Seaforth Land
20-23 Greville Street, London

Energy Statement for Planning for 20-23 Greville Street, London

MLM. Group

Notice

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00	P	For Planning	Bysshe Wallace	Cyril Knabe-Nicol	21/12/2017
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Contents

1 Introduction

MLM Consulting Engineers Ltd have been commissioned by Seaforth Land on behalf of Seaforth Land to undertake an Energy Statement as part of the Planning Application to the London Borough of Camden for the development known as 20-23 Greville Street, Camden, London, EC1N 8SS.

The development involves the change of use of existing Class B1 at ground floor, basement and first floor levels to Class A1/A3 use; demolition of existing fifth floor plant room and construction of rooftop extension at fifth and mezzanine floor level for Class B1 use, rear infill extension to all floors for Class B1 use, external alterations including new façade and glazing, and associated works.

The proposed development is required by London Borough of Camden to make carbon emission reductions in accordance with the London Plan, Camden CPG3 and Camden Local Plan 2017 Policy CC1.

The aim of this report is to assess feasible carbon emission reductions through the implementation of efficient energy measures, the use of an on-site Combined Heat and Power (CHP) system and finally the use of zero carbon technologies.

This report demonstrates how the design has followed the London Borough of Camden Energy Hierarchy by reducing the energy demand of the development. Measures proposed include passive design, energy efficiency measures, generating heat in a clean and efficient system and by using on-site renewable energy systems to further reduce the overall carbon emissions of the development.

The methodology applied follows the guidance set out by the London Borough of Camden for developing energy strategies as detailed in the Camden Local Plan 2017 Policy CC1 and the Camden Planning Guidance -Sustainability CPG3 of the London Borough of Camden.

The energy consumption figures, for the communal part of the scheme are based on SBEM Benchmarks in line with Building Regulations Part L2A and L2B 2013 Compliant Software.

The proposed Sustainability Principles and Engineering Concepts incorporate the requirements and guidelines of the relevant British Standards, CIBSE Guides and DfE Building Bulletins.

2 Executive Summary

The proposed development is broken down into two commercial units. The development will implement energy efficiency measures, to achieve the required carbon emission reductions by the Local Authority. The strategy detailed within this report follows the London Borough of Camden's Energy Hierarchy. The B1 Office portion achieves a 33.88% improvement in CO_2 emissions over the Baseline Requirements within Building Regulations Approved Document Part L2A. The A1/A3 Retail/Restaurant portion achieves a 48.88% improvement in CO_2 emissions over the baseline requirements within Building Regulations Approved Document Part L2B.

The following strategy will be implemented for the proposed development:

B1 Office (New and Existing)

- 'Be Lean': Energy efficiency measures to improve the building fabric and services includes: 1.4 for windows (double glazed) in W/m^{2}K, high efficiency lighting of 90 light lumens per circuit Watt and good air tightness (maximum of 5 m^3/m^2/hr at 50 Pa for the new build element and 15 m^3/m^2/hr at 50 Pa for the existing).
- 'Be Clean': A CHP has not been deemed feasible for the scheme.
- 'Be Green': Photovoltaic panels and Air Source Heat Pump units have been deemed feasible for the proposed development.

A1/A3 Retail/Restaurant

- 'Be Lean': Energy efficiency measures to improve the building fabric and services includes: 1.4 for windows (double glazed) in W/m^{2}K, high efficiency lighting of 90 light lumens per circuit Watt.
- 'Be Clean': A CHP has not been deemed feasible for the scheme.
- 'Be Green': Air Source Heat Pump units have been deemed feasible for the proposed development.

The energy efficiency measures included within this report represent current best practice and the use of a low and zero carbon technology.

The conclusions of the assessment are summarised in the following tables:

Table 1 – B1 Office

	Carbon Dioxide Emissions (Tonnes/Annum)	CO_2 Emissions Reduction at each stage (%)	Incremental CO_2 Emissions Reduction (%)
Step 1 – Baseline	56.52	-	-
Step 2 – 'Be Lean'	46.30	18.08	18.08
Step 3 – 'Be Clean'	46.30	-	-
Step 4 – 'Be Green'	37.38	15.80	33.88

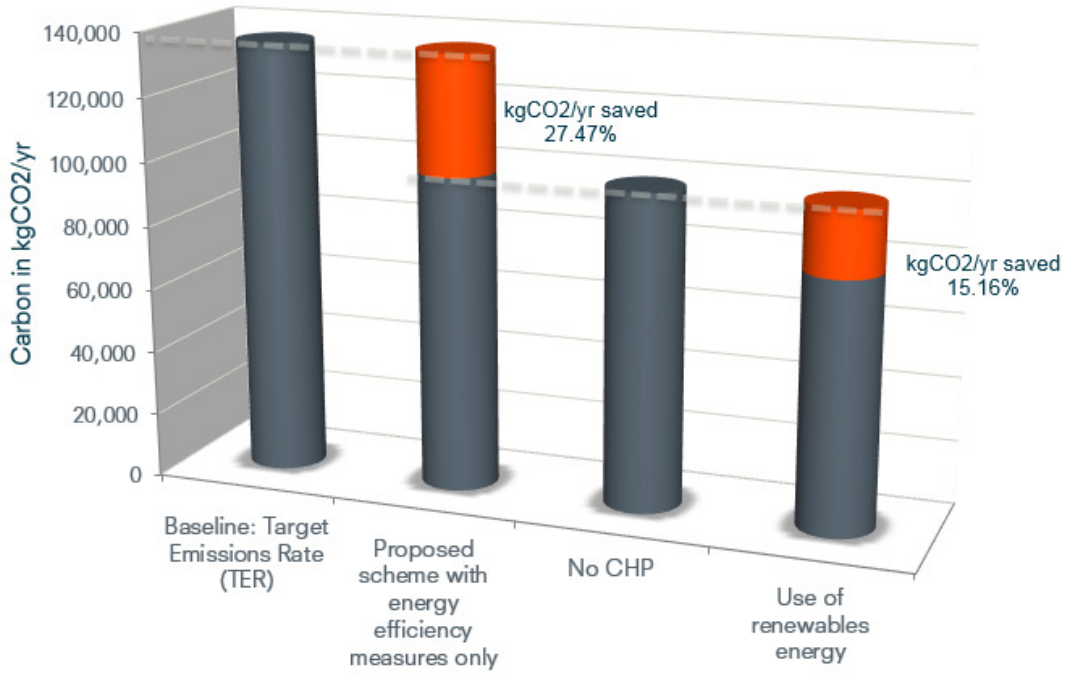
Table 2 – A1/A3 Retail/Restaurant

Residential	Carbon Dioxide Emissions (Tonnes/Annum)	CO_2 Emissions Reduction at Each Stage (%)	Incremental CO_2 Emissions Reduction (%)
Step 1 – Baseline	79.13	-	-
Step 2 – 'Be Lean'	52.08	34.18	34.18
Step 3 – 'Be Clean'	52.08	-	-
Step 4 – 'Be Green'	40.45	14.70	48.88

Table 3 – Site Wide

	Carbon Dioxide Emissions (Tonnes/Annum)	CO_2 Emissions (Reduction (%) at each Stage)	Incremental CO_2 Emissions (Reduction (%))
Step 1 – Baseline	135.65	-	-
Step 2 – 'Be Lean'	98.38	27.47	27.47
Step 3 – 'Be Clean'	98.38	-	-
Step 4 – 'Be Green'	77.82	15.16	42.63

Figure 1 – Energy Hierarchy for Greville Street.



3 Planning Policy Requirement

3.1.1 National Policy

This report has been produced in line with the National Planning Policy Framework (NPPF), from which London Plan is derived from.

3.1.2 Regional Policy

This energy statement has been produced to adhere to the National, Regional and Local Policies. The proposed development is located within the London Borough of Camden area and is therefore requested to implement the Energy Hierarchy from the Camden Local Plan 2017 Policy CC1. This energy hierarchy is identified as:

- Step 1 'Be Lean';
- Step 2 'Be Clean';
- Step 3 'Be Green'.

The Camden Local Plan 2017 Policy CC1 and the Camden Planning Guidance -Sustainability CPG3 of the London Borough of Camden are detailed below.

Camden Local Plan 2017 Policy CC1 Climate Change Mitigation

All developments involving five or more dwellings and/or more than 500 sqm of gross internal) any floorspace will be required to submit an energy statement demonstrating how the energy hierarchy has been applied to make the fullest contribution to CO_2 reduction.

8.11 The Council will expect developments of five or more dwellings and/or more than 500 sqm of any gross internal floor space to achieve a 20% reduction in carbon dioxide emissions from on-site renewable energy generation.

8.12 All major developments will also be expected to demonstrate how relevant London Plan targets for CO_2 reduction, including targets for renewable energy, have been met. Where it is demonstrated that the required London Plan reductions in carbon dioxide emissions cannot be met on site, the Council will require a financial contribution to an agreed borough wide programme to provide for local low carbon projects. The borough wide programme will be connected to key projects identified in the Council's Green Action for Change.

Camden CPG3 – Sustainability

3.20 Policy 5.2 Minimising carbon dioxide emissions of the Draft Replacement London Plan introduces a carbon dioxide reduction target for new development to make a 35% improvement on the current 2013 Building Regulations.

3.2 Baseline Model

The baseline for the Office and the Retail/Restaurant has been taken from the Building Emission Rate (BER) worksheet of the SBEM model based on the minimum fabric values and fixed services as outlined in Approved Document Part L2A and Part L2B 2013.

3.3 'Be Lean'

Implementation of energy efficient 'Be Lean' measures specific to the scheme is encouraged at the earliest design stage of a development and aims to reduce the energy demand. Measures typically include passive design: both Architectural and building fabric measures and active design: energy efficient services.

