‘Be Clean’: Cooling
Energy Assessment
10-11 Lincoln’s Inn Fields

Efficiency Measures taken:

6) Active cooling systems (ensuring the lowest carbon option)

Passive design measures and the use of natural and/or mechanical ventilation were not enough to guarantee the occupant’s comfort. Therefore, air conditioning has been specified for scheme to provide the required level of comfort. Following the methodology of the cooling hierarchy has progressively reduced the demand for cooling.

The proposed building cooling demand is below that of the existing building and is demonstrated in the table below.

	Cooling Demand (kWh/m^2)
Proposed	10.03
Existing	18.24

To ensure the cooling system is the most carbon efficient possible the following parameters have been selected:

- Location: Indoor cooling units have been specified on a localised basis where internal gains are too high. The units will be fully fitted with local temperature controls for optimal usage.
- The location of the outdoor units that ‘dump’ the heat has been carefully conspired carefully so not to cause problems for people and the environment, and not to add to the urban heat island effect. They will be located on the roof space and will allow adequate air movement around the condensing units, this will ensure maximum operating efficiency and will limit the impacts of dumped heat on people and the environment.
- The VRV systems will have the following efficiencies which are in compliance with the Non-Domestic Building Services Compliance Guide:
  - ✓ Energy Efficiency Ratio of 3.7

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‘Be Green’: Renewable Energy

Energy Assessment

10-11 Lincoln’s Inn Fields

Renewable Energy Feasibility:

In line with Policy 5.7 of the London Plan the feasibility of renewable energy technologies has been considered. A detailed site-specific analysis and associated carbon saving calculations has also been provided for renewable energy technologies considered feasible.

Renewable Energy Technology Comparison:

Each technology has been assessed under 5 broader categories. There are key criteria for each category on which the technology is evaluated. The key criteria have been given a weighting based on a tick-system, a graphical representation of this is shown below:

✔✔✔✔✔ = 1 scored out of a possible 5

The weighting of each of the criteria within the categories is shown below:

- **Local, site-specific impact:** (Maximum score of 4)
  - Local planning criteria = ✔✔
  - Land used by all components = ✔
  - Noise impact from operation = ✔
- **Suitability and design impact:** (Maximum score of 4)
  - Interaction on the current building design = ✔✔
  - Building orientation suitability = ✔
  - Buildability of installation = ✔
- **Economic viability:** (Maximum score of 5)
  - Capital cost of all components = ✔✔
  - Grants and funding available = ✔
  - Payback periods (years) 3-5, 5-10, 10-15 = ✔✔✔
- **Operation and maintenance:** (Maximum score of 3)
  - Servicing requirements (low or high) = ✔
  - Maintenance costs (low or high) = ✔
  - Resource use from future maintenance (low or high) = ✔
- **CO_2 and sustainability:** (Maximum score of 10)
  - Carbon saving per year = ✔✔✔✔
  - Impact of future grid decarbonisation (gas vs. electric) = ✔✔
  - Local air quality/pollution = ✔✔
  - Resource use of installation = ✔✔

Key comments on each of the criteria and the corresponding score will be provided in a table (example below) for each of the technologies. The score for each of the criteria will be summed and each of the technologies will then be ranked. The assessment of each technology is undertaken on the following pages.

Renewable Technology	Local, site-specific impact	Suitability and design impact	Economic viability	Operation and maintenance	CO_2 and sustainability
	✔✔✔✔	✔✔✔✔	✔✔✔✔✔	✔✔✔	✔✔✔✔✔ ✔✔✔✔✔

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‘Be Green’: Renewable Energy

Energy Assessment

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Biomass & Biofuel:

Rejected

Biomass is normally considered a carbon ‘neutral’ fuel, as the carbon dioxide emitted on burning has been recently absorbed from the atmosphere by photosynthesis. Although some form of fossil fuel derived inputs are required in the production and transportation of the fuel.

Wood is seen as a by-product of other industries and the small quantity of energy for drying, sawing, pelleting and delivery are typically discounted. Biomass from coppicing is likely to have external energy inputs from fertiliser, cutting, drying etc. and these may need to be considered. In this toolkit, all biomass fuels are considered to have zero net carbon emissions.

Biomass can be burnt directly to provide heat in buildings. Wood from forests, urban tree pruning, farmed coppices or farm and factory waste, is the most common fuel and is used commercially in the form of wood chips or pellets. Biomass boilers can also be designed to burn smokeless to comply with the Clean Air Acts.

Boilers can be fed automatically by screw drives from fuel hoppers. This typically involves daily addition of bagged fuels.

A biomass boiler could be installed on site for supplementary LTHW heating; however, a major factor influencing the suitability of a biomass boiler is the availability of the biomass fuel. A local and reliable fuel source would be essential for the biomass boiler to be an efficient replacement for a conventional boiler system. Therefore, a very comprehensive feasibility assessment needs to be undertaken to understand the practicalities of such a system.

It is estimated that the heating and hot water demand of the site is too small to meet the required CO_2 emissions reduction if a biomass boiler was a standalone system. Therefore a biomass boiler would need to be combined with energy demand reduction measures and/or CHP. In order to meet the 35% CO_2 emissions reduction a biomass boiler would need to be installed. The likely installed cost would be circa 30,000. The additional cost of providing and storing the bio-fuel also needs to be accounted for. The site is likely to be unsuitable for biomass boilers due to site constraints such as limited transport/access issues, and storage of the biomass fuel. A detailed feasibility study will be required to investigate the suitability.

Renewable Technology	Local, site-specific impact	Suitability and design impact	Economic viability	Operation and maintenance	CO_2 and sustainability
Biomass Boiler	✔ ✔ ✔ ✔ Local air quality impacts, increased transport usage on the restricted site, increased plant space.	✔ ✔ ✔ ✔ Increase in plant space required, orientation fine, slightly increased buildability issues.	✔ ✔ ✔ ✔ ✔ Increased capital costs of installation, typical payback of 8 years	✔ ✔ ✔ Increased maintenance relative to gas boiler, resource use not significantly increased if well serviced.	✔ ✔ ✔ ✔ ✔ ✔ ✔ ✔ ✔ ✔ Very low carbon intensity of feedstock if properly procured. Decarbonisation impact not applicable, air quality issues.

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‘Be Green’: Renewable Energy

Energy Assessment

10-11 Lincoln’s Inn Fields

Photovoltaic (PV):

Rejected

Photovoltaic systems convert energy from the sun into electricity through semi conductor cells. Systems consist of semi-conductor cells connected together and mounted into modules. Modules are connected to an inverter to turn the direct current (DC) output into alternating current (AC) electricity for use in buildings.

Photovoltaic systems can be discreet through being designed as an integral part of the roof. An ‘invisible’ design using slates or shingles as opposed to an architectural statement could be preferable in a sensitive area.

