Faarup Associates Ltd
Building Services, Low Carbon & Energy Assessing Consultants

93-103 DRUMMOND STREET, LONDON, NW1 2HJ

ENERGY STATEMENT

INCLUDING APPRAISAL OF LOW CARBON TECHNOLOGIES

& PASSIVE DESIGN MEASURES

Prepared By:
Faarup Associates Ltd
The Old Stables
Friars Alley
Lichfield
WS13 6PW

Prepared For:
Canfield Freehold Limited
Suite 1, Third Floor
1 Duchess Street
London
W1W 6AN

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EXECUTIVE SUMMARY

Faarup Associates Ltd has been commissioned by Canfield Freehold Limited to produce an Energy Statement to support their planning application for a proposed change of use with roof extension to facilitate the insertion of a mezzanine floor at 93-103 Drummond Street, London, NW1 2HJ.

Existing 93-103 Drummond Street Site London

Camden Council confirmed their requirement for the proposed change of use to meet two criteria. The first is to meet BRE BREEAM 'Excellent' and secondly to show a significant "building emission rate" improvement. The cost of the improvement should be a minimum of 10% of the redevelopment cost.

Faarup Associates has produced a simulation model to predict the developments energy demand and consider the un-regulated energy use associated with the development. The BRUKL reports have been produced in draft for the development and are contained in the appendices of this report.

To reduce the energy consumption of the development and to assist in achieving a Building Regulation Part L 2013 compliant development, the following design implications are recommended to be incorporated.

- Building fabric construction U-values significantly improved compared with the existing/ standard Building Regulations U-values.
- Reduced Air Permeability, lower than standard Buildings Regulations, and in accordance with prospective development building occupiers.
- HVAC system controls ensure installed equipment will be operating efficiently and to include automatic monitoring and targeting with alarms for out of range values.
- Mechanical services equipment shall to be of a high efficiency.
- LED lighting used throughout inclusive of presence of daylight control.

The figures used as the basis for this assessment are discussed further in section 2 of this report.

We have undertaken the Building Regulations Part L2B SBEM calculations for the above property, together with a range of additional SBEM calculations to demonstrate compliance with London Borough of Camden Policy CPG3 Sustainability Policy.

L2B Compliance

The building will undergo a full refurbishment and Change of use, and the most appropriate method of Part L2B Compliance is the 'Flexibility of Design' approach.

Consequently an SBEM calculation to determine a 'Notional Building Emission Rate' has been undertaken on the refurbished building using U values and Controlled fittings set at the minimum requirement in L2B 2013 Tables and all Building Services set at the minimum requirements as required by the Non Domestic Building Services Compliance Guild 2013.

A second SBEM calculation to obtain the 'Actual Building Emission Rate' has been undertaken with the actual U values and building services efficiencies proposed.

The results show that the Actual Building Emission Rate is Lower than the Notional Building Emission Rate, therefore complying with Part L2B requirements.

L2B Results

Notional Building Emission Rate	34.5 $kgCO_2/m^2$.annum
Actual Building Emission Rate	14.1 $kgCO_2/m^2$.annum

Please note, under L2B regulations the Target Emission Rates shown on the BRUKL document are irrelevant, as are the pass/fail criteria shown. Only the BER is required, although the criteria 3 for Summer overheating is a useful guideline for optimising the amount of glazing in the building.

Actual Building Specification

U Values:

- Refurbished external walls 0.18W/m^{2}K
- Refurbished floor 0.18W/m^{2}K
- Refurbished flat roof 0.15W/m^{2}K
- New roof 0.15W/m^{2}K
- New windows 1.20W/m^{2}K Tsol 0.54 Lsol 0.68
- New roof lights 1.60W/m^{2}K Tsol 0.54 Lsol 0.68
- New doors 1.80W/m^{2}K

Air Tightness Test 10 m^3/^{m2}/h at 50 pascals.

Heating and cooling to the building will be provided from Air Source Heat Pump VRF air conditioning Systems operating at 400% efficiency in heating and 600% efficiency in cooling modes.

Mechanical supply and extract ventilation with plate heat exchangers serving the three large open plan office areas. The AHU' will have a specific fan power of 1.8w/l/s and a Specific Fan Power of 1.8w/l/s and a plate heat exchanger efficiency of 65%.