3.4 'Be Clean'

3.4.1 Connection to an existing Low Carbon Heating Infrastructure

The Local Authority requires developers to prioritise connections to existing or planned decentralised energy networks, where feasible.

3.4.2 Feasibility of CHP Scheme

The use of 'clean' energy supply refers to the energy efficiency of heating, cooling and power systems. Planning applications should demonstrate how the heating, cooling and power systems have been selected to minimise carbon emissions:

- The proposed development should evaluate the feasibility of the use of Combined Heat and Power (CHP) systems. Where a new CHP system is appropriate, opportunities to extend the system beyond the site boundary to adjacent sites should be examined.

3.5 'Be Green'

The use of renewable energy for inclusion in developments is encouraged at the 'Be Green' stage. Each renewable energy technology is technically feasible for this development and should be reviewed as part of the Energy Statement.

All renewable energy systems should be located and designed to minimise any potential adverse impacts on biodiversity, the natural environment and historical assets.

4 'Be Lean' Stage – Reduction by Energy Efficiency Measures

4.1 Proposed Lean Measures

The following Lean measures are applicable to the scheme and allow the proposed development to comply with Building Regulation Part L2A and L2B 2013 for the Office and Part L2B 2013 for the Retail. The energy efficiency measures include:

4.2 Enhanced Building Fabric U-Values

Enhancements of the building fabric have been assessed, a summary of these values can be found in tables 4 and 5 below. The table below demonstrates the limiting U-Values set by Approved Document Part L and the proposed U-Values to be utilised for the development.

Table 4 – Building U Values – Office (new extension)

Elements	Building Regulations Part L2A 2013 Minimum U-Value (W/m^2K)	Proposed U-Value (W/m^2K) Indicative Build-Up
Existing External Walls	0.55	0.55
New External Walls	0.35	0.35
Floor	0.25	0.25
Flat Roof	0.25	0.13
Windows (Double Glazing)	2.20	1.40 (G-Value 0.35)

Table 5 –Building U-Values – Existing Office and Retail/Restaurant

Elements	Building Regulations Part L2B 2013 Minimum U-Value (W/m^2K)	Proposed U-Value (W/m^2K) Indicative Build-Up
External Walls	0.55	0.55
Floor	0.25	0.25
Floors adjacent to unheated or semi-exposed spaces	0.25	0.22
Flat Roof	0.18	0.13
Windows (Double Glazing)	1.80	1.40 (G-Value 0.35)

4.3 Enhanced Air Tightness

The proposed development will be designed to a high performance with good air tightness. It is proposed that the scheme does not exceed an air permeability level of 5 $m^3/hr/m^2$at 50 Pa for the new 5th and Mezzanine Floors. An air tightness of 15 $m^3/hr/m^2$ at 50 Pa for the existing office floors and 15 m /hr/m at 50 Pa for the retail units will be achieved.

The improvements for these targets will be achieved by ensuring the sensitive areas are accounted for in the design and construction phases to make certain that a tightly sealed building is constructed as intended. The Design Team must ensure that all openings, both major and minor are to be accounted for and assessed to reduce air leakage.

4.4 Ventilation

Natural ventilation for both the office and retail spaces is proposed for this development as the main source of ventilation.

4.5 Heating

The office and retail/restaurant space will have heating and cooling supplied by a split system VRF, Air Source Heat Pumps (ASHP).

4.6 Cooling

Cooling will be provided by the Air Source Heat Pumps for both office and the restaurant/retail units.

4.7 Domestic Hot Water

The domestic hot water will be provided by instantaneous electric at 100% efficiency for the office element and the retail area. The restaurant will be served with an instantaneous gas-fired water heater for the domestic hot water at 95% efficiency. Flue discharge will be in line with the Clean Air Act.

4.8 Lighting

All lighting to office and the retail/restaurant units will be 90 lumens per circuit Watt.

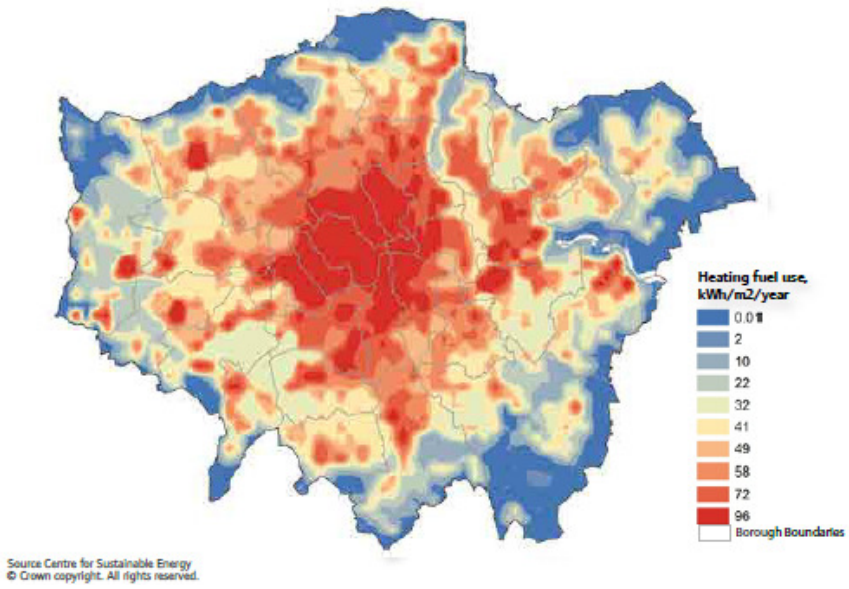
5 'Be Clean' – Selection of Efficient Energy Supply

5.1 London Heat Networks – Connection to Existing Low Carbon Heating Infrastructure

The London Plan Policy 5.6B - Decentralised Energy in Development Proposals outlines the following strategies:

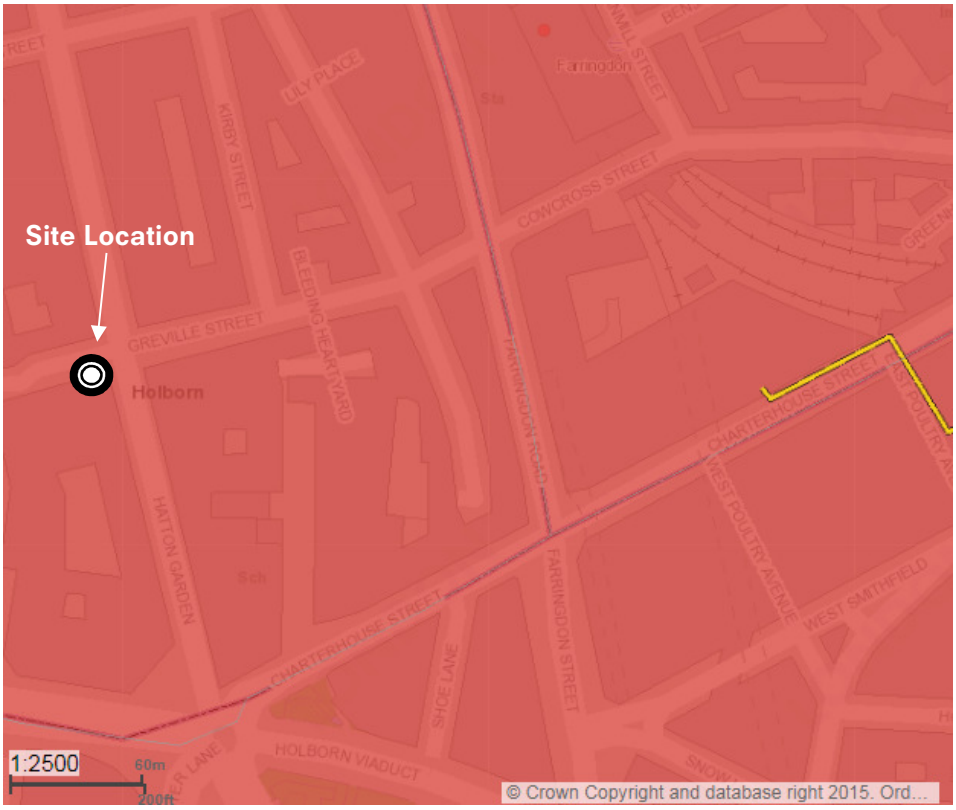
- Development proposals should evaluate the feasibility of Combined Heat and Power (CHP) systems, and where a new CHP system is appropriate also examine opportunities to extend the system beyond the site boundary to adjacent sites.
- Major development proposals should select energy systems in accordance with the following hierarchy:
  - Connection to existing heating or cooling networks;
  - Site wide CHP network;
  - Communal heating and cooling.
- Potential opportunities to meet the first priority in this hierarchy are outlined in the London Heat Map tool. Where future network opportunities are identified, proposals should be designed to connect to these networks.

Figure 2 – Heat Density in London (relative heat demand based on fuel use kWh/m^2/year) Extracted from the London Plan March 2016



According to the London Heat Map, there is an existing heating networks close to the site. However, due to the nature of the development the units have an irregular usage pattern and low heat and water demand. Therefore the units are incompatible with using a District Heating network, as such this criteria has not been considered.

Figure 3 – Site Location and distance from nearest Heat Network (shown as a yellow line). Source: www.london.gov.uk



5.2 Feasibility of CHP Scheme

CHP has been not been deemed feasible for the development.

Combined Heat and Power (CHP)

Combined Heat and Power Generation (CHP) is an important technology for efficient fuel use and can use biomass or gas as the fuel source.

A gas-fired CHP is regarded as a low carbon technology, not a true renewable. Should the supply of fuel to the CHP be biomass then the system can be considered as a true renewable system.

