Method Consulting

Intelligent engineering, sustainable buildings

Imperial Hotel

Energy Statement

June 2019

Document History

This document has been revised and issued as below:

Revision	Date	Description	Created by	Approved by
P01	23/05/19	Preliminary Issue	DN	TK
P02	06/06/19	Revised to design team comments	DN	TK

Contents

1 Introduction

Method Consulting has been appointed to produce an Energy Statement as part of the planning application for the proposed remodelling and extension of the Imperial Hotel at Levels 9 and 10.

This report outlines the sustainable features to be incorporated into the design of the development to improve the overall environmental performance through both good building design and the implementation of renewable technologies.

This report covers the proposed remodelling and extension at Levels 9 and 10 with the provision of a new kitchen restaurant, meeting rooms and bar.

2 Planning Policies & Building Regulations

2.1 Building Regulations Approved Document L2B

As per the Approved Document L2B, proposed extensions that have either a total useful floor area of greater than 100m^2 or greater than 25% of the total useful floor area of the existing building, will be regarded as a new building and the guidance under Approved Document L2A should be followed.

For other extensions that do not fit the above scenarios, the area of the windows and rooflights in the extension should not exceed 40% of the exposed walls.

If both the above cases are not satisfied, then the whole building calculation method should be used. This involves demonstrating that the calculated CO_2 emissions from the building and proposed extension are no greater than for the building plus a notional extension.

The proposed extension is less than 25% of the total useful floor area, and the area of windows and doors exceeds 40% of the exposed walls. This requires the whole building to be assessed, as stated above. However, since the existing building is the same for both cases we have only modelled the proposed Level 9 and 10 extension for the analysis.

2.2 Camden Local Plan

The Camden Local Plan sets out policies for all developments to follow. The following policy has been considered as the basis for this report:

2.2.1 Policy CC1 Climate Change Mitigation

The Council requires all developments to minimise the effects of climate change and encourage all developments to meet the highest feasible environmental standards that are financially viable during construction and occupation. This will be done via the following steps:

- Promotion of zero carbon developments and all developments to reduce carbon dioxide emissions through following the steps in the energy hierarchy.
- All major developments to demonstrate how London Plan targets for carbon dioxide emissions have been met.
- Support and encourage sensitive energy efficiency improvements to existing building.
- All major developments are required to assess the feasibility of connecting to an existing decentralised energy network, or where this is not possible establishing a new network.
- Major developments will be required to install appropriate monitoring equipment to ensure the Council can monitor the effectiveness of renewable and low carbon technologies.

Developments in Camden are expected to minimise energy use and CO_2 emissions in operation through the application of the energy hierarchy:

1. Be Lean – use less energy
2. Be Clean – supply energy efficiently
3. Be Green – use renewable energy

Consistent with the above energy hierarchy, developments of more than 500sqm of any gross internal floorspace are expected to achieve a 20% reduction in carbon dioxide emissions from on-site renewable energy generation, unless it can be demonstrated that such provision is not feasible.

2.3 London Plan

Since the building is not a major development, it is not referable to the London Plan. However, Camden Council requires the building to follow some aspects of the London Plan, which is reflected in the Camden Local Plan.

2.4 Establishing Baseline CO_2 Emissions

Dynamic Part L2A simulations have been carried out using the approved software IES Virtual Environment version 2018.2.0.0.

Images of the constructed model are shown below:

