CRREM-aligned decarbonisation report

20 Old Bailey, London EC4M 7AN

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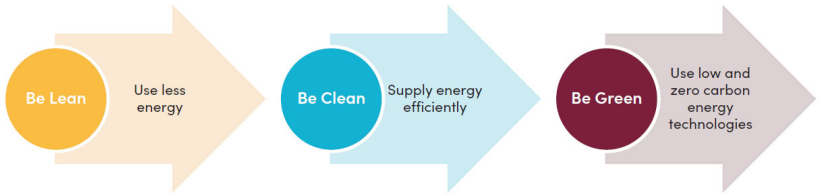
1. Executive summary

1.1. Purpose

1.1.1. The purpose of this report is a comprehensive audit and technical assessment to understand the energy and carbon performance of 20 Old Bailey, London EC4M 7AN, to review improvement potential and to estimate costs associated with reducing the building's energy consumption and emissions in line with Hines' targets.

1.1.2. The suggested strategy to meet Hines' targets follows the 'Be Lean', 'Be Clean' and 'Be Green' Energy Hierarchy approach to reduce overall energy consumption and carbon emissions.



1.2. Hines' targets

- EPC rating B or higher by 2030.
- CRREM 2040 operational energy use intensity.
- CRREM 2040 operational carbon intensity.

Currently, there is a lodged EPC with a rating of B27 (completed in 2017) and as part of this analysis we have completed an EPC Baseline analysis using the latest Building Regulations updates with an EPC rating of B34.

1.3. Current Energy Use Intensity (EUI)

1.3.1. We have compared the EUI for 20 Old Bailey with other existing buildings' energy consumption. The table below shows the comparison using the CIBSE Benchmarking tool, which shows the 'Typical' and 'Good' practices for similar building types.

CIBSE Energy Benchmarking tool	Air-conditioned, prestige (Office)		
	Electricity consumption (kWh/m²/yr)	Gas consumption (kWh/m²/yr)	Total (kWh/m²/yr)
Good practice consumption	234	114	348
Typical practice consumption	358	210	568
20 Old Bailey energy consumption	115.5	33.1	148.6

1.3.2. The above table shows how 20 Old Bailey's energy consumption is relatively low at just 43% of the benchmark for CIBSE Good practice for prestige air-conditioned offices.

1.4. CRREM results & key findings

1.4.1. According to CRREM Risk Assessment Tool v1.20, the target of 2040 operational carbon intensity is 14.2 $kgCO_2/m^2/yr$ and operational energy use intensity is 74.5 $kWh/m^2/yr$ for office buildings in the UK with the goal of keeping global warming to 1.5°C.

1.4.2. With appropriate investment (and subject to full feasibility assessments), it should be viable to improve this asset to the targets below.

	RAG rating
EPC B or higher by 2030 (Target already achieved)	Green
CRREM 2040 operational energy use intensity – 74.5 $kWh/m^2/yr$	Amber
CRREM 2040 operational carbon intensity – 14.2 $kgCO_2/m^2/yr$	Green

RAG rating legend

Red	Significant concerns that the property cannot meet these targets (technically, physically or cost-probative)
Amber	Some concerns that the property can meet these targets. Further actions required to achieve targets
Green	Likely property can meet these targets

1.4.3. Using the CRREM tool with the target to limit global warming to 1.5 degrees (2040 target), it can be seen that the asset's Greenhouse Gas (GHG) emissions and the energy consumption are currently on the right path to meet CRREM 2040 targets, but in its current configuration by 2029 it will drop below the path in relation to energy consumption and by 2038 will drop below the path in relation to carbon emissions.

1.4.4. Although 20 Old Bailey is showing to have a lower EUI than the existing good practice benchmark and currently is on the right path to achieve 2040 NZC targets, it is recommended to follow the 'Be Lean', 'Be Clean' and 'Be Green' sections of this report, thus improving energy efficiency, reducing carbon emissions, and increasing the value of the asset, and also to help achieve the CRREM targets until 2040 and beyond.

1.5. Energy recommendations

1.5.1. 'Be Lean' strategies have not been considered in this report given the good condition of the existing building fabric. 'Be Green' strategies have been already incorporated into the building, therefore, this report will only focus on 'Be Clean' measures.

1.5.2. Regarding the 'Be Clean' recommendations, we recommend installing demand-controlled ventilation using CO_2 sensors to control the flow of fresh air into the building. This improvement would reduce the volume of fresh air when occupancy levels are lower than normal, reducing energy use. As the CO_2 in the air approaches undesirable levels of comfort the fresh air volume ramps back up.

1.5.3. Currently, the energy to the domestic hot water (DHW) is provided by both the gas-fired boilers and the heat pump system. Another 'Be Clean' recommendation is to entirely remove reliance on the gas-fired boilers and instead install electric immersion heaters.

1.5.4. Same as for the DHW system, heating is provided by both the gas-fired boilers and the heat pump system. Our final recommendation is to remove entirely the dependency on natural gas by replacing the fan coil unit (FCU) with a modular VRF system. This work would be disruptive and expensive and so would only likely be implemented at the end of the current FCU system's lifespan.

1.5.5. The current building is already equipped with a photovoltaic (PV) system that takes up all available practical space for such installations. Hence, PV expansion is not an available option. Therefore, 'Be Green' recommendations will not be considered in this report.

1.5.6. The table below shows the energy consumption, carbon emissions and the estimated EPC rating for the Baseline, each recommendation and then scenarios of combinations of recommendations. All recommendations would be subject to a detailed feasibility study to ensure they are practically and technically possible.

Action	EPC (kWh/m²)	EPC ($KgCO_2/m^2$)	EPC rating	Estimated cost***
Current building performance/ Baseline	49.14 (Unregulated energy 48.84*)	6.14 (Unregulated carbon 6.64**)	B34	N/A
'Be Clean' recommendations: 1) Install demand-controlled ventilation CO_2 sensors throughout the building's areas with mechanical ventilation.	41.63 (Unregulated energy 48.84*)	5.85 (Unregulated carbon 6.64**)	B33	£1,418,000
2) Refigure Heat-Pump Waste Heat Recycling circuit to serve DHW only and equip calorifiers with electric immersion heaters.	48.61 (Unregulated energy 48.84*)	4.91 (Unregulated carbon 6.64**)	B27	£30,000
3) Replace the FCU system with a VRF system and replace the LTHW radiators with electric panel radiators at the stair cores.	25.32 (Unregulated energy 48.84*)	3.93 (Unregulated carbon 6.64**)	A22	£4,444,400
S1 Combination of 1) + 2)	**94.39**	**11.21**	**B26**	**£1,448,000**
S2 Combination of 2) + 3)	**78.31**	**9.33**	**A15**	**£4,474,400**

* The unregulated energy use is based on the BRUKL report

** The unregulated carbon has been converted from the unregulated energy use with the electricity carbon factor of 0.136 CO_2/kWh.