CHP primarily offers carbon emission reductions by reducing the amount of electricity imported from the national grid – a 'carbon heavy' source of electricity.

The system produces electricity that can be used in the building or exported to the grid, and heat for space, water and even process heating. Systems must be heat led for high efficiency, which best suits applications to situations where there is a significant demand for heat for long periods of time (particularly through the summer period). This will also apply to residential developments, hospitals, hotels and leisure centres (swimming pools being ideal).

The split of heat to power and losses in both types of CHP systems are slightly different, but in principal each unit of gas supplied would generate approximately 35% electricity, 50% heat and 15% in losses.

CHP units operate most efficiently when supplying the base load of the building. Given the nature of the building (predominantly domestic) the base load will be on the lower side and with peaks and troughs throughout the occupied period.

5.3 Carbon intensity of the UK Electrical Grid

According to DECC (Department of Energy and Climate Change), there will be a significant decarbonisation of the UK electric grid over the next decade. This is due to:

- Closure of coal power stations;
- Construction of new gas power stations;
- Installation of new grid interconnectors (i.e. importing electricity from lower carbon countries like France and possibly Norway in the future);
- Additional renewable technologies;
- New Nuclear power from 2015.

At the moment of writing this report, the actual grid electricity carbon emission factor for the previous 24 hours had averaged 215 g/kWh, whereas the average for the year 2016 had been 320 g/KWh.

UK grid carbon emission factor and the DECC future predictions significantly change the actual performance of the energy strategies being discussed and the comparative performance of alternative energy strategies.

Real-time figures can be found on the following link: http://electricityinfo.org/real-time-british-electricity-supply.Part L 2013 of the Building Regulations requests for modelling carbon emissions to be based on the carbon intensity factors as shown on the table below:

Table 6 – Carbon Intensity Factors

Fuel	Carbon Emission Factor
Grid Electricity	0.519 $KgCO_2$/KWh
Natural Gas	0.216 $KgCO_2$/KWh

6 'Be Green'

The following section reviews the renewable technologies applicable to the proposed development.

6.1 Green Technologies

The following types of green/renewable energy technologies have been considered as suitable for the proposed development:

- Photovoltaic (Office only);
- Air Source Heat Pumps.

Other renewable technology options were investigated and discounted. The justification for discounting these technologies can be found in Appendix E.

These alternative technologies included:

- Solar Thermal;
- Wind Turbines;
- Biomass Boiler;
- Ground Source Heat Pump;

6.2 Proposed Renewable Technologies Applicable to the Proposed Development

Subject to the consideration of the technologies previously discussed, the following green measures will be incorporated into the proposed building to reduce fossil fuel consumption and mitigate carbon emissions:

6.2.1 Considered Technologies

Photovoltaic Panels (PV)

PV systems convert energy from the sun into electricity through semi-conductor cells. A cell consists of two thin layers of different semi-conducting materials, usually based on silicon. When light shines on the cell, a difference in energy is created – otherwise known as voltage. This voltage is used to produce a direct current (DC), which can be used directly or converted into alternating current (AC). AC can be exported to the local electricity network/national grid. The brighter the sunlight, the more power is produced. Shading from other objects (such as nearby buildings and trees) will affect performance and PV cells are more likely to show a drop in output than solar thermal panels. As with solar hot water, the panels should face as close to due south as possible and be unshaded for most of the day. An individual PV cell only produces a small amount of power, therefore they are usually connected together to form a module. Modules can then be linked to form an array and sized to meet the required demand.

The size of a Photovoltaic (PV) installation is expressed by its kilowatt peak (kWp) potential, which is an indication of how much electricity the system could generate at peak/optimum conditions. The electricity generated on-site by Photovoltaic cells would be a direct saving on electricity otherwise sourced from the national grid. The electricity generated would be a direct saving on electricity required for power, lighting, heating and hot water (depending on systems installed). Whilst expensive it should be noted that PV technology off-sets three times the carbon dioxide from grid supplied electricity compared to technology which reduces natural gas consumption therefore as a single simplistic solution it compares favourably. The office element of the site will be connected to 2.16 kWp PV supply. Discussions with the design team indicate there is enough roof space for the area of PV as described above.

Air Source Heat Pumps

A heat pump extracts heat from the ground, air or water and transfers it to a heating system. Often coupled to underfloor heating, as the temperatures involved are usually lower (around 40° where a boiler will be 80°), an electric pump circulates the water in the system. Ground source heat pumps (GSHP) and air source heat pumps (ASHP) are currently the most common type of heat pump used in the UK, and use technology which is essentially the same as a fridge. A typical GSHP system will include a ground heat exchanger (for extracting heat from the ground), the heat pump itself and a heating system.

The overall efficiency of a heat pump is determined by the difference in temperature between the heat source itself (the ground, air or water) and the temperature of the area or environment to be heated. The smaller the temperature difference the higher the coefficient of performance (COP) will be.

Typical COPs will be in the range two - four depending upon operating conditions. Heat pumps can supply 100% of heat demand, but it will usually only pre-heat domestic hot water, so an additional method of heating the hot water (e.g. an immersion heater) may be needed.

Air source heat pumps can be connected in series and thus provide a heating/cooling system, modules only work as and when demand requires thus providing excellent efficiencies.

This is for the office and the retail/restaurant elements with individual systems for each unit. The condenser will be located externally.

7 Conclusion

This report has followed the development management Camden Local Plan 2017 Policy CC1, and in doing so has identified measures to improve energy efficiency and mitigate CO_2 emissions of the proposed development.

The following table summarises the improvements recognised by each step of the energy hierarchy approach identified in the sections 3 to 6 of this report:

Table 7 – Site Wide

	Carbon Dioxide Emissions (Tonnes/Annum)	CO_2 Emissions (Reduction (%) At Each Stage)	Incremental CO_2 Emissions (Reduction (%)
Step 1 – Baseline	135.65	-	-
Step 2 – 'Be Lean'	98.38	27.47	27.47
Step 3 – 'Be Clean'	98.38	-	-
Step 4 – 'Be Green'	77.82	15.16	42.63

This report demonstrates how the proposed development by using the measures identified achieves a site wide energy reduction of 42.63%. The B1 Office portion achieves a 33.88% improvement in CO_2 emissions over the baseline requirements within Building Regulations Approved Document Part L2A. The A1/A3 Retail/Restaurant element achieves a 48.88% improvement in CO_2 emissions over the baseline requirements within Building Regulations Approved Document Part L2B.

Appendix A - Step One – Baseline BRUKL Output Documents

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Units A B & C 20-23 Greville Street

As designed

Date: Tue Dec 19 22:14:31 2017

Administrative information

Building Details

Address: Units A, B & C, 20-23 Greville Street, LONDON, EC1N 8SS

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.3.a.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v5.0.3

BRUKL compliance check version: v5.3.a.0

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Jon West

Telephone number: 07758 760 818

Address: 62 High Street, Stetchworth, CB8 9TJ

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

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	59.5
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	59.5
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	47.1
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

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

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

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.4	0.55	- 0 Lower Ground - Bleeding Heart Bistro (Store)_W_6
Floor	0.25	0.25	0.25	- 0 Lower Ground - Bleeding Heart Bistro (Store)_S_12
Roof	0.25	0.19	0.22	- 0 Lower Ground - Unit B (A1-A3)_R_11
Windows***, roof windows, and rooflights	2.2	1.4	1.4	1 First - Unit A (A3) Eat & Drink_G_6
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

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

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

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

Building services

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

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

1- Radiators and Comfort Cooling

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	0.91	3.8	-	-	-
Standard value	0.91*	2.6	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* 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- Direct gas fired water heater

	Water heating efficiency	**Storage loss factor [kWh/litre per day]**
This building	0.95	-
Standard value	0.9*	N/A
* Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73.		

2- Direct Electric

	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**
- 0 Lower Ground - Bleeding Heart Bistro (Store)	-	-	-	-	-	-	-	-	-	-	N/A
- 0 Lower Ground - Unit B (A1-A3)	-	-	-	-	-	-	-	-	-	-	N/A
- 0 Lower Ground - Unit C (A1-A3)	-	-	-	-	-	-	-	-	-	-	N/A
1 First - Unit A (A3) Eat & Drink	-	-	-	-	-	-	-	-	-	-	N/A
1 First - Unit A (A3) Toilets	-	-	0.5	-	-	-	-	-	-	-	N/A
1 First - Unit A (A3) Food Prep	-	-	-	-	-	-	-	-	1	-	N/A
0 Ground - Unit A (A3) Eat & Drink	-	-	-	-	-	-	-	-	-	-	N/A
0 Ground - Unit B (A1-A3)	-	-	-	-	-	-	-	-	-	-	N/A
0 Ground - Unit C (A1-A3)	-	-	-	-	-	-	-	-	-	-	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	
- 0 Lower Ground - Bleeding Heart Bistro (Store)	110	-	-	51
- 0 Lower Ground - Unit B (A1-A3)	-	110	100	1150
- 0 Lower Ground - Unit C (A1-A3)	-	110	100	887
1 First - Unit A (A3) Eat & Drink	-	110	100	658
1 First - Unit A (A3) Toilets	-	110	-	60
1 First - Unit A (A3) Food Prep	-	110	-	260
0 Ground - Unit A (A3) Eat & Drink	-	110	100	61
0 Ground - Unit B (A1-A3)	-	110	100	1130
0 Ground - Unit C (A1-A3)	-	110	100	1287