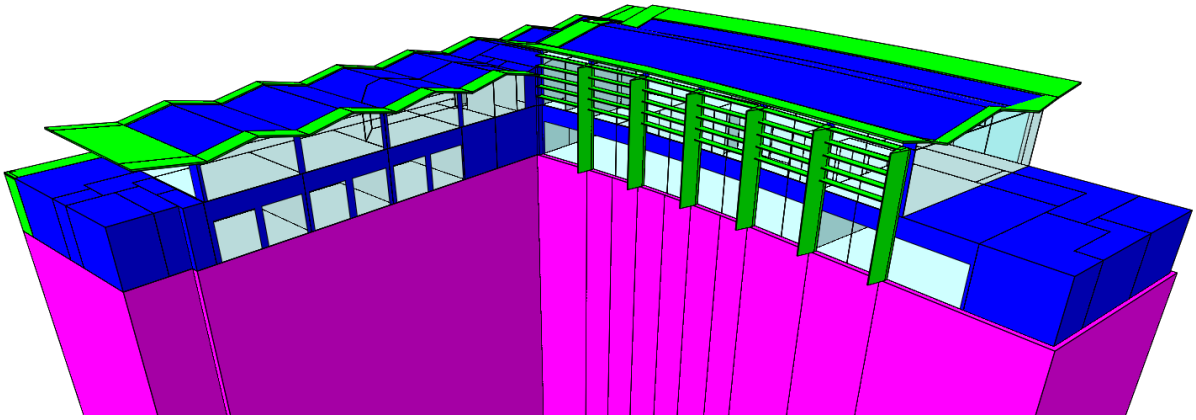

Figure 1: IES virtual environment model of Imperial Hotel

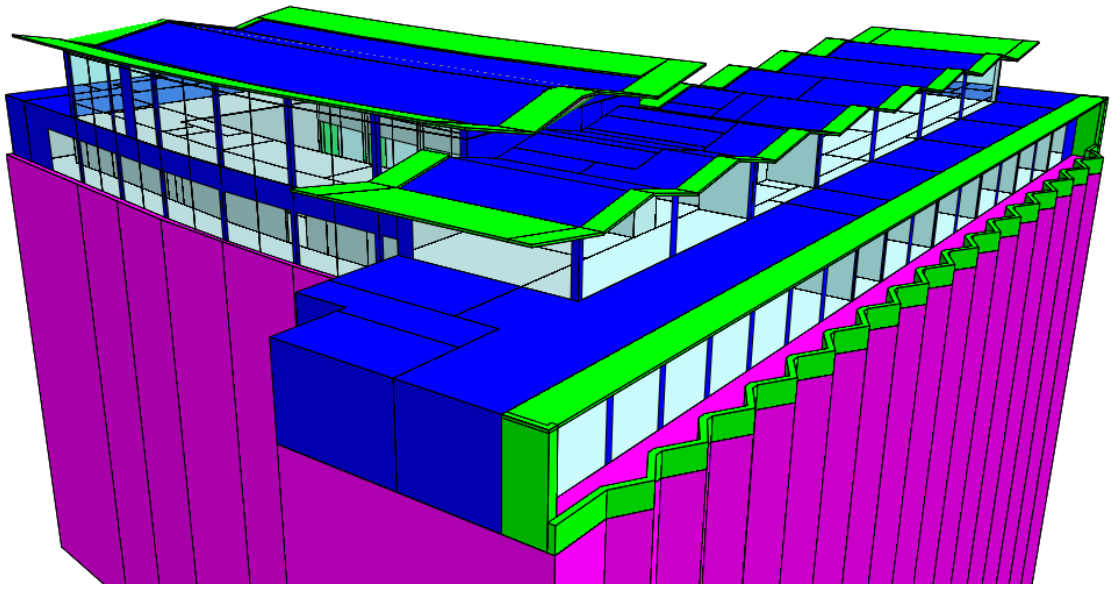

Figure 2: IES virtual environment model of Imperial Hotel

The proposed level 9 and 10 extension is shown in green and blue and the existing building is shown in pink.

2.4.1 Base case scenario

In order to establish the baseline carbon emissions for the development, the methodology described above has been used to model a 'base case scenario' for the development, which is taken as the Building Regulations Part L notional building for each element.

The assumptions for the base case models are detailed in the following section and Appendix A.

(a) Results: Base case energy consumption and CO_2 emissions

From the preliminary BRUKL modelling carried out, the base case scenario is expected to give the following energy consumption and CO_2 emissions for the site.

	Energy Consumption (kWh/m²/year)	CO_2 emissions ($kgCO_2/m^2$/year)
Base case (regulated)	181.34	62
Base case (un-regulated)	82.71	42.93
Base case (Total regulated and un-regulated)	264.05	104.93

Table 1: Base case regulated and un-regulated energy consumption and CO_2 emissions

2.5 Demand Reduction (Be Lean)

In order to ensure that the sustainable aspirations of the development are met, the design team are aiming to provide a high-performance shell for all elements. The proposed building fabric will improve on the requirements of Part L of the Building Regulations 2013. The target U-values are listed in the tables below.

Element	Limiting 2013 U-value ($W/m^2/K$)	Notional building U-value ($W/m^2/K$)	Target U-value ($W/m^2/K$)	% improvement on Notional
Ground Floor	0.25	0.22	0.22	0%
External Walls	0.35	0.26	0.18	30.7%
Roof	0.25	0.18	0.15	16.7%
Windows (Double glazed)	2.2	1.6	1.2	25%
Doors	2.2	2.18	-	-

	Limiting ($m^3/h/m^2$)	Notional ($m^3/h/m^2$)	Target ($m^3/h/m^2$)	
Air Permeability	10	3/5	5	-

Table 2: Limiting, notional building and target U values and air permeability

NB it should be noted that the floor of Level 9 sits directly above the existing hotel and so there is no net heat loss or gain between level 8 and level 9. Therefore the insulation to this floor is actually not critical.

Due to the large areas of glazing to Level 9 and 10, high-specification double glazing with low g-value of 0.3 is specified along with brise soleil to minimise cooling loads, whilst still benefitting from passive solar gains to reduce the winter heating loads.

2.5.1 System Description (Building Services)

The dining space is heated and cooled via an air handling unit; while the other spaces are heated and cooled via local fan coil units. The heating is provided by a gas boiler with an efficiency of 95.8%.

Hot water is heated via a gas boiler, with associated storage and distribution systems. The DHW circulation pipework is set at an assumed 10 W/m to reduce energy losses. Ventilation is provided via a combination of mechanical ventilation with heat recovery (all main occupied areas) and local extract units (isolated WCs only).

The lighting in all spaces is assumed to be via LED fittings, with an assumed minimum efficacy of 100 lumens/Watt and a light output ratio of 100%.

Please see Appendix A for a more detailed description of the building services.

2.5.2 Results: Energy consumption and CO_2 emissions after passive design measures

From the preliminary BRUKL modelling, the passive design measures are expected to improve energy consumption and CO_2 emissions.

In line with Policy CC1's requirement to minimise energy requirements a 'be lean, be clean, be green' philosophy has been applied, with a fabric first approach. High level of insulation and low U-values are being targeted.

	Energy Consumption (kWh/m²/year)	CO_2 emissions ($kgCO_2/m^2$/year)
Passive design case (regulated)	197.46	63.4
Passive design case (un-regulated)	82.71	42.93
Passive design case (Total regulated and un-regulated)	280.17	106.33

Table 2: Base case regulated and un-regulated energy consumption and CO_2 emissions

2.6 Heating Infrastructure (Be Clean)

The review of low and zero carbon technologies carried out for the scheme (see the following section) concludes that photovoltaic panels would be the most appropriate way to achieve a 20% reduction in carbon emissions for this development.

2.6.1 District Heating

As per policy CC1 of the Camden Local Plan, connection to an energy network is not required unless particular circumstances make it viable.

2.7 Low and Zero Carbon Technologies for Energy Production (Be Green)

This section will aim to investigate and determine the most appropriate LZC technology for the development in order to comply with the requirements of CC1 as described earlier in this report.

