83 CLERKENWELL ROAD, LONDON

ENERGY STRATEGY

PROJECT NUMBER: P1683

DOCUMENT REF: P1683-ENE-01

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1.0 EXECUTIVE SUMMARY

QuinnRoss Consultants was commissioned to develop an energy assessment for the refurbishment of 83 Clerkenwell Road, London, that would demonstrate how it will provide heating and power and meet the energy and carbon emission targets set by national and local policy. The site is located on Clerkenwell Road, Holborn, London, and is currently an office space last refurbished in 2002. The proposal is to keep the current use (office) and perform a full refurbishment of all lighting and HVAC systems.

This development will be subject to the following requirements:

Requirement	Description / Summary
Building Regulations Part L2B	You are expected to improve the building's energy efficiency, however there are no specific targets
EPC	An EPC calculation for all buildings must be carried out upon completion by an experienced engineer accredited with a well-established professional body.
Camden Local Plan 2017, policy CC1	The Local Plan does not outline any specific energy or CO_2 targets for refurbishment; however, it does highlight the desire for sustainable construction methods that are better than current national requirements and to aim for high levels of energy efficiency, decentralised & low carbon energy generation in line with the London Plan.
London Plan 2016, Policy 5.4	The London Plan expects refurbishment development to retrofit energy saving measures (Lean), look to connect to decentralised heat networks (Clean) and install renewable energy sources (Green). The target CO_2 emissions is based on a *Baseline* building, the building as of when it was last refurbished (2002 in this case), and the refurbishment must have reduced CO_2 and energy consumption over this Baseline.
BREEAM UK Refurbishment and Fit-Out 2014	There is no requirement for the building to achieve a BREEAM rating, however the client intends to achieve an "Excellent" rating.

Table 1: Summary of energy and sustainability targets

To achieve the above targets, the following energy reduction methods will be required, using the London Plan's Energy Hierarchy:

Method	Description / Summary
Be Lean	
Highly efficient lighting with controls	LED lighting will be installed throughout, with daylight and occupancy sensing controls where possible.
Highly efficient HVAC systems	Highly efficient heat pumps for heating and cooling are specified, and mech vent units with low SFP's and heat recovery.
Insulated pipe work	All Internal heating pipework will be insulated to a standard beyond building regulation requirements.
Unregulated Energy Use	Efforts will be made to reduce the unregulated emissions by providing "best in class" ("A" rated or equivalent) white goods where possible.

Be Clean	
District Heating	The nearest existing heat network is around 600m from the site, which is not an insurmountable distance, however pipe work and excavation would have to cross the Farringdon station train line which would likely cause significant disruption. The nearest proposed network is around 1,700m which is an unfeasible distance for this development. District heating is therefore not considered.
Combined Heat and Power (CHP)	Although CHP is plausible for this site, it would not offer significantly improved savings over heat pumps. It is also worth noting that emerging Building Regs are widely predicted to be moving away from CHP and finite resource consumption, therefore CHP is not considered.
Be Green	
Low or Zero Carbon (LZC) technologies	The development will be fully heated and cooled by the latest high efficiency heat pumps.

Table 2: Summary of energy hierarchy Lean, Clean & Green methods

Thermal and Energy Modelling Results

The whole development has been analysed for its energy use and therefore CO_2 emissions using approved energy modelling software. The predicted tonnes of CO_2 and savings are shown below:

Non-Domestic	Regulated t/CO_2 year
Baseline	135.2
After Energy Demand Reduction	83.0
After Heat Network / CHP	83.0
After Renewable Energy	63.1

Scenario	Regulated Non-Domestic Carbon Dioxide Savings	
	Regulated t/CO_2 year	%
Savings From Energy Demand Reduction	52.2	39%
Savings From Heat Network / CHP	0	0%
Savings From Renewable Energy	20	15%
Cumulative On-Site Savings	72.1	53%

Table 3: Summary of domestic CO_2 emissions and savings

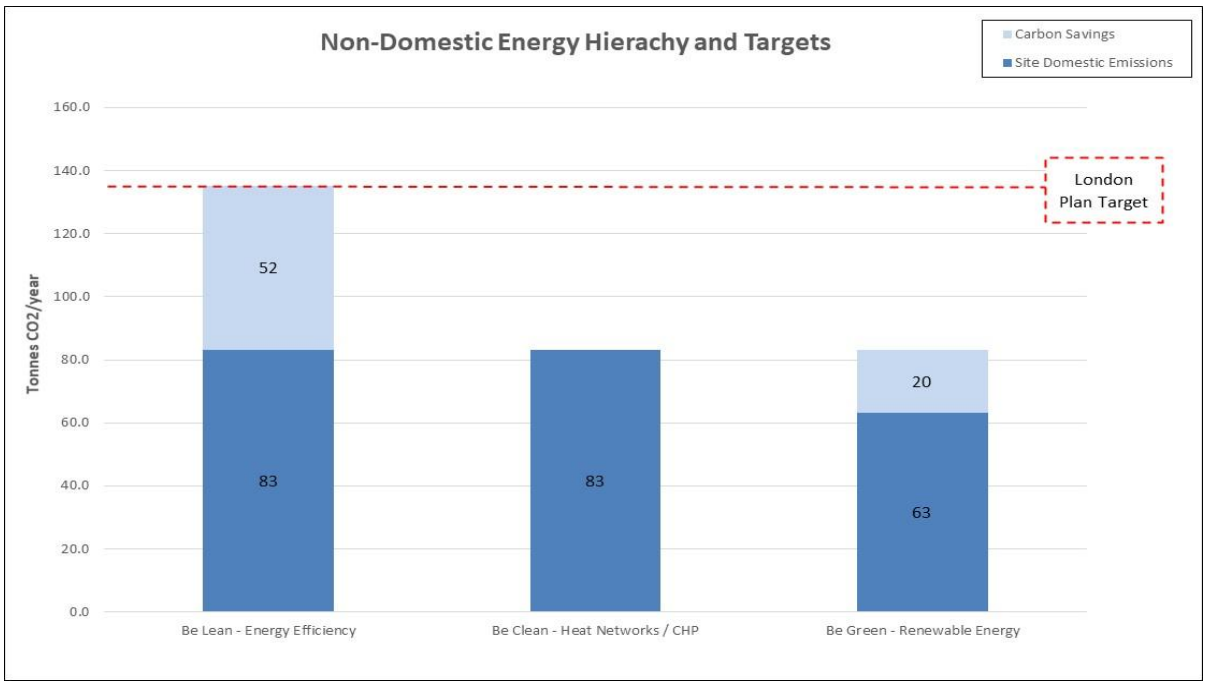


Figure 01: Summary of domestic CO_2 emissions and savings

As the results above show, when including all available Lean, Clean and Green technologies and methods, the whole development will achieve a 53% improvement over London Plan targets.

2.0 INTRODUCTION

QuinnRoss Consultants was commissioned to develop an energy assessment for the refurbishment of 83 Clerkenwell Road, London, that would demonstrate how it will provide heating and power and meet the energy and carbon emission targets set by national and local policy.