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?
- 0 Lower Ground - Bleeding Heart Bistro (Store)	N/A	N/A
- 0 Lower Ground - Unit B (A1-A3)	N/A	N/A
- 0 Lower Ground - Unit C (A1-A3)	N/A	N/A
1 First - Unit A (A3) Eat & Drink	NO (-17.9%)	NO
1 First - Unit A (A3) Toilets	N/A	N/A
1 First - Unit A (A3) Food Prep	NO (-55.4%)	NO
0 Ground - Unit A (A3) Eat & Drink	NO (-13.9%)	NO
0 Ground - Unit B (A1-A3)	YES (+6.4%)	NO
0 Ground - Unit C (A1-A3)	YES (+0.1%)	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?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	994.1	994.1
External area [m^2]	997.5	997.5
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	25	3
Average conductance [W/K]	517.65	426.35
Average U-value [W/m^2K]	0.52	0.43
Alpha value* [%]	17.57	19.55

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

Building Use

% Area	Building Type
53	**A1/A2 Retail/Financial and Professional services**
47	**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
	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	51.15	33.81
Cooling	14.1	22.09
Auxiliary	8.74	5.53
Lighting	26.92	53.76
Hot water	46.06	50.66
Equipment*	61.29	61.29
TOTAL**	**146.96**	**165.85**

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

Energy Production by Technology [kWh/m^2]

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

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	399.6	385.93
Primary energy* [kWh/m^2]	273.02	346.51
Total emissions [kg/m^2]	47.1	59.5

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

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	164.4	235.2	51.1	14.1	8.7	0.89	4.63	0.91	6.2
	Notional	99.7	286.2	33.8	22.1	5.5	0.82	3.6	----	----

Key to terms

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

Key Features

The 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	0.28	- 0 Lower Ground - Bleeding Heart Bistro (Store)_P_8
Floor	0.2	0.22	1 First - Unit A (A3) Eat & Drink_F_4
Roof	0.15	0.18	- 0 Lower Ground - Bleeding Heart Bistro (Store)_R_3
Windows, roof windows, and rooflights	1.5	1.4	1 First - Unit A (A3) Eat & Drink_G_6
Personnel doors	1.5	-	"No external personnel doors"
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	25

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

B1 Office 20-23 Greville Street

As designed

Date: Tue Dec 19 22:26:54 2017

Administrative information

Building Details

Address: 20-23 Greville Street, LONDON, EC1N 8SS

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.3.a.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v5.0.3

BRUKL compliance check version: v5.3.a.0

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Jon West

Telephone number: 07758 760 818

Address: 62 High Street, Stetchworth, CB8 9TJ

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

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	19.4
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	19.4
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	18.1
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

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

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

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.42	0.55	- 0 Lower Ground - Circulation_W_8
Floor	0.25	0.25	0.25	- 0 Lower Ground - Incoming Service_S_8
Roof	0.25	0.22	0.25	6 Sixth (Mezzanine) - Riser_R_9
Windows***, roof windows, and rooflights	2.2	1.4	1.4	- 0 Lower Ground - Circulation_G_5
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

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

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

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	11.35

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- Electric Convector

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

2- Radiators & Comfort Cooling

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	0.91	3.8	-	-	-
Standard value	0.91*	2.6	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* 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- Direct Electric

	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**
- 0 Lower Ground - Bin Store	-	-	-	-	-	-	-	-	-	-	N/A
- 0 Lower Ground - Bike Store	-	-	-	-	-	-	-	-	-	-	N/A
- 0 Lower Ground - Goods Lift	-	-	-	-	-	-	-	-	-	-	N/A
0 Ground - Sub Station	-	-	-	-	-	-	-	-	-	-	N/A
- 0 Lower Ground - Incoming Service	-	-	-	-	-	-	-	-	-	-	N/A
- 0 Lower Ground - Riser	-	-	-	-	-	-	-	-	-	-	N/A
- 0 Lower Ground - Circulation	-	-	-	-	-	-	-	-	-	-	N/A
- 0 Lower Ground - Fire Escape Stairs	-	-	-	-	-	-	-	-	-	-	N/A
- 0 Lower Ground - WC Shower	-	-	0.5	-	-	-	-	-	-	-	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
1 First - Office Fire Escape	-	-	-	-	-	-	-	-	-	-	N/A
2 Second - Fire Escape Stairs	-	-	-	-	-	-	-	-	-	-	N/A
3 Third - Fire Escape Stairs	-	-	-	-	-	-	-	-	-	-	N/A
4 Fourth - Fire Escape Stairs	-	-	-	-	-	-	-	-	-	-	N/A
0 Ground - Office Fire Escape	-	-	-	-	-	-	-	-	-	-	N/A
1 First - Office Goods Lift	-	-	-	-	-	-	-	-	-	-	N/A
1 First - Office Riser	-	-	-	-	-	-	-	-	-	-	N/A
1 First - Office Stairs	-	-	-	-	-	-	-	-	-	-	N/A
2 Second - Open Office	-	-	-	-	-	-	-	-	-	-	N/A
2 Second - Stairs	-	-	-	-	-	-	-	-	-	-	N/A
2 Second - Toilets	-	-	0.5	-	-	-	-	-	-	-	N/A
2 Second - Server	-	-	-	-	-	-	-	-	-	-	N/A
2 Second - Riser	-	-	-	-	-	-	-	-	-	-	N/A
3 Third - Open Office	-	-	-	-	-	-	-	-	-	-	N/A
3 Third - Toilets	-	-	0.5	-	-	-	-	-	-	-	N/A
3 Third - Server	-	-	-	-	-	-	-	-	-	-	N/A
4 Fourth - Open Office	-	-	-	-	-	-	-	-	-	-	N/A
4 Fourth - Stairs	-	-	-	-	-	-	-	-	-	-	N/A
4 Fourth - Toilets	-	-	0.5	-	-	-	-	-	-	-	N/A
6 Sixth (Mezzanine) - Riser	-	-	-	-	-	-	-	-	-	-	N/A
6 Sixth (Mezzanine) - Toilets	-	-	0.5	-	-	-	-	-	-	-	N/A
5 Fifth - Riser	-	-	-	-	-	-	-	-	-	-	N/A
5 Fifth - Server	-	-	-	-	-	-	-	-	-	-	N/A
5 Fifth - Toilets	-	-	0.5	-	-	-	-	-	-	-	N/A
5 Fifth - Open Office	-	-	-	-	-	-	-	-	-	-	N/A
5 Fifth - Stairs	-	-	-	-	-	-	-	-	-	-	N/A
0 Ground - Office Stairs	-	-	-	-	-	-	-	-	-	-	N/A
0 Ground - Office Goods Lift	-	-	-	-	-	-	-	-	-	-	N/A
0 Ground - Reception	-	-	-	-	-	-	-	-	-	-	N/A
0 Ground - Riser	-	-	-	-	-	-	-	-	-	-	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	
- 0 Lower Ground - Bin Store	110	-	-	11
- 0 Lower Ground - Bike Store	110	-	-	45
- 0 Lower Ground - Goods Lift	-	110	-	43
0 Ground - Sub Station	110	-	-	14
- 0 Lower Ground - Incoming Service	110	-	-	11
- 0 Lower Ground - Riser	110	-	-	13
- 0 Lower Ground - Circulation	-	110	-	100
- 0 Lower Ground - Fire Escape Stairs	-	110	-	31
- 0 Lower Ground - WC Shower	-	110	-	28

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
1 First - Office Fire Escape	-	110	-	22
2 Second - Fire Escape Stairs	-	110	-	22
3 Third - Fire Escape Stairs	-	110	-	22
4 Fourth - Fire Escape Stairs	-	110	-	22
0 Ground - Office Fire Escape	-	110	-	28
1 First - Office Goods Lift	-	110	-	19
1 First - Office Riser	110	-	-	9
1 First - Office Stairs	-	110	-	47
2 Second - Open Office	110	-	-	2343
2 Second - Stairs	-	110	-	44
2 Second - Toilets	-	110	-	63
2 Second - Server	110	-	-	8
2 Second - Riser	110	-	-	6
3 Third - Open Office	110	-	-	2343
3 Third - Toilets	-	110	-	63
3 Third - Server	110	-	-	8
4 Fourth - Open Office	110	-	-	2343
4 Fourth - Stairs	-	110	-	44
4 Fourth - Toilets	-	110	-	63
6 Sixth (Mezzanine) - Riser	110	-	-	4
6 Sixth (Mezzanine) - Toilets	-	110	-	56
5 Fifth - Riser	110	-	-	4
5 Fifth - Server	110	-	-	7
5 Fifth - Toilets	-	110	-	57
5 Fifth - Open Office	110	-	-	3116
5 Fifth - Stairs	-	110	-	42
0 Ground - Office Stairs	-	110	-	45
0 Ground - Office Goods Lift	-	110	-	22
0 Ground - Reception	-	110	100	215
0 Ground - Riser	110	-	-	10

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

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
1 First - Office Goods Lift	YES (+51.9%)	NO
1 First - Office Riser	N/A	N/A
1 First - Office Stairs	NO (-26.6%)	NO
2 Second - Open Office	NO (-17.6%)	NO
2 Second - Stairs	NO (-16.5%)	NO
2 Second - Toilets	N/A	N/A
2 Second - Server	N/A	N/A
2 Second - Riser	N/A	N/A
3 Third - Open Office	NO (-24.8%)	NO
3 Third - Toilets	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
3 Third - Server	N/A	N/A
4 Fourth - Open Office	NO (-31.4%)	NO
4 Fourth - Stairs	NO (-79.6%)	NO
4 Fourth - Toilets	N/A	N/A
6 Sixth (Mezzanine) - Riser	N/A	N/A
6 Sixth (Mezzanine) - Toilets	N/A	N/A
5 Fifth - Riser	N/A	N/A
5 Fifth - Server	N/A	N/A
5 Fifth - Toilets	N/A	N/A
5 Fifth - Open Office	NO (-70.8%)	NO
5 Fifth - Stairs	NO (-79.6%)	NO
0 Ground - Office Stairs	N/A	N/A
0 Ground - Office Goods Lift	YES (+19.2%)	NO
0 Ground - Reception	YES (+28.4%)	NO
0 Ground - Riser	N/A	N/A

