Hurley Palmer Flatt.

Energy Statement

Symes Mews, Camden
Malcom Hollis

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1 EXECUTIVE SUMMARY

Hurley Palmer Flatt has been instructed to provide an Energy Statement for the proposed Symes Mews development, located within the Borough of Camden. The approach taken for the energy assessment is in line with GLA London Plan (2019) planning policies for energy.

This Energy Statement document follows the approach to energy statements as detailed in the "GLA Guidance on preparing energy assessments October 2018".

It is proposed for the three-storey building to change its usage type from gallery to office. The roof and windows are to be refurbished and a new LTHW system installed to provide the space heating and domestic hot water. Manually operable windows will provide fresh air and cooling to the spaces. No artificial cooling is to be provided.

Due to the nature of the refurbishment the project will be assessed using UK Building Regulations Part L2B 2013 – Existing Buildings Other than Dwellings.

As well as Part L2B compliance, Camden council require a 35% reduction in carbon emissions. In order to calculate the predicted carbon savings of the proposed development refurbishment a baseline building accounting for the existing conditions has been modelled and the carbon savings from the proposed development against this existing building have been assessed in line with the methodology set out in section 4.9 Part L2B.

The proposed development will aspire to meet the intent of policy by delivering a minimum on-site carbon dioxide emissions reduction of 35% over a baseline building (existing conditions), based on the approach, information, analysis and contents reported in this document.

The figure below shows the carbon savings for each step in the GLAs suggested hierarchy for carbon savings. The current predicted site total savings are 47.6%.

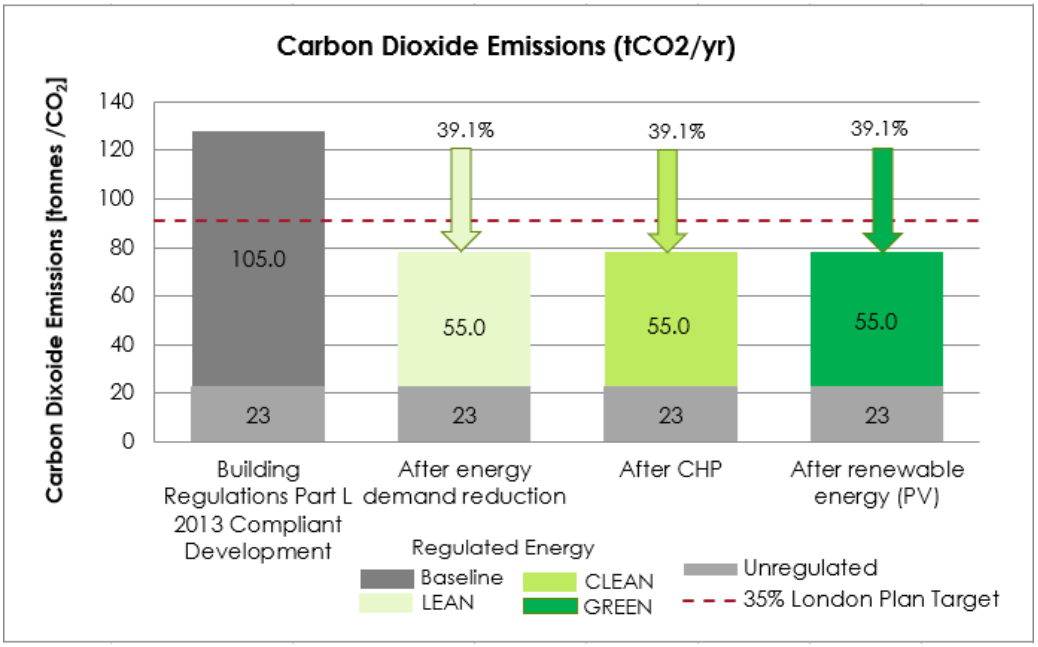


Table 1: Summary of total carbon dioxide emissions for each stage of the hierarchy

	Carbon Dioxide Emissions (tCO_2/yr)		
	Regulated	Unregulated	Total
Baseline Existing Building (TER)	105.0	23.0	128.1
Be Lean - Local Gas Boilers	55.0	23.0	78.1
Be Clean	55.0	23.0	78.1
Be Green	55.0	23.0	78.1

Table 2: Summary of carbon dioxide emissions savings for each stage of the hierarchy

Savings from:	Regulated carbon dioxide savings	
	Tonnes CO_2 per annum	(%)
Be Lean - Local Gas Boilers	50.0	47.6%
Be Clean	0.0	0.0%
Be Green	0.0	0.0%
Total cumulative savings	**50.0**	**47.6%**

2 INTRODUCTION

Hurley Palmer Flatt has been instructed to provide an Energy Statement for the proposed Symes Mews development, located within the Borough of Camden. The report details the assessment process and the estimated CO_2 savings achieved through integration of passive design, energy efficiency measures and Low and Zero Carbon (LZC) technology. It also sets out how the Greater London Authority (GLA) London Plan (2019) and Camden Council policies on energy and CO_2 emissions have been addressed.

The approach taken for the energy assessment is in line with GLA London Plan (2019) planning policies for energy as follows:

- Calculate baseline CO_2 emissions;
- Integrate measures to reduce energy demand and ensure efficient use of energy;
- Connect to a heat distribution network where possible
- Integrate renewable energy technology; and
- Calculate total CO_2 savings and final development CO_2 emissions.

2.1 Project Background

The proposed scheme is an office refurbishment within Camden Council. It is a conversion of a three-storey gallery space with some bedrooms and office into office space. The building is retaining the external façade and the crittall windows on the north façade, the roof is being replaced.