2.7.1 Combined Heat and Power

The building has two existing gas-fired CHP machines of 110kWe (~170kWth) each. These meet the heating baseload for the building and are appropriately sized. It is not proposed to alter or add to the existing CHP installation.

2.7.2 Photovoltaics

Solar energy can be converted to electricity using the photo-electric effect. Simply, photovoltaic (PV) cells use the energy from the sun to induce a current in a circuit. The cells are encapsulated between a sheet of toughened glass at the front and a moisture sealing membrane on the back to make them weatherproof.

In the UK, PV panels are usually installed on roofs of buildings. The optimum position is facing south with a tilt angle of around 30°. PV cells can be purchased in

the form of Building Integrated PV (BIPV) products such as roof tiles and glazing products and, as such, is potentially the easiest of all renewable energy technologies to embed into the built environment.

(a) Suitability of photovoltaics for the proposed development

Initial investigations suggest that photovoltaics would be a good fit for the project, as the new 10th floor of the building has a pitched roof.

150m^2 of photovoltaic panels with an efficiency of 0.165 could be mounted on the roof of the building as calculated from the drawings. This is the practical maximum size of PV array that can be accommodated. A southerly orientation and a 10^o tilt are assumed in the modelling software. All other assumptions are as in the Energy Efficient model.

Adding the PV reduces the CO_2 emissions and energy consumption of the development to a certain extent, as follows:

	Energy Consumption (kWh/m^2/year)	CO_2 emissions (kgCO_2/m^2/year)
Predicted – Passive design (regulated)	197.46	63.4
Predicted – Passive design (regulated & un-regulated))	280.17	106.33
Predicted – PV (regulated)	187.45	58.2
Predicted – PV (regulated & un-regulated)	270.16	101.13
% improvement compared to passive design model (regulated)	5.1%	8.2%

Table 3: Comparison of the predicted annual energy consumption and CO_2 emissions for the passive design case and PV models

The PV array makes use of the maximum available roof area and results in a 8.2% reduction in regulated CO_2 emissions and a 4.9% reduction in regulated and un-regulated CO_2 emissions.

The PV could be connected to the national grid meaning any spare electricity generated (and not used by the building) could be exported when not in use. It is considered that there would be no land use or noise implications from a PV array and if installed discreetly, could not be seen from street level so is unlikely to cause

a planning or aesthetic issue. The PV array would be eligible for a Feed in Tariff which would contribute to the monetary payback of the system.

The table below summarises the estimated costs associated with a PV array of 24.75kWp based on the following assumptions:

- The PV array requires 6.5m^2/kWp.
- The cost of electricity is 15p/kWh.
- The calculation accounts for the cost of installing a new PV inverter after 10 years (i.e. once during the lifetime of the PV array). This cost is spread across the lifetime of the array and is subtracted from the annual cost saving.

Area of PV	Capital Cost	Annual energy generated (kWh)	Annual Carbon savings (kg)	Annual cost saving	Simple Payback (years)	£/kgCO_2 saved
150m^2	£29,700	20,676.7	10,731.2	£3,101.5	9.6	£2.7

Table 4: Simple payback calculation for proposed PV array

A factor has also been applied to the annual energy generated and annual carbon savings figures to take account of performance degradation and maintenance requirements throughout the life of the PV array.

This is based on the following assumed PV specification:

PV Specification	
Module Nominal Efficiency	16.5%
Area	150m^2
Orientation	141° (Clockwise from North- In line with building)
Inclination	10°
Shading Factor	1 (No obstruction)
Electrical Conversion Efficiency	95%

2.7.3 Solar hot water heating

There are two common types of solar collector that are used to provide hot water and space heating in domestic and commercial situations: flat plate collectors and evacuated tube collectors.

In flat plate collectors the working fluid (typically a water/glycol mixture) is directly heated as it circulates through pipework within the collector. The absorber plate and associated pipe work usually sits below a glass cover within a heavily insulated enclosure to reduce heat loss.

Evacuated tube collectors increase the efficiency of the system by enclosing the absorber plate in a near vacuum. This dramatically reduces the heat loss by convection from the absorber surface. The fabrication of the glass tube is expensive and leads to a collector that will perform better, but at higher cost. Flat plate collectors are generally used on residential buildings and evacuated tube collectors on larger commercial buildings.

(a) Suitability of solar hot water heating for the proposed development

Initial investigations suggest that the incorporation of solar thermal would not sufficiently reduce carbon emissions to meet the 20% reduction required. In addition, solar water heating arrays are typically more costly than traditional PV panels and would likely require additional back-up systems due to the high peak loads. As such, they are not considered appropriate to the development and have been discounted from the analysis.

2.7.4 Biomass Heating

Biomass refers to burning natural, vegetative matter to produce heat. This heat can be used both to temper the building, and to meet the hot water requirements. The fuel used for the boiler is typically wood, which comes in the form of either chips or pellets. The CO_2 released when burning this matter is equivalent to the CO_2 the trees have absorbed in their lifetime. Thus, the whole process becomes almost carbon neutral. The only additional emissions will be from processing and transportation of the fuel.

Biomass, like any solid fuel, requires storage on site and, to minimise the frequency of deliveries, significant space and associated access for delivery needs to be allowed for within the site layout. Wood pellets have a higher energy density and a more consistent size, shape and moisture content, so are better suited to smaller boiler installations and where fuel delivery access is restricted.

Currently the cost of woodchips is slightly cheaper than the cost of natural gas, whereas the cost of wood pellets is similar to that of oil. However, the price of natural gas and oil has been very volatile in recent years and for many customers has doubled in price since 2002. In contrast, the price of wood fuel has been much

more stable, and it is thought that this is likely to remain the case in the medium to long term.

(a) Suitability of biomass for the proposed development

Initial investigations suggest that a biomass heating system is not well suited to this site as a biomass boiler installation would require a large area for the boilers, fuel storage, fuel handling and delivery space for lorries which is not available. In addition, the management of deliveries for and storage of fuel represents a high maintenance commitment for the Client, which is not considered desirable. For these reasons, the technology has been discounted from the analysis.