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	2477.9	2477.9
External area [m^2]	2439.4	2439.4
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	11	3
Average conductance [W/K]	1357.18	1288.9
Average U-value [W/m^2K]	0.56	0.53
Alpha value* [%]	13.13	19.57

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

Building Use

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

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	21.01	17.2
Cooling	6.35	8.26
Auxiliary	0.14	0.17
Lighting	9.76	17.12
Hot water	6.62	7.65
Equipment*	34.82	34.82
TOTAL**	**43.87**	**50.4**

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

Energy Production by Technology [kWh/m^2]

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

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	189.57	168.55
Primary energy* [kWh/m^2]	106.27	105.46
Total emissions [kg/m^2]	18.1	19.4

* 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] No Heating or Cooling										
	Actual	360.7	0.3	0	0	0	0	0	0	0
	Notional	178.1	11.3	0	0	0	0	0	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Natural Gas										
	Actual	263	73.4	91.3	0	0.8	0.8	0	1	0
	Notional	161.4	60.2	54.8	0	1	0.82	0	----	----
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	54.8	117.6	17	7.1	0.1	0.89	4.63	0.91	6.2
	Notional	45.2	118.9	15.3	9.2	0.1	0.82	3.6	----	----

Key to terms

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

Key Features

The 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	0.28	- 0 Lower Ground - Circulation_P_14
Floor	0.2	0.22	1 First - Office Goods Lift_F_4
Roof	0.15	0.16	5 Fifth - Open Office_R_25
Windows, roof windows, and rooflights	1.5	1.4	- 0 Lower Ground - Circulation_G_5
Personnel doors	1.5	-	"No external personnel doors"
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	11.35

Appendix B - Step Two ‘Be Lean’ BRUKL Output Documents

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Units A B & C 20-23 Greville Street

As designed

Date: Tue Dec 19 22:14:31 2017

Administrative information

Building Details

Address: Units A, B & C, 20-23 Greville Street, LONDON, EC1N 8SS

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.3.a.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v5.0.3

BRUKL compliance check version: v5.3.a.0

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Jon West

Telephone number: 07758 760 818

Address: 62 High Street, Stetchworth, CB8 9TJ

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

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	59.5
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	59.5
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	47.1
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

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

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

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.4	0.55	- 0 Lower Ground - Bleeding Heart Bistro (Store)_W_6
Floor	0.25	0.25	0.25	- 0 Lower Ground - Bleeding Heart Bistro (Store)_S_12
Roof	0.25	0.19	0.22	- 0 Lower Ground - Unit B (A1-A3)_R_11
Windows***, roof windows, and rooflights	2.2	1.4	1.4	1 First - Unit A (A3) Eat & Drink_G_6
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

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

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

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

Building services

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

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

1- Radiators and Comfort Cooling

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	0.91	3.8	-	-	-
Standard value	0.91*	2.6	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* 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- Direct gas fired water heater

	Water heating efficiency	**Storage loss factor [kWh/litre per day]**
This building	0.95	-
Standard value	0.9*	N/A
* Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73.		

2- Direct Electric

	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**
- 0 Lower Ground - Bleeding Heart Bistro (Store)	-	-	-	-	-	-	-	-	-	-	N/A
- 0 Lower Ground - Unit B (A1-A3)	-	-	-	-	-	-	-	-	-	-	N/A
- 0 Lower Ground - Unit C (A1-A3)	-	-	-	-	-	-	-	-	-	-	N/A
1 First - Unit A (A3) Eat & Drink	-	-	-	-	-	-	-	-	-	-	N/A
1 First - Unit A (A3) Toilets	-	-	0.5	-	-	-	-	-	-	-	N/A
1 First - Unit A (A3) Food Prep	-	-	-	-	-	-	-	-	1	-	N/A
0 Ground - Unit A (A3) Eat & Drink	-	-	-	-	-	-	-	-	-	-	N/A
0 Ground - Unit B (A1-A3)	-	-	-	-	-	-	-	-	-	-	N/A
0 Ground - Unit C (A1-A3)	-	-	-	-	-	-	-	-	-	-	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	
- 0 Lower Ground - Bleeding Heart Bistro (Store)	110	-	-	51
- 0 Lower Ground - Unit B (A1-A3)	-	110	100	1150
- 0 Lower Ground - Unit C (A1-A3)	-	110	100	887
1 First - Unit A (A3) Eat & Drink	-	110	100	658
1 First - Unit A (A3) Toilets	-	110	-	60
1 First - Unit A (A3) Food Prep	-	110	-	260
0 Ground - Unit A (A3) Eat & Drink	-	110	100	61
0 Ground - Unit B (A1-A3)	-	110	100	1130
0 Ground - Unit C (A1-A3)	-	110	100	1287

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?
- 0 Lower Ground - Bleeding Heart Bistro (Store)	N/A	N/A
- 0 Lower Ground - Unit B (A1-A3)	N/A	N/A
- 0 Lower Ground - Unit C (A1-A3)	N/A	N/A
1 First - Unit A (A3) Eat & Drink	NO (-17.9%)	NO
1 First - Unit A (A3) Toilets	N/A	N/A
1 First - Unit A (A3) Food Prep	NO (-55.4%)	NO
0 Ground - Unit A (A3) Eat & Drink	NO (-13.9%)	NO
0 Ground - Unit B (A1-A3)	YES (+6.4%)	NO
0 Ground - Unit C (A1-A3)	YES (+0.1%)	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?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	994.1	994.1
External area [m^2]	997.5	997.5
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	25	3
Average conductance [W/K]	517.65	426.35
Average U-value [W/m^2K]	0.52	0.43
Alpha value* [%]	17.57	19.55

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

Building Use

% Area	Building Type
53	**A1/A2 Retail/Financial and Professional services**
47	**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
	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	51.15	33.81
Cooling	14.1	22.09
Auxiliary	8.74	5.53
Lighting	26.92	53.76
Hot water	46.06	50.66
Equipment*	61.29	61.29
TOTAL**	**146.96**	**165.85**

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

Energy Production by Technology [kWh/m^2]

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

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	399.6	385.93
Primary energy* [kWh/m^2]	273.02	346.51
Total emissions [kg/m^2]	47.1	59.5

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

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	164.4	235.2	51.1	14.1	8.7	0.89	4.63	0.91	6.2
	Notional	99.7	286.2	33.8	22.1	5.5	0.82	3.6	----	----

Key to terms

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

Key Features

The 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	0.28	- 0 Lower Ground - Bleeding Heart Bistro (Store)_P_8
Floor	0.2	0.22	1 First - Unit A (A3) Eat & Drink_F_4
Roof	0.15	0.18	- 0 Lower Ground - Bleeding Heart Bistro (Store)_R_3
Windows, roof windows, and rooflights	1.5	1.4	1 First - Unit A (A3) Eat & Drink_G_6
Personnel doors	1.5	-	"No external personnel doors"
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	25

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

B1 Office 20-23 Greville Street

As designed

Date: Tue Dec 19 22:26:54 2017

Administrative information

Building Details

Address: 20-23 Greville Street, LONDON, EC1N 8SS

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.3.a.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v5.0.3

BRUKL compliance check version: v5.3.a.0

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Jon West

Telephone number: 07758 760 818

Address: 62 High Street, Stetchworth, CB8 9TJ

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

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	19.4
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	19.4
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	18.1
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

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

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

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.42	0.55	- 0 Lower Ground - Circulation_W_8
Floor	0.25	0.25	0.25	- 0 Lower Ground - Incoming Service_S_8
Roof	0.25	0.22	0.25	6 Sixth (Mezzanine) - Riser_R_9
Windows***, roof windows, and rooflights	2.2	1.4	1.4	- 0 Lower Ground - Circulation_G_5
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

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

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

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	11.35

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- Electric Convector

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

2- Radiators & Comfort Cooling

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	0.91	3.8	-	-	-
Standard value	0.91*	2.6	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* 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- Direct Electric

