WEBB YATES ENGINEERS

Energy Assessment

J4617 Windmill Street

Ref: J4617-B-RP-0001
Revision: 01
Status: S9

Webb Yates Engineers Ltd
48-50 Scrutton Street
London. EC2A 4HH
020 3696 1550
london@webbyates.com
www.webbyates.com

Registered in England & Wales No.: 5393930

CONTENTS

REVISION HISTORY

Revision	Status	Date	Author	Reviewer	Approver
00	S9	03.08.2021	AE	ES	AL
01	S9	22.09.2021	AE	ES	AL

1. EXECUTIVE SUMMARY

This report develops the energy strategy for the proposed redevelopment of 27-28 Windmill Street, London W1T 2JJ.

The project consists of the refurbishment an existing office building of approximately 771m^2 along with an extension of an additional storey of approximately 140m^2. The proposed development will have a basement, ground floor and five storeys above.

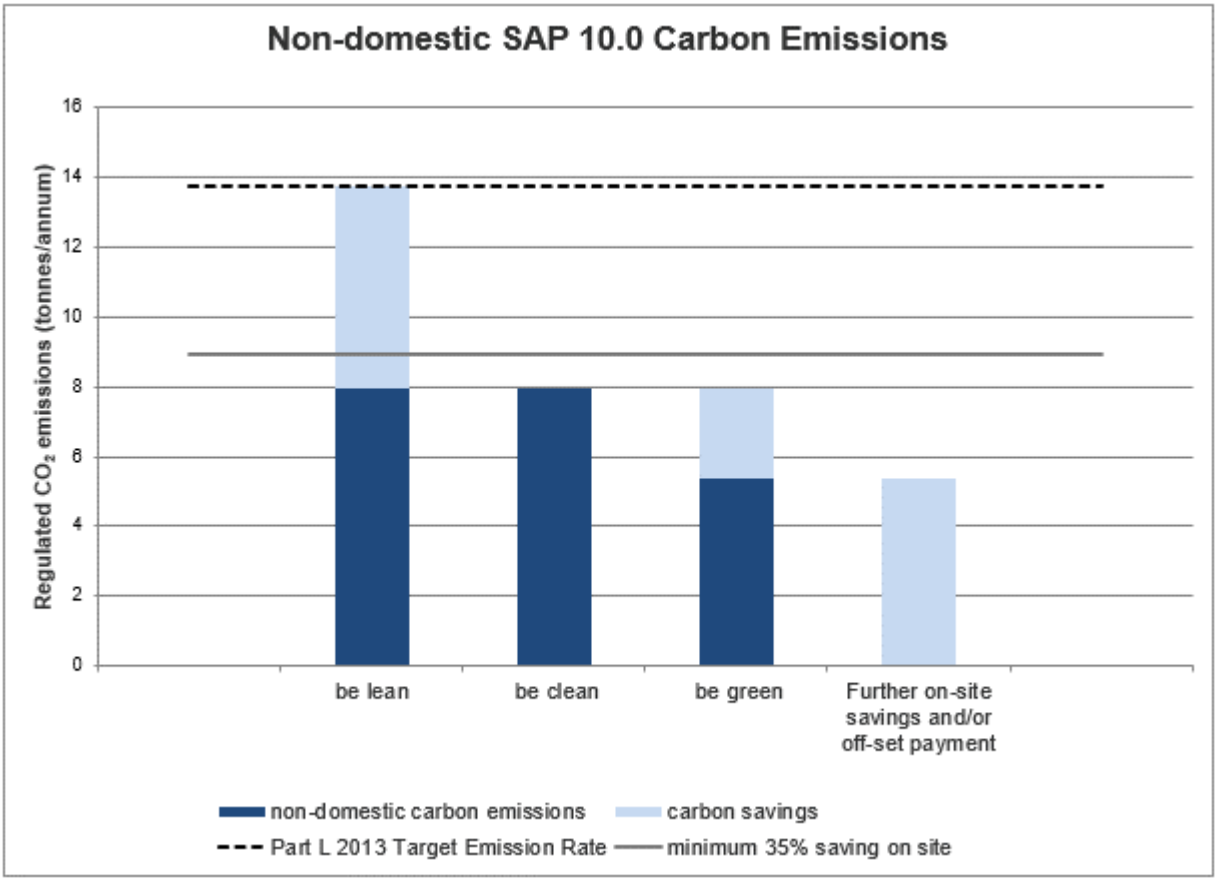
The guidance and policies used in formulating this report are listed below and the resulting findings are compliant with content of each;

- Camden Local Plan 2017;
- London Plan 2021;
- Building Regulations Part L2B

The energy strategy proposed meets the Building Regulations Part L2B requirements and is aimed to achieve the best outcoming in terms of sustainability and energy efficiency. In order to make the development net-zero carbon an offset payment of £15,343 is required.

	Regulated non-domestic carbon dioxide savings	
	(Tonnes CO2 per annum)	(%)
Be lean: savings from energy demand reduction	5.8	42%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	2.6	19%
Total Cumulative Savings	**8.4**	**61%**
Annual savings from off-set payment	5.4	-
	(Tonnes CO2)	
Cumulative savings for off-set payment	**162**	-
Cash in-lieu contribution (£)*	**15,343**	

*carbon price is based on GLA recommended price of £95 per tonne of carbon dioxide unless Local Planning Authority price is inputted in the 'Development Information' tab


Non-domestic SAP 10.0 Carbon Emissions
Regulated CO_2 emissions (tonnes/annum)
16
14
12
10
8
6
4
2
0
be lean
be clean
be green
Further on-site savings and/or off-set payment
non-domestic carbon emissions
carbon savings
Part L 2013 Target Emission Rate
minimum 35% saving on site

2. INTRODUCTION

The redevelopment is located on 27-28 Windmill Street London W1T 2JJ. The property is a five storey building from basement up to the fourth floor. The façade is a post modern red brick design.

The redevelopment will replace the existing façade with a new brick and curtain wall construction, as seen in the figures above, along with a fifth storey added to the building.

This report sets out the energy strategy for the proposed development. In developing this strategy local and regional planning policies have been addressed.

The format of this report follows the Local Plan to ensure that energy needs are met in the most efficient way.

The energy consumption of the development has been assessed in line with the Local policy and the CO_2 emission savings have been estimated with TAS software.

This report identifies the proposed energy strategy to meet Building Regulations Part L requirements and London Plan Policy SI 2 Minimising greenhouse gas emissions. The proposed Sustainability Principles and Engineering Concepts incorporate the requirements and guidelines of the relevant British Standards and CIBSE Guides.

3. PLANNING POLICY BACKGROUND

The main planning documents which constitute the statutory development plan for Camden and form the basis on which decisions will be made for the proposed development are:

- Building Regulations Part L2B;
- Camden Local Plan 2017;
- London Plan 2021;
- CIBSE Technical Manuals and Guide;

The main planning documents which constitute the statutory development plan and form the basis on which decisions will be made for the proposed development are outlined below.

3.1. Building Regulation Compliance

Building Regulations apply to all developments, and are in place to ensure buildings meet health, safety, welfare, convenience and sustainability standards; they focus on the technical aspects of designing and constructing a building.

The proposed development at Windmill Street will be fully compliant with all revisions of the Building Regulations relevant to MEPH design. The most relevant document is the Part L Approved Document: Part L2B: Conservation of Fuel and Power in Existing Buildings Other Than Dwellings.

In accordance with Section 4.2, although the proposed extension to the development is;

- Greater than 100m^2, but
- It is not greater than 25% of the total useful floor area

It therefore does not need to be treated as a major extension and is therefore exempt from having to show compliance with Part L2A. The openings of the extension should not exceed the following sizes, unless the window to wall ratio matches that of the remaining building, and need to have a minimum thermal performance as seen below.

Table 2 **Opening areas in the extension**

Building type	Windows and personnel doors as % of exposed wall	Rooflights as % of area of roof
Residential buildings where people temporarily or permanently reside	30	20
Places of assembly, offices and shops	40	20
Industrial and storage buildings	15	20
Vehicle access doors and display windows and similar glazing	As required	N/A
Smoke vents	N/A	As required

4 Notwithstanding the withdrawal of Approved Document L2A (2010 Edition) in DCLG Circular 04/13 it may be used for this purpose.

Table 3 **Standards for controlled fittings**	
Fitting	**Standard**
Windows in buildings that are essentially domestic in character[2]	Window Energy Rating[3] of Band C or 1.6 W/(m².K)
All other windows and roof windows and rooflights[1,4]	U-value 1.8 W/(m².K) for the whole unit
Curtain walling	See paragraph 4.28
Pedestrian doors where the door has more than 60% of its external face area glazed	U-value 1.8 W/(m².K)
All other pedestrian doors	U-value 1.8 W/(m².K)
High usage entrance doors for people	U-value 3.5 W/(m².K)
Vehicle access and similar large doors	U-value 1.5 W/(m².K)
Roof ventilators (including smoke extract ventilation)	U-value 3.5 W/(m².K)

Notes:

1 Display windows are not required to meet the standard given in this table.

2 For example, student accommodation, care homes and similar uses where the occupancy levels and internal gains are essentially domestic in character.

3 See Guide to the Calculation of Energy Ratings for Windows, Roof Windows and Doors, GGF, 2013 at www.ggf.org.uk.

4 For the purposes of checking compliance with this table, the true U-value based on aperture area can be converted to the U-value based on the developed area of the rooflight. Further guidance on evaluating the U-value of out-of-plane rooflights is given in Assessment of thermal performance of out-of-plane rooflights, NARM Technical Document NTD 2 (2010). See http://www.narm.org.uk/uploads/pdfs/NARM-TAOOPR-030311.pdf.

New thermal fabric for the extension should achieve the following minimum targets.

Table 4 **Standards for new *thermal elements***	
Element[1]	**Standard W/(m².K)**
Wall	0.28[2]
Pitched roof – insulation at ceiling level	0.16
Pitched roof – insulation at rafter level	0.18
Flat roof or roof with integral insulation	0.18
Floors[3]	0.22[4]
Swimming pool basin	0.25[5]

Notes:

1 'Roof' includes the roof parts of dormer windows, and 'wall' includes the wall parts (cheeks) of dormer windows.

2 A lesser provision may be appropriate where meeting such a standard would result in a reduction of more than 5% in the internal floor area of the room bounded by the wall.

3 The U-value of the floor of an extension can be calculated using the exposed perimeter and floor area of the whole enlarged building.

4 A lesser provision may be appropriate where meeting such a standard would create significant problems in relation to adjoining floor levels.

5 See paragraph 4.14.

As more than 25% of the external envelope will undergo renovation, the development is classified as a major renovation and needs to comply with paragraph L1 of Schedule 1. Compliance at the design stage is demonstrated by calculating and comparing the CO2 emissions rate for the proposed development, known as the Building Emissions Rate (BER), and an equivalent notional building of the same geometry but with a set of benchmark performance characteristics as specified in the 2010 NCM modelling guide, known as the Target Emissions Rate (TER). NCM methodologies using TAS software were employed to demonstrate compliance with these regulations.