*** See Appendix C for cost limitations

1.5.7. Hollis recommends following the Scenario 2 (S2) strategy, which includes recommendations 2) and 3), as shown in the above table. S2 provides the best improvement of the EPC rating and also, it is the only option to phase out all fossil fuels within the building, which is one of the key principles of achieving a NZC building.

1.5.8. Although demand-controlled ventilation using CO_2 sensors is typically a good measure to reduce energy consumption when the building is not fully occupied, the measure does not seem to be a cost-effective solution in the current scenario. It is also only applicable to the existing system (FCU) and not to the system proposed in recommendation 3 (VRF).

1.5.9. By applying the proposed measures (S2), the EPC results show that 20 Old Bailey would achieve circa 20% energy reduction from the current energy consumption and a total carbon emission reduction of circa 27%, achieving an EPC rating of A15.

1.5.10. The Behavioural change section of this report suggests some recommendations be applied in terms of behavioural change, which would be very useful to reduce energy consumption to be aligned with the Paris-proof energy target by 2040 and beyond.

1.6. Conclusions

1.6.1. This report shows that the current building is performing very well in terms of energy consumption. The EPC Baseline rating is a B34, which complies with the MEES 2030 target, and the actual EUI of the building is better than the CIBSE Best Practice Benchmarks. It also shows that the building is currently on the pathway to the Paris-proof / CRREM energy and carbon 2040 targets.

1.6.2. However, by 2029 it will drop below the path in relation to energy consumption and by 2038 will drop below the path in relation to carbon emissions.

1.6.3. Therefore, energy efficiency recommendations, quick wins and behavioural change measures have been analysed to further reduce energy consumption and be able to comply with Hines' energy targets until at least 2040. When applying all the recommendations, 20 Old Bailey achieves an EPC rating of A15.

1.6.4. The figure below shows the impact of these measures compared to the real energy consumption and how by applying the suggested energy improvements, the building would be able to reduce its total energy consumption by circa 14.3% (Compare columns 1 and 4 in the figure below). A real consumption adjustment has been considered to take into account the difference between the real energy consumption and the EPC Baseline results. The savings shown below are cumulative.

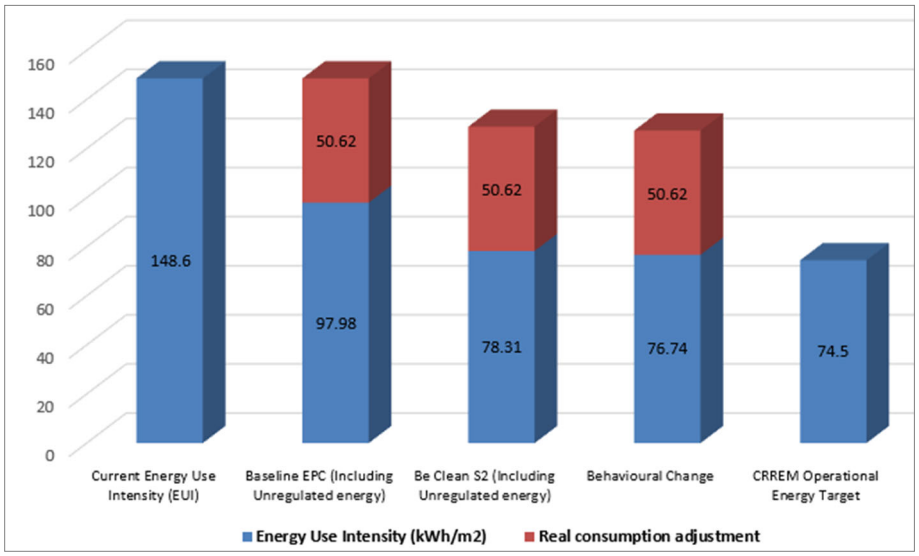


Figure 1. Real consumption & EPC Energy improvement results compared to CRREM 2040 target

1.6.5. If the energy saving recommendations considered within this report are applied to the current energy consumption, the CRREM Risk Assessment tool shows that the building will drop below the path, in relation to carbon emissions consumption (main target), by 2044, achieving therefore Hines' CRREM 2040 Operational carbon target.

1.6.6. Regarding the operational energy of the building, after applying all the recommended measures, the building will drop below the path, in relation to energy use intensity, by 2039, getting very close to achieve Hines' CRREM 2040 energy targets. Further recommendations, such as behavioural change should be applied to make sure energy consumption is reduced to be able to achieve CRREM 2040 energy targets.

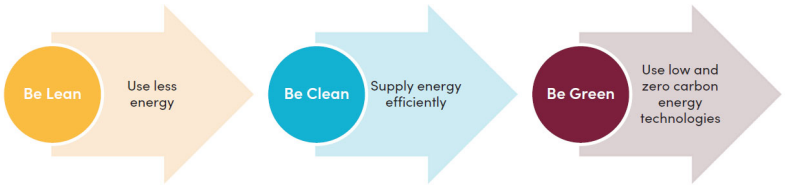
1.6.7. Whilst it is often very difficult for existing buildings to achieve the CRREM 2040 energy consumption targets, it is clear to see how this type of building can achieve these targets after applying all of the energy recommendations, quick wins and behavioural changes set out in this report. It is anticipated that the overall energy consumption will be reduced due to a more efficient equipment being installed in the future and after the suggested behavioural changes have been applied. Therefore, there is a very low risk that the building will not achieve both, the carbon emissions consumption (main target) and the energy consumption CRREM 2040 targets.

2. Introduction and background

2.1. Purpose

2.1.1. The purpose of this report is a comprehensive audit and technical assessment to understand the energy and carbon performance of 20 Old Bailey, London EC4M 7AN, to review improvement potential and to estimate costs associated with reducing the building's energy consumption and carbon emissions in line with Hines' targets.

2.1.2. The suggested strategy to meet Hines' targets follows the 'Be Lean,' 'Be Clean' and 'Be Green' Energy Hierarchy approach to reduce overall energy consumption and carbon emissions.