Figure 1: Photo of the current space

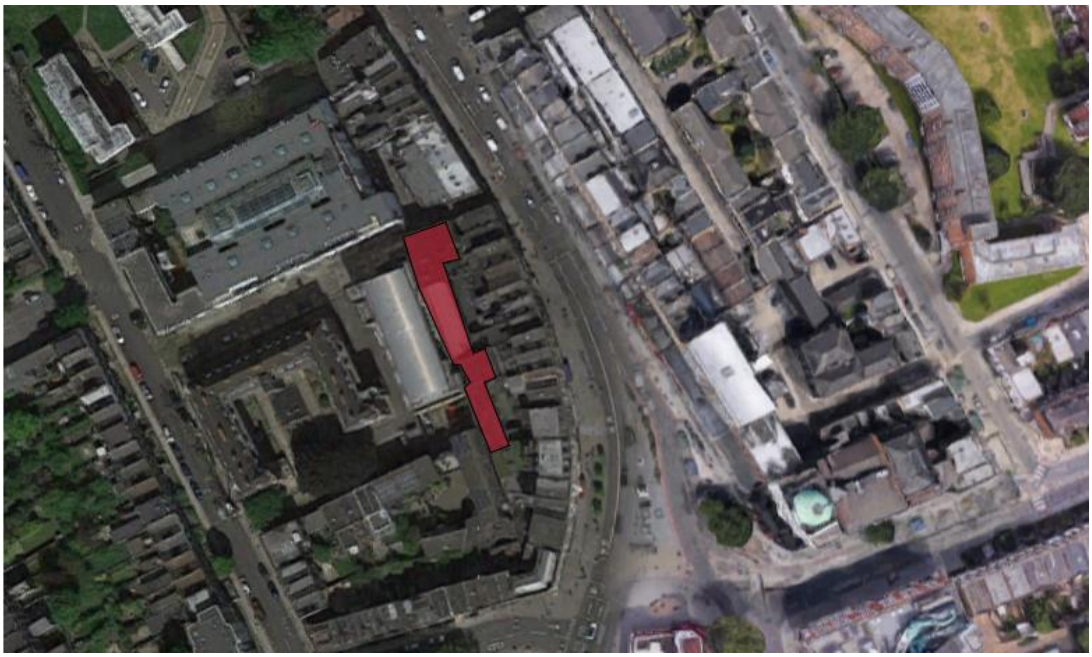


Figure 2: Development Site Location

The calculations in this Energy Statement are based on the drawings issued by pH+ on 5th November 2018.

Table 3: Schedule of areas based on NIA

Zone	Gross Internal Area (GIA) m^2
Office	1,149

3 PLANNING POLICY AND BUILDING REGULATION TARGETS

The development has been designed to meet sustainability and energy targets which are driven through:

1. UK Building Regulations Part L2B – Existing Buildings other than Dwellings
2. Greater London Authority (GLA) London Plan and relevant SPG's/SPD's;
3. Camden Council

3.1 Building Regulation Part L Summary

The development will comply with building regulation Part L 2013 (Conservation of fuel and power in buildings).

a. Part L2B (Existing Buildings other than Dwellings): applies to the existing areas of the development (i.e. all non-dwelling areas).

For this project consequential improvements have not been triggered as:

- there is no added extension
- no provision of an initial fixed service
- no increase in the installed capacity of a fixed building service.

Section 4.9 Whole Building Calculation Method will be used to assess carbon emission savings

"Where even greater design flexibility is required reasonable provisions would be to use an approved calculation tool to demonstrate that the calculated CO_2 emissions for the building and proposed extension are no greater than for the building plus a notional extension complying with the standards of paragraphs 4.3 to 4.5"

In this case none of the improvements to the existing building will be included in the baseline model as there are no consequential improvements. All can be counted in the proposed design and carbon emissions savings calculation.

3.2 Greater London Authority (GLA) London Plan

The Greater London Authority (GLA) has set out guidance relating to sustainable design within the London Plan (Spatial Development Strategy for Greater London). The current adopted London plan is dated March 2016, however in January 2019 policy 5.2 has been updated, Camden Council follows the GLA policies and these are detailed below:

Policy 5.2 Minimising carbon dioxide emissions

Current Planning decisions

A. Development proposals should make the fullest contribution to minimising carbon dioxide emissions in accordance with the following energy hierarchy:

   1) Be lean: use less energy
   2) Be clean: supply energy efficiently
   3) Be green: use renewable energy

B. The Mayor will work with boroughs and developers to ensure that major developments meet the following targets for carbon dioxide emissions reduction in buildings. These targets are expressed as minimum

improvements over the Target Emission Rate (TER) outlined in the national Building Regulations leading to zero carbon residential buildings from 2016 and zero carbon non-domestic buildings from 2019.

Non-Domestic Buildings: - Year Improvement on 2013 Building Regulations

- 2010 – 2013 | 25 per cent
- 2013 – 2016 | 35 per cent
- 2016 – 2019 | As per building regulations requirements
- 2019 – 2031 | Zero carbon

C. Major development proposals should include a detailed energy assessment to demonstrate how the targets for carbon dioxide emissions reduction outlined above are to be met within the framework of the energy hierarchy.

D. As a minimum, energy assessments should include the following details:

1) calculation of the energy demand and carbon dioxide emissions covered by the Building Regulations and, separately, the energy demand and carbon dioxide emissions from any other part of the development, including plant or equipment, that are not covered by the Building Regulations (see paragraph 5.22) at each stage of the energy hierarchy

2) proposals to reduce carbon dioxide emissions through the energy efficient design of the site, buildings and services

3) proposals to further reduce carbon dioxide emissions through the use of decentralised energy where feasible, such as district heating and cooling and combined heat and power (CHP)

4) proposals to further reduce carbon dioxide emissions through the use of on-site renewable energy technologies.

E. The carbon dioxide reduction targets should be met on-site. Where it is clearly demonstrated that the specific targets cannot be fully achieved on-site, any shortfall may be provided off-site or through a cash in lieu contribution to the relevant borough to be ring fenced to secure delivery of carbon dioxide savings elsewhere.

UPDATES January 2019.
The latest version of the guidance contains a number of updates, including:

- From January 2019, planning applicants are encouraged to use updated (SAP 10) carbon emission factors to assess the expected carbon performance of a new development. Applicants should continue to use the current Building Regulations methodology for estimating energy performance against Part L 2013 requirements (as outlined in Section 6) but with the outputs manually converted for the SAP 10 emission factors. A spreadsheet (version 1.1) has been developed for this purpose which should be submitted alongside an energy assessment. It should be noted that the use of the SAP 10 emission factors in this context is for demonstrating performance against planning policy targets and, as such, is separate to Building Regulation compliance. Applications should therefore ensure that compliance with Building Regulations is maintained.
- Reference is made to the latest CIBSE TM59 overheating guidance which should be used for all residential planning applications

- Updated information requirements for applicants proposing to install heat pumps and CHP, including clarification on when CHP is appropriate.
- An appendix containing the existing emission limits for heating and energy plant has been added.

Policy 5.6 Decentralised energy in development proposals

Planning decisions

A. Development proposals should evaluate the feasibility of Combined Heat and Power (CHP) systems, and where a new CHP system is appropriate also examine opportunities to extend the system beyond the site boundary to adjacent sites.

B. Major development proposals should select energy systems in accordance with the following hierarchy:

1) Connection to existing heating or cooling networks
2) Site wide CHP network
3) Communal heating and cooling

C. Potential opportunities to meet the first priority in this hierarchy are outlined in the London Heat Map tool. Where future network opportunities are identified, proposals should be designed to connect to these networks.

Policy 5.7 Renewable energy

Strategic

A. The Mayor seeks to increase the proportion of energy generated from renewable sources and expects that the projections for installed renewable energy capacity outlined in the Climate Change Mitigation and Energy Strategy and in supplementary planning guidance will be achieved in London.

Planning decisions

B. Within the framework of the energy hierarchy (see Policy 5.2), major development proposals should provide a reduction in expected carbon dioxide emissions through the use of on-site renewable energy generation, where feasible.

