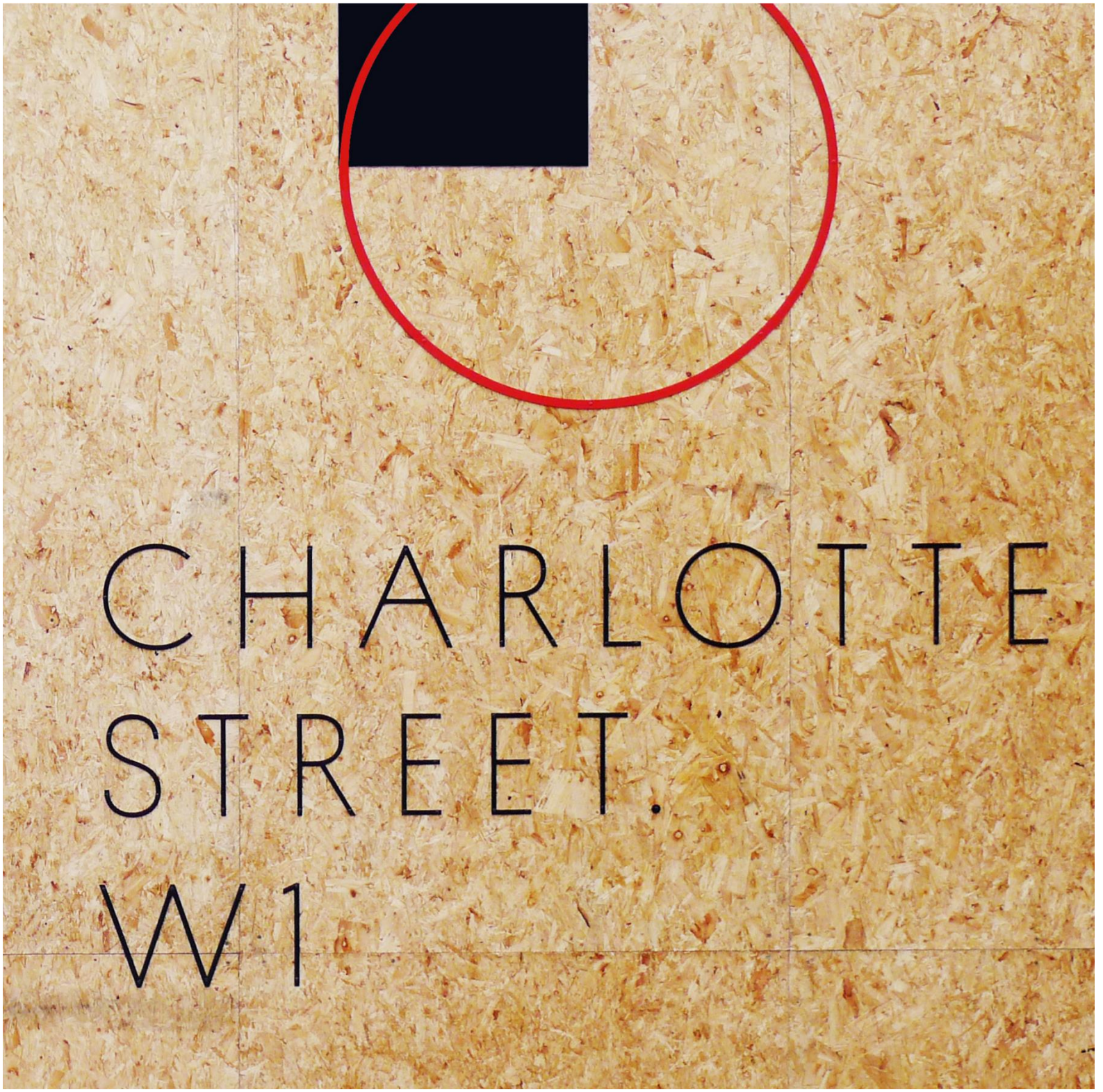
80 Charlotte Street & 65 Whitfield Street:

Minor Material Amendment –

Energy Statement Addendum

Date
December 2015



West London & Suburban Property Investments Ltd

80 Charlotte Street & 65 Whitfield Street

Energy Statement Addendum

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Contents

1 Executive Summary

This addendum Energy Statement is submitted in support of an application for minor material amendments to planning permission reference 2010/6873/P that was granted for the redevelopment of 80 Charlotte Street and 65 Whitfield Street (the SITE) in March 2012.