2.2. Targets

- EPC rating B or higher by 2030
- CRREM 2040 operational energy use intensity
- CRREM 2040 operational carbon intensity

2.2.1. Currently there is a lodged EPC with a rating of B27 (completed in 2017) and as part of this analysis we have completed an EPC Baseline analysis using the latest Building Regulations updates with an EPC rating of B34. It is typical for EPC ratings to worsen when using later editions of the Building Regulations, particularly when the building uses gas fired heating.

2.3. Building overview and description

2.3.1. The property is a multi-storey office building with a pub on the ground floor. The building was built in 1989 with a recent refurbishment in 2017. The property is occupied by four office tenants: Barings, Withers, Phoenix Holdings and Optiver.

Building elevation.

Site location.

2.3.2. The cladding consists of a combination of Portland stonework, with areas of granite, surrounding various combinations of aluminium framed double-glazed fenestration to include large bays of stick system curtain walling and individual casement windows.

2.4. Overview of the building's plant and services

2.4.1. The building is mechanically ventilated by multiple large air handling units (AHUs) located on the roof and basement levels. Cooling is supplied by the Climaveneta chillers. Heating is supplied by a Mitsubishi Ecodan water source heat pump, supplemented by three Hoval gas fired boilers.

2.4.2. Domestic hot water has a similar design to the heating system. A Mitsubishi Ecodan water source heat pump supported by one Hoval gas fired boiler.

2.4.3. Since Domestic Hot Water DHW and heating systems combine water sourced heat pumps and gas boilers, we have set them up as bivalent systems that share 50% load each. The radiators on stair cores are fed by water from the gas fired boilers.

2.4.4. The lighting provision is LED throughout the building. The lighting is controlled by a whole-building PIR system that serves each building area appropriately. Additionally, there are daylight sensors located at the office perimeters.

2.5. Energy modelling

2.5.1. The IES-VE dynamic modelling tool has been utilised to undertake a 'Level 5' Dynamic Simulation Model (DSM) to replicate the current building, normalised as per National Calculation Methodology (NCM) protocols, and a breakdown of the current sources of carbon and energy emissions has been produced from the modelling exercise. Several dynamic simulations were then carried out to predict the NCM potential energy and carbon reduction that could be achieved through the application of various options and measures against the baseline scenario and the findings were analysed.

2.5.2. The building is modelled according to the plans that have been obtained from the 'Zutec' database that have been provided by the building engineering team.

2.5.3. Building fabric U-values (Thermal transmittance factor) and air permeability were not made available and therefore, assumptions based on the building age and relative prevailing backstop regulatory requirements at the time of construction have been adopted for this exercise. Typically, allocating accurate U-values is difficult to be found and this practice is common when completing an analysis such as this one. The system specifications of building services gathered from the site survey have been used for this DSM analysis.

2.5.4. We have simulated the building using the NCM and the EPC methodology to illustrate the quantum of energy and carbon reduction achievable.

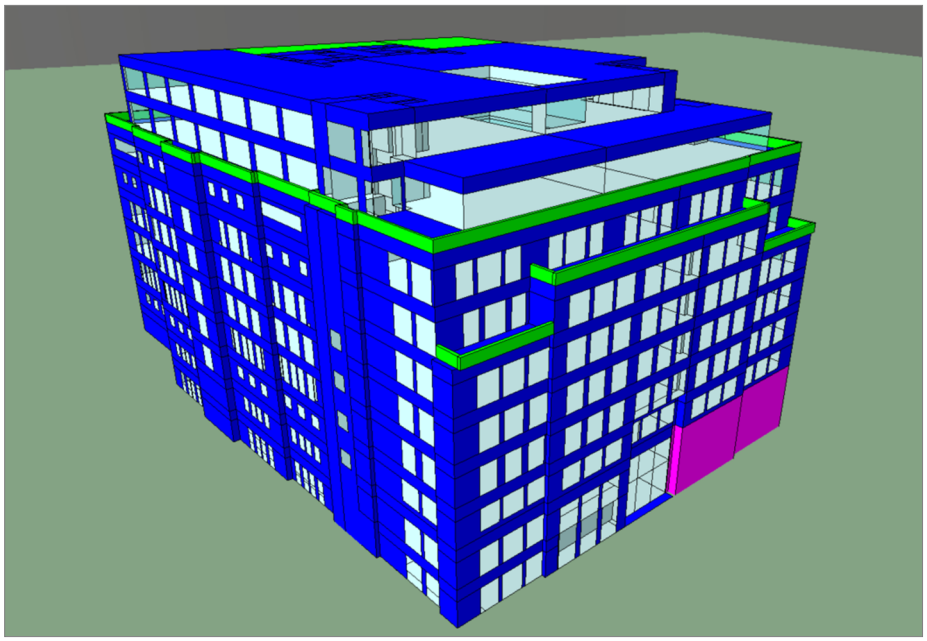


Figure 2. IES VE model of the building

2.5.5. The tables below show the thermal construction and HVAC values used in the Baseline model.

Element	U-value (W/m²k)
Roof	0.25
External wall	0.35
Internal partition * ceiling/floor	1
Ground/exposed floor	0.25
Window/ glazed door	Double glazed – 1.8 / High usage 3.5
Rooflights	2.2
Vehicle access door	1.5
Door	1.8

Mechanical services	SCoP	SEER
Mitsubishi Ecodan CRHV-P600YA-HPB	3.37	-
Climaveneta TECS2-W/HC-S	-	8.04
Ultragas H 720	88.6%	-
Ultragas 250	88.2%	-

3. Existing Energy Performance Certificate (EPC) review

3.1.1. The EPC is a mandatory requirement in England for transactional purposes and to continue to let a property.

3.1.2. **Regulatory compliance:** The Minimum Energy Efficiency Standards (MEES) in England and Wales prohibited the letting of property with an EPC rating of F and G from 01 April 2018. From 2023, this extends to all existing leases. As such, the EPC rating is a critical factor in assessing the risk for commercial assets.

3.1.3. **EPC Rating:** The EPC report dated 29th November 2017 was obtained by Hollis for review. The EPC rating is listed below, as well as the predicted 2030 MEES compliance.

3.1.4. Although the existing EPC (lodged) has a rating of B27, an EPC analysis has been completed to understand the current EPC rating when using the new Building Regulations Part L (Conservation of Fuel and Power) that came into force on 15th June 2022. The results of this updated draft EPC are B34. In both cases, the building is MEES compliant.