2.7.5 Heat pumps

A heat pump uses the same 'vapour compression' technology that is used in a domestic refrigerator, but the cycle is reversed to provide heating and/or cooling to internal spaces. A heat pump uses electricity to transfer heat from one source to another, rather than generating heat, with most of the energy coming from the ambient ground or water to which it is connected. The coefficient of performance (COP) is the ratio of the heat output to the electricity input. With most modern equipment, the Seasonal COP will typically range from 3 to 5, i.e. for 1 kW of electrical input up to 5 kW of heating or cooling can be achieved.

It should be noted that because of the higher CO_2 emissions associated with the grid electricity supply, COPs must be better than 2.5 before there is any reduction in CO_2 emissions compared to heating via gas fired condensing boilers. However, if the electricity is generated from renewable energy sources, heat pumps can be part of a carbon neutral servicing strategy providing both heating and cooling to buildings.

Heat pumps are characterised depending on the source of the heat and the sink used for the heat. In the heating mode, energy can be extracted from the air, water or the ground and delivered to the space via fan powered air supply or a water circuit (such as underfloor heating). It should be noted that high COPs are generally only obtained when the flow temperature of the heating circuit to the building is relatively low, so they are often used with underfloor heating.

(a) Suitability of heat pumps for the proposed development

Air-source heat pumps would require space for external condensing units, relatively close to Level 9 and 10 (to minimise refrigerant pipework lengths). Because of the

proposed layout there is no space for local condensing units for air-source heat pumps at Level 9 or 10. In addition there is a desire to minimise the visual impact of the extension and condensing units at roof level which would be visible from the street and neighbouring buildings are not considered desirable.

The existing building is heated by existing CHP machines and gas boilers and it is proposed to extend the existing low temperature hot water installation to cover levels 9 and 10. This then allows the extension to make best use of the efficient CHP and gas-boiler system.

Air-source heat pumps have therefore been discounted from the analysis.

2.7.6 Wind turbines

Wind turbines use energy from the wind to produce electricity. This electricity can be used on site or sold back to the national grid. The suitability of installing wind turbines is largely dependent on local wind speeds. Accurately estimating the energy available from wind at a specific site is a complex task and requires knowledge of the long-term wind speeds at height, taking into account climatic variations, the effect of topological features and ground friction factors. Average wind speeds of 7 m/s or above are required for large scale wind turbines, although average speeds in the region of 4-6m/s can be sufficient to make smaller turbines viable.

Turbines are rated by the power generated at a specific wind speed. At very low wind speeds turbines do not operate. When they reach their critical cut-in wind speed they generate at a lower level than the rating, and finally once the rated wind speed is reached the turbine is designed to maintain a fairly constant power output. As a turbine is not generating all the time, and sometimes at part load, a good approximation of annual output is 20-30% of that expected if the turbine was operating continuously at its rated level throughout the year. This percentage is known as the capacity factor.

(a) Suitability of a wind turbine for the proposed development

Initial investigations suggest that the site is not well suited to a wind turbine, due to the urban location and associated local planning issues. For these reasons, the technology has been discounted from the analysis.

2.8 Assessment of the percentage emissions reduction from the PV array

2.8.1 Methodology

The Part L2A NCM methodology has been used to assess the CO_2 reductions from the renewable technologies.

2.8.2 IES modelling

The building has been fully modelled using IES in order to demonstrate the building complies with the Building Regulations Part L. The output from this is the BRUKL document and this is attached to this report.

This modelling process and the BRUKL then gives us an accurate estimate of the energy consumption and CO_2 emissions from the building. We have used this data to demonstrate that the proposed PV array will provide 4.95% of the regulated energy requirements generated by the development.

Calculation of CO_2 savings from renewable energy (Regulated only)	
Notional Building CO_2 emissions per m^2 (TER) (from BRUKL page 1 (TER)	62 kg CO2/m2/annum (a)
Total residual CO_2 emissions per m^2 after passive design measures and energy efficient plant (BER without energy from PV savings = g	63.4 kg CO2/m2/annum (b)
Energy production from PV (from BRUKL page	10.01 kWh/m2/annum (c)
CO_2 saving per kWh generated from PV	0.519 kg CO2/m2/annum (d)
Therefore, CO_2 savings per m^2 from PV array (i.e. c x d)	5.195 kg CO2/m2/annum (e)
CO_2 savings from on-site renewables expressed as a percentage of the residual CO2 (i.e. e/b x 100)	8.2 % (f)
CO_2 emissions per m^2 after passive design measures, efficient plant measures & renewable energy provision (BER from Page 1)	58.2 CO_2/m2/annum (g)

While the PV array makes use of the maximum available roof area and achieves a 8.2% reduction in regulated CO_2 emissions, it is not enough to meet the Camden Local Plan Policy CC1 requirement of a 20% reduction in CO_2 from on-site

renewable energy generation. However, steps have been taken to minimise the energy demand.

These steps include the use of high-performance building fabric, low glazing g-values, addition of brise soleil, and high efficiency systems to optimise the building and reduce the energy loads.

Additionally, the result of this analysis is only for the 9th and 10th floors. Since the entire building is being refurbished (basement to 8th floor), there will be an overall improvement in the energy consumption of the entire retrofitted building compared to the existing building.

2.9 Energy Monitoring

The building will be installed with a full energy metering system, for monitoring and targeting, in compliance with TM39. The meters will be linked to the building management system so that meter readings are automatically recorded and they can then be easily analysed for monitoring and targeting with the aim of reducing energy consumption.

This is in line with the requirements of policy CC1, which requires equipment to monitor the effectiveness of renewable and low carbon technologies.

