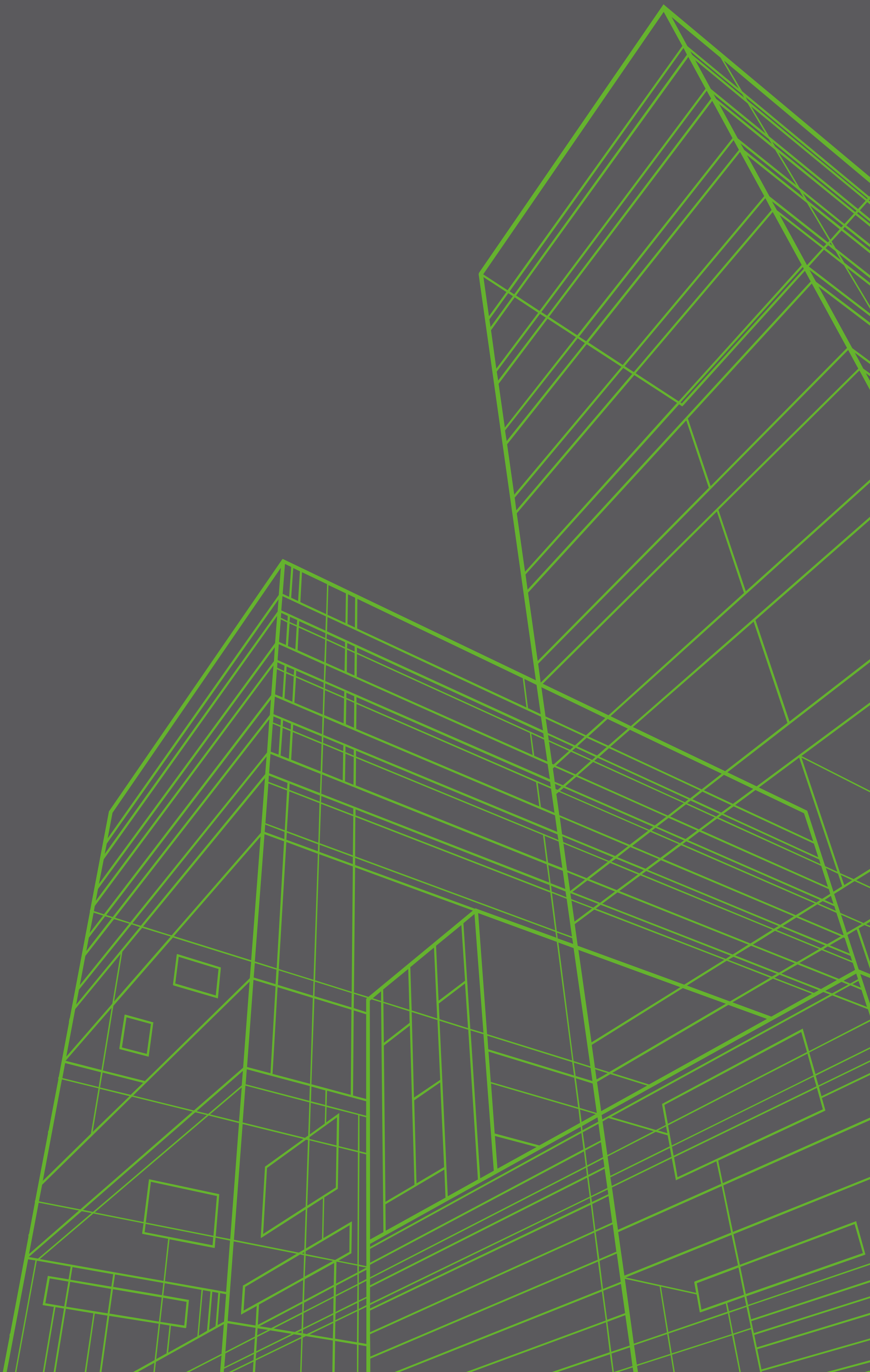
PART 1 - EXECUTIVE SUMMARY



1. Building Context

1.1 Introduction

1.1.1 This study is authored by a multi-disciplinary team of Chartered Building Services Engineers, Surveyors, Carbon Analysts and ESG Consultants and seeks to assess how energy efficiency can be improved at *The Property, Location*. It outlines a range of dynamic, coordinated and fully costed adaptations to the building that aim to reduce peak heat load (heating plant size) and reduce annual energy consumption, both necessary for *The Client* to meet their fund 'net zero by 2040' ambition.

1.1.2 The report works in parallel with a separate specialist report prepared via the Jones Hargreaves Building Services Team scoping a redesign of the building systems and services. Recommendations from this work have been considered and incorporated into this assessment.

1.1.3 *The Property* is an open-plan office building on five levels and lower ground level carpark and was originally designed to accommodate 800 occupants. There is one central full-height atria with glazed rooflights, and the property is partially stripped out. The building has a flat roof.

1.2 Building Summary

1.2.1 This section provides an overview of the existing main property characteristics and known data points which are utilised to provide the benchmark for the subsequent analysis contained within this report.

1.2.2 Building Baseline Data

Building Size:	GIA 121,850sqft (11,320sqm)
Construction date:	2005
Operating hours:	0600 hrs to 2000 hrs
Target internal winter temperature:	20 - 24°C[1]
Gross internal floor area:	121,850 sq. ft. (11,320 sq. m.)
EPC rating:	E 121
Total annual gas consumption[2]:	0 kWh
Total annual electricity consumption[3]:	461,012 kWh
Energy use intensity:	239.31 kWh/m2 per year
Building emission rate:	23.80 $kgCO_2/m^2$ per year
Estimated annual (combined) energy usage:	1,814,422 kWh
Estimated annual (combined) emissions:	54.66 tCO_2 per year
Carbon Risk Real Estate Monitor (CRREM) Stranding Date[4]	2035

[1] The CIBSE (Chartered Institution of Building Services Engineers) recommends a range of acceptable conditions for room temperature of 20ºC to 24ºC operative temperature.
[2] Figures skewed due as property has remained vacant for a number of years due to impacts of Covid.
[3] Figures skewed due as property has remained vacant for a number of years due to impacts of Covid.
[4] Baseline derived from modelled consumption assessed against CRREM and the SBTi aligned decarbonisation pathways.

1.2.3 Property Description

1.2.4 The property comprises a purpose-built, semi-detached office building located in a prominent position on *The Street*, London. The property dates from 2005 and is reported to extend to GIA 121,850sqft (11,320sqm).

1.2.5 The building is on a sloping site and extends to basement, lower ground, ground and four upper storeys, with a central glazed atrium. Entrance to the building is via a revolving door off *The Street* and level entry off *The Hill*. Vehicular access is available to the basement via a service yard and car park accessed off *The Lane*.

1.2.6 Heating is provided by 3no. gas-fired Boilers located in a dedicated Basement plantroom. The LTHW is circulated via 2no. circulating pumps installed in duty/standby configuration and is complete with a pressurisation system and dosing pot for closed water treatment. The LTHW is circulated to serve the heating coil within the main office Air Handling Units (AHU), four-pipe Fan Coil Units (FCU) and radiators throughout the building.

1.2.7 Cooling is provided by 2no. Trane Chillers installed within the roof plant enclosure. Chilled Water (CHW) for the AHU and FCU circuits is produced by an Emerson Network Power air-cooled chiller located on the external plant compound. The CHW is circulated via 2no. circulating pumps installed in duty/standby configuration and is complete with a pressurisation system and dosing pot for closed water treatment. Additional comfort cooling for the tenant's communications room is provided by split Direct Expansion (DX) systems.

1.2.8 Mechanical ventilation to the offices is provided by the landlord's supply and extract AHU located within a dedicated Basement plantroom. The supply and extract fans are both afforded inverter speed drives to facilitate part load operation. A dedicated toilet extract fan is provided at roof level within the external plant compound to serve the WCs and showers.

1.2.9 The lighting in the building is served mainly by fluorescent luminaires. The main office floor plates are served by recessed linear Zumtobel, T16 fluorescent, 49W Slotlights. The office perimeter and WC areas are served by fluorescent downlighters. The stair cores are served by fluorescent wall mounted bulkhead fittings. The back of house and plant areas have impact resistant luminaires installed throughout. The main entrance utilises fluorescent downlighters, uplighters and spotlights and the central atrium has floodlights at first floor and high level.