WC blocks will have mechanical extract at 5l/s/m^2 at a specific fan power of 0.3w/l/s.

Lighting will be LED at 110lumens/circuit watt throughout

Lighting control will be auto on/off, with the addition of Photo sensitive controls and dimming to the occupied areas with glazing.

Power Factor Correction and Out of Range Alarms via the BMS will be included.

London Borough of Camden Policy CP3 Sustainability Policy.

The London Borough of Camden Policy CPG3 Sustainability Policy expects all developments to reduce their carbon dioxide emissions by following the energy hierarchy to reduce energy emissions:

- Be Lean, use less energy
- Be Clean, supply energy efficiently
- Be Green, use renewable energy

In addition, for refurbished buildings, at least 10% of the project cost should be used on emission reduction.

In this development, a significantly greater portion than 10% of the project cost will be expended enhanced insulation, high efficiency plant and ASHP heating, which is a renewable technology.

In order to demonstrate the three hierarchy steps, we have undertaken a series of SBEM calculations that demonstrate the improvement in CO2 emissions achieved at each stage.

Be Lean

An SBEM calculation was undertaken using the minimum standard U values and an additional SBEM was undertaken with the improved proposed U values.

Notional Building Emission Rate	34.5 $kgCO_2/m^2$.annum
Improved U value Building Emission Rate	34.1 $kgCO_2/m^2$.annum

The improvement in the BER of 0.4$kgCO_2/m^2$.annum

Although this may appear to be a small improvement, it should be remembered that the building is also being cooled; therefore the addition of additional insulation will help RETAIN heat and increase the cooling load.

Consequently we propose to run additional energy analysis to fully optimise the buildings fabric efficiency with the potential in further decrease the CO^2 emissions through use of less energy.

Be Clean

An SBEM calculation has been undertaken using building services that are significantly more efficient than the minimum standards required for compliance with building regulations.

The results below show the emissions saved by improved efficiency

Improved U value Building Emission Rate	34.1 $kgCO_2/m^2$.annum
Actual Building Emission Rate	14.1 $kgCO_2/m^2$.annum

This is a significant saving in emissions of 20$kgCO_2/m^2$.annum, over 58% improvement.

The buildings services are Clean.

Be Green

A significant proportion of the buildings emissions are from heating. This building's intended use also generates a cooling requirement that is unlikely to be achieved from natural ventilation strategies.

Consequently Air Source heat pumps, which is considered a low energy system is proposed in preference to a ducted mechanical cooling system.

The building is green.

Conclusion

The proposed refurbishment of 93-103 Drummond Street, London will comply with ADFL2B and follows the London Borough of Camden Policy CPG3 on Sustainability, achieving a Building Emission Rate that shows an improvement of 58% over the minimum requirement.

1 COMPLIANCE SUMMARY

Faarup Associates Ltd has been commissioned by Canfield Freehold Limited to produce an Energy Statement to support their planning application for the change of use with roof extension to facilitate the insertion of a mezzanine floor at 93-103 Drummond Street, London NW1 2HJ.

Scope

This Energy Statement provides information of the predicted energy requirements of the development and an analysis of the potential contribution that low carbon technologies could contribute toward reducing the energy and associated CO^2 emissions of the proposed development.

Faarup Associates have produced a Simulation Model to determine energy consumption and carbon emissions, and to assist with estimating savings from low and zero carbon energy systems.

This Energy Statement sets the parameters of detailed design, but remains at a strategic level. The calculations in this document are an indication of system size and carbon emissions based on guidance documents, approved software and practical experience. They are not design calculations but establish the viability and feasibility of various technologies for the proposed development.

Building Regulations Part L 2013

The development will be subject to the requirements of Building Regulations Part L2B, Conservation of fuel and power in buildings other than dwellings, 2013.

Local Policy

Local policy in the London Borough of Camden heavily references the requirement to meet CPG3 and BREEAM "Excellent" and create a substantial envelope improvement. This report has been written in accordance with these parameters and also to follow the principal of the London plan.