3 Appendix

3.1 Appendix A – M&E systems descriptions for base case and proposed building model

(a) Heating and cooling in dining space

	Limiting value	Proposed building	Comments
Fuel and system type	N/A	Air Handling Unit with gas boiler and Chiller	Heating efficiency 95.8% Cooling seasonal efficiency 4.27 Heat recovery of 80%
Carbon emission factor ($kgCO_2/kWh$)	N/A	0.216	
Emitters	N/A	N/A	Ducted supply grilles

Table 5: Heating system description for proposed building

(b) Heating and cooling in other spaces

	Limiting value	Proposed building	Comments
Fuel and system type	N/A	Air Handling Unit with gas boiler and Chiller	Efficiency 95.8% Cooling seasonal efficiency 4.27 Heat recovery of 80%
Carbon emission factor ($kgCO_2/kWh$)	N/A	0.216	
Emitters	N/A	Indoor fan coil units	

Table 6: Heating system description for proposed building

(c) Heating in kitchen

	Limiting value	Proposed building	Comments
Fuel and system type	N/A	Air Handling Unit with gas boiler	Efficiency 95.8% Heat recovery of 50%
Carbon emission factor ($kgCO_2/kWh$)	N/A	0.216	
Emitters	N/A	Indoor fan coil unit	

Table 7: Heating system description for proposed building

(d) Heating in Stairwell

	Limiting value	Proposed building	Comments
Fuel and system type	N/A	Gas boiler	Efficiency 95.8%
Carbon emission factor ($kgCO_2/kWh$)	N/A	0.216	
Emitters	N/A	Radiators	

Table 8: Heating system description for proposed building

(e) Controls

	Proposed building	Comments
Central time controls	Yes	
Local Time Controls (by room)	Yes	
Local Thermostatic Controls (by room, e.g. TRVs)	Yes	
Optimum start/stop	Yes	
Weather compensation	Yes	
Pump speed control	Variable speed differential sensor across pump	
Energy meters connected to BMS to alert users to high consumption	Yes	

Table 9: Controls description for proposed building

(f) Ventilation

Ventilation System Type	Limiting value		Proposed building		Comments
	SFP (W/l/s)	Heat Recovery Efficiency (%)	SFP (W/l/s)	Heat Recovery Efficiency (%)	
MVHR 1	1.9	73%	1.6	80%	All except dining and stairwell (air-to-air plate heat exchanger)
MVHR 2	1.9	45%	1.5	50%	Kitchen (run-around coil)
Extract	0.3	N/A	0.3	N/A	Toilets
AHU 1 heating and cooling	1.9	73%	1.6	80%	Dining (air-to-air plate heat exchanger)
AHU 2 heating only	1.8	73%	1.5	80%	Kitchen
FCU	0.5	N/A	0.5	N/A	All except dining and stairwell

Table 10: Ventilation system description for proposed building

(g) Hot Water

	Limiting value	Proposed building	Comments
Fuel and system type	N/A	Buffer vessel with LTHW boiler	95.8% efficiency
Carbon emission factor (kg.CO_2/kWh)	N/A	0.216	
Water Cylinder Capacity (litres)	N/A	800 litres	
Circulation Loop?	N/A	Yes	183m. Pipework losses of 10W/m.

Table 11: Hot water system description for proposed building

(h) Lighting

Area	Limiting		Proposed building		Comments
	Luminaire Efficacy (l/W)	LOR	Luminaire Efficacy (l/W)	LOR	
All spaces	The ***luminaire efficacy*** must be at least 60 l/W		100	100%	

Table 12: Lighting system description for proposed building

(i)Lighting Controls

Area	Limiting	Proposed	Comments
	Control	Control	
Circulation areas, general WCs	Dimming for spaces with windows	Presence Detection and timer (auto-on-off)	
Meeting Rooms, Prep. Room	Dimming for spaces with windows	Absence Detection and timer (man-on-auto-off)	
Dining	Dimming	None	
Kitchen	None	None	
Bar, Breakfast Bar	Dimming	None	

Table 13: Lighting controls description for proposed building

3.2 Appendix B – Baseline/ Passive Design case BRUKL

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Imperial Hotel - 9th and 10th Floor

As designed

Date: Thu May 23 15:42:02 2019

Administrative information

Building Details

Address: 61-66 Russell Square, London, WC1B 5BB

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.11

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.11

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

Owner Details

Name: The Imperial London Hotels Ltd.

Telephone number: 00442078373655

Address: 61-66 Russell Square, Holborn, London, WC1B 5BB

Certifier details

Name: Method Consulting LLP.

Telephone number: 01793822044

Address: Berkeley House, Hunts Rise, South Marston Park, Swindon, SN34TG

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, $kgCO_2/m^2.annum$	62
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	62
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	63.4
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	0.18	0.18	09000014:Surf[1]
Floor	0.25	0.22	0.22	10000001:Surf[0]
Roof	0.25	0.15	0.15	09000019:Surf[0]
Windows***, roof windows, and rooflights	2.2	1.2	1.2	09000018:Surf[1]
Personnel doors	2.2	-	-	No Personnel doors in building
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 [$W/(m^2K)$]
$U_{a\text{-}Calc}$ = 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	5

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- FCU - Heating and Cooling

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.96	2.56	0	1.6	0.8
Standard value	0.91*	2.55	N/A	1.6^	0.5
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.

2- Radiators - Stairwell

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.96	-	0	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.

3- AHU - Heating and Cooling

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.96	2.56	0	1.6	0.8
Standard value	0.91*	2.55	N/A	1.6^	0.5
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.

4- FCU - Kitchen heating only

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.96	-	0	1.5	0.5
Standard value	0.91	N/A	N/A	1.5^	0.45
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

^ 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.