1.2.10 The main office areas, back of the house and plant areas are generally controlled via presence detection. The lighting control for the site is provided by Simmtronic and Lighting Control Modules throughout which supply the inputs and outputs of the lighting.

1.3 Headline Energy and Carbon Analysis

1.3.1 The building performs poorly against benchmarks for this age of facility and the facilities and building services appear to be in variable condition.

1.3.2 The gross internal area used to report against benchmarks is larger than the intensely occupied office space. This means that the energy consumption per metre squared may be undercounted when compared to benchmarks.

1.3.3 The building, although vacant and partially stripped out, would in normal operation have been maintained at consistent internal temperature with large heating plant, therefore improvements in building fabric efficiency are likely to translate directly to energy and carbon savings.

1.3.4 Lighting and space cooling are the largest sources of carbon emissions identified in operational modelling (see 1.2.6).

1.3.5 Lighting is the largest energy use at *The Property*, and the largest source of carbon emissions. By extension, cooling the office building is the second largest single source of carbon emissions, and therefore presents one of the largest potential target opportunities for reducing carbon emissions.

Elevation view of the Example Report

1.3.6 Energy Usage Intensity Breakdown (Modelled Baseline)

Building Services Element	kWh/m²	% contribution to overall emissions
Heating	19.94	18
Cooling	49.76	27
Auxiliary[5]	39.80	23
Lighting	51.68	30
Hot Water	3.14	2
Total	**164.32**	

1.3.7 As outlined above, the headline analysis indicates that the lighting and cooling loads for the property are considerable and represent the two largest single sources of operational (carbon) emission from the building. When comparing the results of the analysis to the building configuration, it is evident that the lower floors do not benefit from the same level of natural light as those above, whilst the upper floors are exposed on three sides to considerable solar gain. These observations are consistent with the outcomes of the initial modelling.

1.3.8 Auxiliary and Heating are also both notable contributors to the emissions profile of the building. In the case of emissions attributed to Auxiliary features, this is thought to be related to the building's former use as a bank whereby a large data centre (with high electrical demand) was present on the upper ground floor.

[5] Ventilation (mechanical ventilation from AHUs, toilet extract etc), is included under auxiliary.

1.3.9 In summary, the asset requires an overhaul of building services and now out-dated technologies whilst consideration for the building fabric, particularly with respect to addressing potential solar gain issues, is required.

1.4 Specific Survey Limitations

1.4.1 Building Record Information

1.4.2 The property is currently vacant. The building has been partially stripped out, with lighting, part ceilings, carpets and toilets having been removed. Services have been partially decommissioned.

1.4.3 Considering the above, we received an incomplete (and unrepresentative) dataset of utilities consumption data for the asset, and this has been highlighted within our assessment in order to fully inform our subsequent calculations.

1.4.4 Access

1.4.5 It was not possible to undertake intrusive investigations of building fabric and insulation materials. It is anticipated that such works could form a part of the validation surveys prior to refurbishment.

1.4.6 In the event that intrusive surveys are undertaken, and insulation materials and performance are established, the modelling will be revisited to reflect findings of such investigations.

1.5 Existing Building Fabric Overview

1.5.1 The following section provides an overview of the assumed u-values assigned to different elements of the building fabric serving *The Property Name*.

Fabric Element	Overview	U-values W/m²K	Estimated Heat Loss kWh/m²/yr
Ventilation / Infiltration	There are identified heat losses associated with deliberate and incidental air exchange. The current ventilation system has no heat recovery element and given the large air flow required, it contributes to circa 80% of the ventilation / infiltration energy loss. The infiltration rate is unknown and estimated from fabric condition (defects) and model calibration.	-	37.7 (37%)
Cavity Walls	Construction: Brick faced cavity wall (50mm cavity). Stonework cavity wall (80mm cavity).	- 1.0 1.1	30.6 (30%)
Glazing	Construction: Aluminium frame (not thermally broken) double glazing with 12mm air filled cavity and cold edge spacer.	- 2.9	17.5 (17%)
Roof	Construction: Flat Roof.	- 0.8	10.4 (10%)
Floor - Soffit	Construction: Reinforced concrete waffle slab between ground floor and carpark. Slab on grade.	- 1.6 - 2.5 1.5	-

1.5.2 A calibrated baseline model

1.5.3 The Design Builder Energy Plus calculation has been calibrated against an estimated space heating demand derived from the measured electricity and gas consumption.

1.5.4 Excluding system losses and efficiency

1.5.5 To focus on the building fabric the space heating demand has been used to calibrate the energy model. This is the total amount of heat provided to all rooms by the heating system and can be used, acceptably, as a proxy for fabric efficiency.

1.5.6 In the absence of specific metering the space heating has been estimated from the building consumption.

1.5.7 Carbon emission factors

1.5.8 For comparing the reduction in carbon emissions of fabric improvements against the baseline year of 2019 we have used the average carbon emissions factor for electricity from 2019, reported in the HM Treasury Greenbook: 0.2556 kgCO2e/kWh.

2. Summary of Proposals

2.1 Recommendations

2.1.1 It is advised that the following recommendations are taken into consideration with a view to improving the energy performance and reducing carbon emissions for the building asset.

Option	Works	EPC Rating (Impact)	Annual Energy Consumption (kWh/annum)	Annual CO_2 Emissions (tCO_2/annum)	Estimated Energy Savings (kWh/annum)	Estimated CO_2 Emissions Savings (tCO_2/annum)	Percentage CO_2 Emissions Reduction (over base building)	Budget Costs	Cost per Tonne CO_2 Saved per annum	Payback
	Base Building	E	763,331.52	121.71						
1.	**Building Fabric**									
1.1	No building fabric measures to be considered until meeting with Architect and Structural Teams has been conducted to review planning constraints within existing application.									
2.	**Heating, Ventilation and Air Conditioning Systems**									
2.1	Replace gas heaters with VRF.[6]	High	606,285.37	84.21	157,046.15	37.50	31%	£270,000.00	£7,200/tCO_2	

[6] VRF COP/EER 3.75

Option	Works	EPC Rating (Impact)	Annual Energy Consumption (kWh/annum)	Annual CO_2 Emissions (tCO_2/annum)	Estimated Energy Savings (kWh/annum)	Estimated CO_2 Emissions Savings (tCO_2/annum)	Percentage CO_2 Emissions Reduction (over base building)	Budget Costs	Cost per Tonne CO_2 Saved per annum	Payback
3.	**Lighting**									
3.1	Upgrade fluorescent lighting to LEDs.[7]	Low	711,629.80	115.16	51,701.72	6.55	5%	£89,000.00	£13,588/tCO_2	
4.	**Hot Water**									
4.1	No building fabric measures to be considered.	-	-	-	-	-	-	-	-	
5.	**Low Carbon Technology**									
5.1	Install Solar PV.[8]	High	198,796.42	50.45	564,535.10	71.26	59%	£945,000.00	£13,261/tCO_2	
6.	**All Measures**									
6.1	All works	Band A/A+	19,505.27	4.61	743,826.25	117.10	96%	£1,304,000.00	£11,136/tCO_2	

[7] Minimum LED lighting specification 100 lm/w.
[8] Minimum Solar PV 675kWp.

3. Building Energy and Emissions Overview

3.1 Building Performance Improvements

3.1.1 The potential performance improvements with respect to the designed performance of the building are outlined in the graph below, illustrating a significant reduction in both primary energy demand and modelled energy use.

	Baseline (Current Specification)	Improvements Applied	% Change
Primary Energy	239.31	54.04	77%
Modelled Building Energy Use	164.32	41.75	75%
BER	23.80	4.95	79%

3.1.2 Primary Energy Demand (PED) assesses the energy needed to be supplied to a building to provide heating and hot water as well as lighting, ventilation, cooling systems and showers. Expressed as kWh/m² per annum.

3.1.3 Energy use is the actual modelled energy use of components within the building. Expressed as kWh/m² per annum.

3.1.4 Building Emissions Rate (BER) is the modelled emission rate, which is the annual CO_2 emissions associated with the building operation. Expressed as $kgCO_2/m^2$ per annum.