Policy 5.9 Overheating and cooling

Strategic

A. The Mayor seeks to reduce the impact of the urban heat island effect in London and encourages the design of places and spaces to avoid overheating and excessive heat generation, and to reduce overheating due to the impacts of climate change and the urban heat island effect on an area wide basis.

Planning decisions

B. Major development proposals should reduce potential overheating and reliance on air conditioning systems and demonstrate this in accordance with the following cooling hierarchy:

1) Minimise internal heat generation through energy efficient design
2) Reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and walls
3) Manage the heat within the building through exposed internal thermal mass and high ceilings
4) Passive ventilation
5) Mechanical ventilation
6) Active cooling systems (ensuring they are the lowest carbon options).

C. Major development proposals should demonstrate how the design, materials, construction and operation of the development would minimise overheating and also meet its cooling needs. New development in London should also be designed to avoid the need for energy intensive air conditioning systems as much as possible. Further details and guidance regarding overheating and cooling are outlined in the London Climate Change Adaptation Strategy.

3.3 Camden Council Policy

Policy CC1 Climate change mitigation

The Council will require all development to minimise the effects of climate change and encourage all developments to meet the highest feasible environmental standards that are financially viable during construction and occupation.

We will:

a. promote zero carbon development and require all development to reduce carbon dioxide emissions through following the steps in the energy hierarchy;
b. require all major development to demonstrate how London Plan targets for carbon dioxide emissions have been met;
c. ensure that the location of development and mix of land uses minimise the need to travel by car and help to support decentralised energy networks;
d. support and encourage sensitive energy efficiency improvements to existing buildings;
e. require all proposals that involve substantial demolition to demonstrate that it is not possible to retain and improve the existing building; and
f. expect all developments to optimise resource efficiency.

For decentralised energy networks, we will promote decentralised energy by:

g. working with local organisations and developers to implement decentralised energy networks in the parts of Camden most likely to support them;

h. protecting existing decentralised energy networks (e.g. at Gower Street, Bloomsbury, King's Cross, Gospel Oak and Somers Town) and safeguarding potential network routes; and

i. requiring all major developments to assess the feasibility of connecting to an existing decentralised energy network, or where this is not possible establishing a new network.

To ensure that the Council can monitor the effectiveness of renewable and low carbon technologies, major developments will be required to install appropriate monitoring equipment.

Note:

1. All developments over 500m^2 must follow the energy hierarchy.
2. The Council will expect developments of five or more dwellings and/or more than 500m^2 of any gross internal floorspace to achieve a 20% reduction in carbon dioxide emissions from on-site renewable energy generation

4 ENERGY HIERARCHY AND OVERHEATING

4.1 Carbon emission factors

As this development is not referable to the GLA the carbon emission factors are based upon the Part L 2013 published figures:

Table 4: Carbon Emissions Factors

Gas	0.216	$kgCO_2/kWh$
Grid Supplied Electricity	0.519	$kgCO_2/kWh$
Grid Displaced Electricity	0.519	$kgCO_2/kWh$

4.2 Establishing CO_2 Emissions

Table 5 Regulated carbon dioxide savings from each stage of the energy hierarchy for non-domestic buildings

Regulated non-domestic carbon dioxide savings		
	(Tonnes CO2 per annum)	(%)
Be lean: Savings from energy demand reduction	50.0	47.6%
Be clean: Savings from heat network	0.0	0.0%
Be green: Savings from renewable energy	0.0	0.0%
Cumulative on-site savings	**50.0**	**47.6%**

The development meets the 35% reduction target and so the shortfall in regulated carbon dioxide savings calculation has not been included.

4.3 Calculating Regulated CO_2 Emissions for refurbishments

The strategy considers the existing building in its existing condition as the baseline following the guidance in Part L2B section 4.9 and GLA energy assessments, which has been defined for the commercial (non-residential) building on the site, as follows:

Existing commercial (non-residential) – Part L2B (2013)
Commercial (non-residential) areas within the development have been modelled using Integrated Environmental Solutions (IES), Virtual Environment software 2014. This software creates a dynamic thermal model of the building, using ApacheSIM to calculate the building's loads, energy consumption and resulting CO_2 emissions. This software calculates the Building CO_2 Emissions Rate (BER) and Notional Target Emission Rate (TER) using the Building Regulations 2013 methodology based on the National Calculation Methodology (NCM).

In the case of the proposed scheme, as consequential improvements have not been triggered, the following two models are produced:

1. Baseline – Building in existing condition with
    - Existing façade performance
    - Existing Plant types and efficiencies

- New Proposed usage types

2. Proposed – Building with its newly proposed design
    - New Proposed façade performance
    - New Proposed Plant types and efficiencies
    - New Proposed usage types
    -

These are both run using the NCM methodology and their resulting Building Energy Rates (BER) are compared to predict the carbon emissions savings.

4.3.1 Energy Models

IES calculates regulated energy consumption i.e. energy uses considered under Part L 2013, for example heating, cooling, domestic hot water (DHW), pumps and fans, and electricity for lighting. Unregulated energy consumption includes all energy not considered under Part L 2013, for example, gas for catering, small power, lifts, and external lighting. An IES dynamic thermal model was created for all non-domestic spaces to predict the energy consumption and associated carbon emissions to provide a total development carbon footprint.

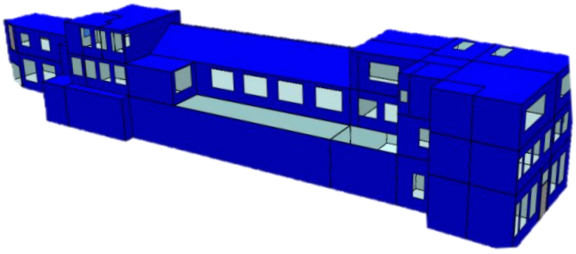


Figure 3: IES-VE model street East facing facade

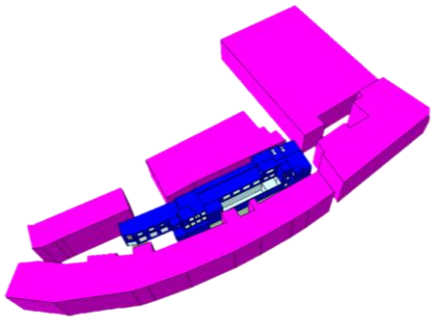


Figure 4: IES-VE model back

4.4 Baseline Energy Consumption and CO_2 Emissions

The tables below demonstrate the CO_2 emissions for Symes Mews

Table 6: CO_2 Emissions for the Baseline Scheme Non-Domestic

BASELINE (Office)	Carbon dioxide emissions [tCO2/yr]		Carbon dioxide emissions [% of total]	
	Regulated	Unregulated	Regulated	Unregulated
Baseline	105.0	23	82%	18%

The baseline CO_2 emissions are **128 tCO_2** (regulated energy uses).