Regional Policy – The London Plan

The current London Plan was published in August 2011. The policies pertaining to energy and CO^2 emissions are set out below:

Policy 5.2 – Minimising Carbon Dioxide Emissions

Reduce carbon dioxide and other emissions that contribute to climate change following the energy hierarchy.

- Base
- Be Lean: use less energy
- Be clean: supply energy efficiently
- Be Green: use renewable energy

Produce an energy report detailing how the hierarchy will be followed on site and show how a significant improvement in carbon emissions over the Building Regulations Part L2B 2013 Building Target Emissions Rate (BER) will be achieved.

Policy 5.3 Sustainable Design and Construction (BE LEAN):

The policy encourages sustainable design and construction to be addressed in the new development. Certain elements relate to the Be Lean measures adopted for the development.

- Reduce carbon dioxide and other emissions that contribute to climate change;
- Avoid internal overheating and excessive heat generation;
- Minimise energy use, including passive solar design, natural ventilation and vegetation on buildings.

Policy 5.5 & 5.6 – Decentralised Energy: Heating, Cooling & Power (BE CLEAN) – Local development frameworks are to encourage the use of decentralised energy. The developer is to identify and assess feasibility of connection to local heat networks, and to incorporate the use of CHP/CCHP and community heating systems. Major development proposals should select energy systems in accordance with the following hierarchy:

- Connection to existing heating or cooling networks
- Site wide CHP network
- Communal heating and cooling

Policy 5.7 – Renewable Energy (BE GREEN) – The Mayor will adopt a presumption that developments will achieve a reduction in carbon dioxide emissions from onsite renewable energy generation (which can include sources of decentralised renewable energy) unless it can be demonstrated that such provision is not feasible (or necessary).

Policy and Guidance Summary

Policy 5.2 of the London Plan recommends that an energy assessment for developments should comprise of the following approaches, which are to be considered in turn.

- Calculation of baseline energy demand and carbon dioxide emissions covered by Building Regulations and, separately, the energy demand and carbon dioxide emissions from un-regulated sources.
- Proposals for the reduction of energy demand and carbon dioxide emissions from heating, cooling and electrical power through efficient design of the site, buildings and services.
- Meeting residual energy demands through sustainable energy measures.
- Proposals to further reduce carbon dioxide emissions through the use of on-site measures.
- Calculation of the remaining energy demand and carbon dioxide emissions.

2 DEVELOPMENT

Building Services

The services input for calculating the baseline has been based upon a network of natural ventilation and heating.

Lighting would be via high efficiency LED luminaires achieving a minimum of 110 lumens/circuit watt.

Baseline Established

The baseline energy demand for the proposed building has been established using CLG approved methodology and software. This is based on information provided from known operation and engineering assumptions.

The calculated energy demand for the Baseline is illustrated below. The baseline demonstrates a Building Regulations 2013 Compliant model. The figures detailed below include un-regulated energy.

Base/Be Lean	Value
Total (KgCO²/m²	34.5
Total Area (m²)	2066.6
Total CO² (KgCO²/yr)	71,297

Energy Efficient Measures

The following outlines a strategy plan for Mechanical and Electrical Services to comply with the local policies:

- Light fittings to be specified as LED low energy minimum 110 Luminaire Lumens per circuit watt photocell control where applicable, shall be incorporated with presence detection.
- Air permeability to be $10m^3/h.m^2$ @ 50Pa.
- Mechanical services equipment shall be of a high efficiency.
- Cooling plant for spacial requirements is proposed.
- Light metering with warnings for out of range values.
- HVAC system controls installed will be operating efficiently and to include automatic monitoring and targeting with alarms for out of range values.
- Specific fan powers:

- Supply Fans: 1.8 W/l/s
- Extract Fans: 1.8 W/l/s
- Toilet Extract Fans: 0.3 W/l/s
- Heat Recovery 65% Efficient
- Power Factor correction >0.95

The following U-values have been used for building elements:

Element	U-value (W/m^2 K)	Maximum Allowable U-value (W/m^2 K)
External Walls	0.18	0.35
Ground Floors	0.18	0.25
Roofs	0.15	0.25
Windows	1.2	2.2
High Usage Entrance Doors	1.8	3.5
New Roof Lights	1.6	2.2