3.2. Camden Council Local Plan 2017

Camden Council encourages new developments to be energy and resource efficient. The Camden Council Local Plan, adopted in 2017, requires new developments to minimise use of energy and other non-renewable resources, as well as to facilitate an increase in the use of low and zero carbon technologies to help reduce carbon dioxide (CO2) emissions and air pollutants harmful to health.

All major developments need to demonstrate how London Plan 2021 carbon reduction targets are met. 20% of carbon dioxide emissions need to be achieved through onsite renewable energy generation.

It does so by demonstrating sustainable energy practices in line with the London Plan Energy Hierarchy (Policy SI 2), by requiring new developments to:

- Use less energy (Be Lean);
- Supply energy efficiently (Be Clean)
- Use renewable energy (Be Green); and
- Monitor, verify and report on energy performance (Be Seen)

3.3. London Plan 2021

Camden Council Local Plan 2017 does not specifically reference the requirements for compliance in terms of a major renovation project such as this. The London Plan 2021 does state that developments involving major refurbishment should aim to meet Policy SI 2: Minimising greenhouse gas emissions.

Policy SI 2 Minimising greenhouse gas emissions stipulate that major developments should be net zero-carbon with a minimum onsite reduction of 35% beyond Building Regulations. Additionally, 15% reduction needs to be achieved through energy efficiency measures alone i.e. without the use of renewable technologies for non-residential buildings.

3.4. Planning Conditions

Prior to commencement of the development, an energy statement shall be submitted to and approved in writing by the Local Planning Authority. The development shall be carried out in accordance with the approved development thereafter.

4. ENVIRONMENTAL DESIGN STRATEGY

It is proposed to use a number of energy efficiency measures to reduce the energy demand of the development in line with the energy hierarchy of Be Lean, Be Clean, Be Green and Be Seen.

4.1. Be Lean

The first step of the London Plan energy hierarchy is to reduce energy use through both passive and active lean design measures. A number of sustainable design and construction methods have been incorporated into the design of the building which comply with the requirement to reduce energy demand. These include:

High Performance Building Envelope

Element	Building Regulation Part L2B Limit U-Value [W/m^{2}K]	Average U-Value [W/m^{2}K] Design
New External Wall	0.28	0.32
Upgraded Retained External Wall	0.70	0.30
Upgraded Floor	0.25	0.25
New Roof	0.18	0.18
Glazing	2.00	1.40

Enhanced Air Tightness and Good Detailing

Where construction elements and thermal fabric are either being replaced or upgraded, good detailing shall be achieved in order to avoid the creation of thermal bridges in the fabric and meeting points of elements such as between walls and floors and ceilings. The development should aim to achieve a greater building airtightness than currently present to reduce heatlosses in the building.

Limit Overheating

Systems have been designed to minimise internal heat gains by creating as short as possible service runs and the use of low energy lighting. The façade will be designed in such a way as to maximise solar gains in colder winter months while limiting them in summer months. The development has a mechanical ventilation system and active cooling to deal with periods of high temperatures to ensure a comfortable indoor environment.

Daylight

The maximisation of daylight is one of the most important environmental factors for buildings. Artificial lighting contributes up to 25% of the energy costs of a typical building, despite operation largely within daylight hours. Anecdotal evidence also suggests that the provision of good levels of natural light can contribute to enhanced health and well-being. The design shall maximise daylight while limiting solar gains during summer months.

Ventilation

It is currently the preferred option to naturally ventilate the building. However, mechanical ventilation has been included should future tenants opt for this solution. In that case the building would either be centrally mechanically ventilated via an air handling unit (AHU) or each floor have its separate system. Heat recovery will use exhaust air to heat up incoming air and therefore reduce heating loads. The AHU will use a summer bypass mode in high temperature periods in order to help maintain a cooler and more comfortable indoor environment.

Efficient Systems

Use of efficient systems and equipment with suitable time and temperature controls which have been appropriately commissioned such that the systems can be operated efficiently.

Minimization of lengths and diameters of 'dead legs'. Efficient components i.e. fans, pumps, refrigeration equipment have been appropriately sized to have no more capacity for demand and standby than is required for the task to operate at their optimum levels.

Insulation of pipework, ductwork and hot water systems have been selected to be in line with the future highest standards.

Minimising Water Usage

The design shall incorporate water saving strategies, such as low flush toilets, and non-concussive spray taps in order to keep the maximum water usage to 105 litres/person per day (in accordance with Policy SI5 Water Infrastructure of the New London Plan). Water consumption will be monitored. Other features shall include mains leak detection and sanitary shut-off.

Energy Efficient Lighting and Appliances

Provision of the required lighting levels whilst minimizing energy consumption by appropriate specification of light fittings and effective control of lighting systems by:

- Specifying 100% of the fixed internal light fittings as dedicated energy efficient fixtures.
- Having suitable energy consumption metering.
- Ensuring systems have been appropriately commissioned.
- Using lighting systems which are efficient and make use of daylight where possible/practical.
- Provision of low output or energy efficient external lighting.
- Avoiding the use of external lighting when communal spaces are unoccupied or during the day by means PIR, daylight sensors and time controls.

A lighting efficacy of average 90 lumens per circuit watt has been used as the design standard. This will be achieved including LED lighting sources throughout.

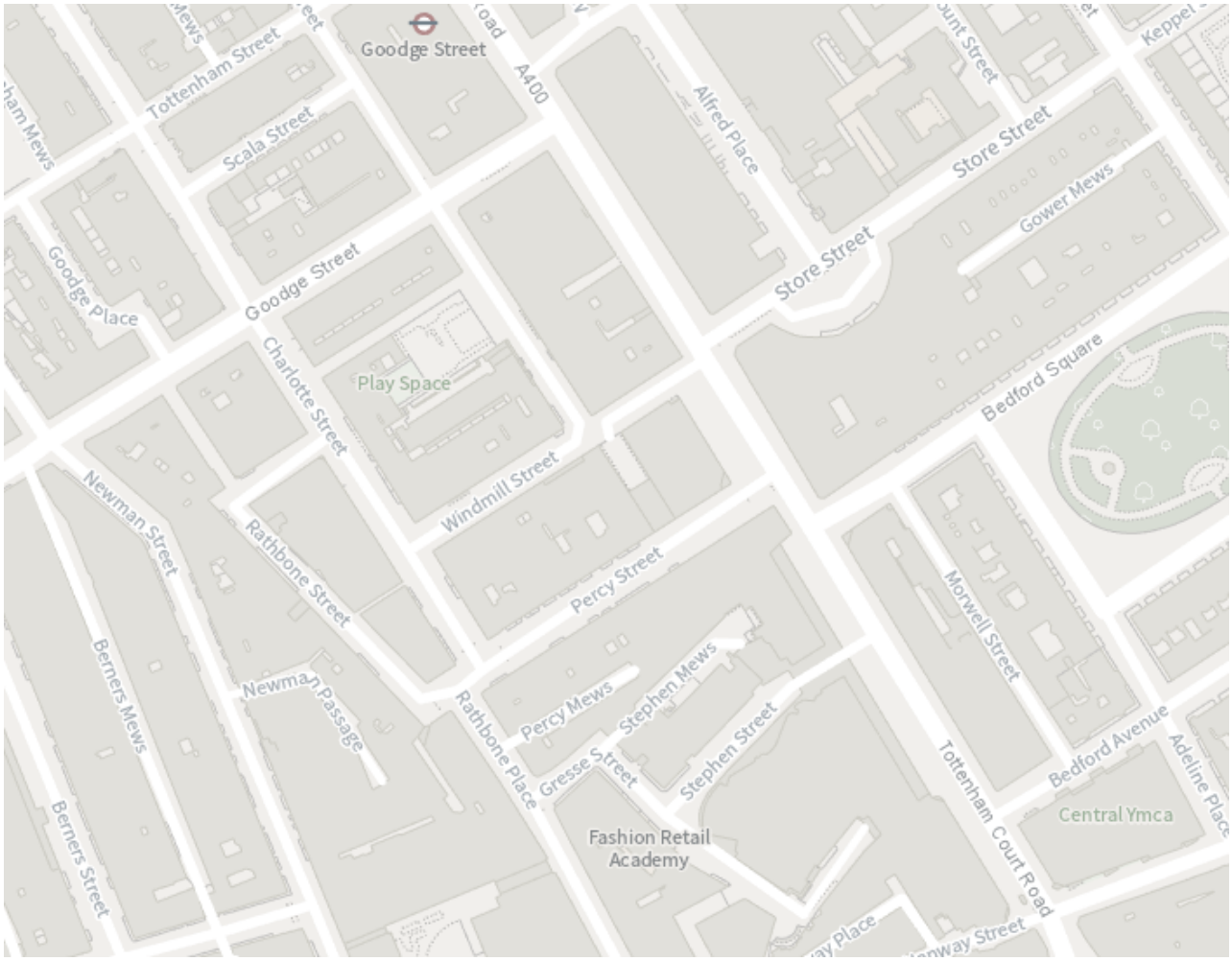
4.2. Be Clean

New Community heat network / Connection to Existing Low Carbon Heating Infrastructure

The map below displays the heat map for the area where the proposed development sits. As can be seen, the area does not fall within the proximity of an existing or proposed heat network and a connection to one is not feasible.

The proposed building will be utilising ASHP's for heating and cooling. This is advantageous for the local air quality of the surrounding area and its users (Policy SI1 Improving air quality).

However, the carbon reduction of this ASHP system will be assessed under the Be Green heading as a renewable energy source, and therefore no additional carbon reduction strategies are proposed for this stage. The aim would be to improve on the efficiency of heat and power delivery. This will reduce the auxiliary energy in association with their operation.



4.3. Be Green

The final reductions in energy consumption and related carbon emissions should be through the use of on-site renewable energy sources in the bid to reach the required carbon reductions. Air Source Heat Pumps are a highly efficient way to generate hot water and heating and will aid the carbon savings for this development.

The energy assessment results (see section 9) show that the carbon savings measures described above give a reduction of 55% compared to Building Regulations Part L – exceeding the minimum on-site reduction of at least 35% to meet the zero-carbon target for commercial development.

4.4. Be Seen

Sufficient information about the building, the fixed building services and their maintenance requirements will be provided to the users so that the building can be operated in such a manner as to use no more fuel and power than is reasonable in the circumstances.

Energy consumption and performance of the proposed design is to be monitored as stipulated in the London Plan 2021 Policy SI 2 Minimising greenhouse gas emissions clause A4) Be Seen.