4.5 Demand Reduction (BE LEAN)

As this development is not referable to the GLA it is not required to meet the 15% improvement on building regulations for the LEAN part of the hierarchy. Although not required this development does meet this target.

A key element of the energy strategy has been to maximise the energy efficiency of the building through passive design and efficient servicing. The measures included within the design are described in detail below.

4.5.1 Form and Façade

The existing building has a brick and concrete façade with single pane windows. The roof is being refurbished and insulation will be added. Alongside this all of the windows will be replaced with energy efficient double glazing except for the crittall windows on the north façade. These updates to the building envelope will increase the energy efficiency of the space.

4.5.2 Optimise Criteria

The design team has looked for opportunities within the design to reduce the heating and cooling loads within the building. Examples of where this has had an impact on the design include the following:

- Optimisation of the lighting strategy has meant that sizable heat loads are removed from the building, negating the requirement for excessive cooling;
- Increasing the performance of the roof will reduce the space heating loads in winter and cooling loads in summer.

4.5.3 Building Fabric and Passive Design

The following table shows the u-values and air permeability of the existing building and the proposed design

Table 7: Target Fabric and Glazing Specifications

Element		Target and proposed Fabric Targets	
		Existing Building u-values	Proposed Building u-value Targets
External Wall	u-value	1.49 W/m^2.K	1.49 W/m^2.K
Ground Floor	u-value	0.80 W/m^2.K	0.80 W/m^2.K
Roof	u-value	0.41 W/m^2.K	0.18 W/m^2.K
Windows	u-value	4.13 W/m^2.K	1.80 W/m^2.K
	g-value	0.60	0.40
Doors	u-value	5.09 W/m^2.K	5.09 W/m^2.K
Air permeability		10 m^3/m^2/hr @ 50Pa	5 m^3/m^2/hr @ 50Pa
Thermal bridging allowance from cold bridges		10% of u-value	10% of u-value

4.5.4 Energy Efficient Building Services

The following energy efficiency measures within the building services are proposed for the development:

- Highly efficient lighting to be specified with luminous efficacy of 100 lm/W for all office areas.
- Lighting to all other areas of the buildings will be highly efficient and incorporate occupancy sensors where applicable.
- Space heating will be low temperature hot water provided through an efficient boiler.

Whilst these are the design standards currently targeted, their achievability will be reviewed through detailed design stages to ensure the overall CO_2 reduction will remain at the targeted 35% over the existing building target, and to consider any design changes.

Table 8 Details of the Lighting inputs

Usage Type	Averaged lighting power density lm/W	Local Manual Switching	Constant illuminance control* [Y/N]	Occupancy Sensor Type / Controls	Automatic Daylighting Control [Y/N]	Daylight Control Type Switching/Dimming	Daylight Sensor Type (Standalone / Addressable)
Office	100	Local PIR Switching	Y	Auto-On-Off (0.9)	Y	Dimming (Daylight only) Rest shall be switched via PIR	Addressable
Circulation	90	Local PIR Switching	Y	Auto-On-Off (0.9)	N	N/A	Addressable
kitchens	60	manual	Y	None (0.1)	N	N/A	Strand Alone
Reception / Entrance	60	Local PIR Switching	Y	Auto-On-Off (0.9)	N	N/A	Strand Alone
Toliet	90	Local PIR Switching	Y	Auto-On-Off (0.9)	N	N/A	Strand Alone

Table 9: Details of the HVAC Inputs

Description	Units	Office/Gallery/Bedrooms and Kitchens Existing	Office / Kitchen Proposed
System Description			
Outdoor air delivery (Ventilation)		Natural Ventilation	Natural Ventilation
Central Plant		none	Gas Boiler
Room Conditioning Heating		Electric Panel Radiator	Radiator
Room Conditioning Cooling		Open Windows	Open Windows
Plant Heating Details			
Heating system type (in model)		Electric panel radiators (100% efficient)	LTHW system, gas boiler w/Radiators
Heat Fuel Type		Electricity	Gas
Heat generator seasonal efficiency	SCOP/%	100	92%
Boiler installed on or after 1998?	Yes/No	n/a	yes
Plant Cooling Details			
Cooling system type (in model)		open windows	open windows
Ventilation / AHU			
System Type		Open Windows	Open Windows
8. DHW			

DHW system type		Electric	From main boiler
DHW system delivery efficiency	%	100%	92%
DHW Fuel Type	Elec/gas	Electricity	Gas
Is the system a storage system?	Yes/No	no	yes
10. Building Management			
Lighting systems have provision for metering?	Yes/No	no	no
Lighting systems metering warns of 'out of range' values?	Yes/No	no	no
11. LZC technologies			
Low carbon and renewable technologies		none	None

4.5.5 Be Lean Energy Consumption and CO_2 Emissions

The IES model has been run to calculate the resulting energy consumption and CO_2 emissions considering the passive design and energy efficiency measures detailed within the previous section.

Referring to the baseline scheme, the resulting CO_2 savings for the energy efficient scheme are detailed in the table below:

Table 10 CO2 savings for the Site-wide Be Lean

'Be Lean' Office	Carbon Dioxide Emissions (tCO_2/yr)		
	Regulated	Unregulated	Total
Emissions after demand reduction (tCO_2/yr)	55.0	23	78.1
Savings (tCO_2/yr)	50.0	0	50.0
Savings (%)	47.6%	0.0%	39.1%

The above table demonstrates that there is up to a **47.6% reduction in regulated CO_2** emissions over the existing building for the development, which reduces to a 39.1% reduction when unregulated emissions are considered.

4.6 Cooling and Overheating

Supplementary Planning Guidance encourages developers to undertake dynamic modelling to assess the risk of overheating in their development. Such an assessment is generally an expectation of the GLA regarding Policy 5.9 'Overheating and Cooling' under climate change adaptation, as stated in GLA's energy planning guidance document dated March 2016.

Minimising internal heat generation through energy efficient design:	Minimal infrastructure will be in place in the building
Reducing the amount of heat entering the building in summer	Maximising fabric efficiency and replacing windows will reduce the solar load entering the building. As well as there being limited windows on the south and west facades of the building
Use of thermal mass and high ceilings to manage the heat within the building:	The building has a brick construction which will allow any summer heat to be absorbed during peak times and released in the evenings, one of

	the main office spaces has a double height ceiling which will allow the heat to rise and the space to remain cool in the summer
Passive Ventilation	The cooling strategy for the building is openable windows, this will help keep the space cool and remove the need for mechanical cooling to be added to the office spaces
Mechanical Ventilation	Cooling is anticipated to be done through operable windows only.