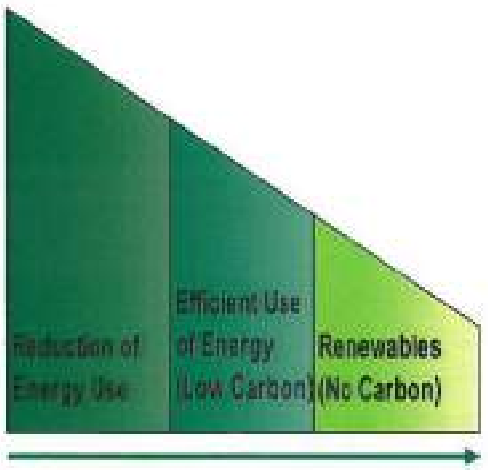
The calculated carbon emissions and total energy demand for the Energy Efficient Measures are illustrated below.

Be Green/Be Clean	Value
Total $KgCO^2/m^2$	14.1
Total Area (m^2)	2066.6
Total CO^2 (Kg CO^2/yr)	29,139

The improvements in building fabric and controls reduces Co^2 by 42.158 tonnes co2/yr. This equates to a 58% carbon reduction over the "Baseline". This includes un-regulated energy.

Low Carbon Technologies

Decentralised Technologies are stand alone energy generation items of equipment that produce electricity (and recover waste heat) locally at the building, reducing dependency on the electrical distribution grid and reducing energy loss in the distribution networks.



Energy hierarchy

The second stage of this appraisal has considered the proposed heating and hot water systems for the Development which has been assessed in terms of applicability with the following decentralised technology criteria:

- Connection to existing CCHP/CHP distribution network;
- Site-wide CCHP/CHP powered by renewable energy;
- Gas-fired CCHP/CHP or hydrogen fuel cells, both accompanied by renewables; and
- Communal heating fuelled by renewables sources of energy and gas fired communal heating.

There is no existing CHP distribution network in close proximity to the site. The London heat map has been reviewed. There is however a proposed network within a reasonable proximity. Service connections will therefore be allowed for future connection to a district heating network; however the installation/connection works would be subject to economic viability at the time when the proposed network is developed or becomes available.

The hot water demand for the development is not high enough to justify using an "on site" CHP unit. As such the application of CHP is not considered economically viable for this scheme. The calculated energy use and total energy demand through incorporation of Low Carbon Technologies are illustrated below. There is no change in the carbon emissions at this stage of the assessment.

London HeatMap

August 2, 2016

3 CONCLUSION

At this stage the solution proposed is considered to be technically feasible and will deliver the Co^2 reduction required.

The solutions recommended are technically and financially viable. For this Energy Statement, the solutions have been optimised to suit the predicted energy consumption and carbon emissions.

There is a high level of electrical energy attributed to lighting and small power within the development as a whole. The ability to reduce electrical energy is limited upon the constraints of building and the types of activities taking place. Based on models, it is unlikely natural daylight will permeate all areas. Instead therefore, computerised lighting control measures have been included to optimise lighting/energy savings. The lighting specified is also high efficiency.

The building fabric is significantly improved over Building Regulations Part L2B minimum values and the proposed services solutions are also of a high efficiency

APPENDIX A: LZC FEASIBILITY STUDY

There are a wide variety of Renewable or Low Carbon Technologies available which are suitable for mixed use developments and these have been evaluated in terms of their feasibility with respect to the proposed Drummond Street development.

The Renewable/Low Carbon Energy Technologies considered are below:

Wind Turbines

Wind turbines are available in a variety of shapes, sizes and duties with the most common being a propeller blade/windmill configuration with a horizontal axis. Turbines are also available in vertical axis arrangements in a number of styles, and purpose built rooftop modules or integrated systems are emerging onto the market.

Due to the size of the wind turbines they are typically ground mounted. Vibration, noise and appearance are issues associated with wind turbines, and must be considered early during the design if they are incorporated into the development. However there are models that can be roof mounted, these usually need solid concrete or steel work frames to be tied back into.

Wind is one of the most cost-effective methods of generating renewable electricity. However wind is more suited to low density areas with less turbulent wind patterns, where there is more space available for maintenance, and where they are less likely to be the cause of noise and vibration to nearby properties. High density areas are not ideal with current wind turbine technology.