5. LOW AND ZERO CARBON TECHNOLOGIES

The following section provides a feasibility analysis of Low or Zero Carbon (LZC) technologies for use at Windmill Street. There are various options when it comes to LZC technology, but a combination of project constraints rules the majority of these out. The constraints are:

- Capital expenditure
- Return on Investment
- Carbon savings potential
- Clean energy output potential
- Spatial requirements
- Operation and maintenance requirements
- Planning requirements

Out of the technologies considered the following were discounted immediately for this site:

- Hydroelectric: there are no suitable water courses or hydroelectric plants near the site.
- Hydrogen: generation and storage are still in the experimental stage at this scale and no systems are currently commercially available.
- Biomass: planning energy and carbon targets rule out the use of a gas boilers or alternatives (including CHP or biomass CHP). It is also considered not a viable solution due to issues with emissions and transport.
- CHP: as above.
- Biomass CHP: as above.
- Wind Turbines: wind turbine technology is not suitable for high density areas and those within close proximity to residential properties.

The feasibility study therefore reviewed the use of the following technologies to offset CO2 emissions:

- Air Source Heat Pumps
- Photovoltaics
- Solar Thermal Panels
- Open/Closed Loop Ground Source Heat Pumps

The following types of green/renewable energy technologies have been selected in order to maximise on-site renewable energy generation:

- Air Source Heating

5.1. Feasibility of Selected Technologies

Air Source Heat Pump and Detailed information

Individual high efficiency air source heat pump providing heating and cooling are proposed; this allows a lower flow temperature. The heating controls will incorporate external temperature compensation allowing fast response to external temperature change, which saves energy by reducing the need for sudden demands of duty.

An air to water heat pump uses the air as a heat sink and transfers the heat in the external space into the heating system. The temperature of the Low Temperature Hot Water (LTHW) providing the heating also affects the COP of the units, with the ideal flow and return temperatures being 45°C/35°C.

On the basis of economic and technical application ASHP are considered appropriate for the project and may also be used for compliance with the Be Green criteria.
The end-users will be supplied with regular information to control and operate the system e.g. at point of occupancy and maintenance visits.
The performance of the heat pump system will need to be monitored postconstruction to ensure it is achieving the expected performance approved during planning as will be specified in the Mechanical Specifications.

Distribution
The heating system will be designed to be as efficient as possible, with an inverter driven pump to adjust the pumping power required dependent on the heating demand.
The building maintenance personnel will be supplied with regular information to control and operate the system e.g. at point of occupancy and maintenance visits.

The difference of temperature will be minimised to ensure the system runs efficiently.

The performance of the heat pump system will be monitored postconstruction to ensure that the heat pumps will be achieving the expected performance approved during planning.

5.2. Feasibility study of the discarded technologies

Solar Photovoltaic (PV) Panels and Detailed information

Photovoltaic (PV) Panels are a renewable technology which will decrease the amount of electricity from the grid used in the building, particularly during the summer months when the solar irradiance is at its peak. Panels can be integrated within the building roof or stand alone; most efficient when south facing and angled at 30° from the horizontal. Such panels would reduce carbon emissions from the electrical uses within the building.

With limited roof space available, this technology has been deemed unfeasible and not adopted to help reduce onsite electric consumption.

Ground Source Heating and Cooling Systems

A Ground Source Heat Pump (GSHP) is a system that extracts heat from the ground, upgrades it to a higher temperature and releases it where required for use for space and water heating. Most systems are 'closed loop' and comprise of plastic piping buried in the ground and connected to a heat pump. A water or water-antifreeze mixture is passed around the looped pipe where it absorbs heat from the ground. The fluid flows into an electrically powered heat pump, comprising a compressor and a pair of heat exchangers before discharging back to the underground loop. Pipes can either be buried in trenches, usually in a slinky arrangement to reduce the amount of surface area that is required, or in a borehole, in a vertical loop system. Vertical loop systems require less surface space but are considerably more expensive.

Although their efficiency and potential for significant carbon reductions are attractive, the capital expenditure and on-going maintenance would add unnecessary costs and complications to the construction process. Extensive ground works would be required on a site with very limited space. Therefore GSHPs are deemed not feasible based on the site constraints, with ASHPs being the preferred technology due to similar efficiencies.

Feasibility of Solar Thermal Systems

Similarly to PV panels, solar thermal panels can either be integrated into the sloped roof structure. Either flat plate or evacuated tube type panels could be used. The solar thermal panels will be used to heat water which can be used for the domestic hot water supply to the dwellings.

It has identified that it would be more efficient for this kind of development to install heat pumps as there isn't any the available unshaded roof surface and therefore ST panels are not recommended for this site.

6. CARBON EMISSION FACTORS

The GLA Energy Assessment Guidance encourages the use of updated carbon emission factors to assess performance against planning policy targets. The New London Plan also uses SAP 10 carbon factors in which electrical energy has been substantially de-carbonised, see figures below:

	Fuel Carbon Factor (kgCO2/kWh)	
	SAP 2012	SAP10
Mains Gas	0.216	0.210
Grid Electricity	0.519	0.233

Therefore, as part of the planning policy energy assessment, the outputs from the current Building Regulations methodology for estimating energy performance against Part L 2013 requirements have been manually converted for the SAP 10 emission factors. The spreadsheets used to do this have been provided by the GLA and will be included as part of the submission.

7. COOLING HIERARCHY

The development has been designed in line with the cooling hierarchy outlined in Policy SI4 Managing heat risk in the New London Plan. The following measures have been taken at each stage of the hierarchy in order to reduce the demand for cooling.

Minimising Internal Heat Gains

Stage one of the Cooling Hierarchy is to minimise internal heat generation through energy efficient design.

Heat distribution infrastructure will be designed to minimise pipe lengths. This will be achieved at coordination stage, ensuring pipework is well insulated and that pipe configurations minimise heat loss. Good daylighting and high efficiency light fittings with occupancy control will also help to reduce excess heat gains from artificial lighting. Low energy lighting has been specified with occupancy controls to be provided for the luminaires.

Reducing Heat Entering the Building

The design of the façade will help to limit solar gains in the summer.

Passive Ventilation

Large openable windows in office spaces will allow sufficient natural cross ventilation during occupied hours, and when acoustic requirements allow, to prevent overheating.

Mechanical Ventilation

The AHU is to employ a summer bypass mode in order to maintain a comfortable internal environment.

Active Cooling

Due to the nature of the building and its use, the measures taken in the previous steps will not fully negate the need for active cooling in the office spaces. It is therefore proposed to use VRF units on each floor.

8. OVERHEATING RISK ANALYSIS

The measures described in the Cooling Hierarchy set out how overheating risk will be mitigated through passive design measures. In cases where those measures are not enough, the VRF cooling system will ensure a comfortable indoor environment in summer months.

9. ENERGY ASSESSMENT

An energy assessment has been carried out to demonstrate how the targets for regulated CO2 emissions reduction over and above 2013 Building Regulations will be met using the energy hierarchy outlined in Policy SI2 Minimising greenhouse gas emissions in the New London Plan.

As part of planning policy, the following criteria apply:

- Non-residential developments should aim to achieve 15% over Part L from energy efficiency measures alone
- An on-site reduction of at least 35% should be achieved to meet the zero-carbon target
- A cash-in-lieu contribution is required to offset the remaining carbon shortfall

For the purpose of the energy assessment the updated SAP10 carbon factors shown in Section 6 have been used, and energy demand has been calculated using the approved TAS software.

Energy use has been converted to carbon emissions using the GLA Carbon Emission Reporting Spreadsheet (version 1.1) for the purpose of the energy assessment. The unregulated energy demands of the development have been estimated based on CIBSE Guide F.

TAS software was used to output a Target Emissions Rate (TER) based on the notional building and a Dwelling Emissions Rate (DER) for each stage of the energy hierarchy outlined below:

- Lean – energy efficiency measures. Compared against a notional building with individual gas boilers for hot water and heat generation
- Clean – Same as Lean
- Green – ASHP technology providing heating and cooling

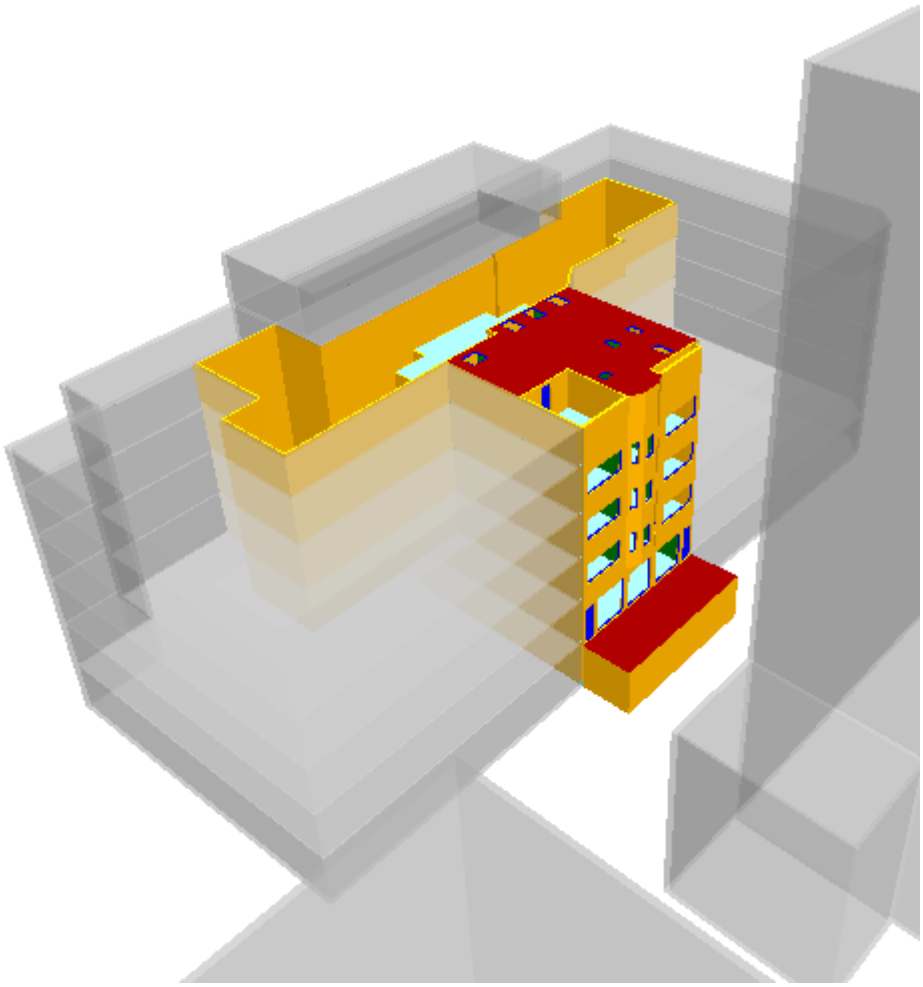
To assess performance against the London Plan energy target of 35% improvement over Part L, two separate models of the existing building and the proposed building were created. Due to the additional area added by the new storey to the proposed building, the two models' building emission rates (BERs) cannot be compared directly. The value for the baseline, on which to achieve a minimum 35%, was calculated by taking the BER of the existing building along with the target emissions rate (TER) of the extension. The emissions of the proposed building was calculated as the BER of the refurbished building along with the extension.