	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**
- 0 Lower Ground - Bin Store	-	-	-	-	-	-	-	-	-	-	N/A
- 0 Lower Ground - Bike Store	-	-	-	-	-	-	-	-	-	-	N/A
- 0 Lower Ground - Goods Lift	-	-	-	-	-	-	-	-	-	-	N/A
0 Ground - Sub Station	-	-	-	-	-	-	-	-	-	-	N/A
- 0 Lower Ground - Incoming Service	-	-	-	-	-	-	-	-	-	-	N/A
- 0 Lower Ground - Riser	-	-	-	-	-	-	-	-	-	-	N/A
- 0 Lower Ground - Circulation	-	-	-	-	-	-	-	-	-	-	N/A
- 0 Lower Ground - Fire Escape Stairs	-	-	-	-	-	-	-	-	-	-	N/A
- 0 Lower Ground - WC Shower	-	-	0.5	-	-	-	-	-	-	-	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
1 First - Office Fire Escape	-	-	-	-	-	-	-	-	-	-	N/A
2 Second - Fire Escape Stairs	-	-	-	-	-	-	-	-	-	-	N/A
3 Third - Fire Escape Stairs	-	-	-	-	-	-	-	-	-	-	N/A
4 Fourth - Fire Escape Stairs	-	-	-	-	-	-	-	-	-	-	N/A
0 Ground - Office Fire Escape	-	-	-	-	-	-	-	-	-	-	N/A
1 First - Office Goods Lift	-	-	-	-	-	-	-	-	-	-	N/A
1 First - Office Riser	-	-	-	-	-	-	-	-	-	-	N/A
1 First - Office Stairs	-	-	-	-	-	-	-	-	-	-	N/A
2 Second - Open Office	-	-	-	-	-	-	-	-	-	-	N/A
2 Second - Stairs	-	-	-	-	-	-	-	-	-	-	N/A
2 Second - Toilets	-	-	0.5	-	-	-	-	-	-	-	N/A
2 Second - Server	-	-	-	-	-	-	-	-	-	-	N/A
2 Second - Riser	-	-	-	-	-	-	-	-	-	-	N/A
3 Third - Open Office	-	-	-	-	-	-	-	-	-	-	N/A
3 Third - Toilets	-	-	0.5	-	-	-	-	-	-	-	N/A
3 Third - Server	-	-	-	-	-	-	-	-	-	-	N/A
4 Fourth - Open Office	-	-	-	-	-	-	-	-	-	-	N/A
4 Fourth - Stairs	-	-	-	-	-	-	-	-	-	-	N/A
4 Fourth - Toilets	-	-	0.5	-	-	-	-	-	-	-	N/A
6 Sixth (Mezzanine) - Riser	-	-	-	-	-	-	-	-	-	-	N/A
6 Sixth (Mezzanine) - Toilets	-	-	0.5	-	-	-	-	-	-	-	N/A
5 Fifth - Riser	-	-	-	-	-	-	-	-	-	-	N/A
5 Fifth - Server	-	-	-	-	-	-	-	-	-	-	N/A
5 Fifth - Toilets	-	-	0.5	-	-	-	-	-	-	-	N/A
5 Fifth - Open Office	-	-	-	-	-	-	-	-	-	-	N/A
5 Fifth - Stairs	-	-	-	-	-	-	-	-	-	-	N/A
0 Ground - Office Stairs	-	-	-	-	-	-	-	-	-	-	N/A
0 Ground - Office Goods Lift	-	-	-	-	-	-	-	-	-	-	N/A
0 Ground - Reception	-	-	-	-	-	-	-	-	-	-	N/A
0 Ground - Riser	-	-	-	-	-	-	-	-	-	-	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	
- 0 Lower Ground - Bin Store	110	-	-	11
- 0 Lower Ground - Bike Store	110	-	-	45
- 0 Lower Ground - Goods Lift	-	110	-	43
0 Ground - Sub Station	110	-	-	14
- 0 Lower Ground - Incoming Service	110	-	-	11
- 0 Lower Ground - Riser	110	-	-	13
- 0 Lower Ground - Circulation	-	110	-	100
- 0 Lower Ground - Fire Escape Stairs	-	110	-	31
- 0 Lower Ground - WC Shower	-	110	-	28

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
1 First - Office Fire Escape	-	110	-	22
2 Second - Fire Escape Stairs	-	110	-	22
3 Third - Fire Escape Stairs	-	110	-	22
4 Fourth - Fire Escape Stairs	-	110	-	22
0 Ground - Office Fire Escape	-	110	-	28
1 First - Office Goods Lift	-	110	-	19
1 First - Office Riser	110	-	-	9
1 First - Office Stairs	-	110	-	47
2 Second - Open Office	110	-	-	2343
2 Second - Stairs	-	110	-	44
2 Second - Toilets	-	110	-	63
2 Second - Server	110	-	-	8
2 Second - Riser	110	-	-	6
3 Third - Open Office	110	-	-	2343
3 Third - Toilets	-	110	-	63
3 Third - Server	110	-	-	8
4 Fourth - Open Office	110	-	-	2343
4 Fourth - Stairs	-	110	-	44
4 Fourth - Toilets	-	110	-	63
6 Sixth (Mezzanine) - Riser	110	-	-	4
6 Sixth (Mezzanine) - Toilets	-	110	-	56
5 Fifth - Riser	110	-	-	4
5 Fifth - Server	110	-	-	7
5 Fifth - Toilets	-	110	-	57
5 Fifth - Open Office	110	-	-	3116
5 Fifth - Stairs	-	110	-	42
0 Ground - Office Stairs	-	110	-	45
0 Ground - Office Goods Lift	-	110	-	22
0 Ground - Reception	-	110	100	215
0 Ground - Riser	110	-	-	10

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

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
1 First - Office Goods Lift	YES (+51.9%)	NO
1 First - Office Riser	N/A	N/A
1 First - Office Stairs	NO (-26.6%)	NO
2 Second - Open Office	NO (-17.6%)	NO
2 Second - Stairs	NO (-16.5%)	NO
2 Second - Toilets	N/A	N/A
2 Second - Server	N/A	N/A
2 Second - Riser	N/A	N/A
3 Third - Open Office	NO (-24.8%)	NO
3 Third - Toilets	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
3 Third - Server	N/A	N/A
4 Fourth - Open Office	NO (-31.4%)	NO
4 Fourth - Stairs	NO (-79.6%)	NO
4 Fourth - Toilets	N/A	N/A
6 Sixth (Mezzanine) - Riser	N/A	N/A
6 Sixth (Mezzanine) - Toilets	N/A	N/A
5 Fifth - Riser	N/A	N/A
5 Fifth - Server	N/A	N/A
5 Fifth - Toilets	N/A	N/A
5 Fifth - Open Office	NO (-70.8%)	NO
5 Fifth - Stairs	NO (-79.6%)	NO
0 Ground - Office Stairs	N/A	N/A
0 Ground - Office Goods Lift	YES (+19.2%)	NO
0 Ground - Reception	YES (+28.4%)	NO
0 Ground - Riser	N/A	N/A

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	2477.9	2477.9
External area [m^2]	2439.4	2439.4
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	11	3
Average conductance [W/K]	1357.18	1288.9
Average U-value [W/m^2K]	0.56	0.53
Alpha value* [%]	13.13	19.57

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

Building Use

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

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	21.01	17.2
Cooling	6.35	8.26
Auxiliary	0.14	0.17
Lighting	9.76	17.12
Hot water	6.62	7.65
Equipment*	34.82	34.82
TOTAL**	**43.87**	**50.4**

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

Energy Production by Technology [kWh/m^2]

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

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	189.57	168.55
Primary energy* [kWh/m^2]	106.27	105.46
Total emissions [kg/m^2]	18.1	19.4

* 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] No Heating or Cooling										
	Actual	360.7	0.3	0	0	0	0	0	0	0
	Notional	178.1	11.3	0	0	0	0	0	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Natural Gas										
	Actual	263	73.4	91.3	0	0.8	0.8	0	1	0
	Notional	161.4	60.2	54.8	0	1	0.82	0	----	----
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	54.8	117.6	17	7.1	0.1	0.89	4.63	0.91	6.2
	Notional	45.2	118.9	15.3	9.2	0.1	0.82	3.6	----	----

Key to terms

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

Key Features

The 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	0.28	- 0 Lower Ground - Circulation_P_14
Floor	0.2	0.22	1 First - Office Goods Lift_F_4
Roof	0.15	0.16	5 Fifth - Open Office_R_25
Windows, roof windows, and rooflights	1.5	1.4	- 0 Lower Ground - Circulation_G_5
Personnel doors	1.5	-	"No external personnel doors"
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	11.35

Appendix C - Step Three – 'Be Clean' BRUKL Output Documents - Not Applicable

Appendix D - Step Four – 'Be Green' BRUKL Output Documents

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Units A B & C 20-23 Greville Street

As designed

Date: Tue Dec 19 22:12:39 2017

Administrative information

Building Details

Address: Units A, B & C, 20-23 Greville Street, LONDON, EC1N 8SS

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.3.a.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v5.0.3

BRUKL compliance check version: v5.3.a.0

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Jon West

Telephone number: 07758 760 818

Address: 62 High Street, Stetchworth, CB8 9TJ

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

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	58
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	58
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	40.9
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and 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	0.4	0.55	- 0 Lower Ground - Bleeding Heart Bistro (Store)_W_6
Floor	0.25	0.25	0.25	- 0 Lower Ground - Bleeding Heart Bistro (Store)_S_12
Roof	0.25	0.19	0.22	- 0 Lower Ground - Unit B (A1-A3)_R_11
Windows***, roof windows, and rooflights	2.2	1.4	1.4	1 First - Unit A (A3) Eat & Drink_G_6
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

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

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

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

Building services

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

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

1- VRF

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	5	3.8	-	-	-
Standard value	2.5*	2.6	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

1- Direct gas fired water heater

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.95	-
Standard value	0.9*	N/A
* Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73.		