Asset	Certificate No.	Expiry date	EPC rating	Main heating fuel	Predicted MEES Compliance
20 Old Bailey, London EC4M 7AN	0190-0433-4819-0129-6096	28 November 2027	**B27**	Natural gas	PASS (Low Risk)
EPC Baseline	n/a	+10 years	**B34**	Natural gas	PASS (Low Risk)

3.1.5. Risk definitions:

- High risk (Below E or non-existent): non-compliant and falling below current MEES legislation.
- Medium risk (E-C): compliant with current MEES legislation but poses a significant investment risk, as future MEES legislation is likely to surpass the current EPC rating. This may lead to value reductions in the asset at the point of sale in anticipation of future MEES compliance issues. The current expectation is the MEES will be C in 2027 and increased to a B for 2030.
- Low risk (A-B): compliant with current MEES legislation and all expected MEES legislation until 2030.

3.1.6. **Comparison against existing building stock:** The EPC certificate for the building indicates that from an energy performance perspective, the building has a better energy performance rating than typical buildings of similar age and stock with a benchmark of E120 reported.

3.1.7. **Comparison against newly built stock:** The building has a better rating than newly built stock, with a benchmark of B45 reported.

3.1.8. **Likelihood of upgrade:** Based on the existing EPC ratings, it is considered that the property is not at risk under MEES legislation. The UK Government is currently consulting on proposals to set a minimum energy efficiency standard of EPC B by 2030 for commercial rented buildings.

3.1.9. Since EPCs are valid for a maximum of 10 years, it must be borne in mind that, when a new EPC is required (even if the building itself remains unchanged), the new EPC rating generated could be lower than the existing EPC. This could be due to building alterations, changes to building regulations, or changes to the modelling methodology such as the carbon factor applied to gas or electric derived energy. It is also possible that the minimum standard could be raised to a higher rating particular where this is no gas energy source. This means that buildings with a current E or D rating may require future investment in both services and fabric to ensure they are not 'energy obsolete' post-2023.

4. CRREM analysis

4.1.1. The United Kingdom intends to decarbonise the building sector by 2050. The Carbon Risk Real Estate Monitor (CRREM) tool aims to accelerate the decarbonisation and climate change resilience of the real estate sector by providing appropriate science-based carbon reduction pathways at property, portfolio and company level. The scope of the tool is to assess the carbon risks associated with operational emissions from standing investments and retrofit actions on real estate properties.

4.1.2. This section provides a summary of the building's baseline and future carbon performance and the alignment of proposed decarbonisation pathways to the CRREM 2040 target, which aligns with the 1.5°C climate target.

4.1.3. The different target trajectories reflect the level of ambition in limiting global warming to 1.5°C or 2°C in line with organisational, local or global policy. As such the risk of stranding (when a property cannot be made to comply with MEES) is higher when comparing assets against the more onerous 1.5°C targets.

4.1.4. Below is the decarbonisation roadmap considering a 1.5°C target as per the CRREM tool. It includes the energy consumption and CO_2 emissions based on the country and type of use of the asset. According to the CRREM Risk Assessment Tool v1.20, Hines' target of 2040 operational carbon intensity is 14.2 $kgCO_2/m^2/yr$ and operational energy use intensity is 74.5 $kWh/m^2/yr$ for office buildings in the UK.

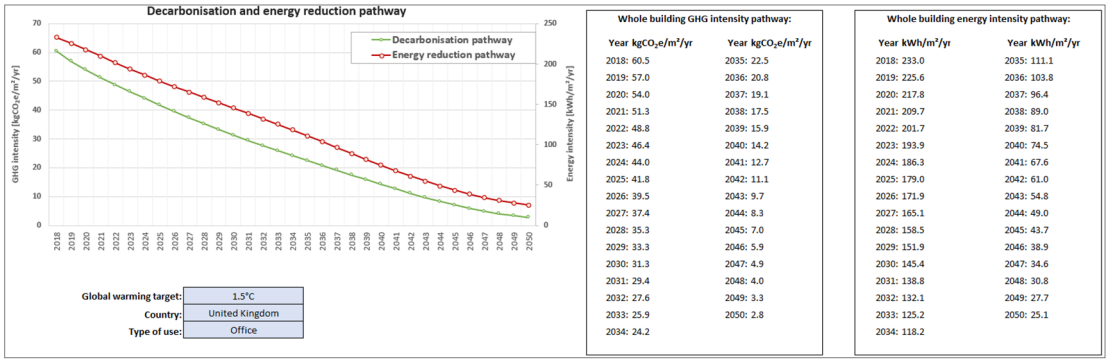


Figure 3. CRREM Risk Assessment Tool v1.20.

4.1.5. The CRREM tool considers all operational energy consumption and carbon emissions within the building, which means both regulated energy uses (heating/cooling, lighting, hot water, ventilation) and unregulated energy uses (occupier equipment, catering, lifts, computers and small power loads etc.) are considered in this target.

4.1.6. 12 months of energy data have been provided (January 2022-December 2022). According to the data provided, the electrical energy use is 3,412,420 kWh/year and the gas consumption is 976,418, kWh/year. The total operational carbon intensity for these would be 132 tonnes of CO_2/year for electricity and 616.6 tonnes of CO_2/year for natural gas.

4.1.7. The gross internal area (excluding the car park) was calculated as 29,540 m^2. Therefore, currently, the building's EUI is circa 148.6 kWh/m^2.