3.1.5 A comparison of improvements in demand are provided below for reference:

Breakdown of Energy Demand by System	Baseline	Post-refurb
	kWh/m²	
Heating	19.94	5.46
Cooling	49.76	16.96
Auxiliary	39.80	6.18
Lighting	51.68	11.97
Hot Water	3.14	1.18

3.2 Impact on Decarbonisation Pathway

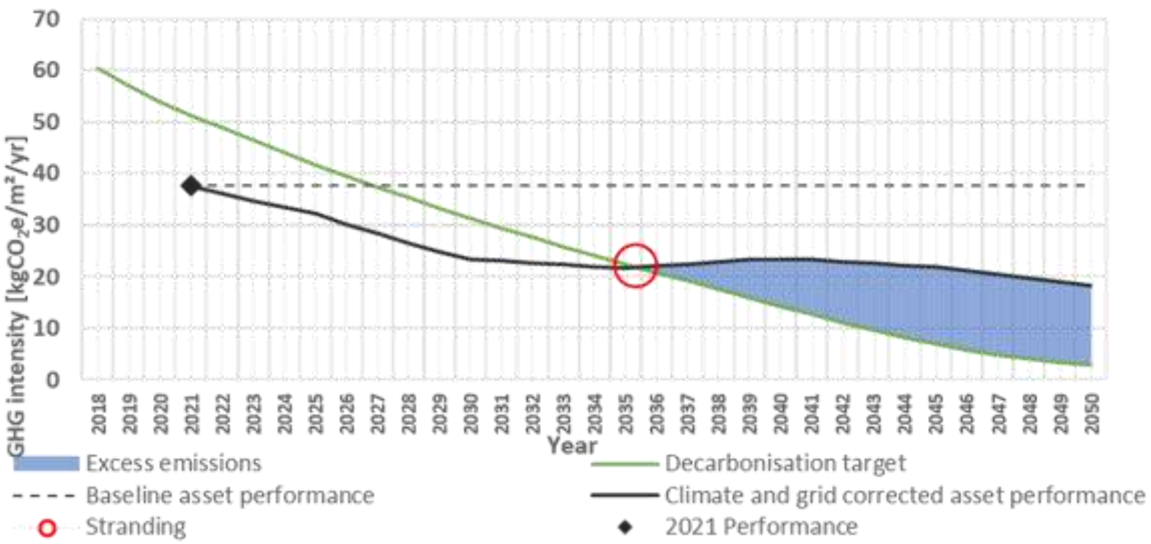
3.2.1 The Carbon Risk Real Estate Monitor (CRREM) is a transition risk measurement tool that provides decarbonisation pathways for different property types and geographies.

3.2.2 The CRREM is both sector-specific and maintains high levels of data granularity. It is an EU-based, open-source initiative with the objective of decarbonising the EU real estate sector and focuses on the financial risks associated with 'climate negligence'[9]. The tool assesses stranding risk and reports the financial implications and losses that arise from poor building energy performance.

[9] Climate change litigation, also known as climate litigation, is an emerging body of environmental law using legal practice to set case law precedent to further climate change mitigation efforts from public institutions, such as governments and companies. The ICC Commission Report '*Resolving Climate Change Related Disputes through Arbitration and ADR*' (ICC Taskforce Report) took a broad view of such disputes as including "*any dispute arising out of or in relation to the effect of climate change and climate change policy, the United Nations Framework Convention on Climate Change ("UNFCCC") and the Paris Agreement*".

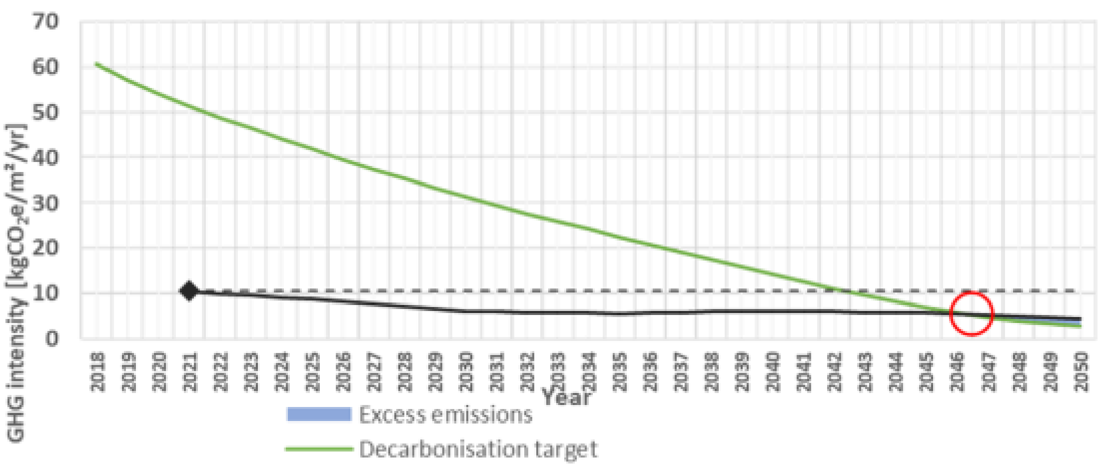
3.2.3 The CRREM provides the real estate industry with transparent, science-based decarbonisation pathways aligned with the Paris Climate Goal of limiting global temperature rise to +2°C, with ambition towards +1.5°C. Pathways for both scenarios can be applied alternatively.

3.2.4 CRREM Stranding Analysis – Baseline Specification



3.2.5 It is the performance gap shown (in $kgCO_2e/m^2$/year) that requires addressing through investment in building performance improvements. **In current configuration, the asset is forecast to be stranded from 2035**.

3.2.6 Net Zero Carbon Stranding Analysis – Post-refurbishment



3.2.7 Post-refurbishment, the asset is forecast to be stranded from 2046 which may align with future refurbishment cycles so that additional performance improvements can be made to align with Net Zero targets. Thus, the strategy outlined in this report provides another 11 years of useful occupation of the asset. Given the high-level assessment above, no concerns are raised with respect to the outcomes illustrated, which are typical for the type and age of the building in question.

4. Next Steps

4.1 Decarbonisation Strategy

4.1.1 We understand that the Client and their investors wish to consider the proposed enhancements in line with a broader refurbishment project aligned to their commercial strategy. As such, we propose that the next steps are to refine the strategy, including undertaking a preliminary assessment of fabric performance in line with the constraints identified in the fabric and cladding report.

4.1.2 Should the scope of fabric enhancements be expanded due to the requirement to remodel the upper floor of the building and address any potential issues with the existing façade then additional inspections and modelling will be undertaken to quantify potential improvements.

4.2 Feasibility Assessment

4.2.1 In order to examine the potential performance improvements of the building's services, then a full feasibility assessment will be required.

4.2.2 In this instance, the Jones Hargreaves MEP team would carefully examine the site constraints when undertaking the detailed feasibility assessment of installing the proposed systems for MEES and sustainability measures.

4.2.3 The key areas to investigate are plant space, plant distribution routes and available electrical capacity. The team will undertake a high-level space planning assessment to determine whether there is sufficient space for the new plant to be installed at the given site. The assessment will take into account existing services and planning conditions.

4.2.4 Redistribution of services will be key when implementing new technologies and therefore risers and routes will be investigated at a high level to ensure the proposed technology is feasible within the building. When higher capacity electrical loads are envisaged, a high-level assessment will be undertaken on the existing capacity and the potential to supply the new technology.