Photovoltaics supply electricity to the building and are attached to electricity gird or to any other electrical load. Excess electricity can be sold to the National Grid when the generated power exceeds the local need. PV systems require only daylight, not sunlight to generate electricity (although more electricity is produced with more sunlight), so energy can still be produced in overcast or cloudy conditions.

The cost of PV cells is heavily dependent on the size of the array. There are significant cost reductions available for larger installations.

The most suitable location for mounting photovoltaic panels is on roofs as they usually have the greatest exposure to the sun. However, this technology has been rejected because that would affect the historic aesthetic of the area.

Renewable Technology	Local, site-specific impact	Suitability and design impact	Economic viability	Operation and maintenance	CO_2 and sustainability
Photovoltaic	✔✔✔✔ No local air quality impacts, use of unutilised roof space, conservation officer has concerns for part of the site, no noise issues.	✔✔✔✔ Can be added to the roof, good orientation, and slightly increased buildability issues for wiring and metering.	✔✔✔✔✔ Increased capital costs of installation, typical payback of 8 years, Feed in Tariff available.	✔✔✔ Limited servicing and maintenance i.e. 1 visit per year, inverter will require replacement.	✔✔✔✔✔✔✔✔✔✔ High carbon saving from electricity, uses minimal grid electricity, no local air impact, high embodied energy of panels.

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‘Be Green’: Renewable Energy

Energy Assessment

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Solar Thermal:

Rejected

Solar water heating systems use the energy from the sun to heat water for domestic hot water needs. The systems use a heat collector, generally mounted on the roof in which a fluid is heated by the sun. This fluid is used to heat up water that is stored in either a separate hot water cylinder or a twin coil hot water cylinder inside the building. The systems work very successfully in all parts of the UK, as they can work in diffuse light conditions.

Like photovoltaic panels the most suitable location for mounting solar hot water panels is on roofs as they usually have the greatest exposure to the sun. However, this technology has been rejected because that would affect the historic aesthetics of the area.

It is estimated that the CO_2 emissions reduction that would be produced by solar hot water as a standalone system would not be adequate to achieve the required CO_2 emissions reduction target. Therefore a solar hot water system would need to be combined with more energy efficiency strategies, a CHP or additional renewable technologies to achieve the carbon reduction target.

Renewable Technology	Local, site-specific impact	Suitability and design impact	Economic viability	Operation and maintenance	CO_2 and sustainability
Solar Thermal	✔✔✔✔ No local air quality impacts, use of unutilised roof space, conservation officer has concerns for part of the site, no noise issues.	✔✔✔✔ Can be added to the roof, good orientation, and slightly increased buildability issues for piping and cylinders.	✔✔✔✔✔ Increased capital costs of installation, typical payback of 8 years, Renewable Heat Incentive available.	✔✔✔ Limited servicing and maintenance i.e. 1 visit every two years, heat transfer fluid requires replacing every 10 years.	✔✔✔✔✔✔✔✔✔✔ Lower carbon saving as primarily displacing gas, uses minimal grid electricity, no local air impact, medium embodied energy of panels.

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‘Be Green’: Renewable Energy

Energy Assessment

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Wind Energy:

Rejected

Wind energy is a cost effective method of renewable power generation. Wind turbines can produce electricity without carbon dioxide emissions in ranges from watts to megawatt outputs. The most common design is for three blades mounted on a horizontal axis, which is free to rotate into the wind on a tall tower.

The blades drive a generator either directly or via a gearbox to produce electricity. The electricity can either be linked to the grid or charge batteries. An inverter is required to convert the electricity from direct current (DC) to alternating current (AC) for feeding into the grid.

Modern quiet wind turbines are becoming viable in low density areas where ease of maintenance and immediate connection to the grid or direct use of the electricity in a building, may make them cost effective, despite lower wind speeds than open areas.

Wind turbines are generally less suited to dense urban areas as their output will be affected by potentially lower and more disrupted wind speeds, and their use of much more cost effective machines may be prohibited by their proximity to some building types. Small turbines can be used in inner city areas mounted on buildings, although there are relatively few installations.

Typically a 1.5 kW turbine can provide 4,000 kWh of electrical power annually. To achieve the required CO_2 emissions reduction target approximately 2 turbines would be required as a standalone solution. The indicative cost of a smaller roof mounted turbine is £2,000/kW so achieving the required CO_2 emissions reduction would cost approximately £6,000.

A detailed wind resource evaluation would be required for the site to fully understand the generation potential and payback period. Also, it is likely that planning restrictions and resistance from small groups within the local community could also affect the viability of wind energy for the project.

Renewable Technology	Local, site-specific impact	Suitability and design impact	Economic viability	Operation and maintenance	CO_2 and sustainability
Wind Energy	✔ ✔ ✔ ✔ No local air quality impacts, use of unutilised roof space, conservation officer will have concerns for the site, minor noise issues.	✔ ✔ ✔ ✔ Can be added to the roof, relatively limited wind speeds in local area, increased buildability issues for wiring and metering.	✔ ✔ ✔ ✔ ✔ Medium capital costs of installation, typical payback < 5 years, Feed in Tariff available.	✔ ✔ ✔ Very limited servicing and maintenance, costs of 2-3% typical.	✔ ✔ ✔ ✔ ✔ ✔ ✔ ✔ ✔ ✔ High carbon saving from electricity, output limited from urban installation, consumes little grid electricity, no local air impact, low embodied energy of panels.

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‘Be Green’: Renewable Energy

Energy Assessment

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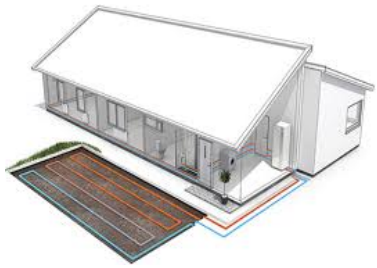
Ground Source Heat Pump (GSHP):

Rejected



Geo-thermal energy is essentially heat collected from the ground. Heat obtained from the ground may be considered it as a source of heating and cooling within the UK by the use of a geo-thermal heat pump or ground source heat pumps.

A ground source heat pump is a device for converting energy in the form of low level heat to heat at a usable temperature. The heat pump consists of five main parts; ground collector loop/or bores, heat exchanger, compressor, condenser heat exchanger and expansion valve.

At approximately 1.2-1.5 metres down below ground level the temperature is a constant 10 to 12ºC. Any bores would need to be sunk to an effective depth of 50 – 120m and a ground feasibility report would be required to ascertain if this method of heat source was viable.

From the bores pre-insulated pipework is laid in the ground to the heat exchanger device. The system is filled with water and antifreeze. The cooled water is pumped around the loop / bore gathering energy as it circulates. The water that has been heated to 10-12ºC is returned to the ground source heat exchanger where the energy is transferred to the refrigerant gas. For every 1kW of energy used to compress the refrigerant, the process ‘gives up’ 4 kW of energy for use in the system being used to heat the building.