4.2. CRREM RESULTS- GHG Carbon emissions:

4.2.1. The figure below shows the CRREM results for the Greenhouse Gas (GHG) intensity Carbon emissions.

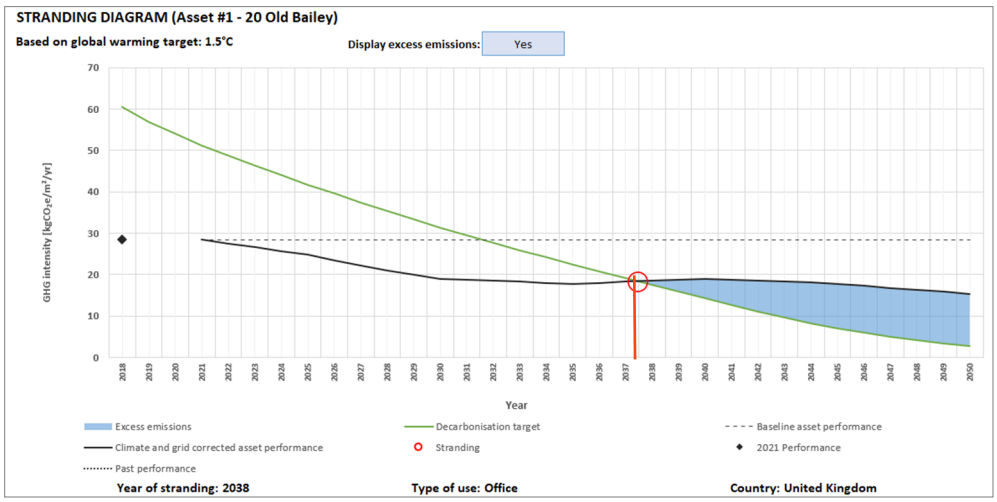


Figure 4. GHG stranding diagram

4.2.2. The black line represents the business-as-usual baseline and future carbon performance in terms of GHG intensity. This is calculated as the amount of annual GHG emissions per building floor area when the grid decarbonisation is considered.

4.2.3. The green line represents the building's target decarbonisation pathway with the 1.5°C climate target. This must not be exceeded if a property intends to be "Paris Proof".

4.2.4. If the emission intensity is above the target value, "stranding" occurs. In that case the asset would have a carbon footprint that is above the pathway shown by CRREM to achieve 2040 targets and the Paris-proof targets.

4.2.5. Economic obsolescence is associated with the stranding date; the higher the excess emissions, the greater the probability of economic obsolescence occurring. Following the 1.5°C climate target, it is projected that 20 Old Bailey will not be stranded in relation to the 2040 targets and therefore the asset's operation is in line with the Paris-proof targets.

4.2.6. However, 20 Old Bailey in its current configuration is anticipated to drop below the path in relation to energy consumption by 2038. To avoid the predicted stranding event in the future and the risk of becoming economically obsolete, energy efficiency interventions should be planned. These, and their impact, are presented in the next sections of this report.

4.3. CRREM RESULTS- Energy consumption:

4.3.1. As illustrated below, from the data provided, the energy consumption of the building is currently on the path to the Paris-proof energy target, however, it is anticipated that the asset will drop below the path in relation to energy consumption by 2029. The energy consumption will need to be reduced further to comply with the CRREM 2040 energy consumption target and beyond.

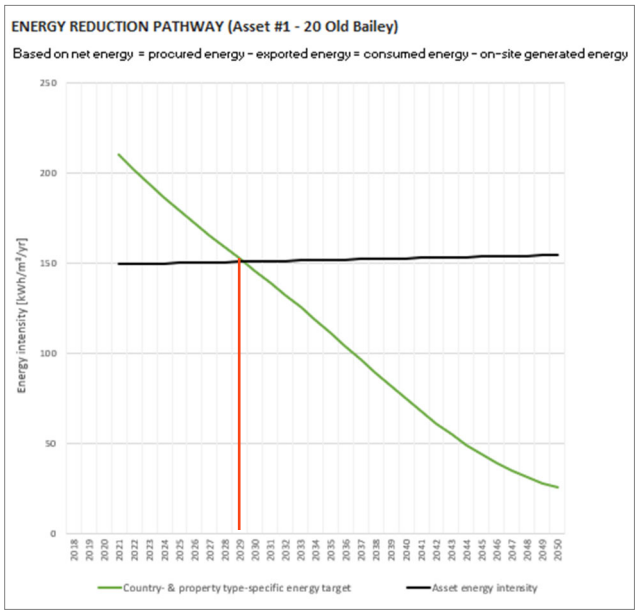


Figure 5. Energy reduction pathway diagram showing stranding point by 2029

4.3.2. The building is currently in line with the Paris-proof energy and carbon targets. However, it is recommended to follow the 'Be Lean', 'Be Clean' and 'Be Green' sections of this report, thus improving energy efficiency, reducing carbon emissions, increasing the value of the asset and making sure the building will be NZC proofed by 2040 and beyond.

5. Energy Use Intensity & NZC Building target

5.1. Energy Use Intensity (EUI)

5.1.1. We have received the total energy consumption of 20 Old Bailey, which is split into electricity and natural gas consumption. The below table highlights this information and the total energy use intensity.

	Energy consumption 2022 (kWh)	EUI (kWh/m²)
Natural Gas	976,418	33.1
Electricity	3,412,420	115.5
Total	**4,388,838**	**148.6**

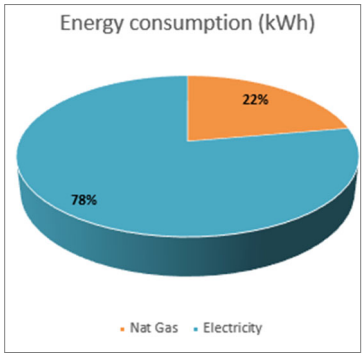


Figure 6. Energy Consumption chart

5.1.2. The graphs below show the comparison using the CIBSE Benchmarking tool, which shows the 'Typical' and 'Good' practices for similar building types compared with 20 Old Bailey.

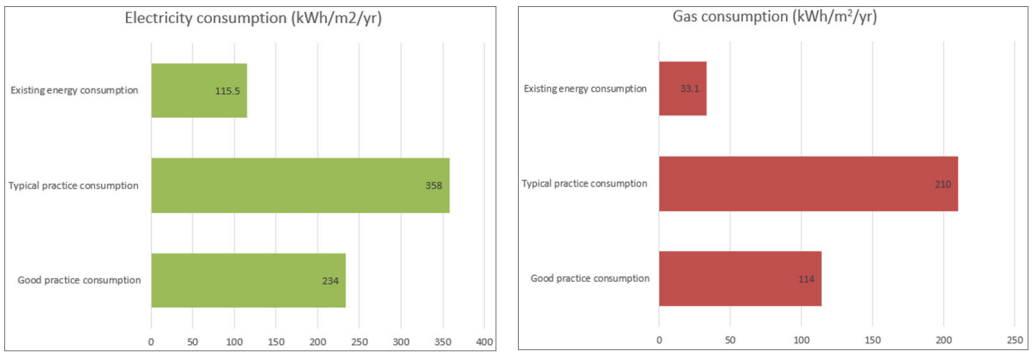


Figure 7. Electricity and gas CIBSE Benchmark figures for offices (air-conditioned, prestige)

5.1.3. The above figure shows how 20 old Bailey's energy consumption is lower than the Good practice benchmark for offices (air-conditioned, prestige).