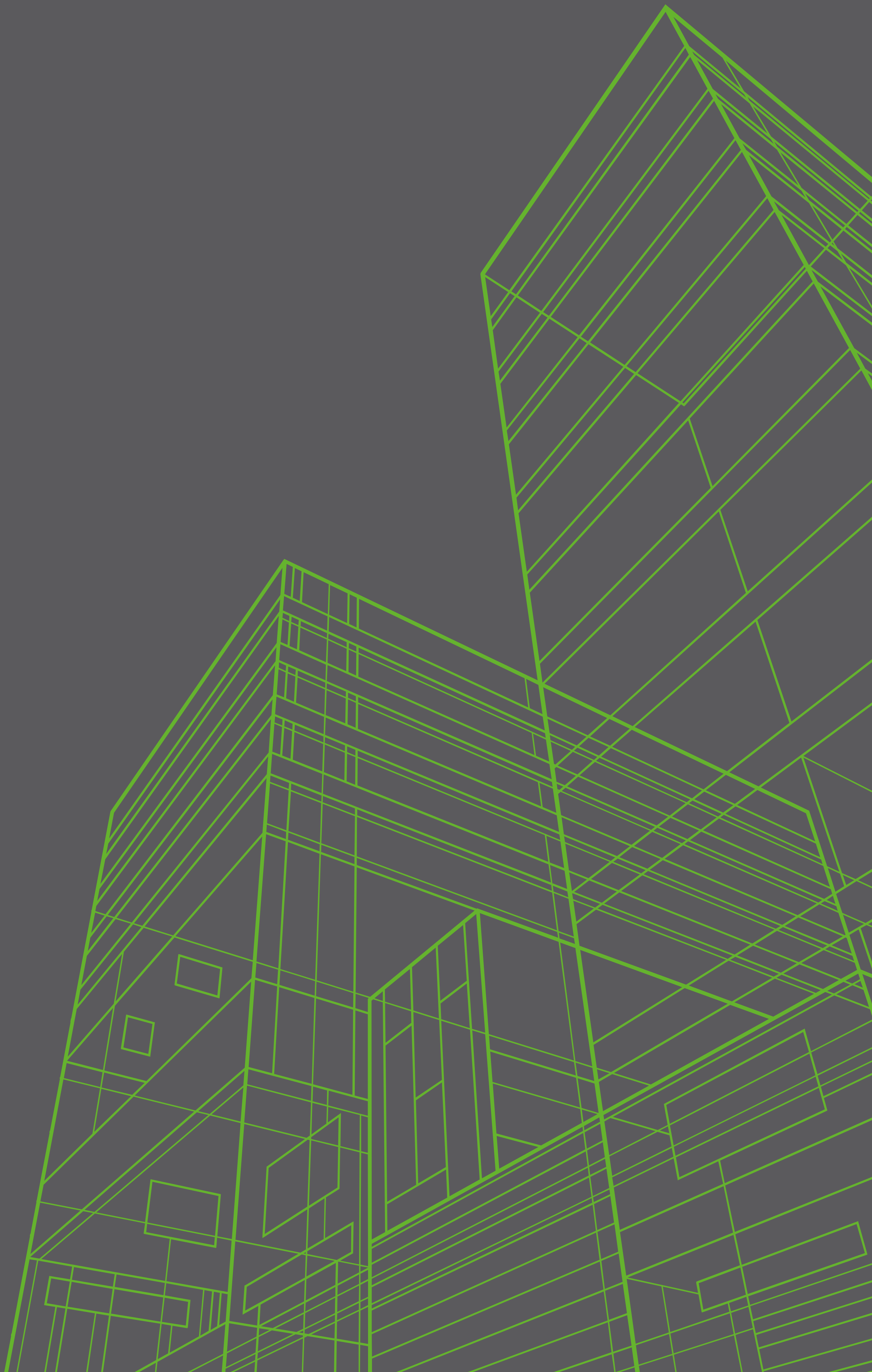
4.2.5 If existing plant is to be retained and the electrical spare capacity is unclear, intrusive validations and testing will be required in which the Jones Hargreaves MEP team would produce the technical specification in order to fully determine whether the proposed technology is feasible. Jones Hargreaves MEP will manage the validations process and input the results into our overall assessment.

4.3 Implementation Plan

4.3.1 We have outlined below the next steps with regards to unlocking the overall asset strategy and being able to commence implementation of decarbonisation measures:

- Meeting with the Client team to discuss outcomes of this report and alignment with the fund's strategy and targets.
- Hold a workshop with the appointed architect, structural engineer, cladding consultant and Client to examine further the feasibility of improving the building fabric as part of these enhancements.
- Open consultation with the planning authority to seek to obtain clarification on points within conditions attached to the pre-existing planning approval for building refurbishment.

PART 2 - DETAILED SUPPORTING OUTPUT



5. Building Survey Observations

5.1 General Construction

5.1.1 The building is typically constructed via a reinforced insitu concrete frame with superstructure floors of two-way post-tensioned reinforced concrete slabs, with steelwork forming window openings and supporting the roof.

5.1.2 The original building was designed as three separate structures, each of which is self-stable and self-supporting, with no vertical or lateral load transfer between each structure.

5.1.3 There are London Underground tunnels that pass adjacent to the building and the building falls within their "Zone of Influence". The District and Circle Lines are relatively shallow and pass beneath the building and the Waterloo and City Lines which are relatively deep and all run beneath the street. We are aware that the presence of the LU Lines affected the original development, but as there are no proposed below ground works, we do not envisage any further impact on the current development proposals.

5.2 Roof

5.2.1 Roofing is an 'inverted warm roof type build-up on a concrete deck. The waterproofing is a one-part, hot applied rubberised bitumen Permaquik 6100 monolithic membrane by Radmat Buildings Products Ltd. The membrane is applied to a primed concrete deck and incorporates flashings for penetrations, copings, and upstands.

5.2.2 The membrane is covered with a protective layer onto which are laid overlapping/interlocking insulation boards. The insulation is covered with a geotextile sheet onto which sits gravel ballast and concrete pavers on supports to access areas at a suitable thickness to provide ballast to hold the roof build-up in place.

5.3 Façade & Glazing

5.3.1 The external envelope (reportedly) consists primarily of a Schuco curtain wall ""stick" system. Between the stair cores on the North elevation the cladding is a structural silicone double glazed curtain wall system incorporating horizontal PPC aluminium coated steel feature channels at each floor level concealing the floor edge. A partially fritted outboard vertical solar screen to the upper floor bands (levels 2, 3 & 4) providing medium shading with high light transmission is also in place.

5.3.2 The south elevation is similarly constructed, although with a varied solar strategy which utilises high performance glass providing minimal heat gain and high light transmission in lieu of the external screen provided at the north of the building, and with the insertion of a solid spandrel panel behind frosted glass at each floor level in lieu of glazing to comply with Building Regulations April 2002 (fire & vicinity).

5.3.3 The northeast corner, east elevation and southeast corner forms a 4-storey atrium zone. Horizontal transom members, complete with tension rods connected to a primary steel column structure and glazed with vertical glass silicone joints together with minimal PPC aluminium external caps to the transoms forms the basis of the construction.

5.4 Floors

5.4.1 The building is typically constructed via a reinforced in situ concrete frame with superstructure floors of two-way post-tensioned reinforced concrete slabs, with some steelwork forming window opening and supporting the roof.

5.4.2 Office ceilings are provided as a fully accessible SAS System 330 metal suspended ceiling system, nominal 1200 x 300mm pressed steel micro-perforated tiles laid flush into 300mm "C" section grid on a 1500 x 1500mm module with PPC finish and acoustic infill. Colour co-ordinated and matching finish fluorescent luminaires, air outlets etc. and cavity barriers are provided. A white vinyl silk painted perimeter ceiling margin in plasterboard is provided, incorporating blind recesses.

5.5 Basement

5.5.1 The basement floor is reinforced concrete with power floated finish and sealed with clear anti-dust sealer. For purposes of future tenant generator provision, a dismountable raised steel deck flooring and staging is provided in the basement storage area where the finished concrete slab level is below the finished floor level of adjacent circulation areas. Upper floors generally comprise fine tamped or skip float finished reinforced concrete suitable to receive a raised access flooring system.

6. Building Services Observations

6.1 Mechanical Services

6.1.1 The following is a summary of the mechanical equipment installed within the building.

6.1.2 Heating

6.1.3 The incoming gas supply for the building is supplied from the adjacent gas main and serves the building's U65 meter in the basement gas intake room in the Basement car park.

6.1.4 Heating services for the building are provided primarily by 2no. 850kW Hoval Cosmo 850 gas-fired boilers which are located within a dedicated basement plant room and serve the low temperature hot water (LTHW) circuits throughout the building. The LTHW circuits serve the heating coils in the four-pipe fan coil units for the open office floors. The fan coil units' duct to the ceiling gird and route air to the space via recessed grille diffusers.