2- Direct Electric

	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**
- 0 Lower Ground - Bleeding Heart Bistro (Store)	-	-	-	-	-	-	-	-	-	-	N/A
- 0 Lower Ground - Unit B (A1-A3)	-	-	-	-	-	-	-	-	-	-	N/A
- 0 Lower Ground - Unit C (A1-A3)	-	-	-	-	-	-	-	-	-	-	N/A
1 First - Unit A (A3) Eat & Drink	-	-	-	-	-	-	-	-	-	-	N/A
1 First - Unit A (A3) Toilets	-	-	0.5	-	-	-	-	-	-	-	N/A
1 First - Unit A (A3) Food Prep	-	-	-	-	-	-	-	-	1	-	N/A
0 Ground - Unit A (A3) Eat & Drink	-	-	-	-	-	-	-	-	-	-	N/A
0 Ground - Unit B (A1-A3)	-	-	-	-	-	-	-	-	-	-	N/A
0 Ground - Unit C (A1-A3)	-	-	-	-	-	-	-	-	-	-	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	
- 0 Lower Ground - Bleeding Heart Bistro (Store)	110	-	-	51
- 0 Lower Ground - Unit B (A1-A3)	-	110	100	1150
- 0 Lower Ground - Unit C (A1-A3)	-	110	100	887
1 First - Unit A (A3) Eat & Drink	-	110	100	658
1 First - Unit A (A3) Toilets	-	110	-	60
1 First - Unit A (A3) Food Prep	-	110	-	260
0 Ground - Unit A (A3) Eat & Drink	-	110	100	61
0 Ground - Unit B (A1-A3)	-	110	100	1130
0 Ground - Unit C (A1-A3)	-	110	100	1287

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?
- 0 Lower Ground - Bleeding Heart Bistro (Store)	N/A	N/A
- 0 Lower Ground - Unit B (A1-A3)	N/A	N/A
- 0 Lower Ground - Unit C (A1-A3)	N/A	N/A
1 First - Unit A (A3) Eat & Drink	NO (-17.9%)	NO
1 First - Unit A (A3) Toilets	N/A	N/A
1 First - Unit A (A3) Food Prep	NO (-55.4%)	NO
0 Ground - Unit A (A3) Eat & Drink	NO (-13.9%)	NO
0 Ground - Unit B (A1-A3)	YES (+6.4%)	NO
0 Ground - Unit C (A1-A3)	YES (+0.1%)	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?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	994.1	994.1
External area [m^2]	997.5	997.5
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	25	3
Average conductance [W/K]	517.65	426.35
Average U-value [W/m^2K]	0.52	0.43
Alpha value* [%]	17.57	19.55

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

Building Use

% Area	Building Type
53	**A1/A2 Retail/Financial and Professional services**
47	**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
	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	9.31	11.4
Cooling	14.1	22.09
Auxiliary	8.74	5.53
Lighting	26.92	53.76
Hot water	46.06	50.66
Equipment*	61.29	61.29
TOTAL**	**105.13**	**143.44**

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

Energy Production by Technology [kWh/m^2]

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

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	399.6	385.93
Primary energy* [kWh/m^2]	239.21	339.37
Total emissions [kg/m^2]	40.9	58

* 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	164.4	235.2	9.3	14.1	8.7	4.9	4.63	5	6.2
	Notional	99.7	286.2	11.4	22.1	5.5	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 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	0.28	- 0 Lower Ground - Bleeding Heart Bistro (Store)_P_8
Floor	0.2	0.22	1 First - Unit A (A3) Eat & Drink_F_4
Roof	0.15	0.18	- 0 Lower Ground - Bleeding Heart Bistro (Store)_R_3
Windows, roof windows, and rooflights	1.5	1.4	1 First - Unit A (A3) Eat & Drink_G_6
Personnel doors	1.5	-	"No external personnel doors"
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	25

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

B1 Office 20-23 Greville Street

As designed

Date: Tue Dec 19 22:23:57 2017

Administrative information

Building Details

Address: 20-23 Greville Street, LONDON, EC1N 8SS

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.3.a.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v5.0.3

BRUKL compliance check version: v5.3.a.0

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Jon West

Telephone number: 07758 760 818

Address: 62 High Street, Stetchworth, CB8 9TJ

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

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	18.8
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	18.8
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	16.2
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	0.42	0.55	- 0 Lower Ground - Circulation_W_8
Floor	0.25	0.25	0.25	- 0 Lower Ground - Incoming Service_S_8
Roof	0.25	0.22	0.25	6 Sixth (Mezzanine) - Riser_R_9
Windows***, roof windows, and rooflights	2.2	1.4	1.4	- 0 Lower Ground - Circulation_G_5
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

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

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

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	11.35

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- Electric Convector

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

2- VRF

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	5	3.8	-	-	-
Standard value	2.5*	2.6	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

1- Direct Electric

	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**
- 0 Lower Ground - Bin Store	-	-	-	-	-	-	-	-	-	-	N/A
- 0 Lower Ground - Bike Store	-	-	-	-	-	-	-	-	-	-	N/A
- 0 Lower Ground - Goods Lift	-	-	-	-	-	-	-	-	-	-	N/A
0 Ground - Sub Station	-	-	-	-	-	-	-	-	-	-	N/A
- 0 Lower Ground - Incoming Service	-	-	-	-	-	-	-	-	-	-	N/A
- 0 Lower Ground - Riser	-	-	-	-	-	-	-	-	-	-	N/A
- 0 Lower Ground - Circulation	-	-	-	-	-	-	-	-	-	-	N/A
- 0 Lower Ground - Fire Escape Stairs	-	-	-	-	-	-	-	-	-	-	N/A
- 0 Lower Ground - WC Shower	-	-	0.5	-	-	-	-	-	-	-	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
1 First - Office Fire Escape	-	-	-	-	-	-	-	-	-	-	N/A
2 Second - Fire Escape Stairs	-	-	-	-	-	-	-	-	-	-	N/A
3 Third - Fire Escape Stairs	-	-	-	-	-	-	-	-	-	-	N/A
4 Fourth - Fire Escape Stairs	-	-	-	-	-	-	-	-	-	-	N/A
0 Ground - Office Fire Escape	-	-	-	-	-	-	-	-	-	-	N/A
1 First - Office Goods Lift	-	-	-	-	-	-	-	-	-	-	N/A
1 First - Office Riser	-	-	-	-	-	-	-	-	-	-	N/A
1 First - Office Stairs	-	-	-	-	-	-	-	-	-	-	N/A
2 Second - Open Office	-	-	-	-	-	-	-	-	-	-	N/A
2 Second - Stairs	-	-	-	-	-	-	-	-	-	-	N/A
2 Second - Toilets	-	-	0.5	-	-	-	-	-	-	-	N/A
2 Second - Server	-	-	-	-	-	-	-	-	-	-	N/A
2 Second - Riser	-	-	-	-	-	-	-	-	-	-	N/A
3 Third - Open Office	-	-	-	-	-	-	-	-	-	-	N/A
3 Third - Toilets	-	-	0.5	-	-	-	-	-	-	-	N/A
3 Third - Server	-	-	-	-	-	-	-	-	-	-	N/A
4 Fourth - Open Office	-	-	-	-	-	-	-	-	-	-	N/A
4 Fourth - Stairs	-	-	-	-	-	-	-	-	-	-	N/A
4 Fourth - Toilets	-	-	0.5	-	-	-	-	-	-	-	N/A
6 Sixth (Mezzanine) - Riser	-	-	-	-	-	-	-	-	-	-	N/A
6 Sixth (Mezzanine) - Toilets	-	-	0.5	-	-	-	-	-	-	-	N/A
5 Fifth - Riser	-	-	-	-	-	-	-	-	-	-	N/A
5 Fifth - Server	-	-	-	-	-	-	-	-	-	-	N/A
5 Fifth - Toilets	-	-	0.5	-	-	-	-	-	-	-	N/A
5 Fifth - Open Office	-	-	-	-	-	-	-	-	-	-	N/A
5 Fifth - Stairs	-	-	-	-	-	-	-	-	-	-	N/A
0 Ground - Office Stairs	-	-	-	-	-	-	-	-	-	-	N/A
0 Ground - Office Goods Lift	-	-	-	-	-	-	-	-	-	-	N/A
0 Ground - Reception	-	-	-	-	-	-	-	-	-	-	N/A
0 Ground - Riser	-	-	-	-	-	-	-	-	-	-	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	
- 0 Lower Ground - Bin Store	110	-	-	11
- 0 Lower Ground - Bike Store	110	-	-	45
- 0 Lower Ground - Goods Lift	-	110	-	43
0 Ground - Sub Station	110	-	-	14
- 0 Lower Ground - Incoming Service	110	-	-	11
- 0 Lower Ground - Riser	110	-	-	13
- 0 Lower Ground - Circulation	-	110	-	100
- 0 Lower Ground - Fire Escape Stairs	-	110	-	31
- 0 Lower Ground - WC Shower	-	110	-	28

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
1 First - Office Fire Escape	-	110	-	22
2 Second - Fire Escape Stairs	-	110	-	22
3 Third - Fire Escape Stairs	-	110	-	22
4 Fourth - Fire Escape Stairs	-	110	-	22
0 Ground - Office Fire Escape	-	110	-	28
1 First - Office Goods Lift	-	110	-	19
1 First - Office Riser	110	-	-	9
1 First - Office Stairs	-	110	-	47
2 Second - Open Office	110	-	-	2343
2 Second - Stairs	-	110	-	44
2 Second - Toilets	-	110	-	63
2 Second - Server	110	-	-	8
2 Second - Riser	110	-	-	6
3 Third - Open Office	110	-	-	2343
3 Third - Toilets	-	110	-	63
3 Third - Server	110	-	-	8
4 Fourth - Open Office	110	-	-	2343
4 Fourth - Stairs	-	110	-	44
4 Fourth - Toilets	-	110	-	63
6 Sixth (Mezzanine) - Riser	110	-	-	4
6 Sixth (Mezzanine) - Toilets	-	110	-	56
5 Fifth - Riser	110	-	-	4
5 Fifth - Server	110	-	-	7
5 Fifth - Toilets	-	110	-	57
5 Fifth - Open Office	110	-	-	3116
5 Fifth - Stairs	-	110	-	42
0 Ground - Office Stairs	-	110	-	45
0 Ground - Office Goods Lift	-	110	-	22
0 Ground - Reception	-	110	100	215
0 Ground - Riser	110	-	-	10