The site is located on Clerkenwell Rd, Holborn, London. See image below:

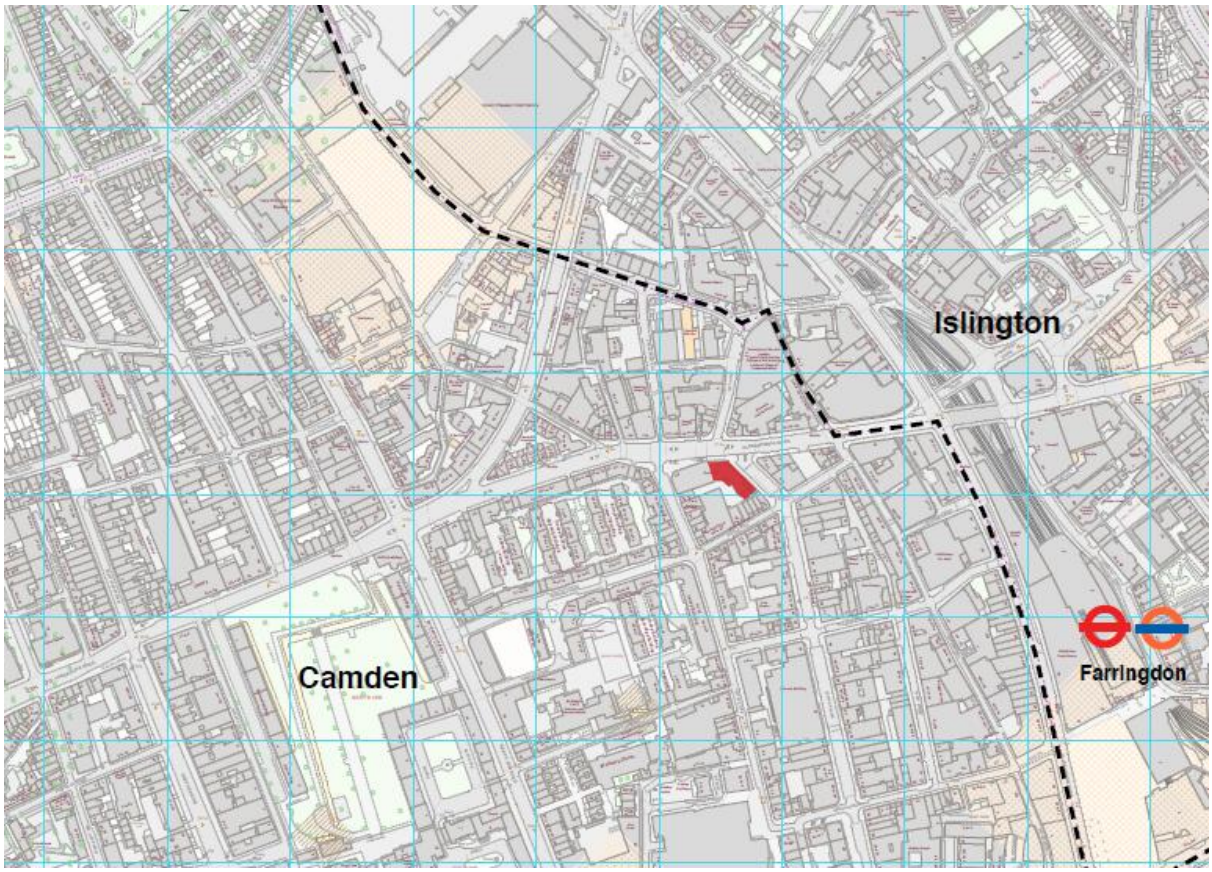


Figure 02: Map image of site

A 3D model image of the development is below:

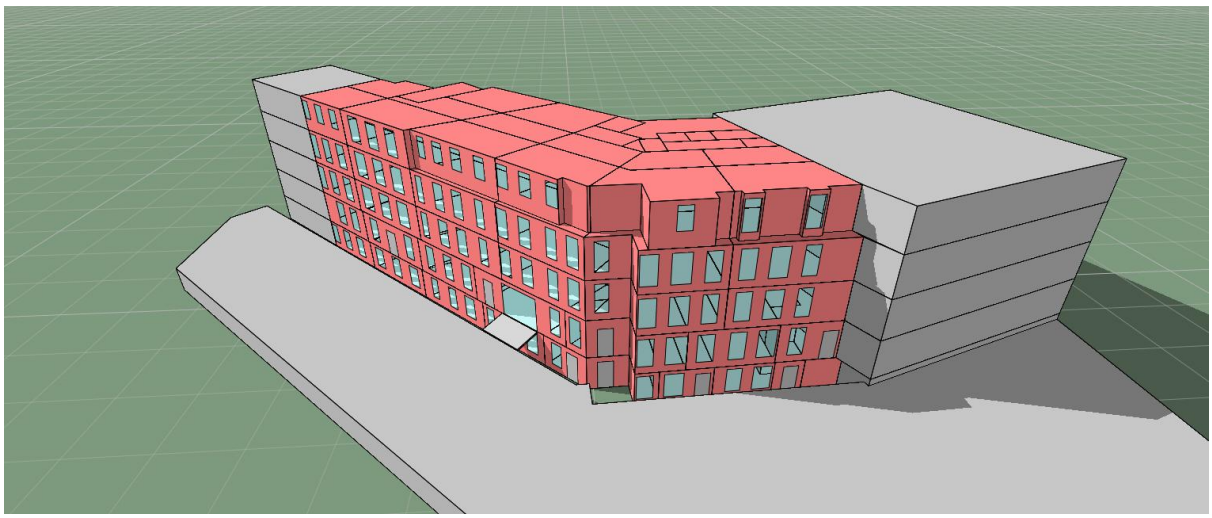


Figure 03: 3D model image of scheme

3.0 PLANNING POLICY AND LEGISLATION

This section describes the planning policies and regulations that will affect the proposed development. These are outlined below:

- Building Regulations Part L2B 2013, existing buildings other than dwellings.
- Energy Performance Certificate (EPC).
- Camden Local Plan 2017.
- London Plan 2016.
- BREEAM UK Refurbishment and Fit-Out 2014.

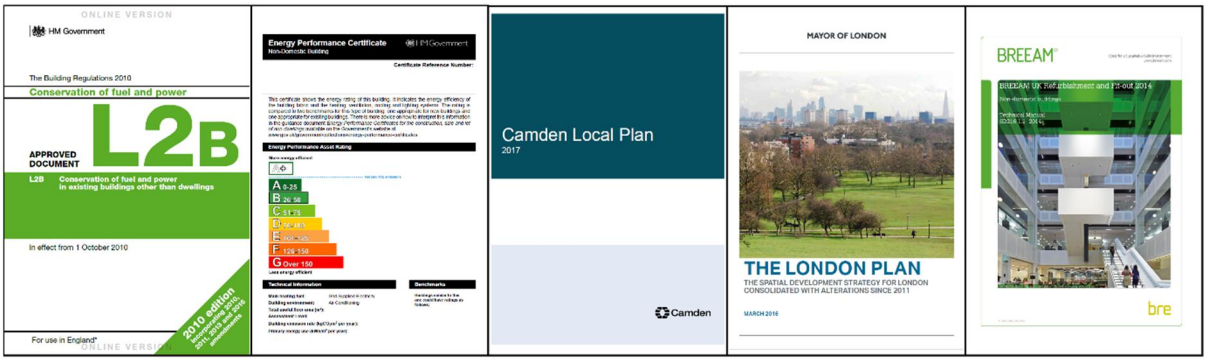


Figure 04: Document front cover images of applicable policies

3.01 Building Regulations Part L2B

The development will come under Part L2B for existing non-domestic buildings. This policy does require refurbishment works to improve the building's energy efficiency, however there are no specific targets or requirements that are mandatory to achieve.