6.1.5 There are LTHW radiator emitters in the main entrance and the stair cores. The main entrance also utilises perimeter LTHW trench heating at low level.

6.1.6 Cooling

6.1.7 Cooling for the building is provided primarily by the 2no. 675kW Trane Air cooled screw Chillers located in the 4th floor open air plant yard.

6.1.8 The chilled water (CHW) circuits are distributed via copper pipework through the dedicated risers and serve the cooling coils in the four-pipe fan coil units for the open office floors and the main reception areas. The fan coil units' duct to the ceiling gird and route air to the space via recessed grille diffusers.

6.1.9 As part of the previous occupant's 2006 fit-out, a data centre was installed on the lower ground floor with 2no. secondary comms rooms installed on each of the Ground to 4th floors, North and South.

6.1.10 Cooling for the main data centre is via Dry air coolers installed on a mezzanine level on the 4th floor plant deck which serve the Computer Room Air Conditioning (CRAC) units in the space.

6.1.11 To support the lower ground data centre and provide resilience, the 2006 fit-out included the installation of a UPS system in the Basement. CRAC units are in the main basement UPS room to regulate the temperature.

6.1.12 The secondary comms rooms are served by dedicated Daikin split air conditioning units with associated wall-mounted temperature controllers. The external VRF condensers on the 4th-floor plant deck and in the basement plantroom.

6.2 Ventilation

6.2.1 The main ventilation plant serving the building are 2no. Air handling units (AHUs), 1no. intake and 1no. extract AHUs. The AHUs are of Colman Moducel construction with a heat recovery run around coil between supply and extract. The supply AHU has a LTHW frost protection coil and before the run around coil and a LTHW coil after the run around coil to temper the fresh air when required prior to distribution of the air to the fan coil units throughout the building. A chilled water coil is also incorporated into the supply air AHU to temper the air in summer months. The fresh is distributed via stainless steel ductwork.

6.2.2 There is a dedicated toilet extract system for the building, served by a series of stainless-steel duct which connect to terminal grilles in each of the WCs and extract to the dedicated 2no. fans in the 4th floor plantroom. One serves from Lower ground to 3rd; the other is dedicated to the 4th floor.

6.2.3 Building Controls

6.2.4 The building is served via a dedicated central Building Management System which is used to monitor and control the HVAC system. The central system has local temperature sensors across the floorplates and a graphical user interface at the Head end in the Basement which can be used to adjust set points.

6.2.5 The data centre cooling units and in the secondary comms rooms split units have standalone local controllers with wall or equipment-mounted controls.

6.3 Electrical Services

6.3.1 The following is a summary of the electrical equipment installed within the building.

6.3.2 Electrical Supply

6.3.3 As part of the fit-out in 2006, there was an enhancement on the supply serving the site and the site is currently supplied by an 11kV 400V ring main unit from EDF Energy which terminates in the basement plantroom.

6.3.4 The supply serves a 1600kVA dry-type transformer manufactured by ABB. The transformer serves the main switchboard for the site which is adjacent via a 3200A overhead busbar. The transformer is in an interlocked enclosure which will stop operation when it is opened.

6.3.5 The main switchboard is of ABB construction and has 2no. 3200Amp air circuit breakers for incoming supplies which are interlocked and a 4000Amp bus coupler between them. 1no. supply is for the mains supply; the other is associated with the Generator switchboard for the 2no. back-up diesel generators. These incoming supplies are connected via 3200A busbar. The main switchboard serves the outgoing ways to the major load centres such as the distribution boards to the North and South risers, fire alarm panel and new major plant equipment such as the Chillers and Lifts.

6.3.6 The main switchboard serves three-phase and neutral distribution on each floor within the North and Risers via XLPE/SWA/LSF sub-mains cabling. The distribution boards were 12-way TP&N, serving the lighting and small power on the office floor plates.

6.3.7 The small power for the office floor plates is served from underfloor busbars, located within the raised access floors to supply the desk and meeting room installations.

6.3.8 Given previous usage as a bank, there are installations in the building to increase resilience. There is an N+N Emerson UPS system installed in the basement plant room with a storage room for the lead acid batteries in the space adjacent. This serves the A&B side of the UPS installation used to back up the main data centres, secondary comms room, BMS system, power and lighting DBs via rising busbars, and life safety systems. There are 2no. 1250A UPS switchboards serving the A&B side and the UPS backs up the main A&B power distribution units (PDUs) in the main and secondary comms rooms.

6.3.9 There are 2no. 1000kVA Broadcrown diesel generators installed in a dedicated Basement plant room. These generators utilise a dedicated 3200A switchboard which serves the main switchboard in the event of a mains supply failure. The configuration is designed to back up the entire site.

6.3.10 Lighting

6.3.11 The lighting in the building is served mainly by fluorescent luminaires. The main office floor plates are served by recessed linear Zumtobel, T16 fluorescent, 49W Slotlights. The office perimeter and toilet areas are served by fluorescent downlighters. The stair cores are served by fluorescent wall mounted bulkhead fittings. The back of house and plant areas have impact resistant luminaires installed throughout.

6.3.12 The main entrance utilises fluorescent downlighters, uplighters and spotlights. The central atrium has floodlights at first floor and high level. The main office areas, back of the house and plant areas are generally controlled via presence detection. The lighting control for the site is provided by Simmtronic and Lighting Control Modules throughout which supply the inputs and outputs of the lighting.

6.3.13 There are external, building-mounted luminaires are installed on the perimeter façade of the building which are controlled via a time clock.

6.3.14 The emergency lighting system is generally provided by luminaries with integral 3-hour battery packs. The emergency lighting is throughout the unit to allow safe egress, in case of emergency. The emergency lighting circuits are fluorescent and are a mixture of maintained and non-maintained fixtures. Toilet areas have integral emergency lighting within the downlighters.

6.3.15 Lifts

6.3.16 The main reception has 4no. traction motor room less main KONE passenger lifts in the southeast of the property which have a capacity of 1000kg/13 people. 1no. serves all floors (Basement – 4th floor), the other 3no. serve the Lower ground to 4th floors. An assisted lift is provided in the main reception to bring persons of reduced mobility from main doors to the reception level.

6.3.17 The Goods lift is located adjacent to the loading bay at the lower ground level which serves the Basement and lower ground levels.

6.4 Renewable Energy

6.4.1 There are no renewable energy sources currently installed at the property.

7. Low and Zero Carbon (LZC) Technology Feasibility

7.1 Optioneering Appraisal

7.1.1 As a means of decarbonising the principal energy demand of the building, this assessment considers applicable renewable energy technologies which may be deployed at the site as part of a major refurbishment or overhaul of the building's energy supply.

Technology	Feasibility	Justification
Roof Mounted Solar PV	High	Significant flat roof space available for roof mounted Solar PV solution.
Other Solar PV	Low	Not viable due to building occupying entire footprint of the property boundary.
Solar Thermal	Moderate	Discounted due to onsite constraints.
Wind Turbines	Low	Not viable due to planning constraints associated with adjacent grid.
District Heating	Low	No district heating systems are installed in the vicinity.
Geothermal	Low	Not viable due to disruptive works required and lack of space within boundary.
Biogas	Low	Not viable due to location and constraints on space and planning.
Variable Refrigerant Heating and Cooling solution	High	Significant flat roof space available for VRF condensers to be installed.