"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
09 - Staff	-	-	-	-	-	-	-	0.5	-	-	N/A
09 - Bar 1	-	-	-	-	-	-	-	0.5	-	-	N/A
09 - Prep.	-	-	-	-	-	-	-	0.5	-	-	N/A
09 - Meeting Room 04	-	-	-	-	-	-	-	0.5	-	-	N/A
09 - Meeting Room 05	-	-	-	-	-	-	-	0.5	-	-	N/A
09 - Meeting Room 06	-	-	-	-	-	-	-	0.5	-	-	N/A
09 - Meeting Room 07	-	-	-	-	-	-	-	0.5	-	-	N/A
09 - Meeting Room 08	-	-	-	-	-	-	-	0.5	-	-	N/A
09 - Corridor 1	-	-	-	-	-	-	-	0.5	-	-	N/A
09 - Corridor 2	-	-	-	-	-	-	-	0.5	-	-	N/A
09 - Corridor 3	-	-	-	-	-	-	-	0.5	-	-	N/A
09 - Meeting Room 01	-	-	-	-	-	-	-	0.5	-	-	N/A
09 - Meeting Room 02	-	-	-	-	-	-	-	0.5	-	-	N/A
09 - Meeting Room 03	-	-	-	-	-	-	-	0.5	-	-	N/A
09 - Kitchen/ Servery	-	-	-	-	-	-	-	0.5	-	-	N/A
09 - Tapas Lounge	-	-	-	-	-	-	-	0.5	-	-	N/A
09 - Lift Lobby	-	-	-	-	-	-	-	0.5	-	-	N/A
09 - Service Lounge	-	-	-	-	-	-	-	0.5	-	-	N/A
10 - Circulation	-	-	-	-	-	-	-	0.5	-	-	N/A
10 - Circulation	-	-	-	-	-	-	-	0.5	-	-	N/A
10 - Servery	-	-	-	-	-	-	-	0.5	-	-	N/A
10 - Bar	-	-	-	-	-	-	-	0.5	-	-	N/A
10 - Lift Lobby	-	-	-	-	-	-	-	0.5	-	-	N/A
10 - Breakfast Bar	-	-	-	-	-	-	-	0.5	-	-	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	
09 - WCs Lobby	-	100	-	21
09 - Male WC's 1	-	100	-	68
09 - Acc. WC 1	-	100	-	33
09 - Staff	100	-	-	154
09 - Female WCs 1	-	100	-	92
09 - Bar 1	-	100	100	76
09 - Services 1	100	-	-	140
09 - Store 2	100	-	-	9
09 - Store 1	100	-	-	9
09 - Stair to 10th 2	-	100	-	28
09 - Stairwell 3	-	100	-	33
09 - Prep.	100	-	-	138
09 - Meeting Room 04	100	-	-	226
09 - Meeting Room 05	100	-	-	226
09 - Meeting Room 06	100	-	-	226

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
09 - Meeting Room 07	100	-	-	226
09 - Meeting Room 08	100	-	-	217
09 - Stairwell 2	-	100	-	47
09 - Corridor 1	-	100	-	31
09 - Corridor 2	-	100	-	40
09 - Corridor 3	-	100	-	112
09 - Meeting Room 01	100	-	-	296
09 - Meeting Room 02	100	-	-	296
09 - Meeting Room 03	100	-	-	296
09 - Acc. WC 2	-	100	-	33
09 - Female WC's 2	-	100	-	102
09 - Male WC's 2	-	100	-	87
09 - Kitchen/ Servery	-	100	-	405
09 - Tapas Lounge	-	100	100	340
09 - Lift Lobby	-	100	-	45
09 - Dining	-	100	100	497
09 - Kitchen	-	100	-	702
09 - Services 2	100	-	-	117
09 - Stair to 10th 3	-	100	-	36
09 - Stairwell 4	-	100	-	36
09 - Service Lounge	-	100	-	244
09 - Stair to 10th 1	-	100	-	44
09 - Stairwell 1	-	100	-	39
10 - Circulation	-	100	-	34
10 - Stairwell	-	100	-	42
10 - Circulation	-	100	-	15
10 - Servery	-	100	100	96
10 - Bar	-	100	100	410
10 - Upper Dining	-	100	100	687
10 - Store 1	100	-	-	8
10 - Store 2	100	-	-	9
10 - WCs 1	-	100	-	50
10 - WCs 2	-	100	-	50
10 - WC Lobby	-	100	-	26
10 - Lift Lobby	-	100	-	81
10 - Breakfast Bar	-	100	100	183

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?
09 - Staff	N/A	N/A
09 - Bar 1	NO (-70.1%)	NO
09 - Prep.	NO (-37.8%)	NO
09 - Meeting Room 04	NO (-37.9%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
09 - Meeting Room 05	NO (-38.2%)	NO
09 - Meeting Room 06	NO (-38.2%)	NO
09 - Meeting Room 07	NO (-37.8%)	NO
09 - Meeting Room 08	NO (-81.5%)	NO
09 - Corridor 1	N/A	N/A
09 - Corridor 2	N/A	N/A
09 - Corridor 3	N/A	N/A
09 - Meeting Room 01	NO (-46.7%)	NO
09 - Meeting Room 02	NO (-45.6%)	NO
09 - Meeting Room 03	NO (-43.9%)	NO
09 - Kitchen/ Servery	NO (-88.8%)	NO
09 - Tapas Lounge	NO (-56.3%)	NO
09 - Lift Lobby	NO (-74.7%)	NO
09 - Dining	NO (-23.8%)	NO
09 - Service Lounge	NO (-55.8%)	NO
10 - Circulation	NO (-31.7%)	NO
10 - Circulation	NO (-74.7%)	NO
10 - Servery	NO (-51.4%)	NO
10 - Bar	NO (-45.8%)	NO
10 - Upper Dining	NO (-55.8%)	NO
10 - Lift Lobby	NO (-84.8%)	NO
10 - Breakfast Bar	NO (-58.9%)	NO