3.02 Energy Performance Certificate (EPC)

It is a legal requirement for all new and existing buildings that are built, sold, or rented to undergo predicted energy consumption calculations and have the results displayed in the form of an EPC. Buildings are assessed on a band A to G scale where A is extremely efficient with low CO_2 emissions and G is poor performance.

All EPC scores are subject to the Minimum Energy Efficiency Standards (MEES) which requires all buildings to achieve a score better than F/no lower than E.

All EPC calculations must also be carried out by an experienced engineer accredited with a well-established professional body.

3.03 Camden Local Plan

Camden Council do not have any additional targets or more onerous requirements over Building Regulations. However, Policy CC1 does highlight the desire for sustainable construction methods that are higher than current national requirements. This may include high levels of energy efficiency and decentralised/low carbon energy generation. It also outlines adhering to the London Plan.

3.04 London Plan 2016

This report will follow the London Plan's guidance for analysing existing or retro-fit buildings. Policy 5.4 requires existing building stock to reduce CO_2 emissions and improve resource efficiency. It also requires the retro-fitting of energy efficiency measures (lean), reviewing connection to decentralised energy measures

(clean) and exploring renewable technologies (green) where possible. This is in line with the *lean*, *clean* and *green* strategy aimed at new buildings.

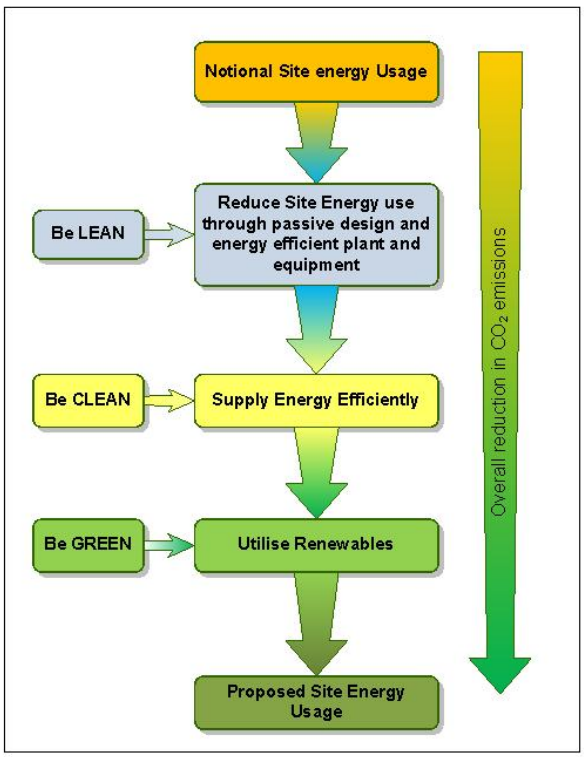
The "target" will be to create a *Baseline* building set up in an approved thermal modelling software that estimates the energy consumption when the building was last refurbished, around 2002 in this case. There is no specific method for producing this energy model, however it is a common approach to use the current Building Regulations calculation software, used for Part L2A calculations, and use the existing building fabric, HVAC systems and lighting from the last refurbishment of the building circa 2001-2002. This *Baseline* building will be the development's target to improve upon.

3.05 BREEAM UK Refurbishment and Fit-Out 2014

There are no requirements to achieve a BREEAM rating, however the client intends to achieve an "Excellent" rating. Please see the separate report produced by Quinn Ross, *P1683-BREEAM-02_Clerkenwell_Rd*, issued 18/05/2020, which outlines this building's intentions for BREEAM.

4.0 ENERGY HIERACHY

As part of our aims to provide a sustainable development we will be following the widely adopted energy hierarchy originally outlined in the London Plan policy. The hierarchy shown below guides our approach to minimising the energy use within the building and to create a comfortable internal environment. This consists of three best practice criteria: Be Lean, Be Clean and Be Green to achieve Low energy and carbon design.



Be Lean – Passive Measures: reducing energy use through consideration of building form and construction in order to minimise the need for mechanical and electrical systems. Minimise plant energy use by selecting the most appropriate engineering systems and optimising system performance.

Be Clean – Decentralised Energy: consideration given to the potential to connect to any local decentralised heating networks.

Be Green – Renewable Energy: the use of appropriate on-site renewable/low carbon technologies.

Figure 05: London Plan's energy hierarchy

The design team has taken the above criteria and applied the most feasible measures to the building.

4.01 Be Lean

4.01.01 Energy efficient services

A number of energy efficient HVAC and lighting strategies are proposed for the development:

- Lighting – LED lighting will be installed throughout and be chosen to minimise over-illumination.
- Energy meters – energy meters will be installed for all major energy uses including water.
- User controls – Efficient and user-friendly controls will be specified throughout.
- Heating – Heating will be provided by high efficiency heat pumps with a 438% heating generator seasonal efficiency.
- Hot water – All hot water will be point of use instantaneous heaters to reduce losses through wasteful storage systems.
- Mechanical ventilation – Any mechanical / fresh air ventilation units will utilise highly efficient heat recovery systems and low specific fan powers (SFP's).
- Cooling – Efficient mechanical equipment (lighting, fans etc) will be specified to minimise internal gains.
- Air conditioning – As with the heating, highly efficiency heat pumps will provide cooling to all areas.

4.01.02 Insulated pipework

All Internal heating pipework will be insulated to a standard beyond building regulation requirements. This will minimise issues of internal heat gain and avoid the need for any additional ventilation or cooling.

4.01.03 Unregulated energy use

In addition, efforts are being made to reduce the unregulated emissions by providing "best in class" ("A" rated or equivalent) white goods in each kitchen area to encourage energy consumption reduction.

Please note the benefits of high efficiency appliances cannot be included in any results shown in this report. These measures interact to some degree (e.g. more low energy lighting reduces the ancillary heat gains from lighting, so increases the space heating demand) so comparisons of individual results can produce apparent anomalies and are not provided as a result.

4.02 Be Clean

4.02.01 District Heating (DH) Networks

Please see below the local London Heat Map for this development, showing existing and proposed district heating networks:

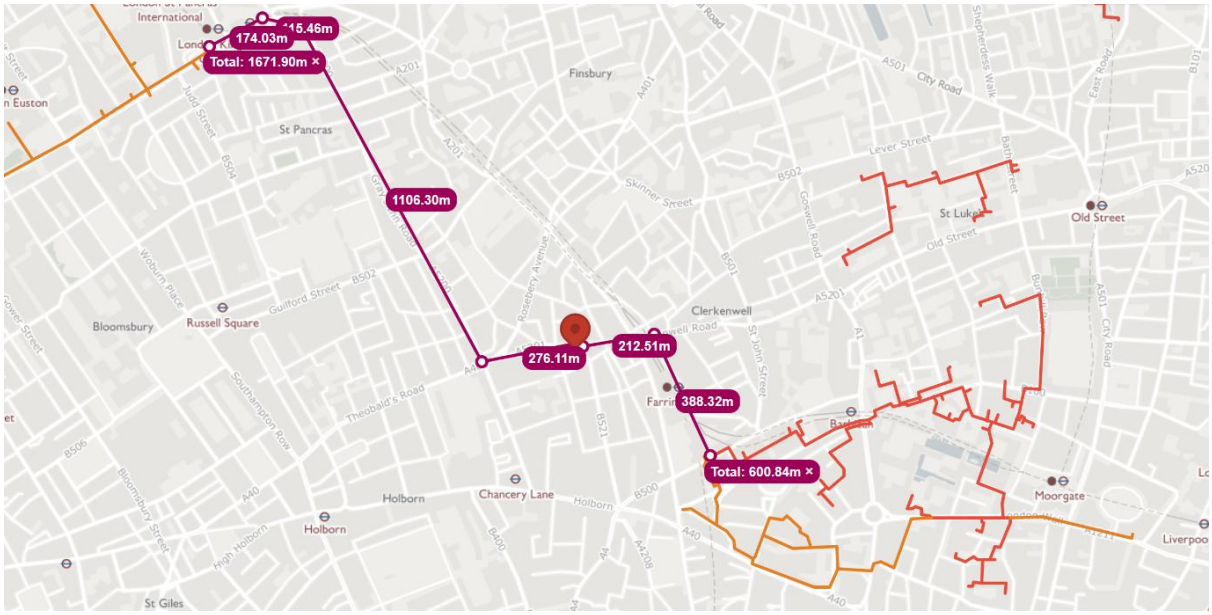


Figure 06: London Heat Map showing existing (red) and proposed (orange) heat networks