Wind speeds are measured in meter per second, at increasing heights above ground level. The BERR's Wind speed Database provides the average site a wind speed across the UK. Wind turbines generally require wind speeds consistently at 5m/s or above to remain efficient and effective.

On review of the UK wind speed data for the site, it is apparent that this site does not satisfy wind speed criteria and for that reason has been discounted.

Solar Thermal Hot Water

Solar thermal is a simple but efficient technology that uses the sun's energy to heat water circulating through panels. Panels are traditionally roof mounted and should face south at an incline of approximately 30°. Typically panel manufacturers predict outputs of approximately 400-700 kWh/m^2/annum.

The preferred use for solar thermal panels is to heat domestic hot water. As there is a lower output from the panels in Winter, the panels usually provide a part of the total hot water demand with top up from the main heating system.

The noise levels associated with these systems would generally be from pumps.

The hot water demand from the development is too small to satisfy any significant energy saving and for this reason the technology has been discounted.

Photovoltaics

PV panels generate clean electricity. Various types of panels are available, varying from low cost with 11% efficiency to high cost with an efficiency approaching 17%. They can be installed vertically, horizontally or on an incline, on building roofs or as a part of the cladding. The highest efficiencies are achieved when they face South/Southwest with an inclination of approximately 30° to the horizontal. The panels will generate electricity in the most daylight conditions.

PV panels typically have an electrical warranty of 20-25 years and an expected system lifetime of 25-40 years.

Air Source Heat Pump

Air sourced heat pumps operate similarly to ground source heat pumps but with the energy being extracted from the surrounding air, rather than the ground. In heating mode they operate most efficiently at low supply temperatures, typically up to 35°C, and so it is recommended that this system is used with air distribution units.

Air sourced pumps typically provide up to 4 units of heat for every unit of electricity supplied. This is termed the Co-efficient of Performance (COP). By providing space heating for the development, air sourced heat pumps can reduce the CO_2 emissions compared to heating using traditional gas boilers. These systems are easily installed and have a low installation cost.

The units would have similar noise levels to a geothermal system. These systems would be contained within plant rooms and it may be a requirement that these systems are ducted to acoustically treated louvres.

Canfield Freehold Limited have carried out a detailed study into the application of ASHP and has been adopted as part of the heating cooling overall strategy. Consequently this technology has been considered for this development.

Ground Source Heat Pump (Geothermal)

Geothermal Energy is the energy stored in the form of heat beneath the surface of solid earth. Heat pumps operate on the same principle as fridges, transferring energy from a cool place to a warmer place. In heating mode they operate most efficiently when providing space heating at a low temperature, typically under floor heating or warm air systems. The pumps require electricity for their operation with resultant CO2 emissions.

There are two types of geothermal installation – open loop and closed loop. While open loop systems are more efficient and typically used for large cooling loads they require consent and licenses from the Environment Agency. They also require certain geological conditions and in the absence of this information Faarup Associates Ltd has discounted the open loop system for the development.

Closed loop systems circulate a fluid around a heat exchanger in the sub-soil, extracting low grade heat from the ground. The main criteria that determines the capacity of the closed loop system is the thermal response of the soil and the area available for the heat exchanger.

Closed loop borehole systems typically require 6-9 metres between each borehole and so the available area will determine the capacity of the system and its suitability for the development.

The heat exchanger for a closed loop horizontal system uses polyethylene pipes laid about 1.5 metres below ground level. The majority of heat exchanger should be under open land where it can be recharged by sunlight and so these systems are not generally suitable for compact development schemes.

Heat exchanger pipe work is expensive however where foundation piling is used in building construction, the heat exchange pipe work can be integrated into the piles to reduce the costs associated with drilling. In this case the footprint of the development determines the amount of heat that can be supplied to the system.

Noise would not be a significant issue with geothermal systems as the main moving parts are pumps

Canfield Freehold Limited have carried out a detailed study into the application of a GSHP and whilst this has been adopted on one of their developments the performance improvement is marginal. Consequently this technology has not been considered for this development as the target improvements require a more effective solution.