Table 11 Reporting template for cooling demand

	Area weighted average non-domestic cooling demand (MJ/m^2)	Total area weighted non-domestic cooling demand (MJ/year)
Actual (Proposed)	0	0
Notional (Existing)	0	0

All spaces pass except one of the open office spaces Criterion 3 as shown in the BRUKL in appendix A. The open office space fails by a very small amount 0.7% and this could possibly be mitigated through the introduction of blinds or a slight reduction in g-value, mitigation could also be sought from building control.

4.7 Heating Infrastructure (BE CLEAN)

The second stage of the 'Be Lean', 'Be Clean', and 'Be Green' methodology concerns the heating infrastructure ('clean' solutions) and follows the hierarchy which have been assessed for this development:

1. Connection to an area wide heat network
2. Communal heating system
3. Individual heating system

4.7.1 Connection to an area wide heat network

The district heating network in Camden does not currently reach this building and so connection to a district heat network was not included in the design.

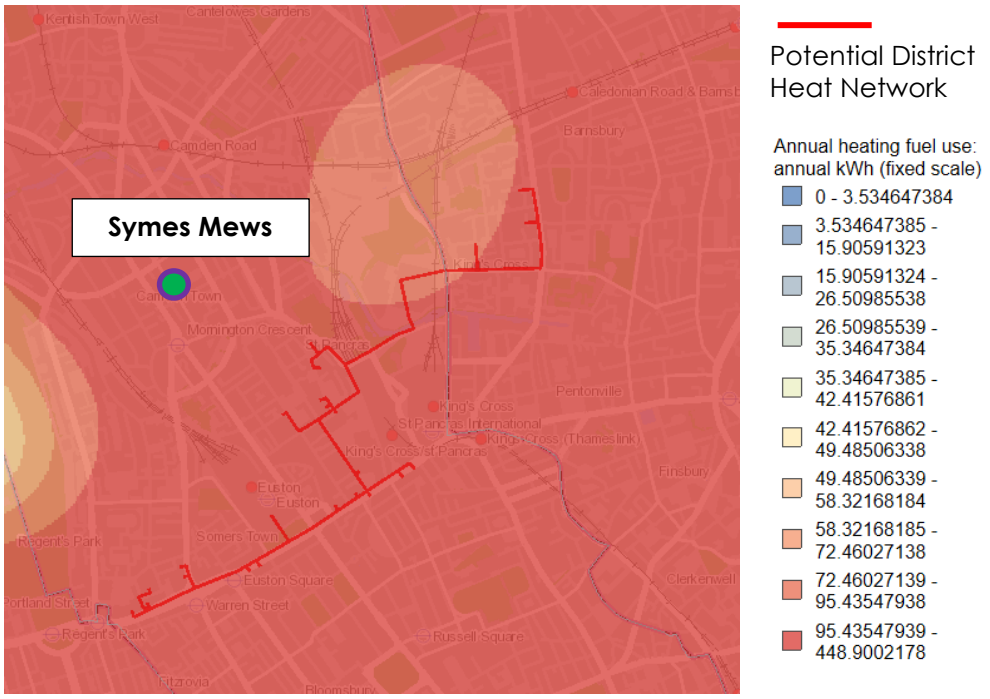


Figure 5: Heat Network Map Camden from https://www.london.gov.uk/what-we-do/environment/energy/london-heat-map/view-london-heat-map

4.7.2 Communal Heating System

The proposed development is a small single development and so will not be connected to a site wide communal heating system

4.7.3 Individual Heating System

The development is proposing to replace the direct electric heating system with a LTHW system which could be compatible with a district network connection should one become available and has a lower carbon emissions impact. The impact of the change in system has been included in the LEAN savings section.

4.7.4 'Be Clean' Energy Consumption and CO^2 Emissions

There are no savings associated with the 'Be Clean' level of the hierarchy as the change from direct electric heating system has been captured under the LEAN energy savings.

4.8 Renewable Energy (BE GREEN)

All Low or Zero Carbon (LZC) technologies identified within both the London Plan and BREEAM credit guidance have been assessed. Where technologies are not considered appropriate to the site and energy demand of the development, justification for their exclusion has been provided.

The following localised green technologies have been considered as non-viable for the site:

- Bio fuel combined heat and power (CHP) local in the building
- Biomass (CHP) local in the building
- Fuel Cells
- Biofuel community heating scheme local in the building
- VRF units

- Photovoltaics (with the possible inclusion of solar thermal)

4.8.1 Feasibility of Renewable Technologies

An initial assessment has been carried out to determine which technologies are technically feasible on the site. For technologies which are identified as feasible, the following factors have been considered to determine which technologies are appropriate in terms of economic and local planning feasibility:

- Energy generated from each LZC energy source per year
- Payback
- Land Use
- Local Planning Criteria
- Noise
- Life cycle cost/lifecycle impact of the potential specification in terms of carbon emissions
- Any available grants

4.8.2 Solar Panels

The site is surrounded by buildings and the length of the buildings faces East / West, this being the case, the roof tops will likely be shaded for the majority of the day and so solar panels have not been deemed feasible for this development.

The table below summarises the desktop study undertaken to determine the feasibility of solar photovoltaic panels at the site:

Table 18: Key considerations of solar technology

Technology	Criteria	Requirement Met?
Photovoltaic panels		
Roof orientation	Are available roofs facing south-west to south-east (through south), or flat?	✓
Roof space	Is there enough un-shaded roof area?	X
Electrical demand	Is there electrical demand on site?	✓

Technology	Criteria	Requirement Met?
Solar Thermal		
Roof orientation	Are available roofs facing south-west to south-east (through south), or flat?	✓
Roof space	Is there sufficient un-shaded roof area?	X
Hot water demand	Is there year-round hot water demand?	✓

Heating system	Would a solar thermal collector be compatible with the proposed heating system?	✓
Hot water storage	Is there space for a hot water storage vessel?	✓
Conflicts with other systems?	Will solar thermal conflict with other systems (e.g. PV) which are higher up the energy hierarchy?	X

4.8.3 Heat Pumps

The table below summarises the desktop study undertaken to determine the feasibility of heat pumps at the site:

Table 19: Key considerations of heat pump technology

Technology	Criteria	Requirement Met?
Heat distribution system	Is it possible to have a low-grade distribution system e.g. under floor heating?	✓
Heat distribution system	Is it compatible with the proposed cooling system?	X
Ground-source Heat Pump		
Ground conditions	Has a basic ground study concluded that the site is suitable for GSHP?	-
Horizontal piping	Is there a large area of open land where horizontal piping could be installed?	X
Vertical piping	Is the ground suitable for vertical piping? Can underground obstacles be avoided?	X
Plant room	Is there space allowed for a GSHP and associated auxiliary equipment?	X
Water-source Heat Pump		
Resource	Is there an available water source close to the site?	X
Access	Can the available water source be accessed?	X
Air Source Heat Pump		
Roof space	Is there available roof space for air-source heat pumps?	✓
Electrical Capacity	Is there sufficient electrical capacity for air-sourced heat pumps	X

4.8.4 Wind Turbines

The table below summarises the desktop study undertaken to determine the feasibility of either roof mounted or standalone wind turbines at the site:

Table 12: Key considerations of wind technology

Technology	Criteria	Requirement Met?
Stand-alone Wind Turbine		
Wind speed	Is average wind speed greater than 6m/s at hub height?	-
Clear air flow to turbine	Is the area free from obstructions that could cause turbulence?	X
Open land around proposed site	Is there sufficient open land for a turbine to be installed?	X
Distance to nearest property	Are surrounding properties far away enough to avoid noise disturbance?	X

4.8.5 Biofuel Community Heating Scheme

Wood chips / pellets would require many deliveries and storage, not compatible with a city centre location. Liquid biofuel requires less storage space and has been considered in further detail by the design team.