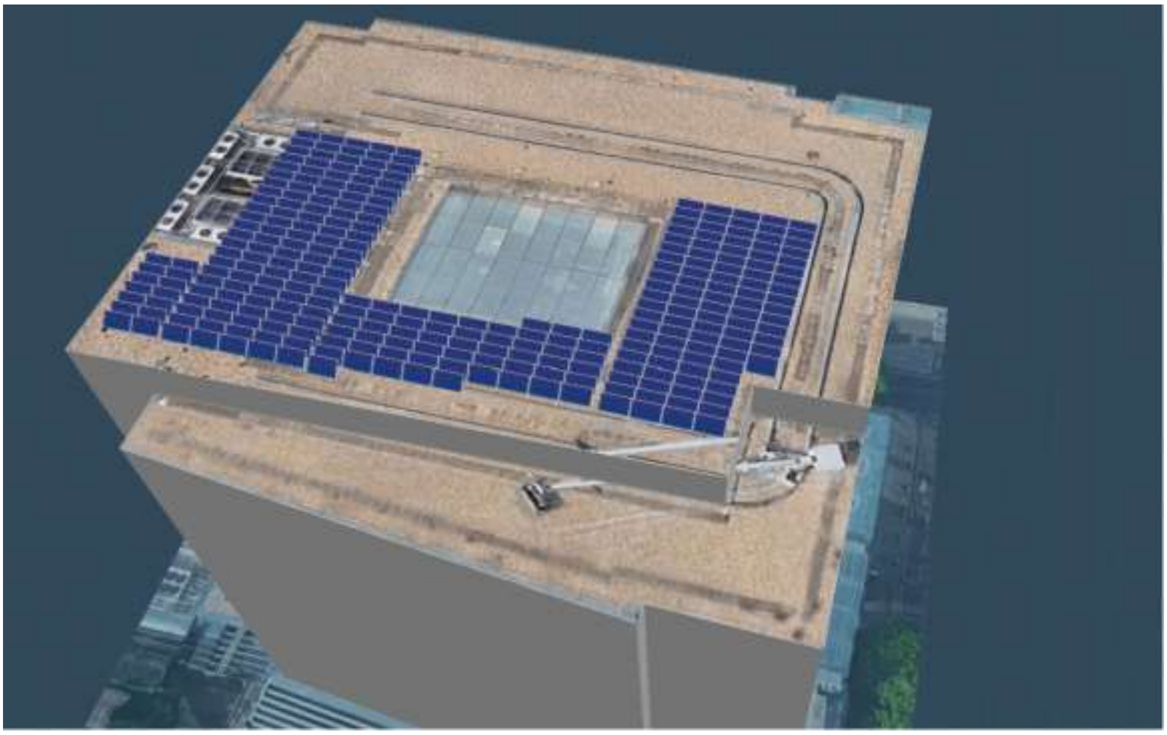
7.1.2 Solar PV Feasibility

7.1.3 Daylight available in London was approximately 4480 hours in 2023 and is generally averaging around this figure annually.

7.1.4 Within the current model, the Energy Production from PV Panels is 55,321 kWh p.a. This can be seen as an energy reduction when used on landlord services.

7.1.5 Therefore, assuming an electrical cost of 33.09 p per kWh, this totals an approximate annual saving of £18,305.72.

7.1.6 Indicative Layout of PV Array illustrated below:



7.1.7 Solar Photovoltaic (PV) systems convert energy from the sun into direct current (DC) electricity using semi-conductor cells which are grouped and mounted into modules. Array modules are then connected to an inverter module via groupings called 'strings' that convert DC into alternating current (AC), enabling integration with the normal grid supply and electrical distribution within the building.

7.1.8 The sub mains cabling from the inverter shall be routed to the Basement main switchboard serving the landlord supplies.

7.1.9 Photovoltaic system panel arrays being specified on the available roof space has a local generation capacity of 75kWp.

8. Energy Modelling

8.1 Compliance

8.1.1 We have reviewed the EPC obtained via the online database and referenced with that supplied via the vendors disclosures with details outlined in the table below.

Existing EPC			
Property Name	**Expiry**	**Rating**	**Primary Fuel Source**
The building	04-11-2028	D (99) (Existing EPC)	Grid Supplied Electricity

8.1.2 Upon review of the existing EPC and following the detailed site visit, Jones Hargreaves expressed reservations with the EPC in respect of the primary fuel source quoted as Grid Supplied Electricity. When considering the building services inspection, it was evident that the building had reliance on natural gas as a heating source as well, which does not appear to be reflected in the EPC. No further information has been forthcoming from the vendor and no further details regarding the EPC calculation methodology were supplied.

8.1.3 The UK government have made it clear that they intend to make it unlawful to continue to let commercial property with an EPC rating of below C by 2027 and below B by 2030 therefore there is a risk, in its current specification that the property does not achieve compliance with future EPC requirements.

8.1.4 In order to provide *the client* with assurances on the EPC rating (given the importance of MEES as the regulatory drive in this instance), Jones Hargreaves have re-assessed the rating, with the outcome expressed below.

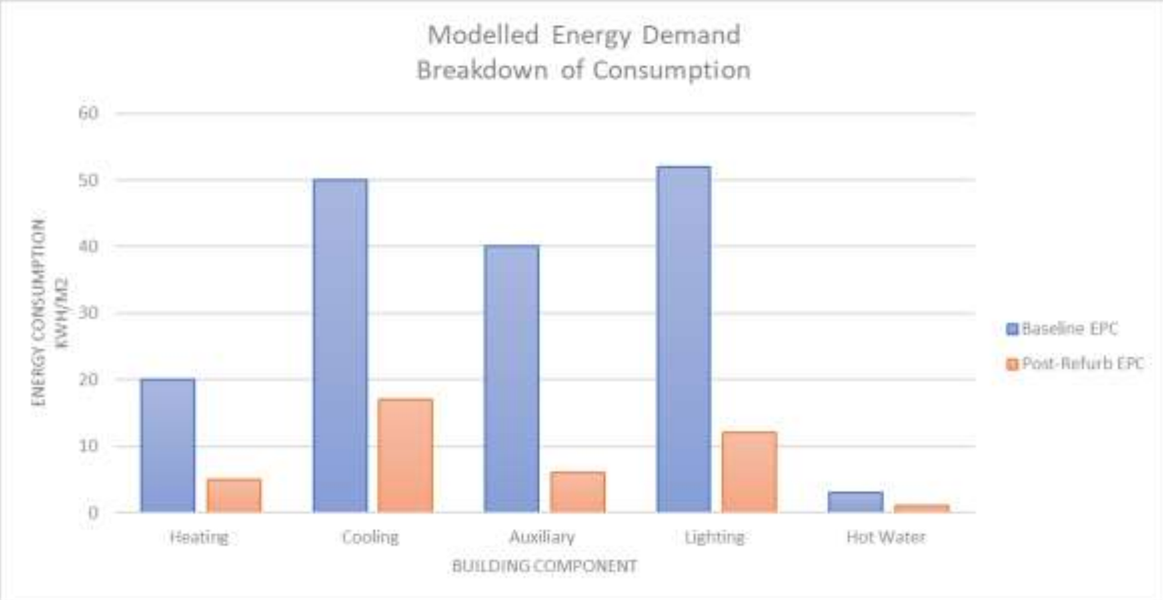
Revised Baseline			
Property Name	**Expiry**	**Rating**	**Primary Fuel Source**
The building	N/A (Draft)	E (121)	Natural Gas

8.1.5 Following the update to UK Building Regulations (Part L) in June 2022, significant alterations were made to the carbon factors attributed to primary heating sources within EPC modelling (across all relevant software types). This has seen a significant shift in favour of grid supplied electricity, as opposed to natural gas which supports the move towards decarbonising buildings and working towards Net Zero.

8.2 Primary Energy Demand

8.2.1 In order to determine the baseline primary energy demand for the building in the absence of available in-use utilities consumption data, Jones Hargreaves have adopted an energy performance modelling approach. The process involves the creation of a 3D model utilising Design Builder software and default building fabric values applied (2002 Building Regulations). The draft building energy model (shown below) has been calculated using simplified building energy modelling (SBEM) level 4, for the initial screening process, the final EPC will be progressed utilising Level 5 dynamic simulation modelling (DSM) to capture detailed upgrades to the building fully as the refurbishment scope progresses.

8.2.2 Working alongside our building services engineers, we have modelled the existing building to determine the likely primary energy demand of existing services. This has been broken down in the graph below to demonstrate which aspects of the building in its current specification are contributing the most to demand (expressed as kWh/m² in blue).



8.2.3 Noting the consumption breakdown above, it is evident that demand is being driven by inefficient lighting and cooling provision (in relation to floor area). As shown below, these contribute considerably to building emissions (in-use), whilst a significant portion (expressed as $kgCO_2/m^2$) is also attributed to the carbon-intensive primary heating source (Natural Gas). This further supports the objective of ensuring that the building primary energy demand is reduced and decarbonised so far as possible.