Typical costs for an installation this are in the region of £100,000 for a commercial installation, with general installation costs at £1200 /kW of energy produced.

Renewable Technology	Local, site-specific impact	Suitability and design impact	Economic viability	Operation and maintenance	CO_2 and sustainability
GSHP	✔✔✔✔ No local air quality impacts, not visible so conservation friendly, no noise issues, however the constrained site may prohibit its installation.	✔✔✔✔ Can be added to the roof, good air-flow on roof, increased buildability issues for pipework and heating emitters internally.	✔✔✔✔✔ High capital costs of installation, typical payback of 15 years where gas is displaced, Renewable Heat Incentive available.	✔✔✔ Limited servicing and maintenance i.e. 1 visit per year, mechanical parts may require replacement over lifespan.	✔✔✔✔✔ ✔✔✔✔✔ Limited carbon saving from gas displacement, consumes some electricity so benefits from decarbonisation, no local air impact, high embodied energy of equipment.

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‘Be Green’: Renewable Energy

Energy Assessment

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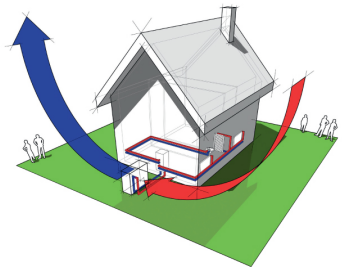
Air Source Heat Pump (ASHP):

Accepted



Air source heat pump systems work on the same principle as a ground source heat pump although they use the outside air as the heat source.

The coefficients of performance given by air source heat pump systems are inferior to that of ground source systems due to varying air temperatures. In the depth of winter the energy efficiency of an air source system will be lower than that of a ground source system, and it is likely that more back-up heat will be required if an air source unit is fitted. This back-up heat often comes from a direct electric heater. They operate over a varying temperatures range of -15°C to +25°C, however, the performance will reduce to below the required 3 to 1 carbon saving ratio in winter, and the also require a defrosting mechanism to melt ice that forms on the air heat exchanger.

ASHPs are cheaper to install than ground source heat pumps but are only available on a relatively small scale. If applied across a larger site a number of plant zones would be required for generation of heat, leading to increased plant space requirements. Typical costs for an installation this are in the region of £40,000 for a commercial installation.

Carbon dioxide emissions savings will typically be less than that of the ground source heat pump. Air source heat pumps may be more suitable as an HVAC solution.

Renewable Technology	Local, site-specific impact	Suitability and design impact	Economic viability	Operation and maintenance	CO_2 and sustainability
ASHP	✔✔✔✔ No local air quality impacts, use of unutilised roof space, conservation officer may have minor concerns over visual impact, no noise issues.	✔✔✔✔ Can be added to the roof, good air-flow on roof, increased buildability issues for pipework and heating emitters internally.	✔✔✔✔✔ Medium- high capital costs of installation, typical payback >15 years where gas is displaced, Renewable Heat Incentive available.	✔✔✔ Limited servicing and maintenance i.e. 1 visit per year, mechanical parts may require replacement over lifespan.	✔✔✔✔✔ ✔✔✔✔✔ Limited carbon saving from gas displacement, less efficient in winter, consumes electricity so benefits from decarbonisation, no local air impact, high embodied energy of equipment.

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‘Be Green’: Summary of Renewable Technologies

Energy Assessment

10-11 Lincoln’s Inn Fields

Summary Comparison Matrix:

An assessment of the feasibility of each of the technologies is shown below.

Renewable Technology	Local, site-specific impact	Suitability and design impact	Economic viability	Operation and maintenance	CO_2 and sustainability	Total Score
Biomass Boiler	✔ ✔ ✔ ✔	✔ ✔ ✔ ✔	✔ ✔ ✔ ✔ ✔	✔ ✔ ✔	✔ ✔ ✔ ✔ ✔ ✔ ✔ ✔ ✔ ✔	15 out of 26
Photovoltaic	✔ ✔ ✔ ✔	✔ ✔ ✔ ✔	✔ ✔ ✔ ✔ ✔	✔ ✔ ✔	✔ ✔ ✔ ✔ ✔ ✔ ✔ ✔ ✔ ✔	17 out of 26
Solar Thermal	✔ ✔ ✔ ✔	✔ ✔ ✔ ✔	✔ ✔ ✔ ✔ ✔	✔ ✔ ✔	✔ ✔ ✔ ✔ ✔ ✔ ✔ ✔ ✔ ✔	16 out of 26
Wind Energy	✔ ✔ ✔ ✔	✔ ✔ ✔ ✔	✔ ✔ ✔ ✔ ✔	✔ ✔ ✔	✔ ✔ ✔ ✔ ✔ ✔ ✔ ✔ ✔ ✔	17 out of 26
GSHP	✔ ✔ ✔ ✔	✔ ✔ ✔ ✔	✔ ✔ ✔ ✔ ✔	✔ ✔ ✔	✔ ✔ ✔ ✔ ✔ ✔ ✔ ✔ ✔ ✔	15 out of 26
ASHP	✔ ✔ ✔ ✔	✔ ✔ ✔ ✔	✔ ✔ ✔ ✔ ✔	✔ ✔ ✔	✔ ✔ ✔ ✔ ✔ ✔ ✔ ✔ ✔ ✔	16 out of 26

Renewable Technology Conclusion & Specification:

Photovoltaic panels and wind energy have scored the best. It is assumed that Photovoltaic panels, solar thermal and wind energy would be considered unsuitable for the area by conservation criteria and that the local residents would raise concerns over potential noise and turbulence. Therefore, an air source heat pump has been considered to be the optimum balance of sustainable and economic objectives.

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'Be Green': ASHP
Energy Assessment
10-11 Lincoln's Inn Fields

ASHP:

A detailed summary of the lifecycle cost, revenue and payback for ASHP is given below.

Lifecycle Cost:

The lifecycle of the proposed system is 25 years. To calculate the lifecycle cost of the ASHP, the maintenance of the system and cost of electricity to run the pumps will be included.

Revenue and Payback Parameters:

The following tables summarise the reduction in carbon emissions and the life cycle cost of the ASHP system compared to a gas boiler.

	Baseline System		Proposed System	
	Heating	Cooling	Heating	Cooling
System Type	Gas Boiler	Air Source Heat Pump	Air Source Heat Pump	
Installation Cost	5,000	30,000	40,000	
Maintenance and replacement cost	6,750	3,000	6,000	
Total	44,750		46,000	
Extra Over cost:			£1,250	

The development has a heating demand of 35,990 kWh per year using a heating boiler. The cost of gas is 4 p/kWh, therefore the annual operational cost would be £1440. With the use of an air source heat pump with 3.5 COP, the heating demand is reduced to 9354 kWh per year. The cost of electricity is 12 p/kWh, therefore the annual operational cost would be £1122.