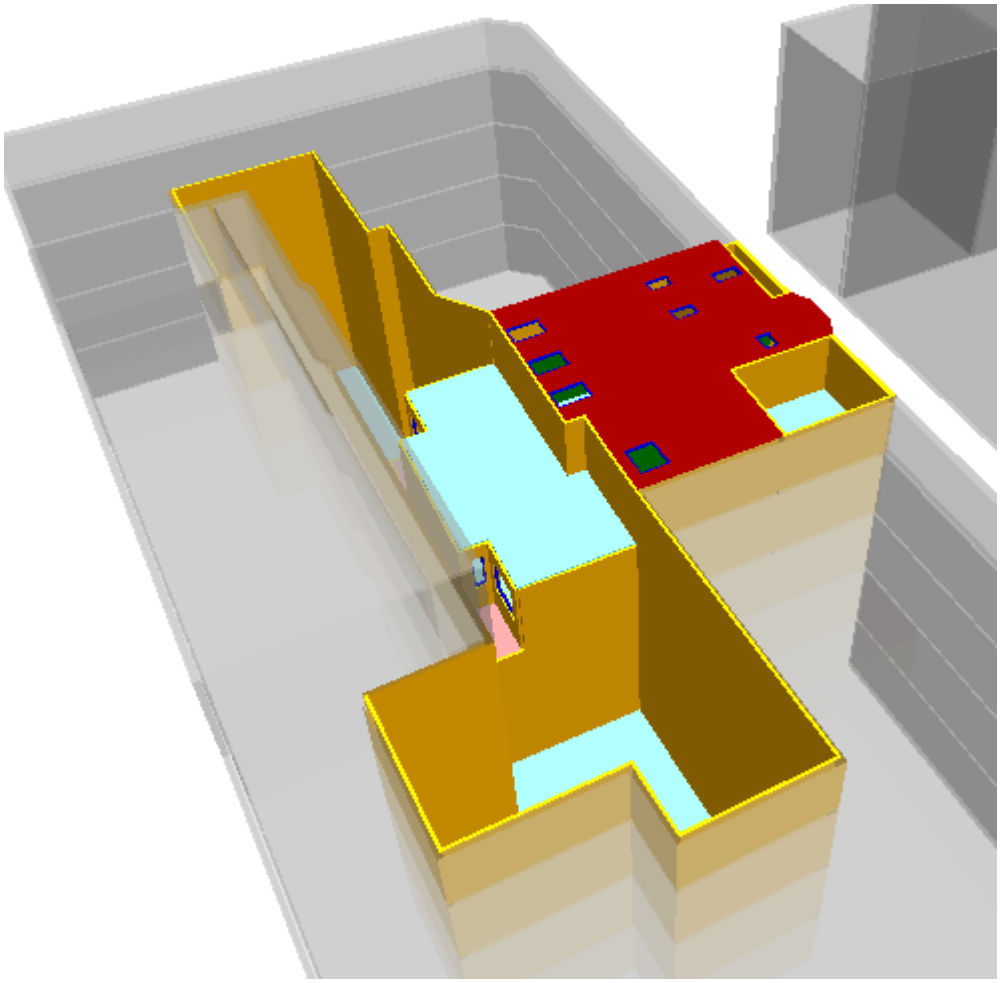
See Appendix A for full BRUKL results.

9.1. TAS Model

As previously discussed, it was chosen to compare the new building to that of the existing in order to more accurately compare the new development. Therefore two models were created, one of the existing and one of the new development.

Existing Development





Each floor has been divided into the rooms based on layouts of the existing building and assigned internal conditions of NCM Activity B1: Offices and Workshops.

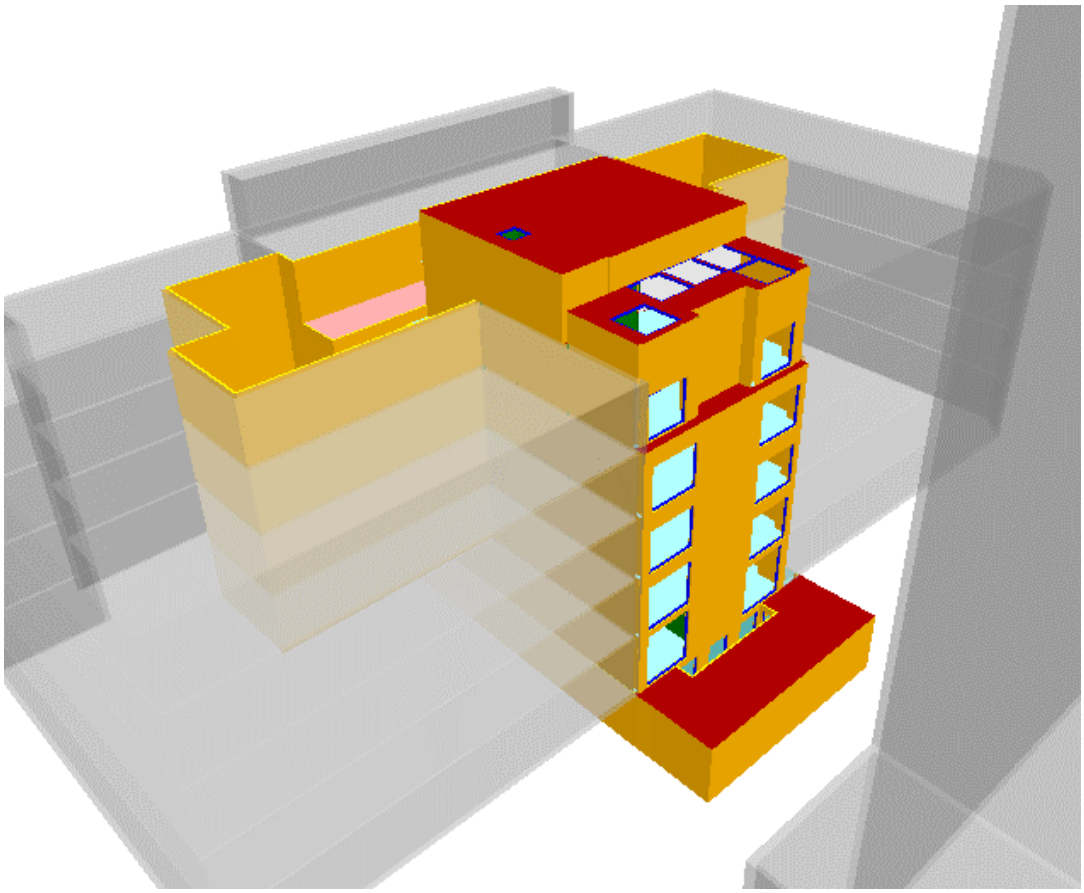
The following fabric U-values have been assigned based on comments from the Architect. An existing drawing was found showing that the basement floor is uninsulated. In cases where there is no information the existing build-ups such as the roof to be demolished and the existing glazing, it has been assumed that the constructions are typical of the time of construction circa 1990.

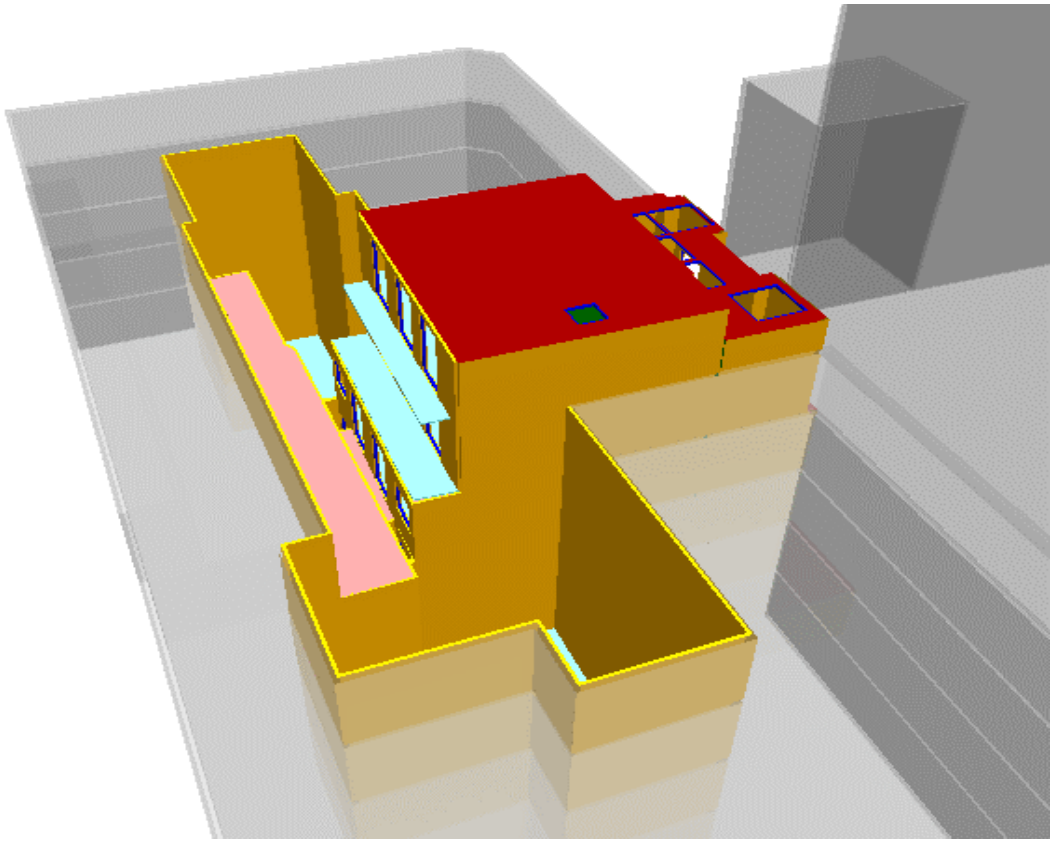
Building Element	**U-value (W/m²K)**
External Wall	0.80
Roof	0.40
Exposed Floor	2.10

Glazing	**U-value (W/m²K)**	**G-value**	**LT-value**
Double Glazed Windows	3.30	0.73	0.80

The building is centrally heated by natural gas and cooled, with central and local air handling units (AHU) providing ventilation, with hot water provided by gas-fired calorifiers. The lighting has been assumed to have a luminous efficacy of roughly 60W/lm.

New Development





Each floor has been divided into the rooms based on layouts of the proposed building and assigned internal conditions of NCM Activity B1: Offices and Workshops.

The following fabric U-values have been assigned based on information from the Architect. In cases where the façade is to be retained, the U-values as assigned in the existing development model have been used.