The nearest existing heat network is around 600m from the site, which is not an insurmountable distance, however pipe work and excavation would have to cross the Farringdon station train line which would likely cause significant disruption.

The nearest proposed network is around 1,700m which is an unfeasible distance for this development.

District heating is therefore not considered.

4.02.02 Combined Heat and Power (CHP)

Although it is not unfeasible to install a CHP engine for this development it must be noted that CHP would not offer significantly better savings over heat pumps.

It must also be noted that future Building Regs are widely predicted to be moving away from CHP and natural resource consumption, therefore CHP is not considered.

4.03 Be Green

All areas of the development are proposed to have a new heat pump heating and cooling system installed, that should provide efficiencies of over 400%.

The outdoor units required for this would take nearly all available roof space, leaving no room for other renewable sources such as solar panels. This was investigated and the area of PV panels available would not offer the CO_2 savings the heat pumps offer when compared to conventional boiler and chiller system.

5.0 CALCULATION RESULTS

5.01 Software Used

All calculations will use the Dynamic Simulation Modelling (DSM) method. The software used is the *Integrated Environmental Suite (IES)* software *Virtual Environment (VE) Version 2019.0.1.0.* IESVE is one of the world leaders in developing DSM software and is used internationally for all manner of dynamic simulation calculations, including Part L2A and ASHRAE 90.1 calculations. IESVE is approved by the Department of Community and Local Government (DCLG) for performing Part L2A 2013 and EPC calculations and for fills the requirements of CIBSE AM11 as a Building Energy and Environmental Modelling (BEEM) software. The software was used to create a 3-D model based on information provided by the design team as defined in the following section. Hourly simulations for a year were then run as part of the CO_2 emissions analysis using the relevant weather file for the location.

https://www.iesve.com/

The calculations were also carried out by an approved CIBSE Low Carbon Energy Assessor (LCEA) who is a fully accredited Level, 3, 4 and 5 users of IESVE.

5.02 Results

The refurbished building was tested using the Lean and Green inputs outlined in this report using the approved software. The results are shown below:

Non-Domestic	Regulated t/CO_2 year
Baseline	135.2
After Energy Demand Reduction	83.0
After Heat Network / CHP	83.0
After Renewable Energy	63.1

Scenario	Regulated Non-Domestic Carbon Dioxide Savings	
	Regulated t/CO_2 year	%
Savings From Energy Demand Reduction	52.2	39%
Savings From Heat Network / CHP	0	0%
Savings From Renewable Energy	20	15%
Cumulative On-Site Savings	72.1	53%

Table 04: Summary of CO_2 emissions

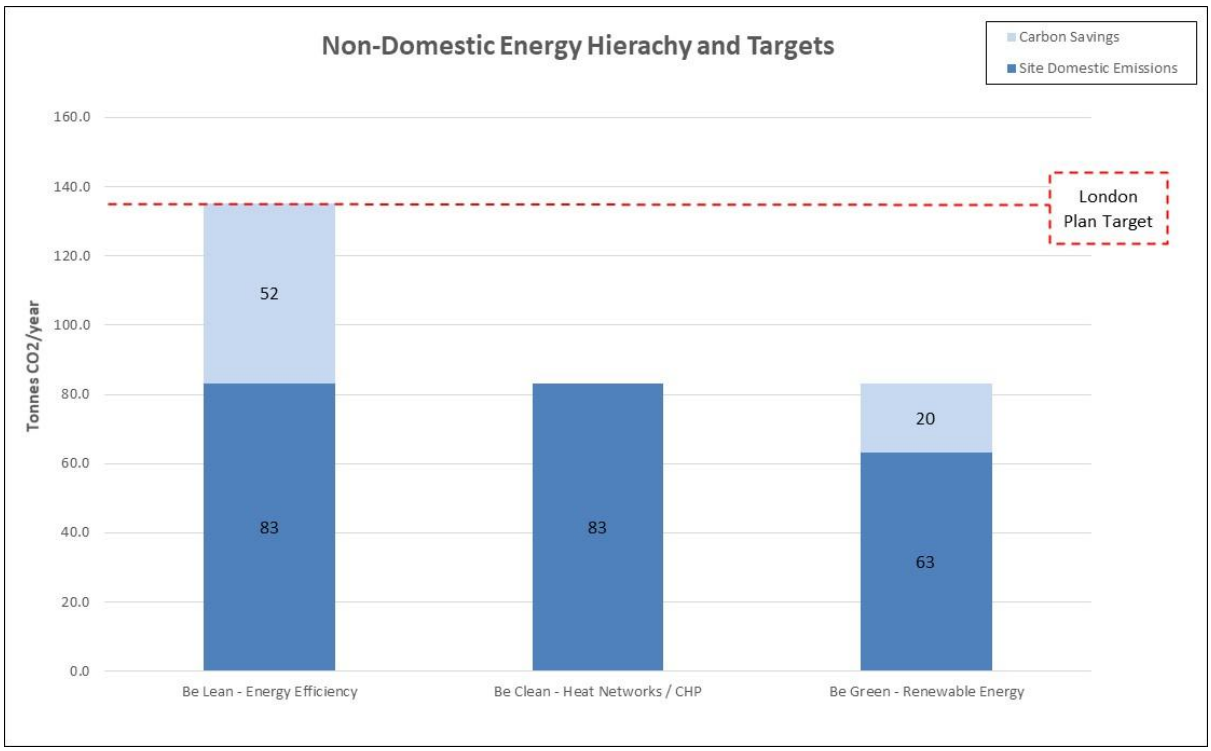


Figure 07: Summary of non-domestic CO_2 emissions

The results show that using energy efficiency measures (Lean) alone the building will have a 39% reduction of CO_2 emissions over how the building was last used.

The results show that using energy efficiency measures (Lean) and renewable technology (Green) the building will have a 53% reduction of CO_2 emissions over how the building was last used.

The building will also potentially achieve a B rating EPC.