Consequently, the office area would have an annual saving of £318 and the simple payback time for the proposed system is 3.9 years

Summary Performance Calculations:

Cost Performance Criteria	Value
Extra Cost Over Life Cycle (£)	1,250
Predicted Annual Savings (£)	318
Payback Period (years)	3.9

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Conclusion
Energy Assessment
10-11 Lincoln's Inn Fields

Summary

The baseline carbon emissions for the scheme are 53.22 Tonnes CO_2/yr.

As demonstrated, the development will reduce carbon emissions by 30.6% from the fabric energy efficiency measures described in the "Be Lean" section, and will reduce total carbon emissions by 36.1% over the existing building with the further inclusion of low and zero carbon technologies (ASHP).

GLA's Energy Hierarchy – Regulated Carbon Emissions				
	Baseline:	Be Lean:	Be Clean:	Be Green:
CO_2 emissions (Tonnes CO_2/yr)	53.22	36.94	-	34.02
CO_2 emissions saving (Tonnes CO_2/yr)	-	16.29	-	2.92
Saving from each stage (%)	-	30.6	-	5.5
Total CO_2 emissions saving (Tonnes CO_2/yr)	4.67			
36.1% Total carbon emissions savings over the existing building achieved				

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Appendix
Energy Assessment
10-11 Lincoln's Inn Fields

Further Information:

As required by the GLA, the emission figures and details of the calculations and methodology used to determine the figures provided within the report can be found in the following pages:

Baseline – BER from the Baseline BRUKL
Lean – BER from the Lean BRUKL
Clean – There is no 'Be Clean' scenario
Green – BER from the Green BRUKL

Appendix
Energy Assessment
10-11 Lincoln's Inn Fields

Baseline Scenario

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

10-11 Lincoln's Inn Fields

As designed

Date: Thu Oct 13 10:52:26 2016

Administrative information

Building Details

Address: 10-11 Lincoln's Inn Fields, ,

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.2.g.3

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v4.7.0

BRUKL compliance check version: v5.2.g.3

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Chris Hocknell

Telephone number: 02031790420

Address: 81 Southwark Street, London, SE10HX

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

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

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	18.9
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	18.9
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	34.7
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 the building services should achieve reasonable overall standards of energy efficiency

Values not achieving 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	0.39	0.39	-1 Floor - B-02 Office_W_11
Floor	0.25	0.15	0.58	-1 Floor - B-09 Lift_S_3
Roof	0.25	1.19	1.19	-1 Floor - B-02 Office_R_5
Windows***, roof windows, and rooflights	2.2	3.69	3.69	-1 Floor - B-02 Office_G_6
Personnel doors	2.2	2.82	2.82	0 Floor - G-02 Bike Store_D_13
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$]
$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

* 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- Existing HVAC

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.81	2.6	-	-	-
Standard value	0.91*	2.6	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.

1- Proposed 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
-1 Floor - B-02 Office	-	-	-	1.9	-	-	-	-	-	0.7	0.5
-1 Floor - B-09 Lift	-	-	-	-	-	-	-	-	-	-	N/A
-1 Floor - B-08 Landlords cupd	-	-	-	-	-	-	-	-	-	-	N/A
-1 Floor - B-06 Stairs	-	-	-	-	-	-	-	-	-	-	N/A
-1 Floor - B-04 WC	0.3	-	-	-	-	-	-	-	-	-	N/A
-1 Floor - B-03 Water Tank	-	-	-	1.9	-	-	-	-	-	0.7	0.5
-1 Floor - B-09 Lift Lobby	-	-	-	-	-	-	-	-	-	-	N/A
-1 Floor - B-05 WC Lobby	-	-	-	-	-	-	-	-	-	-	N/A
-1 Floor - B-03 Elec Intake Cupd	-	-	-	-	-	-	-	-	-	-	N/A
-1 Floor - B-07 Cleaners Cupd	-	-	-	-	-	-	-	-	-	-	N/A
-1 Floor - B-01 Vault	-	-	-	-	-	-	-	-	-	-	N/A
0 Floor - G-05 Lift	-	-	-	-	-	-	-	-	-	-	N/A
0 Floor - G-05 Stairs	-	-	-	-	-	-	-	-	-	-	N/A
0 Floor - G-04 Disabled WC	0.3	-	-	-	-	-	-	-	-	-	N/A
0 Floor - G-02 Bike Store	-	-	-	-	-	-	-	-	-	-	N/A

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
0 Floor - G-02 Bin Store	-	-	-	-	-	-	-	-	-	-	N/A
0 Floor - G-05 EntranceLobby	-	-	-	1.9	-	-	-	-	-	0.7	0.5
0 Floor - G-01 Office	-	-	-	1.9	-	-	-	-	-	0.7	0.5
1 Floor - 1-01 Office	-	-	-	1.9	-	-	-	-	-	0.7	0.5
1 Floor - 1-04 Lift Lobby	-	-	-	-	-	-	-	-	-	-	N/A
1 Floor - 1-03 Stair	-	-	-	-	-	-	-	-	-	-	N/A
1 Floor - 1-02 WC	0.3	-	-	-	-	-	-	-	-	-	N/A
1 Floor - 1-04 Lift	-	-	-	-	-	-	-	-	-	-	N/A
2 Floor - 2-01 Office	-	-	-	1.9	-	-	-	-	-	0.7	0.5
2 Floor - 2-04 Lift Lobby	-	-	-	-	-	-	-	-	-	-	N/A
2 Floor - 2-02 WC	0.3	-	-	-	-	-	-	-	-	-	N/A
2 Floor - 2-04 Lift	-	-	-	-	-	-	-	-	-	-	N/A
2 Floor - 2-03 Stair	-	-	-	-	-	-	-	-	-	-	N/A
3 Floor - 3-01 Office	-	-	-	1.9	-	-	-	-	-	0.7	0.5
4 Floor - 4-01 Office	-	-	-	1.9	-	-	-	-	-	0.7	0.5
4 Floor - 4-02 WC	0.3	-	-	-	-	-	-	-	-	-	N/A
5 Floor - 5-03 Lift	-	-	-	-	-	-	-	-	-	-	N/A
5 Floor - 5-02 Stairs	-	-	-	-	-	-	-	-	-	-	N/A
5 Floor - 5-01 Office	-	-	-	1.9	-	-	-	-	-	0.7	0.5
5 Floor - RWP	-	-	-	-	-	-	-	-	-	-	N/A
5 Floor - 5-03 Lift Lobby	-	-	-	-	-	-	-	-	-	-	N/A
5 Floor - 5-04 Storage	-	-	-	-	-	-	-	-	-	-	N/A