Building Element	**U-value (W/m²K)**
Upgraded Retained External Wall	0.30
New External Wall	0.32 (average)
New Roof	0.18
Upgraded Floor	0.25

Glazing	**U-value (W/m²K)**	**G-value**	**LT-value**
Existing Double Glazed Windows	3.30	0.73	0.80
New Double Glazed Windows	1.40	0.43	0.66

For the Lean stage, the building is centrally heated by gas boilers and cooled through VRF units, with central and local air handling units (AHU) providing ventilation, with hot water provided by direct electric. For the Green stage, heating and cooling is via electric air source heatpumps with ventilation from AHU and hot water provided by direct electric. The lighting has been assumed to have a luminous efficacy of roughly 90W/lm.

As a worst case scenario, the building has been modelled as naturally ventilated. Should the building use a mechanical ventilation system with heat recovery, the heating loads will reduce significantly and result in lower carbon emissions for the development.

9.2. Unregulated Energy

The unregulated energy uses have been estimated by the methods and average values described in CIBSE Guide F and TM54: Evaluating operational energy performance of buildings at the design stage. The table below shows the electrical equipment that is used in the commercial development. The number of items of equipment has been estimated based on the number of occupants, assuming an occupancy density of 10m²/person for the office areas as shown in the architectural drawings of the proposed development.

The power consumption of the equipment has been taken from the CIBSE Guide F 2012, paragraph 12.2. The installed capacity (nameplate rating) does not give an accurate estimate of energy use, so the 'average power consumption' as well as 'sleep mode' consumption have been used for the calculation.

The usage hours of the electrical equipment depend on the operating hours. The number of hours per day takes into account the intermittent usage and the variation of the operation from hour to hour and day to day. Instead of use a diversity factor multiplied by the power consumption, is going to be used an estimated number of hours. Overnight and weekend energy use can contribute significantly to small power energy and has been included. The equation below explains the calculation of the energy consumption.

Annual energy consumption (kWh) =

Number of equipment × {[average power consumption during operation × annual hours of operation] + [sleep mode consumption × (8760 - hours of operation)]}

EQUIPMENT	QUANTITY INSTALLED	AVERAGE POWER DEMAND	SLEEP-MODE POWER DEMAND	HOURS OF OPERATION/DAY	TOTAL HOURS/YEAR	ENERGY CONSUMPTION
		(W)	(W)	hours/day	hours/year	(kWh)
laptops	74	40	4	8	2080	6,183.52
screens	74	60	10	8	2080	9,302.00
multifunction devices	74	135	60	2	728	7,754.64
miscellaneous	74	15		8	2912	3,232.32
microwave	7	800		0.5	182	1,019.20
fridge	7	130	20	24	8760	7,971.60
cooking equipment	0	850		2	730	0.00
					TOT (kWh)	**35,463.28**
					Unregulated/m2 (kWh/m2/yr)	**41.72**
					SAP10 CO2 emissions	**8.26**
					SAP2012 CO2	**18.41**

9.3. Results

Baseline

The Basline scenario consists of the BER (Actual) of the existing building plus the TER (Notional) of the proposed extension.

Existing Development

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	15.6	3.31
Cooling	8.93	8.7
Auxiliary	16.59	7.04
Lighting	15.43	14.9
Hot water	5.89	5.38
Equipment*	42.27	42.27
TOTAL**	**62.43**	**39.33**

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

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	138.2	134.46
Primary energy* [kWh/m²]	151.91	102.31
Total emissions [kg/m²]	25.9	17.4

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

Proposed Extension

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	41.01	11.83
Cooling	3.99	12.25
Auxiliary	0	0
Lighting	12.72	17.95
Hot water	2.26	2.62
Equipment*	35.69	35.69
TOTAL**	**59.98**	**44.65**

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

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	195.84	223.63
Primary energy* [kWh/m²]	108.28	107.73
Total emissions [kg/m²]	18.7	18.7

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

Lean

The Lean scenario consists of the BER (Actual) of the proposed building plus the BER (Actual) of the proposed extension with systems assigned as in Section 9.1.

Refurbished Development

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	22.35	9.39
Cooling	2.94	7.35
Auxiliary	0	0
Lighting	12.41	20.39
Hot water	2.27	2.63
Equipment*	39.74	39.74
TOTAL**	**39.97**	**39.76**

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

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	117.22	145.08
Primary energy* [kWh/m²]	81.37	97.39
Total emissions [kg/m²]	14	16.9

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

Proposed Extension

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	41.01	11.83
Cooling	3.99	12.25
Auxiliary	0	0
Lighting	12.72	17.95
Hot water	2.26	2.62
Equipment*	35.69	35.69
TOTAL**	**59.98**	**44.65**

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

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	195.84	223.63
Primary energy* [kWh/m²]	108.28	107.73
Total emissions [kg/m²]	18.7	18.7

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

Green

The Green scenario consists of the BER (Actual) of the proposed building plus the BER (Actual) of the proposed extension with systems assigned as in Section 9.1.

Refurbished Development

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	8.2	5.08
Cooling	2.92	7.38
Auxiliary	0	0
Lighting	12.43	20.19
Hot water	2.27	2.63
Equipment*	39.41	39.41
TOTAL**	**25.82**	**35.28**

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

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	117.47	147.46
Primary energy* [kWh/m²]	79.27	100.63
Total emissions [kg/m²]	13.4	17.4

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

Proposed Extension

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	14.93	6.13
Cooling	3.99	12.25
Auxiliary	0	0
Lighting	12.72	17.95
Hot water	2.26	2.62
Equipment*	35.69	35.69
TOTAL**	**33.9**	**38.96**

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

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	195.84	223.63
Primary energy* [kWh/m²]	104.08	111.65
Total emissions [kg/m²]	17.6	19.2

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

Full BRUKL reports of the development can be found in Appendix.

These results were then entered into the GLA spreadsheet in order to observe performance with more up to date SAP 10 carbon factors.

	Carbon Dioxide Emissions for non-domestic buildings (Tonnes CO2 per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	13.8	8.3
After energy demand reduction (be lean)	8.0	8.3
After heat network connection (be clean)	8.0	8.3
After renewable energy (be green)	5.4	8.3

	Regulated non-domestic carbon dioxide savings	
	(Tonnes CO2 per annum)	(%)
Be lean: savings from energy demand reduction	5.8	42%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	2.6	19%
Total Cumulative Savings	**8.4**	**61%**
Annual savings from off-set payment	5.4	-
	(Tonnes CO2)	
Cumulative savings for off-set payment	**162**	-
Cash in-lieu contribution (£)*	**15,343**	

*carbon price is based on GLA recommended price of £95 per tonne of carbon dioxide unless Local Planning Authority price is inputted in the 'Development Information' tab

As seen in the summary table, a total 61% improvement over Part L Baseline is achieved at Green scenario. This comfortably meets the minimum requirement of 35% improvement over Part L. Additionally the requirement for the Lean scenario to show a minimum improvement of 15% over the Baseline is met.

The Camden Local Plan requirement of a 20% improvement through the use of renewables is currently not met. Due to the building's use as office space, it will be cooling dominated. The main difference between the Lean and Green scenario is its method of heating. Although the heating efficiency is significantly improved between the two scenarios, because the heating requirements are relatively low the required 20% improvement through renewables can not be met. The use of other renewable technologies, such as photovoltaic panels, is not suitable due to the limited available space on site.

10. CONCLUSION

In line with the Local and London Plan, Planning Policy, and the project Planning conditions, this energy statement outlines the Environmental Design Strategy for the development and demonstrates the energy efficiency and renewable energy measures applied are able to achieve the required onsite carbon reductions in line with the energy hierarchy.

	Regulated non-domestic carbon dioxide savings	
	(Tonnes CO2 per annum)	(%)
Be lean: savings from energy demand reduction	5.8	42%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	2.6	19%
Total Cumulative Savings	**8.4**	**61%**
Annual savings from off-set payment	5.4	-
	(Tonnes CO2)	
Cumulative savings for off-set payment	**162**	-
Cash in-lieu contribution (£)*	**15,343**	

*carbon price is based on GLA recommended price of £95 per tonne of carbon dioxide unless Local Planning Authority price is inputted in the 'Development Information' tab

The baseline emissions for the development have been assessed in accordance with Part L of the Building Regulations for the emissions at 13.8 Tonnes CO_2/year (SAP 10 carbon emissions factors).

When applying proposed construction details and U-Values to all thermal elements, high levels of energy efficient lighting, and high efficiency cooling system the measures equate to a decrease in CO_2 emissions of 42% over the Part L 2013 baseline or 5.8 tonnes CO_2/year savings (SAP 10). The use of ASHPs to supply heating further reduces energy consumption and associated carbon emissions. A 61% savings in carbon emissions is achieved. This is in compliance with the London Plan policy of min 35% carbon reduction over the Part L 2013 baseline through onsite measures. The additional Camden Local Plan requirement for 20% reduction of carbon emissions through onsite renewable technologies is currently not met. As previously explained the reason for this is due the main difference between the Lean and Green scenario is how heating is supplied. As the proposed development, an office, is cooling dominated, it marginally does not meet this requirement. The use of additional renewable technologies to generate electricity, such as PV panels, are not feasible due to the limited space available onsite. However as this energy strategy has outlined, all measures within the means available for the project have been taken to achieve a significant improvement over Part L, Local and London Plan requirements.

The final calculated regulated emissions of the development is 5.4 tonnes CO2/year.

APPENDIX A – BRUKL REPORTS

WEBB YATES ENGINEERS

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

4617 - Windmill Street Proposed Lean Update 160921

As designed

Date: Thu Sep 16 15:07:55 2021

Administrative information

Building Details

Address: ,

Certification tool

Calculation engine: TAS

Calculation engine version: "v9.5.1"

Interface to calculation engine: TAS

Interface to calculation engine version: v9.5.1

BRUKL compliance check version: v5.6.b.0

Certifier details

Name:

Telephone number:

Address: , ,

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

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	16.9
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	16.9
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	14
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	0.32	0.33	External Wall
Floor	0.25	0.25	0.25	Ground Floor
Roof	0.25	0.18	0.18	Roof
Windows***, roof windows, and rooflights	2.2	1.78	3.13	Rear Lightwell Main Window
Personnel doors	2.2	-	-	No personal doors in project
Vehicle access & similar large doors	1.5	-	-	No vehicle doors in project
High usage entrance doors	3.5	-	-	No high usage entrance doors in project

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

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

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	5

Building services

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

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- VRF (6 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	3.6	-	-	-
Standard value	0.91*	2.6	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					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	0
Standard value	1	N/A

"No zones in project where local mechanical ventilation, exhaust, or terminal unit is applicable"

General lighting and display lighting	**Luminous efficacy [lm/W]**			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Basement - Office	90	-	-	889
Basement - Plant	90	-	-	76
Basement - Store	90	-	-	15
Basement - Circulation	-	90	-	32
GF - Office	90	-	-	726
GF - WC	-	90	-	26
GF - Circulation	-	90	-	60
1st - Office	90	-	-	787
1st - WC	-	90	-	25
1st - Circulation	-	90	-	35
2nd - Office	90	-	-	785
2nd - WC	-	90	-	25
2nd - Circulation	-	90	-	35
3rd - Office	90	-	-	742
3rd - WC	-	90	-	25
3rd - Circulation	-	90	-	35
4th - Office	90	-	-	646
4th - WC	-	90	-	25
4th - Circulation	-	90	-	34
5th - Office	90	-	-	422
5th - Circulation	-	90	-	32