6.0 SUMMARY & CONCLUSION

The proposed development will have to achieve the following energy & sustainability targets:

Requirement	Description / Summary
Building Regulations Part L2B	You are expected to improve the building's energy efficiency, however there are no specific targets
EPC	An EPC calculation for all buildings must be carried out upon completion by an experienced engineer accredited with a well-established professional body.
Camden Local Plan 2017, policy CC1	The Local Plan does not outline any specific energy or CO_2 targets for refurbishment; however, it does highlight the desire for sustainable construction methods that are better than current national requirements and to aim for high levels of energy efficiency, decentralised & low carbon energy generation in line with the London Plan.
London Plan 2016, Policy 5.4	The London Plan expects refurbishment development to retrofit energy saving measures (Lean), look to connect to decentralised heat networks (Clean) and install renewable energy sources (Green). The target CO_2 emissions is based on a *Baseline* building, the building as of when it was last refurbished (2002 in this case), and the refurbishment must have reduced CO_2 and energy consumption over this Baseline.
BREEAM UK Refurbishment and Fit-Out 2014	There is no requirement for the building to achieve a BREEAM rating, however the client intends to achieve an "Excellent" rating.

Table 05: Summary of energy and sustainability targets

To achieve the above targets, the following energy reduction methods will be required, using the London Plan's Energy Hierarchy:

Be Lean

- **Highly efficient lighting with controls –** LED lighting installed throughout.
- **Highly efficient HVAC systems –** Highly efficient heat pumps for heating and cooling are specified, and mech vent units with low SFP's and heat recovery.
- **Insulated pipe work -** All Internal heating pipework will be insulated to a standard beyond building regulation requirements.
- **Unregulated Energy Use -** In addition, efforts are being made to reduce the unregulated emissions by providing "best in class" ("A" rated or equivalent) white goods where possible.

Be Clean

- **District Heating (DH) –** The nearest existing heat network is around 600m from the site, which is not an insurmountable distance, however pipe work and excavation would have to cross the Farringdon station train line which would likely cause significant disruption. The nearest proposed network is around 1,700m which is an unfeasible distance for this development. District heating is therefore not considered.

- **Combined Heat and Power (CHP) –** Although CHP is plausible for this site, it would not offer significantly improved savings over heat pumps. It is also worth noting that emerging Building Regs are widely predicted to be moving away from CHP and natural resource consumption, therefore CHP is not considered.

Be Green

- All areas of the development are proposed to have a new heat pump heating and cooling system installed, that should provide efficiencies of 400% and over.

Thermal and Energy Modelling Results

The whole development has been analysed for its energy use using approved energy modelling software.

The predicted tonnes of CO_2 are shown below:

Non-Domestic	Regulated t/CO_2 year	Scenario	Regulated Non-Domestic Carbon Dioxide Savings	
			Regulated t/CO_2 year	%
Baseline	135.2	Savings From Energy Demand Reduction	52.2	39%
After Energy Demand Reduction	83.0	Savings From Heat Network / CHP	0	0%
After Heat Network / CHP	83.0	Savings From Renewable Energy	20	15%
After Renewable Energy	63.1	Cumulative On-Site Savings	72.1	53%

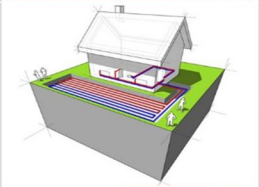
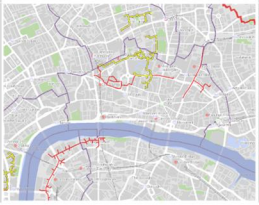
Table 06: Site total summary of CO_2 emissions and savings

As the results above show, when including all available Lean, Clean and Green technologies and methods, the development will achieve a 53% improvement over London Plan requirements.

All inputs, BRUKL documents and draft EPC's, as proof of the above approved calculations, can be found in the appendices.

7.0 APPENDICES

7.01 Appendix A – LZC Technology Feasibility Analysis

Technology		Feasibility	
Photovoltaic (PV) Panels		PV's use semiconductor technology to convert incident solar radiation into electrical power. The building is well suited for solar collection with a large flat roofs located several storeys above ground level. Any electricity that is generated and used on site is preferable as every kWh used is one that the development doesn't have to purchase. Any surplus electricity generated can be exported to the national grid, receiving a further export tariff in addition to the generation tariff. Although PV's are feasible they would take up the roof space meaning no room for the heat pump outdoor units. The CO2 savings from heat pumps will be more significant than the PV panel area available, therefore this option is less desirable than others.	**Medium**
Solar Thermal Panels		Solar thermal panels are a method of harvesting the sun's energy, commonly to provide a source of preheated water. As mentioned above, the building has a large area of roof providing an ideal location for solar thermal collection. The optimum size of a solar thermal array is to provide approximately a third of the daily stored demand, which would benefit the residential areas however it would be at the cost of PV panel area. Electricity demand reduction, from PV's, has a greater impact on CO2 savings than the gas demand used for hot water heating making this tech feasible but less effective than other options.	**Medium**
Ground Source Heat Pump (GSHP)		A GSHP takes low-grade heat from the ground and uses electricity to convert it to useful heat (at approximately 40°C) that can be used to heat a building. The ground can also be used as a heat sink to provide cooling. The bore holes and length of pipework into the ground required for this tech make this option difficult to justify considering the developments suburban location.	**Low**
Air Source Heat Pump (ASHP)		Similar to the GSHP, ASHP utilises the external environment as a heat source. A heat pump uses electricity or gas to run a refrigerant cycle, extracting heat from external air to convert it to useful heat for space heating. ASHPs offer high efficiencies and are suited to institutional and commercial properties. Although these systems are typically comparatively noisy and must be located externally their high efficiencies are too beneficial to rule out.	**High**
Wind Turbines		Wind energy can be converted to electricity by using wind turbines. This renewable technology is suited to exposed areas free from obstructions where the average wind speeds are high. On the site there are plenty of obstructions which would lead to the wind having a turbulent nature resulting in poor output for turbines, plus they have significant visual and noise impacts on neighbouring areas. Hence they are unsuitable for this development.	**Low**
Biomass		Biomass fuel is usually wood chips or wood pellets, and as it comes from plants it is considered a low-carbon source of high-grade heat that can be used for space heating, domestic hot water and, with absorption chillers, cooling (this last option is very rarely implemented due to high capital cost). A biomass boiler needs to operate under a reasonably constant load being a solid fuel boiler; it is unable to respond to load fluctuations as quickly as a gas or oil boiler. This limits the boilers to being suitable to operate for the provision of the base load. This could still be suitable for this development for its likely large base load however biomass also has the potential to have a significantly detrimental effect on air quality in the local vicinity, frequent fuel deliveries are required which could be disruptive to residents and there are significant maintenance costs. Unless a free source of wood can be found, such as waste from a factory or forestry management operation, the biomass fuel is often the same price or more expensive than gas. This means that the additional capital outlay on top of the increased fuel, maintenance costs, air quality, running costs and maintenance issues make biomass less viable than other tech available.	**Low**
Combined Heat and Power		CHP is the simultaneous generation of usable heat and power (usually electricity) in a single process, the heat being distributed in surrounding buildings instead of being wasted. CHP is best suited to buildings with large heating and DHW demands and although feasible for this building they will offer comparable energy savings to heat pumps. Taking into account that emerging Building Regulations will likely look to move away from the use of fossil fuel burning make CHP a less desirable option.	**Medium**
District Heating		DH tends to be large CHP units run by commercial energy firms supplying energy to local buildings through underground pipework. Though they offer the same benefits as an on site CHP, without maintenance costs (provided by the supplier), the limitations are the proposed site needs to be within reasonable distance of a network. The nearest existing heat network is around 600m from the site, which is not an insurmountable distance, however pipe work and excavation would have to cross the Farringdon station train line which would likely cause significant disruption. The nearest proposed network is around 1,700m which is an unfeasible distance for this development. District heating is therefore not considered.	**Low**