<u>Combined Heat and Power</u>

Refer to section 2 of this report

Biofuel/Biomass Fired Boiler

Alternative delivery methods for biomass

Wood is the most commonly used form of biomass fuel and can either be burned in solid fuel boilers for central heating applications or for raising steam for power generation in large installations. The wood is either burned as raw wood chippings or processed into pellets. Pellets have a more even temperature burn and as such are more efficient than raw chippings; however there is a carbon factor to their manufacture so the CO2 reduction potential is lowered.

In considering this type of system, space for storage and the necessary feed system to supply the boilers would need to be provided. In addition a guaranteed ongoing and dependable fuel supply would be required.

Biofuel/biomass systems require more fuel handling and storage equipment than typical gas or oil fired boiler systems. A large storage bin is typically provided which can be used on a rotational basis with a regular top-up of fuel that would be delivered by lorry. The low density and calorific value of wood means that large storage volumes are required and there must be suitable access for the fuel delivery vehicles.

Typically biomass installations are sized to meet a base heat load with peak load and load variations to be met from gas-fired boilers. Biomass boilers operate most efficiently are therefore most cost effective when working continuously a full load, they do not respond well to rapid fluctuating demand. When assessing the feasibility of a biomass installation, storage space and biomass delivery requirements need to be taken into account. Adequate space must be made for trucks to manoeuvre when delivering fuel and removing ash.

Furthermore air quality in the site area may be an issue. Biomass boilers are potentially a source of air pollution. Pollutants associated with biomass combustion include particulate matter (PM10/PM2.5) and Nitrogen Oxide (Nox) emission. These pollution emissions can have an impact on local air quality and affect human health. There is however a range of exempt appliances and authorised fuels that comply with the Clean Air Act. In addition to these certified boilers and boiler fuels, measure such as catalytic converters can be installed to further reduce air emissions in Air Quality Management Area for example.

The air quality plus storage and plant space required for biomass mean this technology has been discounted for this site.

The table below illustrates the feasibility of each of the technologies and rates the In * out of 5 in relation to Wing Yip Ltd. All renewable energy technologies which have been rated with 1 or 2 stars in the above table are deemed to be unsuitable for the development.

Renewable Technology	Application	Feasibility	Rating (Out of 5)
Wind Turbines	Roof mounted wind turbines	A review of wind data for the site suggests average wind speeds of 4.9m/s at 10m. A full wind survey would be required. Not deemed suitable due to noise and vibration issues Discounted for height implications of the turbines	*
Photovoltaic (PV)	Roof mounted	Large un-shaded roof available Least impact on installation Significant carbon savings available	****
Ground Source Heat Pump (GSHP)	Trenches Vertical Boreholes Generally	Discounted due to cost Lower heating temperatures produced by heat pumps require larger heat emitters Large carbon savings can be made and system can produce adequate hot water temperatures, possibly with no additional heat sources i.e. electric immersion heater	***
Air Source Heat Pump (ASHP)		Discounted due to higher running costs in	

		comparison to gas fired systems. COP's not currently high enough to justify use	***
Solar Hot Water (SHW)	Roof mounted	Would have to be used with other technologies to meet London Plan requirements. Hot water supplemented by this technology and is limited to only making savings against hot water demand where in the development case there is is not enough to help achieve the levels required.	**
Combined Heat and Power	Plantroom located CHP	Ideal of a steady base load of heating/hot water. Not applicable in the case of this development Plant space required to CHP and buffer vessels for storing heat load generated. Not available in current design Produces heat and electricity to reduce carbon emissions significantly Not considered a renewable technology	***
Biofuel Fired Boiler	Plantroom located	Ideal of a steady base load of heating/hot water. Not applicable in the case of this development. Plant space required to boiler and buffer vessels for storing heat load generated. Large storage space required for Biofuel	

		wither in the form of wood pellets, chips or liquid Biofuel. Not available in current design.	***

BASE LINE PART L2

CALCULATION

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

L2B Standard services DX

As designed

Date: Wed Aug 03 10:45:42 2016

Administrative information

Building Details

Address: 93-103 Drummond Street, LONDON, NW1 2HJ

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.2.g.3

Interface to calculation engine: iSBEM

Interface to calculation engine version: v5.2.g

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

Owner Details

Name: Information not provided by the user

Telephone number: Information not provided by the user

Address: Information not provided by the user, Information not provided by the user, Information not provided by the user