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

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Basement - Office	NO (-88%)	NO
GF - Office	NO (-52%)	NO
1st - Office	NO (-80%)	NO
2nd - Office	NO (-82%)	NO
3rd - Office	NO (-76%)	NO
4th - Office	NO (-34%)	NO
5th - Office	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

WEBB YATES ENGINEERS

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	804	804
External area [m²]	1017	1017
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	5	3
Average conductance [W/K]	511	421
Average U-value [W/m²K]	0.5	0.41
Alpha value* [%]	8.84	8.84

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

Building Use

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

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	22.35	9.39
Cooling	2.94	7.35
Auxiliary	0	0
Lighting	12.41	20.39
Hot water	2.27	2.63
Equipment*	39.74	39.74
TOTAL**	**39.97**	**39.76**

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

Energy Production by Technology [kWh/m²]

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

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	117.22	145.08
Primary energy* [kWh/m²]	81.37	97.39
Total emissions [kg/m²]	14	16.9

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

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	93	48.5	28.4	3.7	0	0.91	3.6	0.91	3.6
	Notional	12.5	121	2.8	9.3	0	1.26	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	0.31	Retained External Wall
Floor	0.2	0.25	Ground Floor
Roof	0.15	0.18	Roof
Windows, roof windows, and rooflights	1.5	1.47	GF Window
Personnel doors	1.5	-	No personal doors in project
Vehicle access & similar large doors	1.5	-	No vehicle doors in project
High usage entrance doors	1.5	-	No high usage entrance doors in project
$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)]			$U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]
* There might be more than one surface where the minimum U-value occurs.			

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	5

WEBB YATES ENGINEERS

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

4617 - Windmill Street Extension Lean 160921

As designed

Date: Thu Sep 16 14:59:18 2021

Administrative information

Building Details

Address: ,

Certification tool

Calculation engine: TAS

Calculation engine version: "v9.5.1"

Interface to calculation engine: TAS

Interface to calculation engine version: v9.5.1

BRUKL compliance check version: v5.6.b.0

Certifier details

Name:

Telephone number:

Address: , ,

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

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	18.7
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	18.7
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	18.7
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and 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	0.32	0.33	External Wall
Floor	0.25	0.25	0.25	Ground Floor
Roof	0.25	0.18	0.18	Roof
Windows***, roof windows, and rooflights	2.2	1.78	3.13	Rear Lightwell Main Window
Personnel doors	2.2	-	-	No personal doors in project
Vehicle access & similar large doors	1.5	-	-	No vehicle doors in project
High usage entrance doors	3.5	-	-	No high usage entrance doors in project

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

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

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	5

Building services

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

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- VRF (5th - Office)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	3.6	-	-	-
Standard value	0.91*	2.6	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					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	0
Standard value	1	N/A

"No zones in project where local mechanical ventilation, exhaust, or terminal unit is applicable"

General lighting and display lighting	**Luminous efficacy [lm/W]**			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Basement - Office	90	-	-	889
Basement - Plant	90	-	-	76
Basement - Store	90	-	-	15
Basement - Circulation	-	90	-	32
GF - Office	90	-	-	726
GF - WC	-	90	-	26
GF - Circulation	-	90	-	60
1st - Office	90	-	-	787
1st - WC	-	90	-	25
1st - Circulation	-	90	-	35
2nd - Office	90	-	-	785
2nd - WC	-	90	-	25
2nd - Circulation	-	90	-	35
3rd - Office	90	-	-	742
3rd - WC	-	90	-	25
3rd - Circulation	-	90	-	35
4th - Office	90	-	-	646
4th - WC	-	90	-	25
4th - Circulation	-	90	-	34
5th - Office	90	-	-	422
5th - Circulation	-	90	-	32

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

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Basement - Office	N/A	N/A
GF - Office	N/A	N/A
1st - Office	N/A	N/A
2nd - Office	N/A	N/A
3rd - Office	N/A	N/A
4th - Office	N/A	N/A
5th - Office	NO (-92%)	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

WEBB YATES ENGINEERS

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	73	73
External area [m²]	1017	1017
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	5	3
Average conductance [W/K]	511	293
Average U-value [W/m²K]	0.5	0.29
Alpha value* [%]	8.84	8.84

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

Building Use

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

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	41.01	11.83
Cooling	3.99	12.25
Auxiliary	0	0
Lighting	12.72	17.95
Hot water	2.26	2.62
Equipment*	35.69	35.69
TOTAL**	**59.98**	**44.65**

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

Energy Production by Technology [kWh/m²]

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

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	195.84	223.63
Primary energy* [kWh/m²]	108.28	107.73
Total emissions [kg/m²]	18.7	18.7

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

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	171.5	66	52.4	5.1	0	0.91	3.6	0.91	3.6
	Notional	26.9	202.7	5.9	15.6	0	1.26	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	0.31	Retained External Wall
Floor	0.2	0.25	Ground Floor
Roof	0.15	0.18	Roof
Windows, roof windows, and rooflights	1.5	1.47	GF Window
Personnel doors	1.5	-	No personal doors in project
Vehicle access & similar large doors	1.5	-	No vehicle doors in project
High usage entrance doors	1.5	-	No high usage entrance doors in project
$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)]			$U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]
* There might be more than one surface where the minimum U-value occurs.			

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

WEBB YATES ENGINEERS

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

4617 - Windmill Street Proposed Green 160921

As designed

Date: Thu Sep 16 15:16:31 2021

Administrative information

Building Details

Address: ,

Certification tool

Calculation engine: TAS

Calculation engine version: "v9.5.1"

Interface to calculation engine: TAS

Interface to calculation engine version: v9.5.1

BRUKL compliance check version: v5.6.b.0

Certifier details

Name:

Telephone number:

Address: , ,

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	17.4
Target CO_2 emission rate (TER), kgCO_2/m^2.annum	17.4
Building CO_2 emission rate (BER), kgCO_2/m^2.annum	13.4
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

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

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

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.32	0.33	External Wall
Floor	0.25	0.25	0.25	Ground Floor
Roof	0.25	0.18	0.18	Roof
Windows***, roof windows, and rooflights	2.2	1.78	3.13	Rear Lightwell Main Window
Personnel doors	2.2	-	-	No personal doors in project
Vehicle access & similar large doors	1.5	-	-	No vehicle doors in project
High usage entrance doors	3.5	-	-	No high usage entrance doors in project

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

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

Air Permeability	Worst acceptable standard	This building
m^3/(h.m^2) at 50 Pa	10	5

Building services

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

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- VRF (7 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.5	3.6	-	-	-
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	0
Standard value	1	N/A

"No zones in project where local mechanical ventilation, exhaust, or terminal unit is applicable"

General lighting and display lighting	**Luminous efficacy [lm/W]**			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Basement - Office	90	-	-	889
Basement - Plant	90	-	-	76
Basement - Store	90	-	-	15
Basement - Circulation	-	90	-	32
GF - Office	90	-	-	726
GF - WC	-	90	-	26
GF - Circulation	-	90	-	60
1st - Office	90	-	-	787
1st - WC	-	90	-	25
1st - Circulation	-	90	-	35
2nd - Office	90	-	-	785
2nd - WC	-	90	-	25
2nd - Circulation	-	90	-	35
3rd - Office	90	-	-	742
3rd - WC	-	90	-	25
3rd - Circulation	-	90	-	35
4th - Office	90	-	-	646
4th - WC	-	90	-	25
4th - Circulation	-	90	-	34
5th - Office	90	-	-	422
5th - Circulation	-	90	-	32

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

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Basement - Office	NO (-88%)	NO
GF - Office	NO (-52%)	NO
1st - Office	NO (-80%)	NO
2nd - Office	NO (-82%)	NO
3rd - Office	NO (-76%)	NO
4th - Office	NO (-34%)	NO
5th - Office	NO (-92%)	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

WEBB YATES ENGINEERS

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	877	877
External area [m²]	1017	1017
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	5	3
Average conductance [W/K]	511	463
Average U-value [W/m²K]	0.5	0.46
Alpha value* [%]	8.84	8.84

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

Building Use

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

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	8.2	5.08
Cooling	2.92	7.38
Auxiliary	0	0
Lighting	12.43	20.19
Hot water	2.27	2.63
Equipment*	39.41	39.41
TOTAL**	**25.82**	**35.28**

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

Energy Production by Technology [kWh/m²]

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

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	117.47	147.46
Primary energy* [kWh/m²]	79.27	100.63
Total emissions [kg/m²]	13.4	17.4

* 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] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	93.8	48.1	10.4	3.7	0	2.5	3.6	2.5	3.6
	Notional	14.9	121.6	1.7	9.4	0	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	0.31	Retained External Wall
Floor	0.2	0.25	Ground Floor
Roof	0.15	0.18	Roof
Windows, roof windows, and rooflights	1.5	1.47	GF Window
Personnel doors	1.5	-	No personal doors in project
Vehicle access & similar large doors	1.5	-	No vehicle doors in project
High usage entrance doors	1.5	-	No high usage entrance doors in project
$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)]			$U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]
* There might be more than one surface where the minimum U-value occurs.			

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

WEBB YATES ENGINEERS

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

4617 - Windmill Street Extension Green 160921

As designed

Date: Thu Sep 16 15:31:15 2021

Administrative information

Building Details

Address: ,

Certification tool

Calculation engine: TAS

Calculation engine version: "v9.5.1"

Interface to calculation engine: TAS

Interface to calculation engine version: v9.5.1

BRUKL compliance check version: v5.6.b.0

Certifier details

Name:

Telephone number:

Address: , ,

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

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	19.2
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	19.2
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	17.6
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	0.32	0.33	External Wall
Floor	0.25	0.25	0.25	Ground Floor
Roof	0.25	0.18	0.18	Roof
Windows***, roof windows, and rooflights	2.2	1.78	3.13	Rear Lightwell Main Window
Personnel doors	2.2	-	-	No personal doors in project
Vehicle access & similar large doors	1.5	-	-	No vehicle doors in project
High usage entrance doors	3.5	-	-	No high usage entrance doors in project

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

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

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	5

Building services

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

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- VRF (5th - Office)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.5	3.6	-	-	-
Standard value	0.91*	2.6	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					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	0
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.