The biodiesel is typically tested against EN14214 and supplied as pure Biodiesel at B100. Certain suppliers have plans to supply liquid biodiesel to sites around London via tanker. The tanker is anticipated to be sized to hold between 3,000 and 5,000 litres per delivery. Once delivered, the fuel would be pumped to a holding tank onsite, so the location of this tank would need to be accommodated.

Suppliers link their prices to crude oil and kerosene, reviewing prices monthly against the Rotterdam Exchange which considers waste oil prices. As waste oil is now traded as a commodity, prices are high and subject to fluctuation.

Suppliers sell Biodiesel as both road transport fuel and heating oil. When sold as a road transport fuel, the supply company can claim a subsidy through the Renewable Transport Fuel Certificates (RTFC's). This subsidy is not available for biodiesel heating fuel so, to compensate, this additional cost is added into the fuel price and passed onto the client.

Typical prices of Biodiesel are based upon the supplier's fixed processing costs (15p) + RTFC (~25p) + price of waste cooking oil (variable, but potentially 45p – 60p). This means that the overall fuel cost is likely to be in the region of 85p - £1.00 per litre, compared to gas which is currently in the region of 30-50p per litre. Discussions with various suppliers determined that there is a lot of uncertainty regarding pricing in the market and this fuel price is likely to fluctuate over the next few years.

Liquid Biofuel, including FAME, are not currently included as recognised fuels within the Renewable Heat Incentive (RHI) Scheme, so unlike other renewable heating fuels, additional funding is not available.

Due to uncertainties in the market, regarding pricing and supply, as well as the demand from the transport industry, liquid biofuel is not recommended for the 27 Eccleston Place development.

The inclusion of centralised heating plant will ensure that biofuel technology could be implemented in the future if viability improves.

The table below summarises the desktop study undertaken to determine the feasibility of a biofuel heating scheme at the site:

Table 13: Key considerations of biofuel technology

Technology	Criteria	Requirement Met?
Woody Biomass		
Heat demand	Is there a year-round heat demand?	X
Supply chain	Is there an established supply chain in the local area?	-
Delivery logistics	Is the site accessible for deliveries? Is there sufficient space for a supply vehicle to access a biomass storage tank?	X
Storage	Is there sufficient space for fuel storage to allow a reasonable number of deliveries?	X
Plant room	Is there sufficient space for a biofuel boiler and associated auxiliary equipment?	X
Flue	Can the flue be designed to meet planning authority requirements?	-
Liquid Biofuel		
Heat demand	Is there a year-round heat demand?	X
Supply chain	Is there an established supply chain in the local area? And can the required quantities of biofuel be guaranteed?	-
Security of supply	Is the future supply of biofuel guaranteed?	-
Delivery logistics	Is the site accessible for deliveries? Is there sufficient space for a supply vehicle to access a biofuel storage tank?	X
Storage	Is there sufficient space for fuel storage to allow a reasonable number of deliveries?	X
Running costs	Are the high running costs acceptable?	-

4.8.6 Biofuel Combined Heat and Power (CHP)

A CHP system has been analysed and is not recommended for the site as there is no constant hot water baseload demand.

The inclusion of a centralised heating plant will ensure that biofuel technology could be implemented in the future, if viability improves.

4.8.7 Fuel Cells

The primary fuel source for fuel cells is hydrogen. This can be obtained (using a reformer) from a wide range of fuel supplies including natural gas, coal gas, methanol, landfill gas and other fuels containing hydrogen.

Fuel cells produce zero emissions (at the point of use) when running on pure hydrogen. However most building applications to date have involved the use of carbon-based fuels (primarily natural gas) requiring the use of a reformer. A consequence of the reforming process is the emission of carbon dioxide, although emissions are still lower than conventional combustion processes due to the higher operating efficiency of the fuel cell.

The efficiencies of fuel-cell plants are in the range of 40 to 55% (electrical power generation) and waste heat is generated making it a co-generation energy source.

There is not currently a hydrogen network in London, although there is a very good natural gas infrastructure hence most fuel cells operate using natural gas. Analysis has shown that the carbon savings realised from gas fired CHP outweigh those from a hydrogen fuel cell that is powered by natural gas due to the conversion process from gas to hydrogen.

The lower efficiencies when compared to a gas-fired CHP unit coupled with the higher capital costs mean that fuel cell technology is not considered appropriate at this time for Symes Mews.

The table below summarises the desktop study undertaken to determine the feasibility of fuel cell technology at the site:

Table 14: Key considerations of fuel cell technology

Technology	Criteria	Requirement Met?
Fuel Cells		
Fuel Supply	Is there a source of hydrogen available?	X
Fuel Supply	Is there an alternate fuel source available?	X
Plant room	Is there space allowed for a fuel cell and associated auxiliary equipment?	X

4.8.8 'Be Green' Energy Consumption and CO_2 Emissions

There are no savings associated with the 'Be Green' level of the hierarchy as no renewable technologies have been deemed viable for this development.