7.02 Appendix B – Input data used for the Baseline building

B1 Office or Workshop - Input Data		Source
Constructions U-values W/m².K		
Existing floor	0.68	Assumed - based on uninsulated concrete slab
Existing wall	1.22	Assumed - based on uninsulated solid brick wall
Existing roof	1.50	Assumed - based on uninsulated tiled roof
Door	2.20	Assumed
Existing Glazing		
Overall U-value (including frame)	3.30 W/m²K	Assumed - double glazing witnessed on site, small air gap
g-value	0.70	assumed
Air Permeability		
Air permeability	25.0 m³/m²h	Assumed - Correct assumption for existing buildings with no air test
HVAC Systems		
Chiller and boilers with AHU mech vent		
System description	4 pipe fan coil system with centralised mech vent	Witnessed on site
NCM system type	Fan coil systems	Witnessed on site
Heat source	LTHW boiler	Witnessed on site
Heating fuel type	Gas	Witnessed on site
Heating generator seasonal efficiency	0.89	Assumed - unknown efficiency, plant is 2002 installed
Heating SCoP	0.82	Assumed - unknown efficiency, plant is 2002 installed
Cooling system	Air cooled	Witnessed on site
Cooling fuel type	Electricity	Witnessed on site
Cooling seasonal energy efficiency rating (SEER)	2.50	Assumed - unknown efficiency, plant is 2001 installed
AHU Specific fan power (SFP)	2.90	Assumed - unknown efficiency, plant is 2001 installed
AHU Pump type	Constant	Assumed
Heat recovery efficiency	None	Assumed
FCU SFP (per unit) W/l/s	-	-
Ventilation controls	-	-
Applicable rooms	Office spaces	Witnessed on site
Hot water rads		
System description	Hot water rads from gas fired boiler	Witnessed on site
NCM system type	Central heating using water: radiators	Witnessed on site
Heat source	LTHW boiler	Witnessed on site
Heating fuel type	Natural gas	Witnessed on site
Heating generator seasonal efficiency	0.89	Assumed - unknown efficiency, plant is 2002 installed
Heating generator SCoP	0.79	Assumed - unknown efficiency, plant is 2002 installed
Cooling system	-	-
Cooling fuel type	-	-
Cooling seasonal energy efficiency rating (SEER)	-	-
AHU Specific fan power (SFP)	-	-
AHU Pump type	-	-
Heat recovery efficiency	-	-
FCU SFP (per unit) W/l/s	-	-
Ventilation controls	-	-
Applicable rooms	WC's, circulation / stairs	Witnessed on site
Extract Ventilation		
System description	Centralised extract ventilation	Witnessed on site
SFP W/l/s	0.50	Assumed - 2006 Build regs
Extract flow rate ach	10	Assumed
Areas served	WC's	Witnessed on site
DHW		
Electric water heater on each floor		
Generator type	Stand-alone water heater	Same as space heating
Delivery efficiency	100%	Assumed - correct assumption when details below are known
Storage volume litres	300	Witnessed on site
Insulation thickness mm	none	Witnessed on site
Lighting		
Lighting power densities	**lm/W**	
Office	36.3	Assumed - T8 fluorescent tube lighting witnessed on site
Reception / Entrance lobby	22.5	Assumed - Compact fluorescent lighting witnessed on site
WC	22.5	Assumed - Compact fluorescent lighting witnessed on site
Lobby	22.5	Assumed - Compact fluorescent lighting witnessed on site
Lighting controls		
Electric Power Factor	0.90 - 0.95	Assumed
PIR's	None	None witnessed on site
Daylight sensors	None	None witnessed on site
Metering / Monitoring	Yes	Assumed
Lighting control parasitic power	0.10	Assumed

7.03 Appendix C – Input data used for LEAN building

B1 Office or Workshop - Input Data		Source
Constructions U-values W/m².K		
Existing floor	0.68	Assumed - based on uninsulated concrete slab
Existing wall	1.22	Assumed - based on uninsulated solid brick wall
Existing roof	1.50	Assumed - based on uninsulated tiled roof
New extension wall	0.35	Assumed
New extension roof	0.25	Assumed
Door	2.20	Assumed
Existing Glazing		
Overall U-value (including frame)	3.30 W/m²K	Assumed - double glazing witnessed on site, small air gap
g-value	0.70	assumed
New Extension Glazing		
Overall U-value (including frame)	1.60 W/m²K	Assumed
g-value	0.40	Assumed - recommended g-value
Air Permeability		
Air permeability	25.0 m^3/m^2h	Assumed - Correct assumption for existing buildings with no air test
HVAC Systems		
VRF heat pump with AHU mech vent		
System description	2 pipe fan coil system with centralised mech vent	Design intent
NCM system type	Split or Multi-split	Design intent
Heat source	Heat pump (electric): air source	Design intent
Heating fuel type	Electricity	Design intent
Heating generator seasonal efficiency	2.00	Assumed - Standard efficiency for heat pumps to be not classed as renewable
Heating SCoP	1.86	Assumed - Standard efficiency for heat pumps to be not classed as renewable
Cooling system	Heat pump (electric)	Design intent
Cooling fuel type	Electricity	Design intent
Cooling seasonal energy efficiency rating (SEER)	2.00	Assumed - Standard efficiency for heat pumps to be not classed as renewable
AHU Specific fan power (SFP)	1.80	Design intent
AHU Pump type	Variable	Design intent
Heat recovery efficiency	75%	Design intent
FCU SFP (per unit) W/l/s	-	-
Ventilation controls	-	-
Applicable rooms	Office spaces	Design intent
Elec panel heaters		
System description	Electric panel heaters with extract vent	Design intent
NCM system type	Other local room heater - unfanned	Design intent
Heat source	Direct or storage electric heater	Design intent
Heating fuel type	Electrcity	Design intent
Heating generator seasonal efficiency	1.00	Design intent
Heating generator SCoP	0.80	Design intent
Cooling system	-	-
Cooling fuel type	-	-
Cooling seasonal energy efficiency rating (SEER)	-	-
AHU Specific fan power (SFP)	-	-
AHU Pump type	-	-
Heat recovery efficiency	-	-
FCU SFP (per unit) W/l/s	-	-
Ventilation controls	-	-
Applicable rooms	WC's, tea point, circulation / stairs	Design intent
Extract Ventilation		
System description	Centralised extract ventilation	Design intent
SFP W/l/s	0.40	Design intent
Extract flow rate ach	10	Design intent
Areas served	WC's	Design intent
DHW		
Electric water heater on each floor		
Generator type	Stand-alone water heater	Design intent
Delivery efficiency	100%	Assumed - correct assumption when details below are known
Storage volume litres	80	Design intent - 1 no. 15 litre unit per floor
Insulation thickness mm	none	Small units are not insulated as storage is so low
Lighting		
Lighting power densities	**lm/W**	
Office	90	Design intent
WC	70	Design intent
Lobby	70	Design intent
Lighting controls		
Electric Power Factor	0.90 - 0.95	Assumed
PIR's	Yes in all core areas	Design intent
Daylight sensors	Yes in office areas	Design intent
Metering / Monitoring	Yes	Design intent
Lighting control parasitic power	0.10	Assumed