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

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
1 First - Office Goods Lift	YES (+51.9%)	NO
1 First - Office Riser	N/A	N/A
1 First - Office Stairs	NO (-26.6%)	NO
2 Second - Open Office	NO (-17.6%)	NO
2 Second - Stairs	NO (-16.5%)	NO
2 Second - Toilets	N/A	N/A
2 Second - Server	N/A	N/A
2 Second - Riser	N/A	N/A
3 Third - Open Office	NO (-24.8%)	NO
3 Third - Toilets	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
3 Third - Server	N/A	N/A
4 Fourth - Open Office	NO (-31.4%)	NO
4 Fourth - Stairs	NO (-79.6%)	NO
4 Fourth - Toilets	N/A	N/A
6 Sixth (Mezzanine) - Riser	N/A	N/A
6 Sixth (Mezzanine) - Toilets	N/A	N/A
5 Fifth - Riser	N/A	N/A
5 Fifth - Server	N/A	N/A
5 Fifth - Toilets	N/A	N/A
5 Fifth - Open Office	NO (-70.8%)	NO
5 Fifth - Stairs	NO (-79.6%)	NO
0 Ground - Office Stairs	N/A	N/A
0 Ground - Office Goods Lift	YES (+19.2%)	NO
0 Ground - Reception	YES (+28.4%)	NO
0 Ground - Riser	N/A	N/A

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	2477.9	2477.9
External area [m^2]	2439.4	2439.4
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	11	3
Average conductance [W/K]	1357.18	1288.9
Average U-value [W/m^2K]	0.56	0.53
Alpha value* [%]	13.13	19.57

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

Building Use

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

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	8.44	8.04
Cooling	6.35	8.26
Auxiliary	0.14	0.17
Lighting	9.76	17.12
Hot water	6.62	7.65
Equipment*	34.82	34.82
TOTAL**	**31.31**	**41.24**

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

Energy Production by Technology [kWh/m^2]

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

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	189.57	168.55
Primary energy* [kWh/m^2]	96.12	102.54
Total emissions [kg/m^2]	16.2	18.8

* 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] No Heating or Cooling										
	Actual	360.7	0.3	0	0	0	0	0	0	0
	Notional	178.1	11.3	0	0	0	0	0	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Natural Gas										
	Actual	263	73.4	91.3	0	0.8	0.8	0	1	0
	Notional	161.4	60.2	54.8	0	1	0.82	0	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	54.8	117.6	3.1	7.1	0.1	4.9	4.63	5	6.2
	Notional	45.2	118.9	5.2	9.2	0.1	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 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	0.28	- 0 Lower Ground - Circulation_P_14
Floor	0.2	0.22	1 First - Office Goods Lift_F_4
Roof	0.15	0.16	5 Fifth - Open Office_R_25
Windows, roof windows, and rooflights	1.5	1.4	- 0 Lower Ground - Circulation_G_5
Personnel doors	1.5	-	"No external personnel doors"
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	11.35

Appendix E - Discounted Renewable Technologies and Reasons for Exclusion from Development

With the reference to Item 6.1 Green Technologies, the following describes the renewable technologies that have been discounted in respect of the proposed development and why:

Domestic Hot Water Heating

Solar thermal or solar hot water (SHW) systems use a collector which is generally mounted on the roof, and typically contains a water glycol mixture which is heated by the sun. The heated liquid is then passed through a coil in a hot water storage cylinder. The water in the cylinder is then further heated (if required) by a boiler or electric immersion heater. The free energy obtained from the sun can be used to offset the amount of energy required for providing domestic hot water, and will reduce both running costs (due to the fuel being displaced electricity, natural gas, Liquefied Petroleum Gas (LPG) or oil) and the associated CO_2 emissions.

These systems are not good enough to provide space heating in the UK due to the climate but are among the most cost-effective renewable energy systems that can be installed to assist with domestic hot water demand.

Solar water heating could be installed by utilizing either evacuated tube type panels or flat plate collectors mounted on the roof of the building.

Reasons for Excluding this Technology for this Site

SHW only contributes to the water heating demand of the building and has reduced effectiveness during the winter months. Consequently they do not supply sufficient carbon reduction. This technology is not considered suitable for this project and is not investigated further.

The technology cannot produce a material contribution to the energy needs of a commercial development such as this, as the demand for hot water is for occasional hand washing which represents a very small proportion of the total demand. It is quite possible that the energy consumed by the solar circuit pump would be greater than the energy used by instantaneous water heaters to provide the same amount of hot water. For these reasons solar thermal panels are only suitable for specific commercial applications which have a quantifiable demand for hot water that can be matched to the output characteristic of a solar thermal system.

Biomass Boilers

Biomass heating is the combustion of a biomass fuel such as wood in a boiler to supply space heating and hot water. Biomass is biological in origin and when from sustainable sources is regarded as a renewable.

The most common fuel is wood, supplied in three forms, logs, chips and compressed wood pellets.

Any biomass heating system requires the following main components:

- Fuel storage;
- One or more boilers;
- One or more heat accumulators;
- A chimney stack or flue;
- A heat meter.

Sufficient fuel must be stored on-site to maintain operations in between deliveries. The amount will depend on circumstances, but is typically no less than a week of operation at full load.

The store must keep the fuel dry. Wet fuel will cause the boiler to malfunction.

The design of the store will depend on the fuel selected; logs can be kept in a simple shed, chips in a storage bay and pellets in an enclosed hopper.

Typical solutions are silos similar to animal feed storage or partitioned sections in an enclosed barn, outhouse or commodity store.

Access is needed for deliveries and some is needed to convey the fuel to the boiler on demand.

There are two main types of boiler – continuously fuelled and batch fuelled. Continuously fuelled boilers use wood chip or pellet fuels and can be made fully automatic.

The space requirement for biomass plant, equipment and associated fuel storage is significant and given the footprint of the building and its central Stain upon Thames location the site has limited off-street loading and delivery areas. Biomass requires frequent and regular deliveries of fuel which would impact on local transportation due to site servicing constraints and would therefore not be suitable for this redevelopment.

Reasons for Excluding this Technology for this Site

There are many discussions at this time with regards to the suitability of biomass within area due to the Clean Air Act Requirements and the viability of clean biomass systems has not yet been proven.

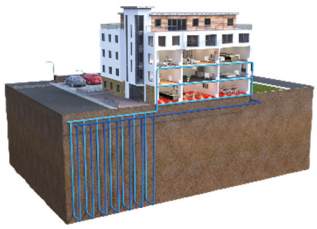
Storage limitations dictate whether it is physically feasible to include within the development's renewable energy strategy; a large dry space for storing the fuel would be required to hold several months' worth of fuel. In addition, a fuel supplier would need to be within reasonable vicinity; otherwise the emissions associated with delivery will significantly reduce the on-site carbon savings.

Biomass boilers do not operate in the same way as gas and oil boilers. They have a more limited operating range and cannot respond as rapidly to changes in demand. Short operating cycles are not recommended. The use of a hot water tank or accumulator in the system to balance the output of the boiler and the demand of the heating system is highly recommended. The necessary volume depends on the type of boiler and the character of the heating system. Pellet boilers have a good operating range and a relatively small tank would be used. Log boilers have little range and a large tank that can absorb the energy contained within one or more charges of wood is necessary.

Biomass boilers are combustion appliances and are subject to regulation on placing height and the quantity of pollutant emissions. This should be discussed with the Environmental Health Officer of the Local Authority.

Therefore the inclusion of biomass has not been deemed appropriate and is not considered further.

Ground Source Heat Pumps



Ground source heat pumps can be used to provide heating and or cooling to the building. Whilst ground source does rely on fossil fuels (indirectly) to provide the energy source, they are considered renewable given their high coefficient of performance and hence reduced fossil fuel reliance.

This can be one of four methods:

i. Closed horizontal loops, generally comprising a number of flow and return horizontal coiled loops sometimes called 'slinkies'.
ii. Closed vertical loops, generally comprising a number of flow and return vertical loops to approximately 100 m.
iii. Open loop, generally comprising of an abstraction and rejection well.
iv. Abstraction only open loop, comprising of an abstraction well with water rejected to either the local sewer systems or river/water course.

Reasons for Excluding this Technology for this Site

In order to provide the anticipated heating and cooling bore holes would be required with sufficient distance needed between them. With the site having limited external areas, ground source heat pumps are deemed not suitable for this project and have not been considered further.

Existing services within the ground would prohibit the installation of a borehole type heat pump, please refer to the utilities report. Space limitations prohibit the installation of a 'slinky' type heat pump.

Wind Turbines

This section covers both large scale and micro wind solutions.

Large scale wind generation systems have capacities over 100kW and are usually used to power larger developments such as, larger scale housing, industrial estates and hotels with many rooms. These systems cannot be roof mounted due to their size and weight.

Reasons for Excluding this Technology for this Site

Due to the large capital cost and surroundings, large scale wind turbine systems are not considered viable at this project.

It is difficult to obtain predictable or large amounts of wind energy in city centre locations, as they require non-turbulent, horizontal air streams to be most effective. Surrounding buildings, trees, etc. can cause significant issues with regards to micro and large scale installations unless the rotors are positioned at a considerable height.

Micro wind turbine technology has been found to be extremely difficult to achieve a contribution economically. A significant number of units would be required to provide any reasonable energy savings which would have serious visual impact implications.

Tall buildings give their own specific problems in that the building act as a spoiler, pushing wind upwards and over the turbine, reducing effectiveness considerably.

Additional considerations with large and micro wind solutions are the potential issues from stroboscopic light, topple distance, noise, impact on wildlife and structural enhancements which all raise major concerns given the building location in London.

Given the building location and its close proximity to nearby buildings, achieving an acceptable solution that will provide sufficient renewable contribution as well as overcome the installation impacts is unlikely and therefore has not been considered for this project.

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