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?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	2065.6	2065.6
External area [m^2]	3004.7	3004.7
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	5	3
Average conductance [W/K]	1448.92	1459.68
Average U-value [W/m^2K]	0.48	0.49
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
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
100	**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/m^2]

	Actual	Notional
Heating	35.31	11.37
Cooling	7.52	13.57
Auxiliary	44.79	25.34
Lighting	16.25	39.76
Hot water	93.6	91.3
Equipment*	82.71	82.71
TOTAL**	**197.46**	**181.34**

* 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/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]	179.08	220.41
Primary energy* [kWh/m^2]	367.74	360.74
Total emissions [kg/m^2]	63.4	62

* 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] Single-duct VAV, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	176.3	81.6	70.1	8.4	76.1	0.7	2.69	0.96	4.27
	Notional	0	0	0	0	0	0	0	----	----
[ST] Fan coil systems, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	84.7	113.9	28.8	9.9	42.7	0.82	3.18	0.96	4.27
	Notional	43.9	231.9	14.1	17	32.7	0.86	3.79	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	140.2	0	45.5	0	3.5	0.85	0	0.96	0
	Notional	29.9	233.4	9.6	17.1	27.7	0.86	3.79	----	----
[ST] Central heating using air distribution, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	0.1	0	0	0	29.6	0.86	0	0.96	0
	Notional	177	0	57	0	2	0.86	0	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	20.9	0.86	0	----	----

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 Building Control Body is advised to give particular attention to items whose specifications 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	0.18	09000014:Surf[1]
Floor	0.2	0.22	10000001:Surf[0]
Roof	0.15	0.15	0900000D:Surf[0]
Windows, roof windows, and rooflights	1.5	1.2	09000018:Surf[1]
Personnel doors	1.5	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	-	No High usage entrance doors in building

$U_{i\text{-}Typ}$ = 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
m³/(h.m²) at 50 Pa	5	5

3.3 Appendix C – BRUKL with PV

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Imperial Hotel - 9th and 10th Floor

As designed

Date: Thu May 23 15:36:41 2019

Administrative information

Building Details

Address: 61-66 Russell Square, London, WC1B 5BB

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.11

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.11

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

Owner Details

Name: The Imperial London Hotels Ltd.

Telephone number: 00442078373655

Address: 61-66 Russell Square, Holborn, London, WC1B 5BB

Certifier details

Name: Method Consulting LLP.

Telephone number: 01793822044

Address: Berkeley House, Hunts Rise, South Marston Park, Swindon, SN34TG

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

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	62
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	62
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	58.2
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	0.18	0.18	09000014:Surf[1]
Floor	0.25	0.22	0.22	10000001:Surf[0]
Roof	0.25	0.15	0.15	09000019:Surf[0]
Windows***, roof windows, and rooflights	2.2	1.2	1.2	09000018:Surf[1]
Personnel doors	2.2	-	-	No Personnel doors in building
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 [$W/(m^2K)$]
$U_{a\text{-}Calc}$ = 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	5

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- FCU - Heating and Cooling

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.96	2.56	0	1.6	0.8
Standard value	0.91*	2.55	N/A	1.6^	0.5
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.

2- Radiators - Stairwell

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.96	-	0	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.

3- AHU - Heating and Cooling

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.96	2.56	0	1.6	0.8
Standard value	0.91*	2.55	N/A	1.6^	0.5
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.

4- FCU - Kitchen heating only

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.96	-	0	1.5	0.5
Standard value	0.91	N/A	N/A	1.5^	0.45
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

^ 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.

"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
09 - Staff	-	-	-	-	-	-	-	0.5	-	-	N/A
09 - Bar 1	-	-	-	-	-	-	-	0.5	-	-	N/A
09 - Prep.	-	-	-	-	-	-	-	0.5	-	-	N/A
09 - Meeting Room 04	-	-	-	-	-	-	-	0.5	-	-	N/A
09 - Meeting Room 05	-	-	-	-	-	-	-	0.5	-	-	N/A
09 - Meeting Room 06	-	-	-	-	-	-	-	0.5	-	-	N/A
09 - Meeting Room 07	-	-	-	-	-	-	-	0.5	-	-	N/A
09 - Meeting Room 08	-	-	-	-	-	-	-	0.5	-	-	N/A
09 - Corridor 1	-	-	-	-	-	-	-	0.5	-	-	N/A
09 - Corridor 2	-	-	-	-	-	-	-	0.5	-	-	N/A
09 - Corridor 3	-	-	-	-	-	-	-	0.5	-	-	N/A
09 - Meeting Room 01	-	-	-	-	-	-	-	0.5	-	-	N/A
09 - Meeting Room 02	-	-	-	-	-	-	-	0.5	-	-	N/A
09 - Meeting Room 03	-	-	-	-	-	-	-	0.5	-	-	N/A
09 - Kitchen/ Servery	-	-	-	-	-	-	-	0.5	-	-	N/A
09 - Tapas Lounge	-	-	-	-	-	-	-	0.5	-	-	N/A
09 - Lift Lobby	-	-	-	-	-	-	-	0.5	-	-	N/A
09 - Service Lounge	-	-	-	-	-	-	-	0.5	-	-	N/A
10 - Circulation	-	-	-	-	-	-	-	0.5	-	-	N/A
10 - Circulation	-	-	-	-	-	-	-	0.5	-	-	N/A
10 - Servery	-	-	-	-	-	-	-	0.5	-	-	N/A
10 - Bar	-	-	-	-	-	-	-	0.5	-	-	N/A
10 - Lift Lobby	-	-	-	-	-	-	-	0.5	-	-	N/A
10 - Breakfast Bar	-	-	-	-	-	-	-	0.5	-	-	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	
09 - WCs Lobby	-	100	-	21
09 - Male WC's 1	-	100	-	68
09 - Acc. WC 1	-	100	-	33
09 - Staff	100	-	-	154
09 - Female WCs 1	-	100	-	92
09 - Bar 1	-	100	100	76
09 - Services 1	100	-	-	140
09 - Store 2	100	-	-	9
09 - Store 1	100	-	-	9
09 - Stair to 10th 2	-	100	-	28
09 - Stairwell 3	-	100	-	33
09 - Prep.	100	-	-	138
09 - Meeting Room 04	100	-	-	226
09 - Meeting Room 05	100	-	-	226
09 - Meeting Room 06	100	-	-	226