"No zones in project where local mechanical ventilation, exhaust, or terminal unit is applicable"

General lighting and display lighting	**Luminous efficacy [lm/W]**			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Basement - Office	90	-	-	889
Basement - Plant	90	-	-	76
Basement - Store	90	-	-	15
Basement - Circulation	-	90	-	32
GF - Office	90	-	-	726
GF - WC	-	90	-	26
GF - Circulation	-	90	-	60
1st - Office	90	-	-	787
1st - WC	-	90	-	25
1st - Circulation	-	90	-	35
2nd - Office	90	-	-	785
2nd - WC	-	90	-	25
2nd - Circulation	-	90	-	35
3rd - Office	90	-	-	742
3rd - WC	-	90	-	25
3rd - Circulation	-	90	-	35
4th - Office	90	-	-	646
4th - WC	-	90	-	25
4th - Circulation	-	90	-	34
5th - Office	90	-	-	422
5th - Circulation	-	90	-	32

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

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Basement - Office	N/A	N/A
GF - Office	N/A	N/A
1st - Office	N/A	N/A
2nd - Office	N/A	N/A
3rd - Office	N/A	N/A
4th - Office	N/A	N/A
5th - Office	NO (-92%)	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

WEBB YATES ENGINEERS

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	73	73
External area [m²]	1017	1017
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	5	3
Average conductance [W/K]	511	293
Average U-value [W/m²K]	0.5	0.29
Alpha value* [%]	8.84	8.84

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

Building Use

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

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	14.93	6.13
Cooling	3.99	12.25
Auxiliary	0	0
Lighting	12.72	17.95
Hot water	2.26	2.62
Equipment*	35.69	35.69
TOTAL**	**33.9**	**38.96**

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

Energy Production by Technology [kWh/m²]

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

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	195.84	223.63
Primary energy* [kWh/m²]	104.08	111.65
Total emissions [kg/m²]	17.6	19.2

* 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] Electricity, [CFT] Electricity										
	Actual	171.5	66	19.1	5.1	0	2.5	3.6	2.5	3.6
	Notional	26.9	202.7	3.1	15.6	0	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

WEBB YATES ENGINEERS

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	0.31	Retained External Wall
Floor	0.2	0.25	Ground Floor
Roof	0.15	0.18	Roof
Windows, roof windows, and rooflights	1.5	1.47	GF Window
Personnel doors	1.5	-	No personal doors in project
Vehicle access & similar large doors	1.5	-	No vehicle doors in project
High usage entrance doors	1.5	-	No high usage entrance doors in project
$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)]			$U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]
* There might be more than one surface where the minimum U-value occurs.			

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

APPENDIX B – GLA SPREADSHEET

NON-DOMESTIC ENERGY CONSUMPTION AND CO_2 ANALYSIS

Building Use	Model Area (m^2)	Number of units	Total area represented by model (m^2)	VALIDATION CHECK: Calculated TER 2012 ($kgCO_2 / m^2$)	VALIDATION CHECK: BRUKL TER 2012 ($kgCO_2 / m^2$)	REGULATED ENERGY CONSUMPTION BY END USE (kWh/m² p.a.) TER - SOURCE: BRUKL OUTPUT: Space Heating (kWh/m² p.a.)	Fuel type Space Heating	Domestic Hot Water (kWh/m² p.a.)	Fuel type Domestic Hot Water	Lighting (kWh/m² p.a.)	Auxiliary (kWh/m² p.a.)	Cooling (kWh/m² p.a.)
Existing Storeys	799	1	799	29.7	29.7	20.38	Natural Gas	5.89	Natural Gas	20.45	17.09	8.71
Extension	73	1	73	18.8	18.7	11.83	Natural Gas	2.62	Natural Gas	17.95	0	12.25
Sum	872	2	872	28.8	-	17,147	N/A	4,897	N/A	17,650	13,655	7,854

Building Use	REGULATED ENERGY CONSUMPTION BY FUEL TYPE (kWh/m² p.a.) TER - SOURCE: BRUKL.INP or *SIM.CSV FILE: Natural Gas	Grid Electricity	Equipment	2012 CO_2 emissions ($kgCO_2$ p.a.)	REGULATED ENERGY CONSUMPTION BY FUEL TYPE (kWh/m² p.a.) - TER BRUKL: Natural Gas	Grid Electricity	Unregulated Grid Electricity	REGULATED CO_2 EMISSIONS: SAP10.0 CO_2 emissions ($kgCO_2$ p.a.)	BRUKL TER SAP10.0 ($kgCO_2 / m^2$)
	0.216 $kgCO_2$/kWh	0.519 $kgCO_2$/kWh	0.519 $kgCO_2$/kWh		0.210 $kgCO_2$/kWh	0.233 $kgCO_2$/kWh	0.233 $kgCO_2$/kWh		
Existing Storeys	26	46		23,713	26	46		13,018	16.3
Extension	14	30		1,372	14	30		735	10.1
Sum	22,045	39,158	0	*25,085*	22,045	39,158	0	*13,753*	15.8

SITE-WIDE ENERGY CONSUMPTION AND CO_2 ANALYSIS

Use	Total Area (m^2)	Calculated TER 2012 ($kgCO_2 / m^2$)	-	REGULATED ENERGY CONSUMPTION: Space Heating (kWh p.a.)	N/A	Domestic Hot Water (kWh p.a.)	N/A	Lighting (kWh p.a.)	Auxiliary (kWh p.a.)	Cooling (kWh p.a.)	REGULATED CO_2 EMISSIONS: 2012 CO_2 emissions ($kgCO_2$ p.a.)	REGULATED CO_2 EMISSIONS PER UNIT: SAP 10.0 CO_2 emissions ($kgCO_2$ p.a.)	Calculated TER SAP 10.0 ($kgCO_2 / m^2$)
Sum	872	28.8	-	17,147	N/A	4,897	N/A	17,650	13,655	7,854	*25,085*	*13,753*	15.8

NON-DOMESTIC ENERGY CONSUMPTION AND CO_2 ANALYSIS

Building Use	Model Area (m^2)	Number of units	Total area represented by model (m^2)	VALIDATION CHECK		REGULATED ENERGY CONSUMPTION BY END USE (kWh/m^2 p.a.) 'BE LEAN' BER - SOURCE: BRUKL OUTPUT									REGULATED ENERGY CONSUMPTION BY FUEL TYPE (kWh/m^2 p.a.) 'BE LEAN' BER - SOURCE: BRUKL.INP or *SIM.CSV FILE							REGULATED CO_2 EMISSIONS PER UNIT						
				Calculated BER 2012 ($kgCO_2$ / m^2)	BRUKL BER 2012 ($kgCO_2$ / m^2)	Space Heating (kWh/m^2 p.a.)	Fuel type Space Heating	Domestic Hot Water (kWh/m^2 p.a.)	Fuel type Domestic Hot Water		Lighting (kWh/m^2 p.a.)	Auxiliary (kWh/m^2 p.a.)	Cooling (kWh/m^2 p.a.)		Natural Gas	Grid Electricity	Equipment				2012 CO_2 emissions ($kgCO_2$ p.a.)	Natural Gas	Grid Electricity	Equipment			SAP 10.0 CO_2 emissions ($kgCO_2$ p.a.)	BRUKL BER SAP 10.0 ($kgCO_2$ / m^2)	
															0.216 $kgCO_2$/kWh	0.519 $kgCO_2$/kWh	0.519 $kgCO_2$/kWh					0.210 $kgCO_2$/kWh	0.233 $kgCO_2$/kWh	0.233 $kgCO_2$/kWh					N/A
Existing Storeys	*799*	*1*	*799*	14.0	14.0	*22.35*	*Natural Gas*	*2.27*	*Grid Electricity*		*12.41*	*0*	*2.94*		22	18					11,164	22	18				7,030	8.8	
Extension	*73*	*1*	*73*	18.7	18.7	*41.01*	*Natural Gas*	*2.26*	*Grid Electricity*		*12.72*	*0*	*3.99*		41	19					1,365	41	19				951	13.0	
Sum	872	2	872	14.4	-	20,851	N/A	1,979	N/A	N/A	10,844	0	2,640		20,851	15,463	0	N/A	N/A	N/A	*12,529*	20,851	15,463	0			*7,982*	9.2	

SITE-WIDE ENERGY CONSUMPTION AND CO_2 ANALYSIS

Use	Total Area (m^2)	Calculated BER 2012 ($kgCO_2$ / m^2)	-	REGULATED ENERGY CONSUMPTION									REGULATED CO_2 EMISSIONS		REGULATED CO_2 EMISSIONS		
				Space Heating (kWh p.a.)	N/A	Domestic Hot Water (kWh p.a.)	N/A	Secondary Heating System (kWh p.a.)	N/A	Lighting (kWh p.a.)	Auxiliary (kWh p.a.)	Cooling (kWh p.a.)		2012 CO_2 emissions ($kgCO_2$ p.a.)		SAP 10.0 CO_2 emissions ($kgCO_2$ p.a.)	Calculated BER SAP 10.0 ($kgCO_2$ / m^2)	N/A
Sum	872	14.4	-	20,851		1,979		0		10,844	0	2,640		*12,529*		*7,982*	9.2	

NON-DOMESTIC ENERGY CONSUMPTION AND CO_2 ANALYSIS

Building Use	Model Area (m^2)	Number of units	Total area represented by model (m^2)	VALIDATION CHECK: Calculated BER 2012 ($kgCO_2$ / m^2)	VALIDATION CHECK: BRUKL BER 2012 ($kgCO_2$ / m^2)	REGULATED ENERGY CONSUMPTION BY END USE (kWh/m^2 p.a.) 'BE CLEAN' BER - SOURCE: BRUKL OUTPUT: Space Heating (kWh/m^2 p.a.)	Fuel type Space Heating	Domestic Hot Water (kWh/m^2 p.a.)	Fuel type Domestic Hot Water			Electricity generated by CHP (-) if applicable			Lighting (kWh/m^2 p.a.)	Auxiliary (kWh/m^2 p.a.)	Cooling (kWh/m^2 p.a.)
Existing Storeys	799	1	799	14.0	14.0	22.35	Natural Gas	2.27	Grid Electricity						12.41	0	2.94
Extension	73	1	73	18.7	18.7	41.01	Natural Gas	2.26	Grid Electricity						12.72	0	3.99
Sum	872	2	872	14.4	-	20,851	N/A	1,979	N/A			0			10,844	0	2,640

Building Use	REGULATED ENERGY CONSUMPTION BY FUEL TYPE (kWh/m^2 p.a.) 'BE CLEAN' BER - SOURCE: BRUKL.INP or *SIM.CSV FILE: Natural Gas	Grid Electricity	Bespoke DH Factor	Electricity generated by CHP (-) if applicable	Equipment			2012 CO_2 emissions ($kgCO_2$ p.a.)	REGULATED CO_2 EMISSIONS PER UNIT: Natural Gas	Grid Electricity	Bespoke DH Factor	Electricity generated by CHP (-) if applicable	Equipment		SAP 10.0 CO_2 emissions ($kgCO_2$ p.a.)	BRUKL BER SAP10.0 ($kgCO_2$ / m^2)
	0.216 $kgCO_2$/kWh	0.519 $kgCO_2$/kWh	0.000 $kgCO_2$/kWh	0.519 $kgCO_2$/kWh	0.519 $kgCO_2$/kWh				0.210 $kgCO_2$/kWh	0.233 $kgCO_2$/kWh	0.000 $kgCO_2$/kWh	0.233 $kgCO_2$/kWh	0.233 $kgCO_2$/kWh			
Existing Storeys	22	18							11,164	22	18					7,030	8.8
Extension	41	19							1,365	41	19					951	13.0
Sum	20,851	15,463	0	0	0				12,529	20,851	15,463	0	0	0		7,982	9.2