8.2.4 Estimated consumption (informed by modelled primary energy use) and carbon emissions (informed by the building emissions rate) are provided below:

Estimated Annual Consumption	Estimated Annual Emissions
kWh per annum (combined)	$KgCO_2$ per annum (combined)
1,814,422	262,800.00

8.2.5 Grid Electricity consumption modelled at 1,594,244 kWh per annum.

8.2.6 Natural Gas consumption modelled at 220,178 kWh per annum.

8.2.7 In order to gauge the likely obtainable performance post-refurbishment, we have utilised the proposed refurbishment scope to model proposed enhancements to the building. Utilising the same modelling process to cycle through the applicable and appropriate actions to improve the energy performance rating, but also reduce building emissions and primary energy demand. Please refer to the Jones Hargreaves TDD for further detail.

8.2.8 In order to gauge the likely obtainable performance post-refurbishment, we have utilised the pre-existing refurbishment scope to model proposed enhancements to the building. Utilising the same modelling process to cycle through the applicable and appropriate actions to improve the energy performance rating, but also reduce building emissions and primary energy demand.

8.2.9 In summary, the following upgrades were applied to the model (PED improvement breakdown is not possible per intervention until design stage has commenced):

- Lighting upgrade to LED, 120lm/w.
- Chiller and boiler replaced with VRF (COP/EER 4.50) and electric panel heaters.
- Air Handling Units, 1.25 w/l/s. Heat recovery.
- HWS via Air source Heat Pump (COP 3.00). 450ltr HW Cylinder.
- Roof-top Solar PV added. 90kWp.

- No changes to internal layout added to the model at this stage (for ease of comparison).

8.2.10 The specification of improvements at this stage is speculative yet conservative in that we fully expect any subsequent design to achieve further improvements over and above those currently modelled. Furthermore, enhancements to in-use energy efficiency for the building, including use of smart building controls are proposed which are not reflected fully in the modelling at this stage.

8.2.11 The potential performance improvements with respect to the designed performance of the building are outlined in the graph below, illustrating a significant reduction in both primary energy demand and modelled energy use.

	Baseline (Current Specification)	Improvements Applied	% Change
Primary Energy	239.31	54.04	77%
Modelled Building Energy Use	164.32	41.75	75%
BER	23.80	4.95	79%

8.2.12 Primary Energy Demand (PED) assesses the energy needed to be supplied to a building to provide heating and hot water to a as well as lighting, ventilation, cooling systems and showers. Expressed as kWh/m² per annum.

8.2.13 Energy use is the actual modelled energy use of components within the building. Expressed as kWh/m² per annum.

8.2.14 Building Emissions Rate (BER) is the modelled emission rate is the annual CO_2 emissions associated with the building operation. Expressed as $kgCO_2/m^2$ per annum.

8.2.15 A comparison of improvements in demand are provided below for reference:

Breakdown of Energy Demand by System	Baseline	Post-refurb
	kWh/m²	
Heating	19.94	5.46
Cooling	49.76	16.96
Auxiliary	39.80	6.18
Lighting	51.68	11.97
Hot Water	3.14	1.18

8.2.16 Please note that should Solar PV not be feasible (subject to detailed design), the projected EPC improvement would sit at B 29.

8.2.17 This however may be offset by the conservatism deployed in the modelling to date, which, subject to design confirmation may improve the EPC further when the full specification of improvements and performance measures becomes known.

8.2.18 Taking into consideration the modelling undertaken to date, we are confident that a significant reduction in building energy demand can be achieved through the proposed refurbishment project.

8.2.19 There is further refinement and detailed modelling required at design stage to set appropriate targets for improvement however, it can be stated that the project is **likely to deliver a greater performance outcome than the minimum required as stipulated within the Climate Impact Fund metrics** (i.e., 30% reduction in PED, post-completion).

8.2.20 Please Note: all analysis and modelling has been conducted using the information provided. Quoted figures are subject to change upon reassessment as part of the detailed design process.

8.3 Carbon Footprint

8.3.1 In order to determine the baseline primary energy demand for the building in the absence of available in-use utilities consumption data, Jones Hargreaves have adopted an energy performance modelling approach. The process involves the creation of a 3D model utilising Design Builder software and default building fabric values applied (2002 Building Regulations).

8.3.2 The draft building energy model (shown below) has been calculated using simplified building energy modelling (SBEM) level 4, for the initial screening process, the final EPC will be progressed utilising Level 5 dynamic simulation modelling (DSM) to capture detailed upgrades to the building fully as the refurbishment scope progresses.

8.3.3 Comparison of improvements in carbon emissions are provided below for reference:

Breakdown of carbon emissions by System	Baseline	Post-refurb
	% share of total in-use operational emissions	
Heating	18	15
Cooling	27	38
Auxiliary	23	15
Lighting	30	29
Hot Water	2	3

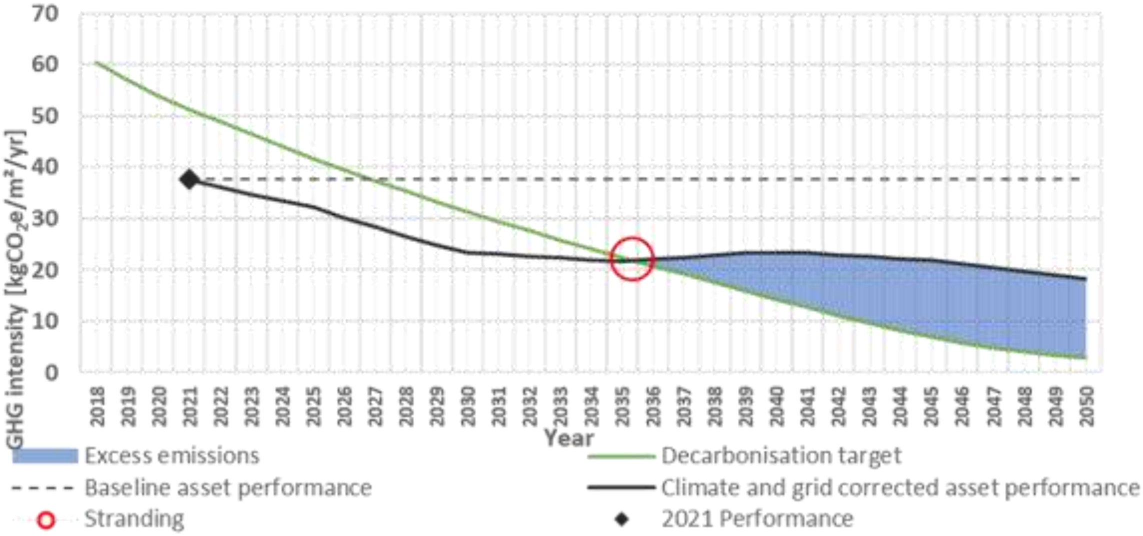
8.4 CRREM Stranding Analysis

8.4.1 The Carbon Risk Real Estate Monitor (CRREM) is a transition risk measurement tool that provides decarbonisation pathways for different property types and geographies.

8.4.2 The CRREM is both sector-specific and maintains high levels of data granularity. It is an EU-based, open-source initiative with the objective of decarbonizing the EU real estate sector and focuses on the financial risks associated with climate negligence. The tool assesses stranding risk and reports the financial implications and losses that arise from poor energy performance.