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
-1 Floor - B-02 Office	60	-	-	2469
-1 Floor - B-09 Lift	-	60	-	22
-1 Floor - B-08 Landlords cupd	60	-	-	11
-1 Floor - B-06 Stairs	-	60	-	55
-1 Floor - B-04 WC	-	60	-	110
-1 Floor - B-03 Water Tank	60	-	-	32
-1 Floor - B-09 Lift Lobby	-	60	-	43
-1 Floor - B-05 WC Lobby	-	60	-	41
-1 Floor - B-03 Elec Intake Cupd	60	-	-	12
-1 Floor - B-07 Cleaners Cupd	60	-	-	7
-1 Floor - B-01 Vault	60	-	-	17
0 Floor - G-05 Lift	-	60	-	34
0 Floor - G-05 Stairs	-	60	-	63
0 Floor - G-04 Disabled WC	-	60	-	74
0 Floor - G-02 Bike Store	60	-	-	39
0 Floor - G-02 Bin Store	60	-	-	17
0 Floor - G-05 EntranceLobby	-	60	55	199

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
0 Floor - G-01 Office	60	-	-	1838
1 Floor - 1-01 Office	60	-	-	2476
1 Floor - 1-04 Lift Lobby	-	60	-	38
1 Floor - 1-03 Stair	-	60	-	50
1 Floor - 1-02 WC	-	60	-	102
1 Floor - 1-04 Lift	-	60	-	34
2 Floor - 2-01 Office	60	-	-	1364
2 Floor - 2-04 Lift Lobby	-	60	-	36
2 Floor - 2-02 WC	-	60	-	82
2 Floor - 2-04 Lift	-	60	-	30
2 Floor - 2-03 Stair	-	60	-	48
3 Floor - 3-01 Office	60	-	-	1364
4 Floor - 4-01 Office	60	-	-	1364
4 Floor - 4-02 WC	-	60	-	82
5 Floor - 5-03 Lift	-	60	-	18
5 Floor - 5-02 Stairs	-	60	-	36
5 Floor - 5-01 Office	60	-	-	1189
5 Floor - RWP	60	-	-	8
5 Floor - 5-03 Lift Lobby	-	60	-	23
5 Floor - 5-04 Storage	60	-	-	9

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
-1 Floor - B-02 Office	NO (-74%)	NO
-1 Floor - B-09 Lift	N/A	N/A
-1 Floor - B-08 Landlords cupd	N/A	N/A
-1 Floor - B-06 Stairs	N/A	N/A
-1 Floor - B-04 WC	N/A	N/A
-1 Floor - B-03 Water Tank	N/A	N/A
-1 Floor - B-09 Lift Lobby	N/A	N/A
-1 Floor - B-05 WC Lobby	N/A	N/A
-1 Floor - B-03 Elec Intake Cupd	N/A	N/A
-1 Floor - B-07 Cleaners Cupd	N/A	N/A
-1 Floor - B-01 Vault	N/A	N/A
0 Floor - G-05 Lift	N/A	N/A
0 Floor - G-05 Stairs	N/A	N/A
0 Floor - G-04 Disabled WC	N/A	N/A
0 Floor - G-02 Bike Store	N/A	N/A
0 Floor - G-02 Bin Store	N/A	N/A
0 Floor - G-05 EntranceLobby	NO (-62.4%)	NO
0 Floor - G-01 Office	NO (-7.1%)	NO
1 Floor - 1-01 Office	YES (+89.5%)	NO
1 Floor - 1-04 Lift Lobby	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
1 Floor - 1-03 Stair	N/A	N/A
1 Floor - 1-02 WC	N/A	N/A
1 Floor - 1-04 Lift	N/A	N/A
2 Floor - 2-01 Office	NO (-10.3%)	NO
2 Floor - 2-04 Lift Lobby	N/A	N/A
2 Floor - 2-02 WC	NO (-8.6%)	NO
2 Floor - 2-04 Lift	N/A	N/A
2 Floor - 2-03 Stair	N/A	N/A
3 Floor - 3-01 Office	NO (-10.3%)	NO
4 Floor - 4-01 Office	NO (-10.3%)	NO
4 Floor - 4-02 WC	NO (-8.6%)	NO
5 Floor - 5-03 Lift	N/A	N/A
5 Floor - 5-02 Stairs	N/A	N/A
5 Floor - 5-01 Office	NO (-71%)	NO
5 Floor - RWP	N/A	N/A
5 Floor - 5-03 Lift Lobby	N/A	N/A
5 Floor - 5-04 Storage	N/A	N/A

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	1551.3	1551.3
External area [m²]	1378.4	1378.4
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	25	3
Average conductance [W/K]	1453.48	586.25
Average U-value [W/m²K]	1.05	0.43
Alpha value* [%]	7.89	22.65

* 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 Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: 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	32.01	7.1
Cooling	18.24	8.67
Auxiliary	6.11	2.44
Lighting	27.01	21.51
Hot water	2.21	2.56
Equipment*	34.06	34.06
TOTAL**	**85.58**	**42.28**

* Energy used by equipment does not count towards the total for 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]	208.25	133.3
Primary energy* [kWh/m²]	203.53	109.12
Total emissions [kg/m²]	34.7	18.9

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

HVAC Systems Performance

System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	87	121.2	32	18.2	6.1	0.76	1.85	0.81	2.6
Notional	20.9	112.4	7.1	8.7	2.4	0.82	3.6	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

Key Features

The BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.39	-1 Floor - B-02 Office_W_11
Floor	0.2	0.03	-1 Floor - B-02 Office_S_3
Roof	0.15	1.19	-1 Floor - B-02 Office_R_5
Windows, roof windows, and rooflights	1.5	3.69	-1 Floor - B-02 Office_G_6
Personnel doors	1.5	2.82	0 Floor - G-02 Bike Store_D_13
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
$m^3/(h.m^2)$ at 50 Pa	5	25

Appendix
Energy Assessment
10-11 Lincoln's Inn Fields

LEAN Scenario

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

10-11 Lincoln's Inn Fields

As designed

Date: Thu Oct 13 10:31:12 2016

Administrative information

Building Details

Address: 10-11 Lincoln's Inn Fields, ,

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.2.g.3

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v4.7.0

BRUKL compliance check version: v5.2.g.3

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Chris Hocknell

Telephone number: 02031790420

Address: 81 Southwark Street, London, SE10HX

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

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

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	18.9
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	18.9
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	23.8
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 the building services should achieve reasonable overall standards of energy efficiency

Values not achieving 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	0.37	0.39	-1 Floor - B-02 Office_W_11
Floor	0.25	0.14	0.58	-1 Floor - B-09 Lift_S_3
Roof	0.25	0.45	0.58	-1 Floor - B-02 Office_R_5
Windows***, roof windows, and rooflights	2.2	2.67	3.69	1 Floor - 1-01 Office_G_16
Personnel doors	2.2	2.82	2.82	0 Floor - G-02 Bike Store_D_13
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$]
$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

* 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- Proposed HVAC

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	0.91	3.7	-	-	-
Standard value	0.91*	2.6	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.