The minor material amendment seeks to complete the demolition of the original 1960's post office building. This additional demolition does not result in any change to the consented massing, areas and uses. It does result in some design amendments to the replacement buildings, and modifications to the energy strategy for the commercial element, hence the Energy Statement has been updated to reflect these.

The residential elements do not change, and as such are not considered further in this report.

The proposed amendments to the approved development follow the holistic approach to sustainability - to be as energy efficient as possible – as per the previous submission. To comply with the Mayor's Energy Strategy and The London Plan, a Lean, Clean and Green staged approach has been adopted.

Since the development was approved in 2012, the London Plan has been updated to reflect changes in regulations. Subsequently, updates described within this report have been completed using the most recent version of Part L (Part L2A 2013). This emissions assessment has been undertaken based on conceptual design information, and was performed separately for the commercial office and retail elements.

The percentage savings are estimates and may be targeted using alternative technologies as the design develops. The following conclusions were drawn:

- Commercial: The implementation of energy efficient measures and passive design features on the commercial office element reduced the emissions by approximately **9.7%** (based on regulated energy).
- Commercial: The addition of renewables lead to further reduction to reach around **14.9%**.
- Retail: The implementation of energy efficient measures and passive design features reduced the emissions by approximately **7.0%** (based on regulated energy).

The consented assessment was conducted against Part L 2006, where an improvement of 46% was cited for the commercial element. The baseline for buildings since that time as tightened significantly (circa 33%, excluding changes to carbon factors). Despite this, the proposed development is still reporting a 15% improvement above current Building Regulations (Part L 2013). Against 2006, it is anticipated that the improvement would be better than that reported in the

consented scheme, in excess of 46%. In overall terms, the energy strategy and associated reductions are in line with those previously approved.

This is enabled by improvements across the board to the energy strategy to keep up with current developments in design and technology.

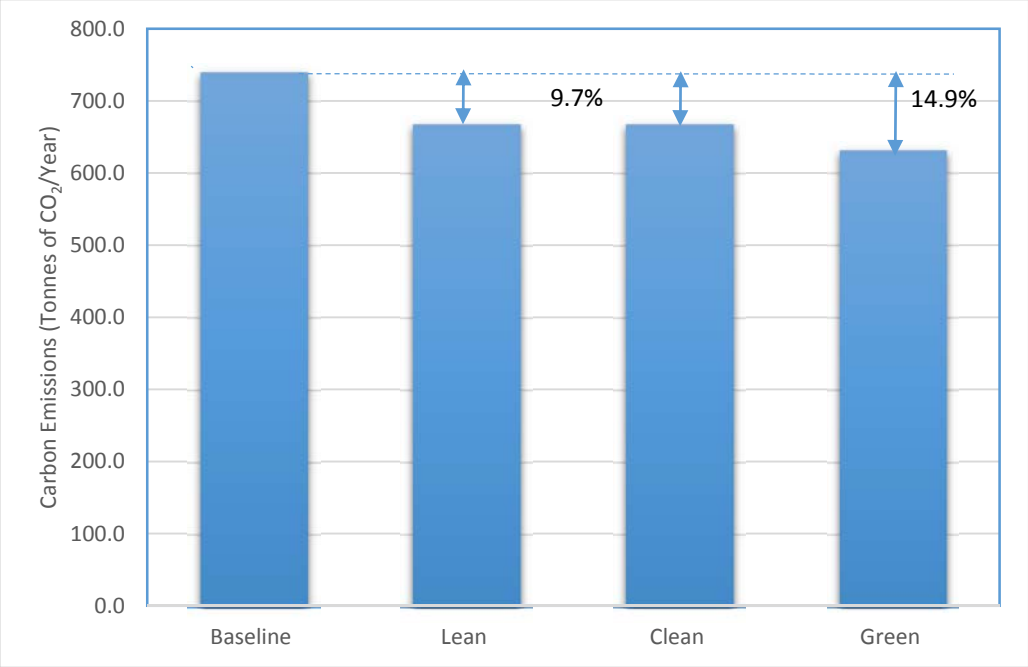

Figure 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy.

Limitations:

This Energy Statement in support of planning has been generated at an early stage of design and therefore its findings are likely to change as the design progresses. All calculations and sizings are approximate and the result of software available at the time of publication. Although produced in compliance with current guidance, it is highly likely that the methodology for calculating carbon dioxide emissions for buildings will change in time, as will the CO_2 fuel factors.

1 Introduction

This Addendum is submitted in support of an application for minor material amendments to planning permission reference 2010/6873/P which was granted for the redevelopment of 80 Charlotte Street and 65 Whitfield Street (the SITE) on 16 March 2012.