5.1.4. The building's current energy consumption is very good, with electricity use at just 49% and gas use at just 29% of the CIBSE Good practice benchmark.

6. Recommendations

6.1.1. As discussed in the previous section, to be able to achieve CRREM 2040 we will require to consider energy efficiency recommendations following the 'Be Lean', 'Be Clean' and 'Be Green' energy hierarchy.

6.2. 'BE LEAN' - Fabric first approach

6.2.1. The first step in the energy and carbon reduction hierarchy is to 'Be Lean.' This considers fabric improvements. Implementing a fabric-first approach is a priority as it reduces the primary conditioning loading and the subsequent capacity of the cooling and heating systems as well as ensuring the efficient performance of the building services. However, given the good condition of the existing building fabric, we do not consider it cost-effective to upgrade the building fabric at this stage.

6.3. 'BE CLEAN' – Supply Energy Efficiently

6.3.1. The next step in the energy and carbon reduction hierarchy is to 'Be Clean'. This considers efficient building services within the building. The below table shows the 'Be Clean' improvement measures, showing the impact on the EPC rating and the cost estimates for each of the measures.

Action	EPC (kWh/m²)	EPC ($KgCO_2/m^2$)	EPC rating	Estimated cost***
Current building performance/ Baseline EPC	49.14 (Unregulated energy 48.84*)	6.14 (Unregulated carbon 6.64**)	B34	N/A
'Be Clean' recommendations: 1) Install demand-controlled ventilation CO_2 sensors throughout the building's areas with mechanical ventilation.	41.63 (Unregulated energy 48.84*)	5.85 (Unregulated carbon 6.64**)	B33	£1,418,000
2) Refigure Heat-Pump Waste Heat Recycling circuit to serve DHW only and equip calorifiers with electric immersion heaters.	48.61 (Unregulated energy 48.84*)	4.91 (Unregulated carbon 6.64**)	B27	£30,000
3) Replace the FCU system with a VRF system and replace the LTHW radiators with electric panel radiators at the stair cores.	25.32 (Unregulated energy 48.84*)	3.93 (Unregulated carbon 6.64**)	A22	£4,444,400[1]
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* The unregulated energy use is based on the BRUKL report

** The unregulated carbon has been converted from the unregulated energy use with the electricity carbon factor of 0.136 CO_2/kWh.

*** See Appendix C for cost limitations

1. Associated costs with upgrading the electrical Substation have not been considered in the estimated costs.

6.3.2. 1). Install demand-controlled ventilation using CO_2 sensors to control the flow of fresh air into the building. This improvement would reduce the volume of fresh air when occupancy levels are lower than normal, reducing energy use. As the CO_2 in the air approaches undesirable levels of comfort the fresh air volume ramps back up. Before proceeding with the recommendation, a full feasibility study would be required to ensure this improvement would be practical.

6.3.3. 2). Currently, the energy to the domestic hot water (DHW) is provided by both the gas-fired boilers and the heat pump system. Another 'Be Clean' recommendation is to entirely remove reliance on the gas-fired boilers and instead install electric immersion heaters.

6.3.4. 3). Same as for the DHW system, heating is provided by both the gas-fired boilers and the heat pump system. Our final recommendation is to remove entirely the dependency on natural gas by replacing the fan coil unit (FCU) with a modular VRF system. This work would be disruptive and expensive and so would only likely be implemented at the end of the current FCU system's lifespan. In conjunction with the recommendation above, this will completely remove the property's gas dependency, increasing its EPC rating, and property value and aligning with the Net Zero Carbon strategy. The stair core radiators fed from the boilers would be replaced with electric panel heaters.

6.3.5. Hollis recommends following the Scenario 2 (S2) strategy, which includes recommendations 2) and 3), as shown in the above table. S2 provides the best improvement of the EPC rating and also, it is the only option to phase out all fossil fuels within the building, which is one of the key principles of achieving a NZC building.

6.3.6. Although demand-controlled ventilation using CO_2 sensors is typically a good measure to reduce energy consumption when the building is not fully occupied, the measure does not seem to be a cost-effective solution in the current scenario. It is also only applicable to the existing system and not to the system proposed in VRF recommendation 3.

6.3.7. The VRF recommendation is a better solution as it reduces both the carbon and energy intensity of the building. If this recommendation is considered, gas-fired will be phased out from the building. LTHW radiators located within the stair cores will have to be replaced with electric panel heaters. This has been considered in the recommendation 3.

6.3.8. With all the 'Be Clean' measures, we would achieve an EPC rating of A15 and energy savings of circa 20% and carbon savings of circa 27% from the Baseline EPC (B34).

6.3.9. Please be aware the existing electrical supply to the property may need to be upgraded as the energy use moves away from gas towards electricity. This will require further analysis and we have not provided any costs for this work.

6.3.10. The current gas usage for this property is circa 980,000 kWh (2021). If the different 'Be Clean' recommendations are applied, electricity consumption is expected to increase. Further investigation is required to understand the total increase, but we estimate that the total electricity consumption increase would be circa 320,000 kWh (assuming the proposed equipment will be around 3 times more efficient than the existing gas-fired equipment).

6.4. 'BE GREEN' - Implementing on-site renewables

6.4.1. The final stage of the hierarchy is 'Be Green'. This stage looks into the possible implementation of on-site renewable technologies. The current building is already equipped with a PV system that takes up all available practical space for this type of installation. Hence, PV expansion is not an available option. In addition, 20 Old Bailey uses heat pump technology to produce part of its DHW and heating load.

6.4.2. Other on-site renewable technologies would require a feasibility study to be considered.

Wind

6.4.3. The site is relatively built up and is poorly suited to the application of a wind turbine due to the turbulence induced by the surrounding buildings.

6.4.4. A vertical axis (Gorlov Type) turbine may be technically feasible, however, there are a limited number of manufacturers of this type of turbine, so in this instance, wind energy has been discounted as a viable means of generating on-site renewable energy.

Battery storage

6.4.5. Advances in battery storage technology and a decrease in the cost of Lithium-ion batteries have meant that the economic benefits of installing battery storage have become more viable, and there is a strong business case for deploying battery storage alongside large-scale PV systems.

6.4.6. The benefits of adding battery storage include:

- Deferred usage: excess on-site renewable power can be stored and used when required.
- Future-proofing the site: allowing excess capacity to be installed to provide energy for future innovations such as electric vehicle charging.