4.9 Total Carbon Emission Savings

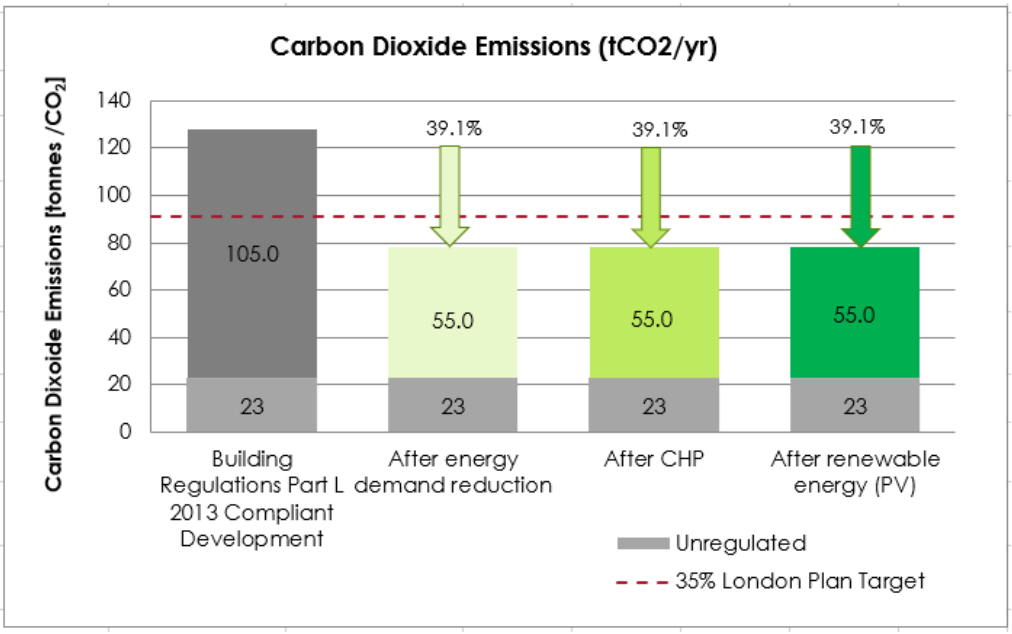
The total CO_2 savings achieved by the energy strategy are predicted as up to **55 tCO_2** when compared against the Part L 2013 baseline scenario. The tables below show the breakdown in predicted savings for each stage of the energy hierarchy. The combined savings equate to up to a predicted **47.6%** reduction in regulated CO_2 emissions over the baseline Part L 2013 compliant scheme.

Table 15: Summary of non-domestic regulated and unregulated CO_2 emissions savings

	Carbon Dioxide Emissions (tCO_2/yr)		
	Regulated	Unregulated	Total
Building Regulations Part L 2013 Compliant Development (TER)	105.0	23.0	128.1
Be Lean - Local Gas Boilers	55.0	23.0	78.1
Be Clean	55.0	23.0	78.1
Be Green	55.0	23.0	78.1

Table 16: Summary of non-domestic CO_2 emissions savings for each stage of the hierarchy

Savings from:	Regulated carbon dioxide savings	
	Tonnes CO_2 per annum	(%)
Be Lean - Local Gas Boilers	50.0	47.6%
Be Clean	0.0	0.0%
Be Green	0.0	0.0%
Total cumulative savings	**50.0**	**47.6%**



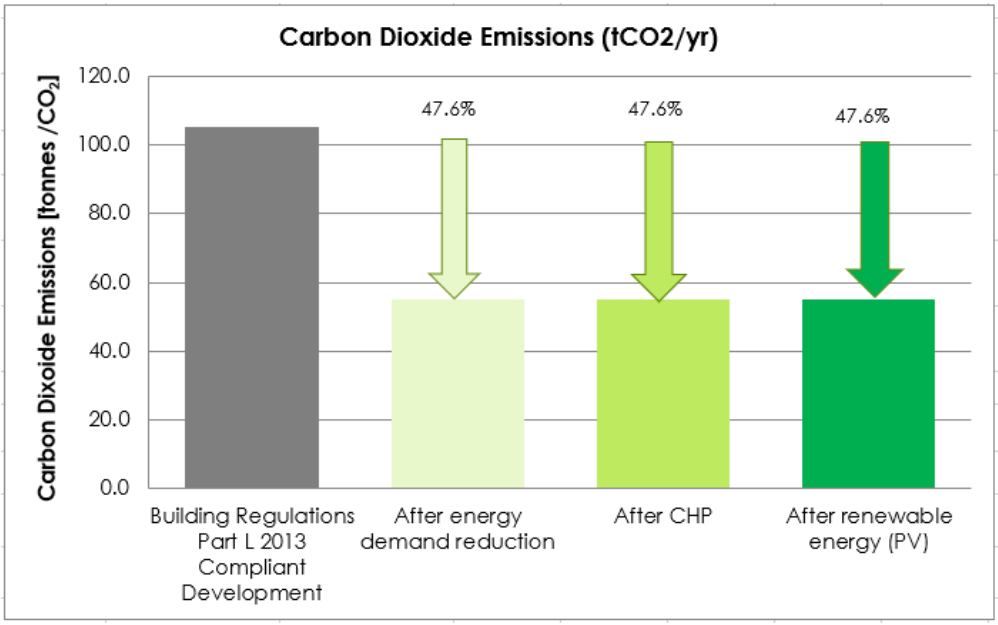


Figure 6: Summary of total carbon dioxide emissions for each stage of the hierarchy

APPENDIX A

COMPLIANCE RESULT BRUKL

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Symes Mews - Exisiting Building

As designed

Date: Tue Feb 12 11:06:30 2019

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.10

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.10

BRUKL compliance check version: v5.4.b.0

Owner Details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

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

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

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	23.2
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	23.2
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	86.1
Are emissions from the building less than or equal to the target?	BER > TER
Are as built details the same as used in the BER calculations?	Separate submission

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

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

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	1.49	1.49	00000008:Surf[3]
Floor	0.25	0.8	0.8	00000008:Surf[0]
Roof	0.25	0.41	0.41	00000004:Surf[1]
Windows***, roof windows, and rooflights	2.2	4.63	5.76	00000009:Surf[3]
Personnel doors	2.2	5.09	5.09	00000008:Surf[1]
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(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	10

Building services

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

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	>0.95

1- Electric Panel radiator system

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0	0	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

"No HWS in project, or hot water is provided by HVAC system"

Local mechanical ventilation, exhaust, and terminal units

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

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
01 Kitchen	-	-	1	-	-	-	-	-	-	-	N/A
02 Kitchen	-	-	1	-	-	-	-	-	-	-	N/A
00 Kitchen	-	-	1	-	-	-	-	-	-	-	N/A

General lighting and display lighting

	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
00 Entrance	-	52	15	156
00 Gallery02	36	-	-	2508
00 Gallery03a	36	-	-	1720
00 Misc	36	-	-	1322
00 Office1	36	-	-	400
00 OpenPlan2	36	-	-	1102
00 Stairs1	-	52	-	64
00 Store	36	-	-	178
00 WC1	-	52	-	162
00 WC2	-	52	-	140
01 Bedroom2	36	-	-	541
01 Gallery02	36	-	-	2445

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
01 Gallery3	36	-	-	1634
01 Kitchen	36	-	-	375
01 Office1	36	-	-	383
01 Stairs1	-	52	-	57
01 WC2	-	52	-	103
02 Bedroom1	36	-	-	541
02 Bedroom2	36	-	-	344
02 Bedroom3	36	-	-	401
02 Corridor	-	52	-	47
02 Kitchen	36	-	-	670
02 Misc1	36	-	-	427
02 Stairs	-	52	-	51
02 Store1	36	-	-	18
02 WC1	-	52	-	87
02 WC2	-	52	-	183
01 Office2	36	-	-	576
02 Office1	36	-	-	757
00 Gallery01	36	-	-	876
00 Corridor	-	52	-	96
00 Kitchen	36	-	-	309
01 Bedroom3	36	-	-	735
01 Bedroom1	36	-	-	807
01 StairsAndCorridor	-	52	-	124
01 Stairs2	-	52	-	62