1- Proposed 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**
-1 Floor - B-02 Office	-	-	-	1.5	-	-	-	-	-	0.7	0.5
-1 Floor - B-09 Lift	-	-	-	-	-	-	-	-	-	-	N/A
-1 Floor - B-08 Landlords cupd	-	-	-	-	-	-	-	-	-	-	N/A
-1 Floor - B-06 Stairs	-	-	-	-	-	-	-	-	-	-	N/A
-1 Floor - B-04 WC	0.3	-	-	-	-	-	-	-	-	-	N/A
-1 Floor - B-03 Water Tank	-	-	-	1.5	-	-	-	-	-	0.7	0.5
-1 Floor - B-09 Lift Lobby	-	-	-	-	-	-	-	-	-	-	N/A
-1 Floor - B-05 WC Lobby	-	-	-	-	-	-	-	-	-	-	N/A
-1 Floor - B-03 Elec Intake Cupd	-	-	-	-	-	-	-	-	-	-	N/A
-1 Floor - B-07 Cleaners Cupd	-	-	-	-	-	-	-	-	-	-	N/A
-1 Floor - B-01 Vault	-	-	-	-	-	-	-	-	-	-	N/A
0 Floor - G-05 Lift	-	-	-	-	-	-	-	-	-	-	N/A
0 Floor - G-05 Stairs	-	-	-	-	-	-	-	-	-	-	N/A
0 Floor - G-04 Disabled WC	0.3	-	-	-	-	-	-	-	-	-	N/A
0 Floor - G-02 Bike Store	-	-	-	-	-	-	-	-	-	-	N/A

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
0 Floor - G-02 Bin Store	-	-	-	-	-	-	-	-	-	-	N/A
0 Floor - G-05 EntranceLobby	-	-	-	1.5	-	-	-	-	-	0.7	0.5
0 Floor - G-01 Office	-	-	-	1.5	-	-	-	-	-	0.7	0.5
1 Floor - 1-01 Office	-	-	-	1.5	-	-	-	-	-	0.7	0.5
1 Floor - 1-04 Lift Lobby	-	-	-	-	-	-	-	-	-	-	N/A
1 Floor - 1-03 Stair	-	-	-	-	-	-	-	-	-	-	N/A
1 Floor - 1-02 WC	0.3	-	-	-	-	-	-	-	-	-	N/A
1 Floor - 1-04 Lift	-	-	-	-	-	-	-	-	-	-	N/A
2 Floor - 2-01 Office	-	-	-	1.5	-	-	-	-	-	0.7	0.5
2 Floor - 2-04 Lift Lobby	-	-	-	-	-	-	-	-	-	-	N/A
2 Floor - 2-02 WC	0.3	-	-	-	-	-	-	-	-	-	N/A
2 Floor - 2-04 Lift	-	-	-	-	-	-	-	-	-	-	N/A
2 Floor - 2-03 Stair	-	-	-	-	-	-	-	-	-	-	N/A
3 Floor - 3-01 Office	-	-	-	1.5	-	-	-	-	-	0.7	0.5
4 Floor - 4-01 Office	-	-	-	1.5	-	-	-	-	-	0.7	0.5
4 Floor - 4-02 WC	0.3	-	-	-	-	-	-	-	-	-	N/A
5 Floor - 5-03 Lift	-	-	-	-	-	-	-	-	-	-	N/A
5 Floor - 5-02 Stairs	-	-	-	-	-	-	-	-	-	-	N/A
5 Floor - 5-01 Office	-	-	-	1.5	-	-	-	-	-	0.7	0.5
5 Floor - RWP	-	-	-	-	-	-	-	-	-	-	N/A
5 Floor - 5-03 Lift Lobby	-	-	-	-	-	-	-	-	-	-	N/A
5 Floor - 5-04 Storage	-	-	-	-	-	-	-	-	-	-	N/A

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
-1 Floor - B-02 Office	85	-	-	1743
-1 Floor - B-09 Lift	-	85	-	16
-1 Floor - B-08 Landlords cupd	85	-	-	8
-1 Floor - B-06 Stairs	-	85	-	39
-1 Floor - B-04 WC	-	85	-	77
-1 Floor - B-03 Water Tank	85	-	-	22
-1 Floor - B-09 Lift Lobby	-	85	-	30
-1 Floor - B-05 WC Lobby	-	85	-	29
-1 Floor - B-03 Elec Intake Cupd	85	-	-	9
-1 Floor - B-07 Cleaners Cupd	85	-	-	5
-1 Floor - B-01 Vault	85	-	-	12
0 Floor - G-05 Lift	-	85	-	24
0 Floor - G-05 Stairs	-	85	-	44
0 Floor - G-04 Disabled WC	-	85	-	52
0 Floor - G-02 Bike Store	85	-	-	28
0 Floor - G-02 Bin Store	85	-	-	12
0 Floor - G-05 EntranceLobby	-	85	55	140

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
0 Floor - G-01 Office	85	-	-	1298
1 Floor - 1-01 Office	85	-	-	1748
1 Floor - 1-04 Lift Lobby	-	85	-	27
1 Floor - 1-03 Stair	-	85	-	35
1 Floor - 1-02 WC	-	85	-	72
1 Floor - 1-04 Lift	-	85	-	24
2 Floor - 2-01 Office	85	-	-	962
2 Floor - 2-04 Lift Lobby	-	85	-	25
2 Floor - 2-02 WC	-	85	-	58
2 Floor - 2-04 Lift	-	85	-	21
2 Floor - 2-03 Stair	-	85	-	34
3 Floor - 3-01 Office	85	-	-	962
4 Floor - 4-01 Office	85	-	-	962
4 Floor - 4-02 WC	-	85	-	58
5 Floor - 5-03 Lift	-	85	-	13
5 Floor - 5-02 Stairs	-	85	-	25
5 Floor - 5-01 Office	85	-	-	839
5 Floor - RWP	85	-	-	6
5 Floor - 5-03 Lift Lobby	-	85	-	16
5 Floor - 5-04 Storage	85	-	-	7