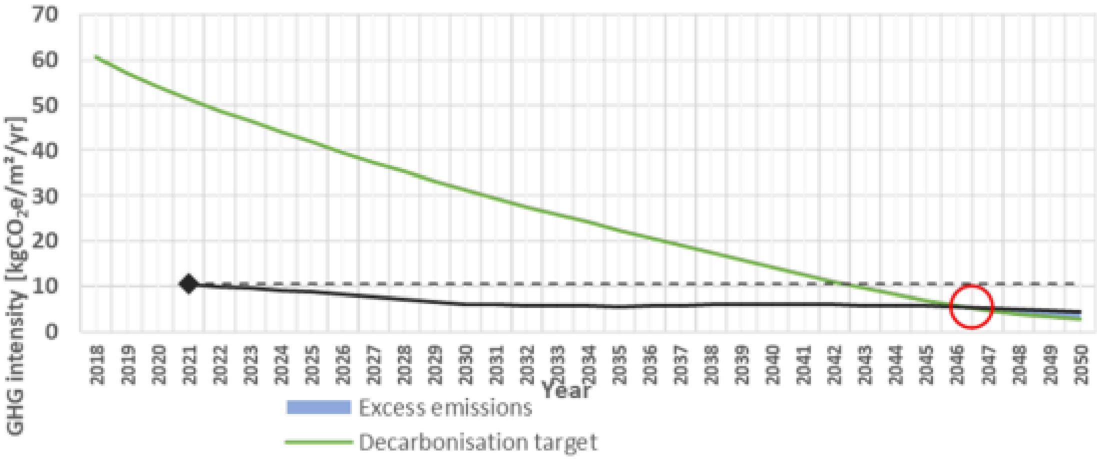
8.4.3 The CRREM provides the real estate industry with transparent, science-based decarbonisation pathways aligned with the Paris Climate Goal of limiting global temperature rise to +2°C, with ambition towards +1.5°C. Pathways for both scenarios can be applied alternatively.

8.4.4 CRREM Stranding Analysis – Baseline Specification



8.4.5 It is the performance gap shown (in $kgCO_2e/m^2$/year) that requires addressing through investment in building performance improvements. The asset is forecast to be stranded from 2035.

8.4.6 Net Zero Carbon Stranding Analysis – Post-refurbishment (high-level scope)



8.4.7 Post-refurbishment, the asset is forecast to be stranded from 2046 which may align with future refurbishment cycles so that additional performance improvements can be made to align with Net Zero targets. Thus, the strategy outlined in this report provides another 11 years of useful occupation of the asset.

8.4.8 Given the high-level assessment above, no concerns are raised with respect to the outcomes illustrated, which are typical for the type and age of the building in question.

8.4.9 For an accurate CRREM assessment the use of actual in use data (most recent 12-month consumption) is always best to forecast when the asset will be stranded and the impact of any proposed measures on energy consumption. Limited recent data provided by the vendor relates to a period when the building was unoccupied which reduces the accuracy and validity of utilising this data.

8.4.10 Where no in use data can be provided, the energy consumption from the energy model could be used to forecast asset stranding. However, this will not be as accurate as having known in use data with energy models always assuming occupancy levels within the building.

8.4.11 Actual energy consumption within the model is different from primary energy consumption value shown on the EPC itself. Primary energy will always be higher than actual energy consumption and includes the additional 'cost' of generating energy and delivering energy to the building.

8.4.12 EPC certificates do not show actual energy use of the energy model, only primary energy use (actual consumption can only be seen with the energy model). In the absence of the existing energy model, it is not possible to compare actual energy consumption with a new model (unless provision of the existing energy model can be made available).

8.4.13 Furthermore, since the release of SBEM 6.1e in June 2022, the carbon factors assigned to buildings have significantly changed to reflect the decarbonisation of grid supplied electricity within the UK. Lower carbon factor values are now assigned to grid supplied electricity, and higher for natural gas. Comparing previous EPC data would give an inaccurate comparison. Conversion of the previous energy model to SBEM 6.1e would allow for an accurate comparison to be made.

9. Site Specific Constraints

9.1 Site Specific Logistics and Buildability

9.1.1 Please note our reporting has been prepared based on the subject asset being in a state of vacant possession (i.e., unoccupied) and does not make any budget allowances or commentary in relation to undertaking works in occupied premises (which present substantial logistical and cost complications which cannot be accurately forecast without recourse to a detailed feasibility exercise, beyond the scope of this initial technical assessment).

9.1.2 Should it be unviable for the works to be undertaken in a vacant property (e.g. due to subsisting occupational lease terms) or if the age and condition of services dictate that highly extensive works are required (which would cause disproportionate disruption to a tenant, or tenants), it may not ultimately be practicable to undertake the full package of works recommended and an alternative strategy to improve asset efficiency may need to be developed.

9.1.3 Where it is subsequently found that it is unfeasible to create a situation of vacant possession, thus jeopardising the viability of a recommended package of works, it is often possible that creative solutions can be identified. Such solutions might be generating 'swing space' in order to temporarily relocate tenants to facilitate a package of works, or re-order works on a seasonal basis (such as removal of heating in summer for example). Where issues are identified, we will do all we can to assist the feasibility process to find a solution to facilitate progress of the intended package(s) of works.

9.1.4 Please note that due to the various rationale outlined above, all the recommendations presented for consideration at this stage are subject to an additional process of feasibility studies and onsite validations to determine full viability and cost.

9.2 Planning Constraints

9.2.1 Since 1937, the City of London Corporation has had a policy known as the 'St Paul's Heights' to protect and enhance important local views of the Cathedral from the South Bank, Thames bridges and certain points to the north, west and east.

9.2.2 In the case of *the property* St Paul's Grid effectively caps the height to which the roof of the property can reach. Owing to the way the grid is calculated, there is less effective height to the southern boundary of the property when compared to the north due to the gradient of the grid.

9.2.3 As such, further consultation is needed within the proposed project team and with the planning authority to determine whether any improvements or enhancements can be made to the roof structure. At present Solar PV is proposed, assuming that a low-profile roof mounted PV solution is adopted.

Appendix 1. Assumptions for Baseline Case

Appendix 2. Full Proposal List and Costing Spreadsheet

Appendix 3. Cost Assumptions

Budget Costs - Option 1

i) Replace gas boilers and chiller system with VRF system

Item	Description	Quantity	Unit	Rate (£)	Total (£)
Building Works					
1.0	VRF Replacement	3045	m²	175	£532,875.00
2.0	Boiler removal	1	Item	15000	£15,000.00
3.0	-	-	-	-	-
4.0	-	-	-	-	-
5.0	Builders works in connection	1	@	10%	£54,787.50
				Sub-Total	**£602,662.50**
Contractors Preliminaries and OH&P					
6.0	Preliminaries / OH&P	1	@	15%	£90,399.38
				Sub-Total	**£693,061.88**
Professional & Statutory Fees					
7.0	Professional & Statutory Fees	1	@	15%	£103.959.28
				Sub-Total	**£797,021.16**
General Contingency					
8.0	General Contingency	1	@	5%	£39,851.06
				Sub-Total	**£836,872.21**
				TOTAL	**£837,000.00**

Budget Cost – Option 2

ii) Replace the gas boiler and chiller system with ASPH and replace the AHUs.

Item	Description	Quantity	Unit	Rate (£)	Total (£)
Building Works					
1.0	ASHP & WSHP installation	3045	m^2	175	£532,875.00
2.0	Boiler removal	1	Item	15000	£15,000.00
3.0	AFU replacement	1	Item	50000	£50,000.00
4.0	-	-	-	-	-
5.0	Builders works in connection	1	@	10%	£59,787.50
				Sub-Total	**£657,662.50**
Contractors Preliminaries and OH&P					
6.0	Preliminaries / OH&P	1	@	15%	£98,649.38
				Sub-Total	**£756,311.88**
Professional & Statutory Fees					
7.0	Professional & Statutory Fees	1	@	15%	£113,446.78
				Sub-Total	**£869,758.66**
General Contingency					
8.0	General Contingency	1	@	5%	£43,487.93
				Sub-Total	**£913,246.59**
				TOTAL	**£914,000.00**

Budget Cost – Option 3

iii) Upgrade office lighting within the building to high efficiency LEDs.

Item	Description	Quantity	Unit	Rate (£)	Total (£)
Building Works					
1.0	LED lighting replacement	3045	m^2	175	£228,375.00
2.0	-	-	-	-	-
3.0	-	-	-	-	-
4.0	-	-	-	-	-
5.0	Builders works in connection	1	@	10%	£22,837.50
				Sub-Total	**£251,212.50**
Contractors Preliminaries and OH&P					
6.0	Preliminaries / OH&P	1	@	15%	£37,681.88
				Sub-Total	**£288,894.38**
Professional & Statutory Fees					
7.0	Professional & Statutory Fees	1	@	15%	£43,334.16
				Sub-Total	**£332,228.53**
General Contingency					
8.0	General Contingency	1	@	5%	£16,611.43
				Sub-Total	**£348,839.96**
				TOTAL	**£349,000.00**

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