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?
00 Entrance	NO (-85.1%)	NO
00 Gallery02	N/A	N/A
00 Gallery03a	NO (-86.6%)	NO
00 Misc	N/A	N/A
00 Office1	NO (-79%)	NO
00 OpenPlan2	YES (+0.7%)	NO
01 Bedroom2	NO (-81.2%)	NO
01 Gallery02	NO (-82.4%)	NO
01 Gallery3	NO (-95.6%)	NO
01 Kitchen	NO (-83.2%)	NO
01 Office1	NO (-62.7%)	NO
02 Bedroom1	NO (-52.3%)	NO
02 Bedroom2	NO (-11%)	NO
02 Bedroom3	NO (-73.1%)	NO
02 Kitchen	NO (-79.3%)	NO
02 Misc1	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
01 Office2	NO (-75.6%)	NO
02 Office1	NO (-70.7%)	NO
00 Gallery01	NO (-89.2%)	NO
00 Kitchen	NO (-89.4%)	NO
01 Bedroom3	NO (-85.2%)	NO
01 Bedroom1	NO (-85.7%)	NO

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	1219.9	1219.9
External area [m²]	2504.4	2504.4
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	10	3
Average conductance [W/K]	3529.2	1235.51
Average U-value [W/m²K]	1.41	0.49
Alpha value* [%]	10	10

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

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
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	109.43	26.45
Cooling	0	0
Auxiliary	7.4	10.87
Lighting	50.74	16.56
Hot water	2.55	2.66
Equipment*	36.44	36.44
TOTAL**	**170.12**	**56.54**

* 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]	420.34	82.1
Primary energy* [kWh/m²]	509.22	114.12
Total emissions [kg/m²]	86.1	23.2

* 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] Central heating using air distribution, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	465.7	0	121.2	0	7.5	1.07	0	1	0
	Notional	0	0	0	0	0	0	0	----	----
[ST] No Heating or Cooling										
	Actual	0	0	0	0	0	0	0	0	0
	Notional	91	0	29.3	0	11.2	0.86	0	----	----

Key to terms

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

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	1.49	00000008:Surf[3]
Floor	0.2	0.8	00000008:Surf[0]
Roof	0.15	0.41	00000004:Surf[1]
Windows, roof windows, and rooflights	1.5	2.4	00000006:Surf[3]
Personnel doors	1.5	5.09	00000008:Surf[1]
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	-	No High usage entrance doors in building

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

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

Air Permeability	Typical value	This building
$m^3/(h.m^2)$ at 50 Pa	5	10

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Symes Mews - Proposed Building LEAN CLEAN and GREEN

As designed

Date: Tue Feb 12 11:52:53 2019

Administrative information

Building Details

Address: 15a-37 Camden High Street, London, NW1 7JE

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.10

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.10

BRUKL compliance check version: v5.4.b.0

Owner Details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

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

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

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	22.7
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	22.7
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	45.1
Are emissions from the building less than or equal to the target?	BER > TER
Are as built details the same as used in the BER calculations?	Separate submission

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

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

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	1.49	1.49	00000008:Surf[3]
Floor	0.25	0.8	0.8	00000008:Surf[0]
Roof	0.25	0.18	0.18	00000004:Surf[1]
Windows***, roof windows, and rooflights	2.2	3.87	5.76	00000009:Surf[3]
Personnel doors	2.2	5.09	5.09	00000008:Surf[1]
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(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	10

Building services

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

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	>0.95

1- LTHW radiator system

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.92	-	0	0	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					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.

"No HWS in project, or hot water is provided by HVAC system"

Local mechanical ventilation, exhaust, and terminal units

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

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
01 Kitchen	-	-	1	-	-	-	-	-	-	-	N/A
02 Kitchen	-	-	1	-	-	-	-	-	-	-	N/A
00 Kitchen	-	-	1	-	-	-	-	-	-	-	N/A

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
	Luminaire	Lamp	Display lamp	
Standard value	60	60	22	
00 Entrance	-	60	10	94
00 Gallery02	100	-	-	910
00 Gallery03a	100	-	-	625
00 Misc	100	-	-	480
00 Office1	100	-	-	145
00 OpenPlan2	100	-	-	400
00 Stairs1	-	90	-	26
00 Store	60	-	-	108
00 WC1	-	90	-	65
00 WC2	-	90	-	56
01 Bedroom2	100	-	-	196

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
01 Gallery02	100	-	-	888
01 Gallery3	100	-	-	593
01 Kitchen	60	-	-	227
01 Office1	100	-	-	139
01 Stairs1	-	90	-	23
01 WC2	-	90	-	42
02 Bedroom1	100	-	-	197
02 Bedroom2	100	-	-	125
02 Bedroom3	100	-	-	146
02 Corridor	-	90	-	19
02 Kitchen	60	-	-	405
02 Misc1	100	-	-	155
02 Stairs	-	90	-	21
02 Store1	60	-	-	11
02 WC1	-	90	-	35
02 WC2	-	90	-	74
01 Office2	100	-	-	209
02 Office1	100	-	-	275
00 Gallery01	100	-	-	318
00 Corridor	-	90	-	39
00 Kitchen	60	-	-	187
01 Bedroom3	100	-	-	267
01 Bedroom1	100	-	-	293
01 StairsAndCorridor	-	90	-	50
01 Stairs2	-	90	-	25

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?
00 Entrance	NO (-85.1%)	NO
00 Gallery02	N/A	N/A
00 Gallery03a	NO (-86.2%)	NO
00 Misc	N/A	N/A
00 Office1	NO (-79%)	NO
00 OpenPlan2	YES (+0.7%)	NO
01 Bedroom2	NO (-81.2%)	NO
01 Gallery02	NO (-82.3%)	NO
01 Gallery3	NO (-95.5%)	NO
01 Kitchen	NO (-83%)	NO
01 Office1	NO (-61.8%)	NO
02 Bedroom1	NO (-52.3%)	NO
02 Bedroom2	NO (-11%)	NO
02 Bedroom3	NO (-74.4%)	NO
02 Kitchen	NO (-79.3%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
02 Misc1	N/A	N/A
01 Office2	NO (-75%)	NO
02 Office1	NO (-69.9%)	NO
00 Gallery01	NO (-89.2%)	NO
00 Kitchen	NO (-89.4%)	NO
01 Bedroom3	NO (-86%)	NO
01 Bedroom1	NO (-85.7%)	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