7.04 Appendix D – Input data used for LEAN and GREEN building

B1 Office or Workshop - Input Data		Source
Constructions U-values W/m².K		
Existing floor	0.68	Assumed - based on uninsulated concrete slab
Existing wall	1.22	Assumed - based on uninsulated solid brick wall
Existing roof	1.50	Assumed - based on uninsulated tiled roof
New extension wall	0.35	Assumed
New extension roof	0.25	Assumed
Door	2.20	Assumed
Existing Glazing		
Overall U-value (including frame)	3.30 W/m²K	Assumed - double glazing witnessed on site, small air gap
g-value	0.70	assumed
New Extension Glazing		
Overall U-value (including frame)	1.60 W/m²K	Assumed
g-value	0.40	Assumed - recommended g-value
Air Permeability		
Air permeability	25.0 m³/m²h	Assumed - Correct assumption for existing buildings with no air test
HVAC Systems		
VRF heat pump with AHU mech vent		
System description	2 pipe fan coil system with centralised mech vent	Design intent
NCM system type	Split or Multi-split	Design intent
Heat source	Heat pump (electric): air source	Design intent
Heating fuel type	Electricity	Design intent
Heating generator seasonal efficiency	4.38	Design intent
Heating SCoP	4.08	Design intent
Cooling system	Heat pump (electric)	Design intent
Cooling fuel type	Electricity	Design intent
Cooling seasonal energy efficiency rating (SEER)	3.97	Design intent
AHU Specific fan power (SFP)	1.80	Design intent
AHU Pump type	Variable	Design intent
Heat recovery efficiency	75%	Design intent
FCU SFP (per unit) W/l/s	-	-
Ventilation controls	-	-
Applicable rooms	Office spaces	Design intent
Elec panel heaters		
System description	Electric panel heaters with extract vent	Design intent
NCM system type	Other local room heater - unfanned	Design intent
Heat source	Direct or storage electric heater	Design intent
Heating fuel type	Electrcity	Design intent
Heating generator seasonal efficiency	1.00	Design intent
Heating generator SCoP	0.80	Design intent
Cooling system	-	-
Cooling fuel type	-	-
Cooling seasonal energy efficiency rating (SEER)	-	-
AHU Specific fan power (SFP)	-	-
AHU Pump type	-	-
Heat recovery efficiency	-	-
FCU SFP (per unit) W/l/s	-	-
Ventilation controls	-	-
Applicable rooms	WC's, tea point, circulation / stairs	Design intent
Extract Ventilation		
System description	Centralised extract ventilation	Design intent
SFP W/l/s	0.40	Design intent
Extract flow rate ach	10	Design intent
Areas served	WC's	Design intent
DHW		
Electric water heater on each floor		
Generator type	Stand-alone water heater	Design intent
Delivery efficiency	100%	Assumed - correct assumption when details below are known
Storage volume litres	80	Design intent - 1 no. 15 litre unit per floor
Insulation thickness mm	none	Small units are not insulated as storage is so low
Lighting		
Lighting power densities	**lm/W**	
Office	90	Design intent
WC	70	Design intent
Lobby	70	Design intent
Lighting controls		
Electric Power Factor	0.90 - 0.95	Assumed
PIR's	Yes in all core areas	Design intent
Daylight sensors	Yes in office areas	Design intent
Metering / Monitoring	Yes	Design intent
Lighting control parasitic power	0.10	Assumed

7.05 Appendix E – Baseline BRUKL

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

BASELINE

As designed

Date: Tue May 26 12:32:08 2020

Administrative information

Building Details

Address: 83 Clerkenwell Rd, LONDON, EC1R 5AR

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.12

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.12

BRUKL compliance check version: v5.6.a.1

Owner Details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Certifier details

Name: Christopher Armstrong

Telephone number: Phone

Address: Street Address, City, Postcode

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

The building does not comply with England Building Regulations Part L 2013

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	22.4
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	22.4
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	60.4
Are emissions from the building less than or equal to the target?	BER > TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	1.22	1.22	BS000011:Surf[2]
Floor	0.25	0.67	0.67	BS000011:Surf[5]
Roof	0.25	1.48	1.48	BS000016:Surf[1]
Windows***, roof windows, and rooflights	2.2	3.3	3.3	BS000011:Surf[0]
Personnel doors	2.2	2.2	2.2	BS000011:Surf[3]
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m²K)]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m²K)]
$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	25

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Gas rads + nat vent

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.89	-	0.2	0	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

2- Existing 4 pipe

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.89	3.13	0	2.9	-
Standard value	0.91*	2.55	N/A	1.6^	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.

3- Gas rads + extract vent

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.89	-	0.2	0	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

"No HWS in project, or hot water is provided by HVAC system"

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
Basement: Office zone 01	-	-	-	-	-	-	-	0.8	-	-	N/A
Basement: Office zone 02	-	-	-	-	-	-	-	0.8	-	-	N/A

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	2238.5	2238.5
External area [m²]	2232.3	2232.3
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	25	3
Average conductance [W/K]	3226.32	0
Average U-value [W/m²K]	1.45	0
Alpha value* [%]	10.14	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
100	**B1 Offices and Workshop businesses**
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	86.05	9.62
Cooling	7.85	6.8
Auxiliary	35.04	12.15
Lighting	33.27	20.02
Hot water	10.47	2.58
Equipment*	35.9	35.9
TOTAL**	**172.7**	**51.17**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	300.7	122.62
Primary energy* [kWh/m²]	351.59	131.54
Total emissions [kg/m²]	60.4	22.4

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

7.06 Appendix F – LEAN BRUKL

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

LEAN

As designed

Date: Wed May 27 17:02:54 2020

Administrative information

Building Details

Address: 83 Clerkenwell Rd, LONDON, EC1R 5AR

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.12

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.12

BRUKL compliance check version: v5.6.a.1

Owner Details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Certifier details

Name: Christopher Armstrong

Telephone number: Phone

Address: Street Address, City, Postcode

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

The building does not comply with England Building Regulations Part L 2013

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	17.6
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	17.6
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	37.1
Are emissions from the building less than or equal to the target?	BER > TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	1.08	1.22	BS000011:Surf[2]
Floor	0.25	0.67	0.67	BS000011:Surf[5]
Roof	0.25	1.36	1.48	BS000016:Surf[1]
Windows***, roof windows, and rooflights	2.2	2.88	3.3	BS000011:Surf[0]
Personnel doors	2.2	2.2	2.2	BS000011:Surf[3]
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m²K)]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m²K)]
$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	25

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Elec panel heaters + nat vent

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.2	0	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

2- Mitsubishi VRF

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2	2.5	0	0	0.68
Standard value	2.5*	3.2	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

3- Elec panel heaters + extract vent

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.2	0	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

1- DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
Standard value	1	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
Basement: Office zone 01	-	-	-	1.8	-	-	-	-	-	-	N/A
Basement: Office zone 02	-	-	-	1.8	-	-	-	-	-	-	N/A
Basement: Office zone 03	-	-	-	1.8	-	-	-	-	-	-	N/A
Basement: Office zone 04	-	-	-	1.8	-	-	-	-	-	-	N/A

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	2238.5	2238.5
External area [m²]	2232.3	2232.3
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	25	3
Average conductance [W/K]	2910.87	0
Average U-value [W/m²K]	1.3	0
Alpha value* [%]	10.09	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
100	**B1 Offices and Workshop businesses**
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	41.2	5.34
Cooling	6.49	6.8
Auxiliary	6.24	2.2
Lighting	13.31	20.02
Hot water	4.21	2.58
Equipment*	35.9	35.9
TOTAL**	**71.44**	**36.94**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	249.77	122.62
Primary energy* [kWh/m²]	297.87	106.21
Total emissions [kg/m²]	37.1	17.6