6.5. Behavioural change

6.5.1. This section suggests some recommendations to be considered in terms of Behavioural change, which would be very useful to reduce energy consumption to be aligned with the Paris-proof energy target.

6.5.2. Energy awareness campaigns are critical in enabling tenants to become more aware of the impacts of energy use and to effectively establish sustainable habits and work-life practices. They can provide a foundation of energy literacy and sustainability to office workers and can help them reduce energy wastage.

6.5.3. Behavioural change can produce highly significant energy reductions. Behavioural change is related to metering and energy monitoring. To save energy you first need to understand how the energy is used within your buildings and then you will be able to apply effective measures where and when they are needed.

6.5.4. Even small changes are a good start, and this type of positive attitude opens more possibilities for further improvements in the future. Besides having the metering strategy, the behavioural change could save circa 2% electricity consumption.

✚ Finding Motivation

6.5.5. Raising awareness of the benefits of saving energy is a good start. It will pay dividends to promote energy efficiency across all your assets, because small behavioural changes, such as switching off equipment and lights when not in use will have a major impact.

- Appointing Carbon Champions for every building encourages competition in carbon savings between the different buildings across your assets.
- A little friendly competition between floors/departments, etc. could spur their energy-saving efforts. Make sure that the prize for the competition is something worth the extra effort.

✚ No Cost Actions

6.5.6. The following is a list of actions that people in your buildings can make. These actions will not cost any money and will save some!

- Equipment on standby still uses energy and all appliances should be fully turned off when they are not being used.

✚ Low-Cost Actions

6.5.7. The following list details actions that will cost a small amount but will save more money with time.

- You can save energy by using a power strip/BMS as a central "shut off" point for your consumer electronics, so you can cut the power entirely from one button when they are not being used.
- Use timer plugs on appliances that have a regular operating schedule.
- Encourage staff and clients to use window blinds. These are useful in winter to maintain heat in the building and also reduce solar gain in summer. Both types of usage will reduce energy consumption.

6.5.8. Behavioural energy savings applied to this building have not been taken into account in the calculations, as these would be subject to further consideration/engagement with the tenants.

7. Conclusions

7.1.1. This report shows that the current building is performing very well in terms of energy consumption. The EPC Baseline rating is a B34, which complies with the MEES 2030 target, and the actual EUI of the building is better than the CIBSE Best Practice Benchmarks. It also shows that the building is currently on the pathway to the Paris-proof/CRREM energy and carbon 2040 targets.

7.1.2. However, by 2029 it will drop below the path in relation to energy consumption and by 2038 will drop below the path in relation to carbon emissions.

7.1.3. Therefore, energy efficiency recommendations, quick wins and behavioural change measures have been analysed to further reduce energy consumption and be able to comply with Hines' energy targets until at least 2040.

7.1.4. When applying all the recommendations, 20 Old Bailey achieves an EPC rating of A15.

7.1.5. The figure below shows the impact of these measures compared to the real energy consumption and how by applying the suggested energy improvements, the building would be able to reduce its total energy consumption by circa 14.3% (Compare columns 1 and 4 in the figure below). A real consumption adjustment has been considered to take into account the difference between the real energy consumption and the EPC Baseline results. The savings shown below are cumulative.

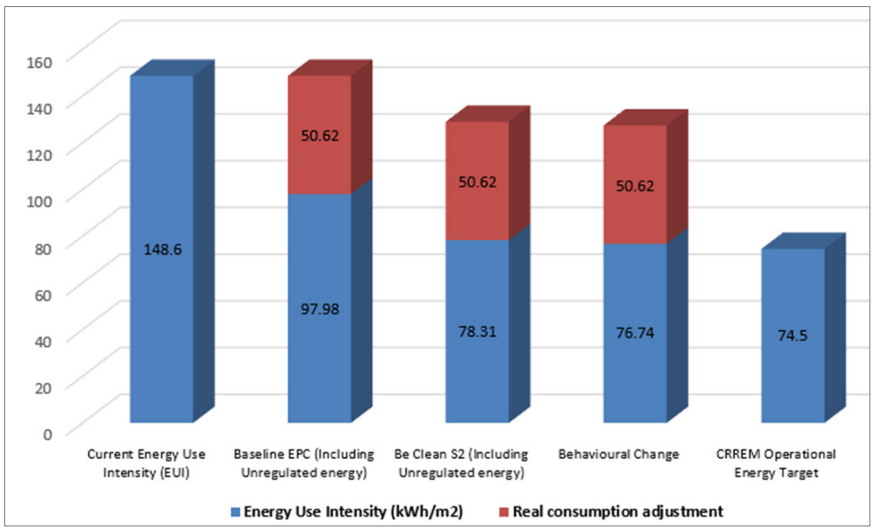

Figure 8. EPC Energy improvements compared to CRREM 2040 target

7.1.6. If the energy saving recommendations considered within this report are applied to the current energy consumption, the CRREM Risk Assessment tool shows that the building will drop below the path, in relation to carbon emissions consumption (main target), by 2044, achieving therefore Hines' CRREM 2040 Operational carbon target.

7.1.7. Regarding the operational energy of the building, after applying all the recommended measures, the building will drop below the path, in relation to energy use intensity, by 2039, therefore almost achieving Hines' CRREM 2040 energy targets. Further recommendations, such as behavioural change should be applied to make sure energy consumption is reduced to be able to achieve CRREM 2040 energy targets.

7.1.8. Whilst it is often very difficult for existing buildings to achieve the CRREM 2040 energy consumption targets, it is clear to see how this type of building can achieve these targets after applying all of the energy recommendations, quick wins and behavioural changes set out in this report. It is anticipated that the overall energy consumption will be reduced due to a more efficient equipment being installed in the future and after the suggested behavioural changes have been applied. Therefore, there is a very low risk that the building will not achieve both, the carbon emissions consumption (main target) and the energy consumption CRREM 2040 targets.

Appendix A

Baseline/existing EPC

Energy Performance Certificate

Non-Domestic Building

HM Government

20 Old Bailey
Greater London
london
EC4M 7N

Certificate Reference Number:
9088-0753-0689-4207-2348

This certificate shows the energy rating of this building. It indicates the energy efficiency of the building fabric and the heating, ventilation, cooling and lighting systems. The rating is compared to two benchmarks for this type of building: one appropriate for new buildings and one appropriate for existing buildings. There is more advice on how to interpret this information in the guidance document *Energy Performance Certificates for the construction, sale and let of non-dwellings* available on the Government's website at www.gov.uk/government/collections/energy-performance-certificates.