Certifier details

Name: Tony Wood

Telephone number:

Address:

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	19.7
Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	19.7
Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	34.5
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	$U_{a-Limit}$	U_{a-Calc}	U_{i-Calc}	Surface where the maximum value occurs*
Wall**	0.35	0.28	0.28	Basement Stairs/nwi
Floor	0.25	0.12	1	Ground Floor Stairs/fi.1
Roof	0.25	0.35	1.8	Basement offices/c
Windows***, roof windows, and rooflights	2.2	1.8	1.8	Basement offices/ne.1/g
Personnel doors	2.2	2.2	2.2	Basement Offices/nw/fd
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

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

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

Air Permeability	Worst acceptable standard	This building
m³/(h.m²) at 50 Pa	10	10

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- Air Conditioning

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

2- Gas LPHW

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.84	-	-	-	-
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.

1- DHW

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

Local mechanical ventilation, exhaust, and terminal units

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

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	**Zone**	**Standard**
Basement Stairs	-	-	-	-	-	-	-	-	-	-	N/A
Basement offices	-	-	-	2.2	-	-	-	-	-	0.5	0.5
Basement WC	0.4	-	-	-	-	-	-	-	-	-	N/A
Ground Floor Open Plan Office	-	-	-	2.2	-	-	-	-	-	0.5	0.5
Ground Floor Small office	-	-	-	2.2	-	-	-	-	-	0.5	0.5
Ground Floor Stairs	-	-	-	-	-	-	-	-	-	-	N/A
Ground Floor WC	0.4	-	-	-	-	-	-	-	-	-	N/A
First Floor Stairs	-	-	-	-	-	-	-	-	-	-	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
Mezz deck Offices	-	-	-	2.2	-	-	-	-	-	0.5	0.5
First Floor Tower office	-	-	-	-	-	-	-	-	-	-	N/A
Second Floor Tower office	-	-	-	-	-	-	-	-	-	-	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	
Basement Stairs	-	60	-	74
Basement offices	60	-	-	7681
Basement WC	-	60	-	231
Ground Floor Open Plan Office	60	-	-	5023
Ground Floor Small office	60	-	-	1278
Ground Floor Stairs	-	60	-	102
Ground Floor WC	-	60	-	160
First Floor Stairs	-	60	-	68
Mezz deck Offices	60	-	-	4258
First Floor Tower office	60	-	-	410
Second Floor Tower office	60	-	-	466

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?
Basement Stairs	N/A	N/A
Basement offices	NO (-83.4%)	NO
Basement WC	N/A	N/A
Ground Floor Open Plan Office	NO (-2.6%)	NO
Ground Floor Small office	NO (-67%)	NO
Ground Floor Stairs	N/A	N/A
Ground Floor WC	N/A	N/A
First Floor Stairs	N/A	N/A
Mezz deck Offices	NO (-2.8%)	NO
First Floor Tower office	NO (-79%)	NO
Second Floor Tower office	NO (-83.5%)	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 [m²]	2066.6	2066.6
External area [m²]	3222.5	3222.5
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	10	3
Average conductance [W/K]	1166.49	1322.18
Average U-value [W/m²K]	0.36	0.41
Alpha value* [%]	9.43	13.26

* 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	6.16	3.76
Cooling	20.66	9.11
Auxiliary	7.97	2.63
Lighting	29.04	21.38
Hot water	2.7	3.12
Equipment*	40.12	40.12
TOTAL**	**66.53**	**40.01**

* 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]	191.01	150.97
Primary energy* [kWh/m²]	204.24	113.85
Total emissions [kg/m²]	34.5	19.7

* 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	53.7	137.3	6.2	20.7	8	2.42	1.85	2.6	2.6
	Notional	32.9	118.1	3.8	9.1	2.6	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	Basement Stairs/nwi
Floor	0.2	0.11	Basement offices/f
Roof	0.15	0.18	Ground Floor Open Plan Office/c
Windows, roof windows, and rooflights	1.5	1.8	Basement offices/ne.1/g
Personnel doors	1.5	2.2	Basement Offices/nw/fd
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
m³/(h.m²) at 50 Pa	5	10