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
09 - Meeting Room 07	100	-	-	226
09 - Meeting Room 08	100	-	-	217
09 - Stairwell 2	-	100	-	47
09 - Corridor 1	-	100	-	31
09 - Corridor 2	-	100	-	40
09 - Corridor 3	-	100	-	112
09 - Meeting Room 01	100	-	-	296
09 - Meeting Room 02	100	-	-	296
09 - Meeting Room 03	100	-	-	296
09 - Acc. WC 2	-	100	-	33
09 - Female WC's 2	-	100	-	102
09 - Male WC's 2	-	100	-	87
09 - Kitchen/ Servery	-	100	-	405
09 - Tapas Lounge	-	100	100	340
09 - Lift Lobby	-	100	-	45
09 - Dining	-	100	100	497
09 - Kitchen	-	100	-	702
09 - Services 2	100	-	-	117
09 - Stair to 10th 3	-	100	-	36
09 - Stairwell 4	-	100	-	36
09 - Service Lounge	-	100	-	244
09 - Stair to 10th 1	-	100	-	44
09 - Stairwell 1	-	100	-	39
10 - Circulation	-	100	-	34
10 - Stairwell	-	100	-	42
10 - Circulation	-	100	-	15
10 - Servery	-	100	100	96
10 - Bar	-	100	100	410
10 - Upper Dining	-	100	100	687
10 - Store 1	100	-	-	8
10 - Store 2	100	-	-	9
10 - WCs 1	-	100	-	50
10 - WCs 2	-	100	-	50
10 - WC Lobby	-	100	-	26
10 - Lift Lobby	-	100	-	81
10 - Breakfast Bar	-	100	100	183

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?
09 - Staff	N/A	N/A
09 - Bar 1	NO (-70.1%)	NO
09 - Prep.	NO (-37.8%)	NO
09 - Meeting Room 04	NO (-37.9%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
09 - Meeting Room 05	NO (-38.2%)	NO
09 - Meeting Room 06	NO (-38.2%)	NO
09 - Meeting Room 07	NO (-37.8%)	NO
09 - Meeting Room 08	NO (-81.5%)	NO
09 - Corridor 1	N/A	N/A
09 - Corridor 2	N/A	N/A
09 - Corridor 3	N/A	N/A
09 - Meeting Room 01	NO (-46.7%)	NO
09 - Meeting Room 02	NO (-45.6%)	NO
09 - Meeting Room 03	NO (-43.9%)	NO
09 - Kitchen/ Servery	NO (-88.8%)	NO
09 - Tapas Lounge	NO (-56.3%)	NO
09 - Lift Lobby	NO (-74.7%)	NO
09 - Dining	NO (-23.8%)	NO
09 - Service Lounge	NO (-55.8%)	NO
10 - Circulation	NO (-31.7%)	NO
10 - Circulation	NO (-74.7%)	NO
10 - Servery	NO (-51.4%)	NO
10 - Bar	NO (-45.8%)	NO
10 - Upper Dining	NO (-55.8%)	NO
10 - Lift Lobby	NO (-84.8%)	NO
10 - Breakfast Bar	NO (-58.9%)	NO

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?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	2065.6	2065.6
External area [m^2]	3004.7	3004.7
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	5	3
Average conductance [W/K]	1448.92	1459.68
Average U-value [W/m^2K]	0.48	0.49
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
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
100	**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/m^2]

	Actual	Notional
Heating	35.31	11.37
Cooling	7.52	13.57
Auxiliary	44.79	25.34
Lighting	16.25	39.76
Hot water	93.6	91.3
Equipment*	82.71	82.71
TOTAL**	**197.46**	**181.34**

* 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/m^2]

	Actual	Notional
Photovoltaic systems	10.01	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]	179.08	220.41
Primary energy* [kWh/m^2]	367.74	360.74
Total emissions [kg/m^2]	58.2	62

* 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] Single-duct VAV, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	176.3	81.6	70.1	8.4	76.1	0.7	2.69	0.96	4.27
	Notional	0	0	0	0	0	0	0	----	----
[ST] Fan coil systems, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	84.7	113.9	28.8	9.9	42.7	0.82	3.18	0.96	4.27
	Notional	43.9	231.9	14.1	17	32.7	0.86	3.79	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	140.2	0	45.5	0	3.5	0.85	0	0.96	0
	Notional	29.9	233.4	9.6	17.1	27.7	0.86	3.79	----	----
[ST] Central heating using air distribution, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	0.1	0	0	0	29.6	0.86	0	0.96	0
	Notional	177	0	57	0	2	0.86	0	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	0	0	0	0	20.9	0.86	0	----	----

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 Building Control Body is advised to give particular attention to items whose specifications 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	0.18	09000014:Surf[1]
Floor	0.2	0.22	10000001:Surf[0]
Roof	0.15	0.15	0900000D:Surf[0]
Windows, roof windows, and rooflights	1.5	1.2	09000018:Surf[1]
Personnel doors	1.5	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	-	No High usage entrance doors in building

$U_{i\text{-}Typ}$ = 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
m³/(h.m²) at 50 Pa	5	5

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