Application 2010/6873/P proposed the partial redevelopment and refurbishment of the site to create a mixed use office and residential scheme with some flexible units at ground and lower ground floor in either office, retail or restaurant use (the Approved Development).

The amendments to the approved application relate to a requirement for further demolition at the site (the Amended Development).

The residential elements of the scheme at 65 and 67-69 Whitfield Street remain unchanged from the Approved Development and are not addressed in this document.

This document follows the structure of the Energy Statement for the Approved Development dated December 2010. Only changes to the approach and relevant policies are described. Otherwise the principles of sustainable development adopted are unchanged from the Consented proposals.

This report is submitted in accordance with the London Borough of Camden requirements for major developments to comply with their Core Strategy and Development Policies, as well as the London Plan (2015).

Energy efficiency is one of the key design aspirations for this development, within the constraints of the site as described hereon in. The design team has thus far followed a holistic approach to sustainability and the aim to minimise the carbon emissions of the development has been, and will continue, to be a high priority throughout the design process.

2 Planning Context

The energy performance and carbon emissions for the approved development have been considered against both regional and local current planning guidance.

2.1 The London Plan

The London Plan (2015) is the Spatial Development Strategy for London published by the Greater London Authority (GLA) and covers all 32 London Boroughs and includes the City of London Corporation.

The energy strategy for the amended development has been based around the energy hierarchy set out within The London Plan as follows:

1. **Be Lean**: Use Less Energy
2. **Be Clean**: Supply Energy Efficiently
3. **Be Green**: Use Renewable Energy

The Plan contains a number of policies which are relevant to Energy:

Policy 5.2: Minimising carbon dioxide emissions

"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 2010 Building Regulations
2010 – 2013 25 per cent
2013 – 2016 40 per cent (or 35% less than Part L 2013)
2016 – 2019 As per building regulations requirements
2019 – 2031 Zero carbon"

Also highlighted in this Policy is:

"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."

Policy 5.3: Sustainable design and construction

"Development proposals should demonstrate that sustainable design standards are integral to the proposal, including its construction and operation, and ensure that they are considered at the beginning of the design process."

Policy 5.6: Decentralised energy in development proposals

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

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

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

Policy 5.7: Renewable energy

"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."

This document has been produced in line with the update note to Energy Planning Guidance relating to the changes to Part L of the Building Regulations which came into force from April 2014.

2.2 The London Borough of Camden

The London Borough of Camden Local Plan was adopted in 2010. The Local Plan contain planning policies covering energy consumption and carbon emissions.

Camden's Local Development Framework (LDF) contains policies covering energy performance and carbon emissions of proposed developments, in particular policies CS13 and DP22. Policy DP22 is entitled *"Promoting Sustainable Design and Construction"* and promotes energy efficiency and sustainability through design and construction and resilience to climate change. Policy CS13 is entitled *"Tackling Climate Change through Promoting Higher Environmental Standards"* and looks at reducing the effects of and adapting to climate change, local energy generation, water and surface water flooding and carbon reduction measures.

3 Baseline Energy Demand and Carbon Emissions

The baseline emissions for the amended development have been estimated using the Be Lean, Be Clean, Be Green methodology as outlined in the The London Plan.

The baseline emissions are calculated using the regulated energy emissions (i.e. those emissions covered by Building Regulations such as lighting, heating, cooling and ventilation energy use). Unregulated energy emissions (i.e. those that are not covered by Building Regulations) such as equipment use are displayed in accordance with GLA guidance.

3.1 Commercial Element

The commercial office element comprises of a lower ground, ground and 8 storeys above ground. The additional demolition proposed does not result in any change to the consented massing, areas and uses.

3.1.1 Office Component

3.1.1.1 Methodology

The regulated energy emissions have been estimated by the use of IES Virtual Environment 2015, a government approved thermal modelling software package for the assessment of Part L Compliance.

The baseline emissions rate is the Target Emission Rate (TER) for the building, which is equivalent to a building that is compliant with Part L2 (2013). The calculation of the TER has been undertaken utilising the National Calculation Methodology set out in the 2013 Part L document. Finally, for the baseline model a gas boiler is used as the heating source in compliance to the Greater London Authority Energy Planning Guidance document

The baseline emissions for the unregulated energy have been estimated from the figures given in Energy Consumption Guide 19 (ECG19) and CIBSE TM46:2008. The figures that have been used represent a Type 4 ‘Good Practice’ air conditioned office within ECG19. Within TM46, the average benchmark values for general retail and restaurant have been used.