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
-1 Floor - B-02 Office	NO (-86.3%)	NO
-1 Floor - B-09 Lift	N/A	N/A
-1 Floor - B-08 Landlords cupd	N/A	N/A
-1 Floor - B-06 Stairs	N/A	N/A
-1 Floor - B-04 WC	N/A	N/A
-1 Floor - B-03 Water Tank	N/A	N/A
-1 Floor - B-09 Lift Lobby	N/A	N/A
-1 Floor - B-05 WC Lobby	N/A	N/A
-1 Floor - B-03 Elec Intake Cupd	N/A	N/A
-1 Floor - B-07 Cleaners Cupd	N/A	N/A
-1 Floor - B-01 Vault	N/A	N/A
0 Floor - G-05 Lift	N/A	N/A
0 Floor - G-05 Stairs	N/A	N/A
0 Floor - G-04 Disabled WC	N/A	N/A
0 Floor - G-02 Bike Store	N/A	N/A
0 Floor - G-02 Bin Store	N/A	N/A
0 Floor - G-05 EntranceLobby	NO (-80.2%)	NO
0 Floor - G-01 Office	NO (-51.1%)	NO
1 Floor - 1-01 Office	YES (+27.9%)	NO
1 Floor - 1-04 Lift Lobby	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
1 Floor - 1-03 Stair	N/A	N/A
1 Floor - 1-02 WC	N/A	N/A
1 Floor - 1-04 Lift	N/A	N/A
2 Floor - 2-01 Office	NO (-10.3%)	NO
2 Floor - 2-04 Lift Lobby	N/A	N/A
2 Floor - 2-02 WC	NO (-8.6%)	NO
2 Floor - 2-04 Lift	N/A	N/A
2 Floor - 2-03 Stair	N/A	N/A
3 Floor - 3-01 Office	NO (-10.3%)	NO
4 Floor - 4-01 Office	NO (-10.3%)	NO
4 Floor - 4-02 WC	NO (-8.6%)	NO
5 Floor - 5-03 Lift	N/A	N/A
5 Floor - 5-02 Stairs	N/A	N/A
5 Floor - 5-01 Office	NO (-88.5%)	NO
5 Floor - RWP	N/A	N/A
5 Floor - 5-03 Lift Lobby	N/A	N/A
5 Floor - 5-04 Storage	N/A	N/A

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	1551.3	1551.3
External area [m²]	1378.4	1378.4
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	25	3
Average conductance [W/K]	983.68	586.25
Average U-value [W/m²K]	0.71	0.43
Alpha value* [%]	11.73	22.67

* 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 Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: 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	23.2	7.1
Cooling	10.03	8.67
Auxiliary	4.87	2.44
Lighting	19.11	21.51
Hot water	2.21	2.56
Equipment*	34.06	34.06
TOTAL**	**59.43**	**42.28**

* Energy used by equipment does not count towards the total for 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]	165.67	133.3
Primary energy* [kWh/m²]	139.52	109.12
Total emissions [kg/m²]	23.8	18.9

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

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	70.8	94.9	23.2	10	4.9	0.85	2.63	0.91	3.7
	Notional	20.9	112.4	7.1	8.7	2.4	0.82	3.6	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

Key Features

The BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.28	0 Floor - G-01 Office_W_12
Floor	0.2	0.03	-1 Floor - B-02 Office_S_3
Roof	0.15	0.18	1 Floor - 1-01 Office_R_7
Windows, roof windows, and rooflights	1.5	1.8	-1 Floor - B-02 Office_G_6
Personnel doors	1.5	2.82	0 Floor - G-02 Bike Store_D_13
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
$m^3/(h.m^2)$ at 50 Pa	5	25

Appendix
Energy Assessment
10-11 Lincoln's Inn Fields

GREEN Scenario

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

10-11 Lincoln's Inn Fields

As designed

Date: Thu Oct 13 10:28:36 2016

Administrative information

Building Details

Address: 10-11 Lincoln's Inn Fields, ,

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.2.g.3

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v4.7.0

BRUKL compliance check version: v5.2.g.3

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Chris Hocknell

Telephone number: 02031790420

Address: 81 Southwark Street, London, SE10HX

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

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

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	18.5
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	18.5
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	21.9
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 the building services should achieve reasonable overall standards of energy efficiency

Values not achieving 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	0.37	0.39	-1 Floor - B-02 Office_W_11
Floor	0.25	0.14	0.58	-1 Floor - B-09 Lift_S_3
Roof	0.25	0.45	0.58	-1 Floor - B-02 Office_R_5
Windows***, roof windows, and rooflights	2.2	2.67	3.69	1 Floor - 1-01 Office_G_16
Personnel doors	2.2	2.82	2.82	0 Floor - G-02 Bike Store_D_13
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$]
$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

* 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- Proposed HVAC

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	3.5	3.7	-	-	-
Standard value	2.5*	2.6	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 all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

1- Proposed 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**
-1 Floor - B-02 Office	-	-	-	1.5	-	-	-	-	-	0.7	0.5
-1 Floor - B-09 Lift	-	-	-	-	-	-	-	-	-	-	N/A
-1 Floor - B-08 Landlords cupd	-	-	-	-	-	-	-	-	-	-	N/A
-1 Floor - B-06 Stairs	-	-	-	-	-	-	-	-	-	-	N/A
-1 Floor - B-04 WC	0.3	-	-	-	-	-	-	-	-	-	N/A
-1 Floor - B-03 Water Tank	-	-	-	1.5	-	-	-	-	-	0.7	0.5
-1 Floor - B-09 Lift Lobby	-	-	-	-	-	-	-	-	-	-	N/A
-1 Floor - B-05 WC Lobby	-	-	-	-	-	-	-	-	-	-	N/A
-1 Floor - B-03 Elec Intake Cupd	-	-	-	-	-	-	-	-	-	-	N/A
-1 Floor - B-07 Cleaners Cupd	-	-	-	-	-	-	-	-	-	-	N/A
-1 Floor - B-01 Vault	-	-	-	-	-	-	-	-	-	-	N/A
0 Floor - G-05 Lift	-	-	-	-	-	-	-	-	-	-	N/A
0 Floor - G-05 Stairs	-	-	-	-	-	-	-	-	-	-	N/A
0 Floor - G-04 Disabled WC	0.3	-	-	-	-	-	-	-	-	-	N/A
0 Floor - G-02 Bike Store	-	-	-	-	-	-	-	-	-	-	N/A

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
0 Floor - G-02 Bin Store	-	-	-	-	-	-	-	-	-	-	N/A
0 Floor - G-05 EntranceLobby	-	-	-	1.5	-	-	-	-	-	0.7	0.5
0 Floor - G-01 Office	-	-	-	1.5	-	-	-	-	-	0.7	0.5
1 Floor - 1-01 Office	-	-	-	1.5	-	-	-	-	-	0.7	0.5
1 Floor - 1-04 Lift Lobby	-	-	-	-	-	-	-	-	-	-	N/A
1 Floor - 1-03 Stair	-	-	-	-	-	-	-	-	-	-	N/A
1 Floor - 1-02 WC	0.3	-	-	-	-	-	-	-	-	-	N/A
1 Floor - 1-04 Lift	-	-	-	-	-	-	-	-	-	-	N/A
2 Floor - 2-01 Office	-	-	-	1.5	-	-	-	-	-	0.7	0.5
2 Floor - 2-04 Lift Lobby	-	-	-	-	-	-	-	-	-	-	N/A
2 Floor - 2-02 WC	0.3	-	-	-	-	-	-	-	-	-	N/A
2 Floor - 2-04 Lift	-	-	-	-	-	-	-	-	-	-	N/A
2 Floor - 2-03 Stair	-	-	-	-	-	-	-	-	-	-	N/A
3 Floor - 3-01 Office	-	-	-	1.5	-	-	-	-	-	0.7	0.5
4 Floor - 4-01 Office	-	-	-	1.5	-	-	-	-	-	0.7	0.5
4 Floor - 4-02 WC	0.3	-	-	-	-	-	-	-	-	-	N/A
5 Floor - 5-03 Lift	-	-	-	-	-	-	-	-	-	-	N/A
5 Floor - 5-02 Stairs	-	-	-	-	-	-	-	-	-	-	N/A
5 Floor - 5-01 Office	-	-	-	1.5	-	-	-	-	-	0.7	0.5
5 Floor - RWP	-	-	-	-	-	-	-	-	-	-	N/A
5 Floor - 5-03 Lift Lobby	-	-	-	-	-	-	-	-	-	-	N/A
5 Floor - 5-04 Storage	-	-	-	-	-	-	-	-	-	-	N/A