SITE-WIDE ENERGY CONSUMPTION AND CO_2 ANALYSIS

Use	Total Area (m^2)	Calculated BER 2012 ($kgCO_2$ / m^2)	-	REGULATED ENERGY CONSUMPTION: Space Heating (kWh p.a.)		Domestic Hot Water (kWh p.a.)		Space and Domestic Hot Water from CHP (kWh p.a.)		Electricity generated by CHP (kWh p.a.) if applicable	Secondary Heating System (kWh p.a.)		Lighting (kWh p.a.)	Auxiliary (kWh p.a.)	Cooling (kWh p.a.)
Sum	872	14.4	-	20,851		1,979		0		0	0		10,844	0	2,640

REGULATED CO_2 EMISSIONS: 2012 CO_2 emissions ($kgCO_2$ p.a.)	REGULATED CO_2 EMISSIONS PER UNIT: SAP 10.0 CO_2 emissions ($kgCO_2$ p.a.)	Calculated BER SAP 10.0 ($kgCO_2$ / m^2)
12,529	7,982	9.2

NON-DOMESTIC ENERGY CONSUMPTION AND CO_2 ANALYSIS

VALIDATION CHECK / REGULATED ENERGY CONSUMPTION BY END USE (kWh/m² p.a.) 'BE GREEN' BER - SOURCE: BRUKL OUTPUT

Use	Area per unit (m²)	Number of units	Total area represented by model (m²)	Calculated BER 2012 ($kgCO_2 / m^2$)	BRUKL BER 2012 ($kgCO_2 / m^2$)	Space Heating (kWh/m² p.a.)	Fuel type Space Heating	Domestic Hot Water (kWh/m² p.a.)	Fuel type Domestic Hot Water	N/A	N/A	N/A	N/A	N/A	N/A	Electricity generated by CHP (-) if applicable	N/A	N/A	Electricity generated by renewable technology (-) if applicable	Lighting (kWh/m² p.a.)	Auxiliary (kWh/m² p.a.)	Cooling (kWh/m² p.a.)
Existing Storeys	799	1	799	13.4	13.4	8.2	Grid Electricity	2.27	Grid Electricity											12.43	0	2.92
Extension	73	1	73	17.6	17.6	14.93	Grid Electricity	2.26	Grid Electricity											12.72	0	3.99
Sum	872	2	872	13.8	-	7,642	N/A	1,979	N/A							0			0	10,860	0	2,624

REGULATED ENERGY CONSUMPTION BY FUEL TYPE (kWh/m² p.a.) 'BE GREEN' BER - SOURCE: BRUKL.INP or *SIM.CSV FILE

Use	Natural Gas	Grid Electricity	Bespoke DH Factor	Electricity generated by CHP (-) if applicable	Electricity generated by renewable technology (-) if applicable	Enter Carbon Factor 1	Enter Carbon Factor 2	Enter Carbon Factor 3	Equipment	2012 CO_2 emissions ($kgCO_2$ p.a.)
	0.216 $kgCO_2$/kWh	0.519 $kgCO_2$/kWh	0.000 $kgCO_2$/kWh	0.519 $kgCO_2$/kWh	0.519 $kgCO_2$/kWh	0.000 $kgCO_2$/kWh	0.000 $kgCO_2$/kWh	0.000 $kgCO_2$/kWh	0.519 $kgCO_2$/kWh	
Existing Storeys		26								10,707
Extension		34								1,284
Sum	0	23,105	0	0	0	0	0	0	0	11,991

REGULATED CO_2 EMISSIONS PER UNIT

Use	Natural Gas	Grid Electricity	Bespoke DH Factor	Electricity generated by CHP (-) if applicable	Electricity generated by renewable technology (-) if applicable	Enter Carbon Factor 1	Enter Carbon Factor 2	Enter Carbon Factor 3	Equipment	SAP 10.0 CO_2 emissions	BRUKL BER SAP 10.0 ($kgCO_2 / m^2$)
	0.210 $kgCO_2$/kWh	0.233 $kgCO_2$/kWh	0.000 $kgCO_2$/kWh	0.233 $kgCO_2$/kWh	0.233 $kgCO_2$/kWh	0.000 $kgCO_2$/kWh	0.000 $kgCO_2$/kWh	0.000 $kgCO_2$/kWh	0.233 $kgCO_2$/kWh		
Existing Storeys		26								4,807	6.0
Extension		34								577	7.9
Sum	0	23,105	0	0	0	0	0	0	0	5,383	6.2

SITE-WIDE ENERGY CONSUMPTION AND CO_2 ANALYSIS

REGULATED ENERGY CONSUMPTION / REGULATED CO_2 EMISSIONS

Use	Total Area (m²)	Calculated BER 2012 ($kgCO_2 / m^2$)	-	Space Heating (kWh p.a.)	N/A	Domestic Hot Water (kWh p.a.)	N/A	Space Heating (Heat source 2) (kWh p.a.)	N/A	Domestic Hot Water (Heat source 2) (kWh p.a.)	N/A	Space and Domestic Hot Water from CHP (kWh p.a.)	N/A	Electricity generated by CHP (kWh p.a.) if applicable	Secondary Heating system (kWh p.a.)	N/A	Electricity generated by renewable (kWh p.a.) if applicable	Lighting (kWh p.a.)	Auxiliary (kWh p.a.)	Cooling (kWh p.a.)	2012 CO_2 emissions	N/A	SAP 10.0 CO_2 emissions	Calculated BER SAP 10.0 ($kgCO_2 / m^2$)
Sum	872	13.8	-	7,642		1,979		0		0		0		0	0		0	10,860	0	2,624	11,991		5,383	6.2

SAP 2012 Performance

Domestic

Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for domestic buildings

	Carbon Dioxide Emissions for domestic buildings (Tonnes CO_2 per annum)	
	Regulated	**Unregulated**
Baseline: Part L 2013 of the Building Regulations Compliant Development	0.0	
After energy demand reduction (be lean)	0.0	
After heat network connection (be clean)	0.0	
After renewable energy (be green)	0.0	

Table 2: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for domestic buildings

	Regulated domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	**(%)**
Be lean: savings from energy demand reduction	0.0	0%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	0.0	0%
Cumulative on site savings	**0.0**	**0%**
Annual savings from off-set payment	0.0	-
	(Tonnes CO_2)	
Cumulative savings for off-set payment	**0**	-
Cash in-lieu contribution (£)	**0**	

*carbon price is based on GLA recommended price of £95 per tonne of carbon dioxide unless Local Planning Authority price is inputted in the 'Development Information' tab

SAP 10.0 Performance

Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for domestic buildings

	Carbon Dioxide Emissions for domestic buildings (Tonnes CO_2 per annum)	
	Regulated	**Unregulated**
Baseline: Part L 2013 of the Building Regulations Compliant Development	0.0	
After energy demand reduction (be lean)	0.0	
After heat network connection (be clean)	0.0	
After renewable energy (be green)	0.0	

Table 2: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for domestic buildings

	Regulated domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	**(%)**
Be lean: Savings from energy demand reduction	0.0	0%
Be clean: Savings from heat network	0.0	0%
Be green: Savings from renewable energy	0.0	0%
Cumulative on site savings	**0.0**	**0%**
Annual savings from off-set payment	0.0	-
	(Tonnes CO_2)	
Cumulative savings for off-set payment	**0**	-
Cash in-lieu contribution (£)	**0**	

*carbon price is based on GLA recommended price of £95 per tonne of carbon dioxide unless Local Planning Authority price is inputted in the 'Development Information' tab

Non-domestic

Table 3: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for non-domestic buildings

	Carbon Dioxide Emissions for non-domestic buildings (Tonnes CO_2 per annum)	
	Regulated	**Unregulated**
Baseline: Part L 2013 of the Building Regulations Compliant Development	25.1	
After energy demand reduction (be lean)	12.5	
After heat network connection (be clean)	12.5	
After renewable energy (be green)	12.0	

Table 4: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for non-domestic buildings

	Regulated non-domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	**(%)**
Be lean: savings from energy demand reduction	12.6	50%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	0.5	2%
Total Cumulative Savings	**13.1**	**52%**
Annual savings from off-set payment	12.0	-
	(Tonnes CO_2)	
Cumulative savings for off-set payment	**360**	-
Cash in-lieu contribution (£)	**34,176**	

*carbon price is based on GLA recommended price of £95 per tonne of carbon dioxide unless Local Planning Authority price is inputted in the 'Development Information' tab

Table 3: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for non-domestic buildings

	Carbon Dioxide Emissions for non-domestic buildings (Tonnes CO_2 per annum)	
	Regulated	**Unregulated**
Baseline: Part L 2013 of the Building Regulations Compliant Development	13.8	8.3
After energy demand reduction (be lean)	8.0	8.3
After heat network connection (be clean)	8.0	8.3
After renewable energy (be green)	5.4	8.3

Table 4: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for non-domestic buildings

	Regulated non-domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	**(%)**
Be lean: savings from energy demand reduction	5.8	42%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	2.6	19%
Total Cumulative Savings	**8.4**	**61%**
Annual savings from off-set payment	5.4	-
	(Tonnes CO_2)	
Cumulative savings for off-set payment	**162**	-
Cash in-lieu contribution (£)*	**15,343**	

*carbon price is based on GLA recommended price of £95 per tonne of carbon dioxide unless Local Planning Authority price is inputted in the 'Development Information' tab

SITE-WIDE

	Total regulated emissions (Tonnes CO_2 / year)	CO_2 savings (Tonnes CO_2 / year)	Percentage savings (%)
Part L 2013 baseline	25.1		
Be lean	12.5	12.6	50%
Be clean	12.5	0.0	0%
Be green	12.0	0.5	2%
Total Savings	-	13.1	52%
	-	**CO_2 savings off-set (Tonnes CO_2)**	-
Off-set	-	**359.7**	-

	Total regulated emissions (Tonnes CO_2 / year)	CO_2 savings (Tonnes CO_2 / year)	Percentage savings (%)
Part L 2013 baseline	13.8		
Be lean	8.0	5.8	42%
Be clean	8.0	0.0	0%
Be green	5.4	2.6	19%
Total Savings	-	8.4	61%
	-	**CO_2 savings off-set (Tonnes CO_2)**	-
Off-set	-	**161.5**	-

	Target Fabric Energy Efficiency (kWh/m²)	Dwelling Fabric Energy Efficiency (kWh/m²)	Improvement (%)
Development total	0.00	0.00	

	Area weighted non-domestic cooling demand (MJ/m²)	Total area weighted non-domestic cooling demand (MJ/year)
Actual		
Notional