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

7.07 Appendix G – LEAN and GREEN BRUKL

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

LEAN and GREEN

As designed

Date: Wed May 27 16:52:21 2020

Administrative information

Building Details

Address: 83 Clerkenwell Rd, LONDON, EC1R 5AR

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.12

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.12

BRUKL compliance check version: v5.6.a.1

Owner Details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Certifier details

Name: Christopher Armstrong

Telephone number: Phone

Address: Street Address, City, Postcode

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

The building does not comply with England Building Regulations Part L 2013

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	17.6
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	17.6
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	28.2
Are emissions from the building less than or equal to the target?	BER > TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	1.08	1.22	BS000011:Surf[2]
Floor	0.25	0.67	0.67	BS000011:Surf[5]
Roof	0.25	1.36	1.48	BS000016:Surf[1]
Windows***, roof windows, and rooflights	2.2	2.88	3.3	BS000011:Surf[0]
Personnel doors	2.2	2.2	2.2	BS000011:Surf[3]
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m²K)]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m²K)]
$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	25

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Elec panel heaters + nat vent

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.2	0	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

2- Mitsubishi VRF

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.38	3.97	0	0	0.68
Standard value	2.5*	3.2	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

3- Elec panel heaters + extract vent

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.2	0	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

1- DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
Standard value	1	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
Basement: Office zone 01	-	-	-	1.8	-	-	-	-	-	-	N/A
Basement: Office zone 02	-	-	-	1.8	-	-	-	-	-	-	N/A
Basement: Office zone 03	-	-	-	1.8	-	-	-	-	-	-	N/A
Basement: Office zone 04	-	-	-	1.8	-	-	-	-	-	-	N/A

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	2238.5	2238.5
External area [m²]	2232.3	2232.3
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	25	3
Average conductance [W/K]	2910.87	0
Average U-value [W/m²K]	1.3	0
Alpha value* [%]	10.09	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
100	**B1 Offices and Workshop businesses**
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	27.3	5.34
Cooling	3.27	6.8
Auxiliary	6.24	2.2
Lighting	13.31	20.02
Hot water	4.21	2.58
Equipment*	35.9	35.9
TOTAL**	**54.32**	**36.94**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	249.77	122.62
Primary energy* [kWh/m²]	202.63	106.21
Total emissions [kg/m²]	28.2	17.6

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

7.08 Appendix H – LEAN and GREEN Draft EPC

Energy Performance Certificate

Non-Domestic Building

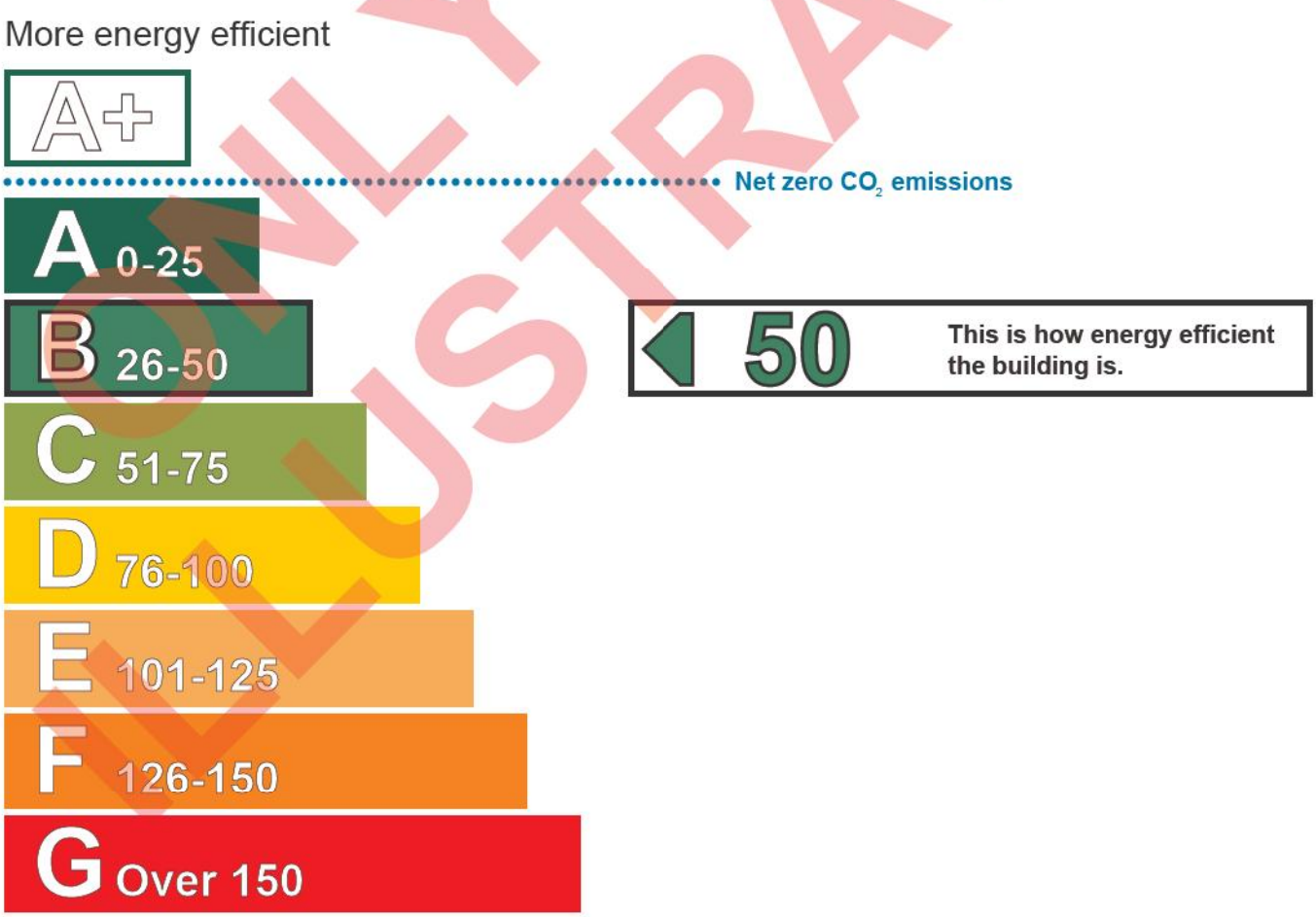
HM Government

83 Clerkenwell Rd
Holborn
LONDON
EC1R 5AR

Certificate Reference Number:
0693-0030-5342-6997-6002

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



Technical information

Main heating fuel:	Grid Supplied Electricity
Building environment:	Air Conditioning
Total useful floor area (m^2):	2238.447
Building complexity (NOS level):	5
Building emission rate ($kgCO_2/m^2$ per year):	27.17
Primary energy use (kWh/m^2 per year):	194.5

Benchmarks

Buildings similar to this one could have ratings as follows:

32 If newly built

85 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 v7.0.12 using calculation engine ApacheSim v7.0.12
Property Reference:	964360950003
Assessor Name:	Christopher Armstrong
Assessor Number:	LCEA135681
Accreditation Scheme:	CIBSE Certification Limited
Employer/Trading Name:	Quinn Ross Consultants
Employer/Trading Address:	Unit 3, Grove Dairy Farm Business Centre, Bobbing Hill, bobbing, Sittingbourne, ME9 8NY
Issue Date:	29 May 2020
Valid Until:	28 May 2030 (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: 0626-9075-4940-6300-9033

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 CIBSE Certification Limited. You can obtain contact details of the Accreditation Scheme at www.cibsecertification.com.

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.