Energy Performance Asset Rating

More energy efficient

A+

Net zero CO_2 emissions

A 0-25

B 26-50

C 51-75

D 76-100

E 101-125

F 126-150

G Over 150

34 This is how energy efficient the building is.

Less energy efficient

Technical information

Main heating fuel:	Grid Supplied Electricity
Building environment:	Air Conditioning
Total useful floor area (m^2):	30823.615
Building complexity:	Level 5
Building emission rate ($kgCO_2/m^2$ per year):	6.14
Primary energy use (kWh/m^2 per year):	49.14

Benchmarks

Buildings similar to this one could have ratings as follows:

23 If newly built

61 If typical of the existing stock

Administrative information

This is an Energy Performance Certificate as defined in the Energy Performance of Buildings Regulations 2012 as amended.

Assessment Software:	Virtual Environment v7.0.15 using calculation engine ApacheSim v7.0.15
Property Reference:	UPRN-000000000000
Assessor Name:	Jose Alvarez
Assessor Number:	ABCD123456
Accreditation Scheme:	Information not available
Assessor Qualifications:	NOS5
Employer/Trading Name:	Trading Name
Employer/Trading Address:	Trading Address
Issue Date:	08 Mar 2023
Valid Until:	07 Mar 2033 (unless superseded by a later certificate)
Related Party Disclosure:	Not related to the owner

Recommendations for improving the energy performance of the building are contained in the associated Recommendation Report: 1746-6779-7544-6162-6981

About this document and the data in it

This document has been produced following an energy assessment undertaken by a qualified Energy Assessor, accredited by Information not available. You can obtain contact details of the Accreditation Scheme at Information not available.

A copy of this certificate has been lodged on a national register as a requirement under the Energy Performance of Buildings Regulations 2012 as amended. It will be made available via the online search function at www.ndepcregister.com. The certificate (including the building address) and other data about the building collected during the energy assessment but not shown on the certificate, for instance heating system data, will be made publicly available at www.opendatacommunities.org.

This certificate and other data about the building may be shared with other bodies (including government departments and enforcement agencies) for research, statistical and enforcement purposes. For further information about how data about the property are used, please visit www.ndepcregister.com. To opt out of having information about your building made publicly available, please visit www.ndepcregister.com/optout.

There is more information in the guidance document *Energy Performance Certificates for the construction, sale and let of non-dwellings* available on the Government website at: www.gov.uk/government/collections/energy-performance-certificates. It explains the content and use of this document and advises on how to identify the authenticity of a certificate and how to make a complaint.

Opportunity to benefit from a Green Deal on this property

The Green Deal can help you cut your energy bills by making energy efficiency improvements at no upfront costs. Use the Green Deal to find trusted advisors who will come to your property, recommend measures that are right for you and help you access a range of accredited installers. Responsibility for repayments stays with the property - whoever pays the energy bills benefits so they are responsible for the payments.

To find out how you could use Green Deal finance to improve your property please call 0300 123 1234.

Appendix B

Predicted EPC with ‘BE CLEAN’ S2 recommendations implemented

Energy Performance Certificate

Non-Domestic Building

HM Government

20 Old Bailey
Greater London
london
EC4M 7N

Certificate Reference Number:
5250-2142-0271-0702-9907

This certificate shows the energy rating of this building. It indicates the energy efficiency of the building fabric and the heating, ventilation, cooling and lighting systems. The rating is compared to two benchmarks for this type of building: one appropriate for new buildings and one appropriate for existing buildings. There is more advice on how to interpret this information in the guidance document *Energy Performance Certificates for the construction, sale and let of non-dwellings* available on the Government's website at www.gov.uk/government/collections/energy-performance-certificates.

Energy Performance Asset Rating

More energy efficient

A+

Net zero CO_2 emissions

A 0-25

B 26-50

C 51-75

D 76-100

E 101-125

F 126-150

G Over 150

15 **This is how energy efficient the building is.**

Less energy efficient

Technical information

Main heating fuel:	Grid Supplied Electricity
Building environment:	Air Conditioning
Total useful floor area (m^2):	30823.615
Building complexity:	Level 5
Building emission rate ($kgCO_2/m^2$ per year):	2.69
Primary energy use (kWh/m^2 per year):	29.47

Benchmarks

Buildings similar to this one could have ratings as follows:

17 If newly built

47 If typical of the existing stock

Administrative information

This is an Energy Performance Certificate as defined in the Energy Performance of Buildings Regulations 2012 as amended.

Assessment Software:	Virtual Environment v7.0.15 using calculation engine ApacheSim v7.0.15
Property Reference:	UPRN-000000000000
Assessor Name:	Jose Alvarez
Assessor Number:	ABCD123456
Accreditation Scheme:	Information not available
Assessor Qualifications:	NOS5
Employer/Trading Name:	Trading Name
Employer/Trading Address:	Trading Address
Issue Date:	16 Mar 2023
Valid Until:	15 Mar 2033 (unless superseded by a later certificate)
Related Party Disclosure:	Not related to the owner

Recommendations for improving the energy performance of the building are contained in the associated Recommendation Report: 8860-7102-1709-7969-5247

About this document and the data in it

This document has been produced following an energy assessment undertaken by a qualified Energy Assessor, accredited by Information not available. You can obtain contact details of the Accreditation Scheme at Information not available.

A copy of this certificate has been lodged on a national register as a requirement under the Energy Performance of Buildings Regulations 2012 as amended. It will be made available via the online search function at www.ndepcregister.com. The certificate (including the building address) and other data about the building collected during the energy assessment but not shown on the certificate, for instance heating system data, will be made publicly available at www.opendatacommunities.org.

This certificate and other data about the building may be shared with other bodies (including government departments and enforcement agencies) for research, statistical and enforcement purposes. For further information about how data about the property are used, please visit www.ndepcregister.com. To opt out of having information about your building made publicly available, please visit www.ndepcregister.com/optout.

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Appendix C

Cost table limitations

The costs are indicative of the specific element only and should only be relied on as a rough benchmarking of costs. The costs do not include preliminaries, inflation, allowance for working within occupied buildings, design/professional fees, planning or any other regulations/approval fees, access cost, and other works associated with asbestos/contamination and making good work required to facilitate recommendations.