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
-1 Floor - B-02 Office	85	-	-	1743
-1 Floor - B-09 Lift	-	85	-	16
-1 Floor - B-08 Landlords cupd	85	-	-	8
-1 Floor - B-06 Stairs	-	85	-	39
-1 Floor - B-04 WC	-	85	-	77
-1 Floor - B-03 Water Tank	85	-	-	22
-1 Floor - B-09 Lift Lobby	-	85	-	30
-1 Floor - B-05 WC Lobby	-	85	-	29
-1 Floor - B-03 Elec Intake Cupd	85	-	-	9
-1 Floor - B-07 Cleaners Cupd	85	-	-	5
-1 Floor - B-01 Vault	85	-	-	12
0 Floor - G-05 Lift	-	85	-	24
0 Floor - G-05 Stairs	-	85	-	44
0 Floor - G-04 Disabled WC	-	85	-	52
0 Floor - G-02 Bike Store	85	-	-	28
0 Floor - G-02 Bin Store	85	-	-	12
0 Floor - G-05 EntranceLobby	-	85	55	140

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
0 Floor - G-01 Office	85	-	-	1298
1 Floor - 1-01 Office	85	-	-	1748
1 Floor - 1-04 Lift Lobby	-	85	-	27
1 Floor - 1-03 Stair	-	85	-	35
1 Floor - 1-02 WC	-	85	-	72
1 Floor - 1-04 Lift	-	85	-	24
2 Floor - 2-01 Office	85	-	-	962
2 Floor - 2-04 Lift Lobby	-	85	-	25
2 Floor - 2-02 WC	-	85	-	58
2 Floor - 2-04 Lift	-	85	-	21
2 Floor - 2-03 Stair	-	85	-	34
3 Floor - 3-01 Office	85	-	-	962
4 Floor - 4-01 Office	85	-	-	962
4 Floor - 4-02 WC	-	85	-	58
5 Floor - 5-03 Lift	-	85	-	13
5 Floor - 5-02 Stairs	-	85	-	25
5 Floor - 5-01 Office	85	-	-	839
5 Floor - RWP	85	-	-	6
5 Floor - 5-03 Lift Lobby	-	85	-	16
5 Floor - 5-04 Storage	85	-	-	7

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
-1 Floor - B-02 Office	NO (-86.3%)	NO
-1 Floor - B-09 Lift	N/A	N/A
-1 Floor - B-08 Landlords cupd	N/A	N/A
-1 Floor - B-06 Stairs	N/A	N/A
-1 Floor - B-04 WC	N/A	N/A
-1 Floor - B-03 Water Tank	N/A	N/A
-1 Floor - B-09 Lift Lobby	N/A	N/A
-1 Floor - B-05 WC Lobby	N/A	N/A
-1 Floor - B-03 Elec Intake Cupd	N/A	N/A
-1 Floor - B-07 Cleaners Cupd	N/A	N/A
-1 Floor - B-01 Vault	N/A	N/A
0 Floor - G-05 Lift	N/A	N/A
0 Floor - G-05 Stairs	N/A	N/A
0 Floor - G-04 Disabled WC	N/A	N/A
0 Floor - G-02 Bike Store	N/A	N/A
0 Floor - G-02 Bin Store	N/A	N/A
0 Floor - G-05 EntranceLobby	NO (-80.2%)	NO
0 Floor - G-01 Office	NO (-51.1%)	NO
1 Floor - 1-01 Office	YES (+27.9%)	NO
1 Floor - 1-04 Lift Lobby	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
1 Floor - 1-03 Stair	N/A	N/A
1 Floor - 1-02 WC	N/A	N/A
1 Floor - 1-04 Lift	N/A	N/A
2 Floor - 2-01 Office	NO (-10.3%)	NO
2 Floor - 2-04 Lift Lobby	N/A	N/A
2 Floor - 2-02 WC	NO (-8.6%)	NO
2 Floor - 2-04 Lift	N/A	N/A
2 Floor - 2-03 Stair	N/A	N/A
3 Floor - 3-01 Office	NO (-10.3%)	NO
4 Floor - 4-01 Office	NO (-10.3%)	NO
4 Floor - 4-02 WC	NO (-8.6%)	NO
5 Floor - 5-03 Lift	N/A	N/A
5 Floor - 5-02 Stairs	N/A	N/A
5 Floor - 5-01 Office	NO (-88.5%)	NO
5 Floor - RWP	N/A	N/A
5 Floor - 5-03 Lift Lobby	N/A	N/A
5 Floor - 5-04 Storage	N/A	N/A

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	1551.3	1551.3
External area [m^2]	1378.4	1378.4
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	25	3
Average conductance [W/K]	983.68	586.25
Average U-value [W/m^2K]	0.71	0.43
Alpha value* [%]	11.73	22.67

* 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 Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: 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/m^2]

	Actual	Notional
Heating	6.03	2.39
Cooling	10.03	8.67
Auxiliary	4.87	2.44
Lighting	19.11	21.51
Hot water	2.21	2.56
Equipment*	34.06	34.06
TOTAL**	**42.26**	**37.57**

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

Energy Production by Technology [kWh/m^2]

	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/m^2]	165.67	133.3
Primary energy* [kWh/m^2]	129.74	107.62
Total emissions [kg/m^2]	21.9	18.5

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

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	70.8	94.9	6	10	4.9	3.26	2.63	3.5	3.7
	Notional	20.9	112.4	2.4	8.7	2.4	2.43	3.6	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

Key Features

The BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.28	0 Floor - G-01 Office_W_12
Floor	0.2	0.03	-1 Floor - B-02 Office_S_3
Roof	0.15	0.18	1 Floor - 1-01 Office_R_7
Windows, roof windows, and rooflights	1.5	1.8	-1 Floor - B-02 Office_G_6
Personnel doors	1.5	2.82	0 Floor - G-02 Bike Store_D_13
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
$m^3/(h.m^2)$ at 50 Pa	5	25