3.1.1.2 Regulated Energy

Table 1 summarises the 'baseline' or TER regulated energy consumptions and carbon emissions for the commercial office section of the amended development.

	Electricity Consumption *(kWh/m²/yr)*	**Gas Consumption** *(kWh/m²/yr)*	**Carbon Emissions**[1] *(tonnes of CO_2/yr)*
Heating		1.88	13.3
Cooling	7.48		127.1
Fan & Pump Energy	11.57		196.7
Hot Water		2.91	20.6
Lighting	23.65		402.0
TOTAL (TER)	**42.7**	**4.79**	**759.7**

Table 1: Baseline Regulated Energy Consumption and Carbon Emissions for Commercial Office

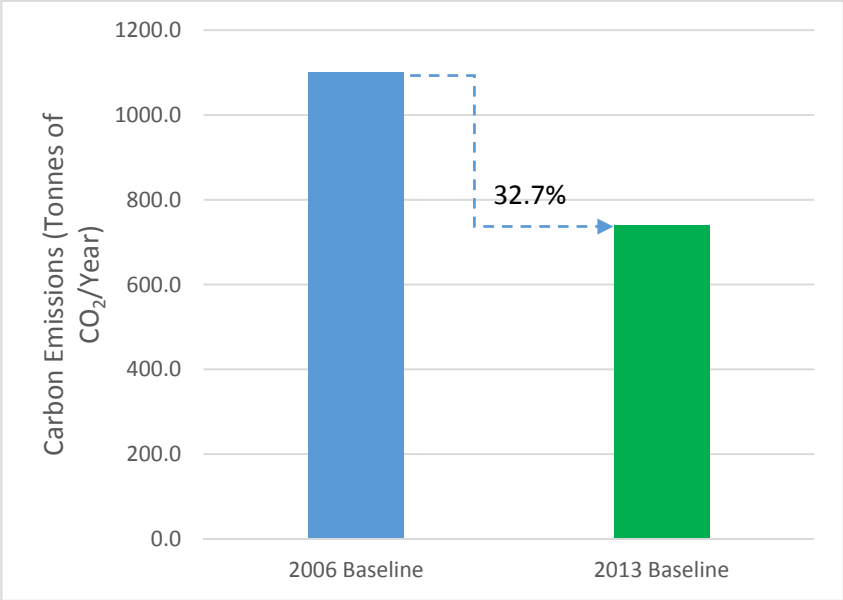

Figure 2: Comparison of the baseline regulated emissions (TER) between 2006 and 2013

The consented assessment was conducted against Part L 2006; the current assessment is against Part L 2013. The baseline for buildings over this period has tightened significantly, circa 33%, excluding changes to carbon factors, as illustrated in Figure 2.

Improvements hereon in are reported against the 2013 figures.

[1] The carbon emission factors taken for gas and electricity are 0.216 and 0.519kg.CO_2/kWh respectively (SAP 2012).

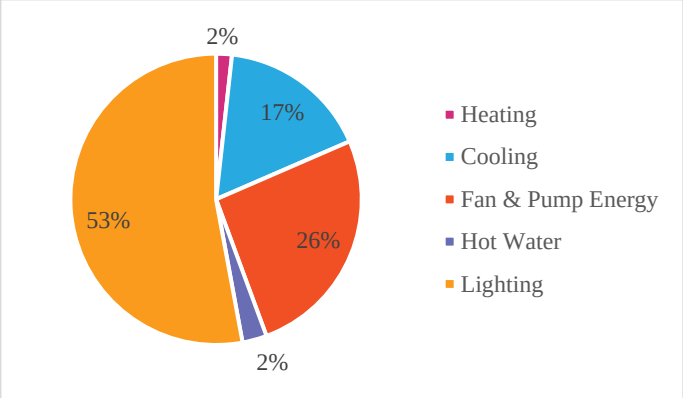

Figure 3: Commercial Office Baseline Total Carbon Emissions by Use

3.1.1.3 Unregulated Energy

Table 2 summarises the estimated 'baseline' unregulated energy consumptions and carbon emissions for the commercial office section of the amended development.

	Electricity Consumption *(kWh/m²/yr)*	**Carbon Emissions**[1] *(tonnes of CO_2/yr)*
Equipment	23	391
Catering	5	84.9
TOTAL	**28**	**475.9**

Table 2: Baseline Un-Regulated Energy Consumption and Carbon Emissions for Commercial Office

3.1.1.4 Total Energy

Figure 4 illustrates the proportion of total baseline carbon emissions by use including both regulated and un-regulated energy uses.

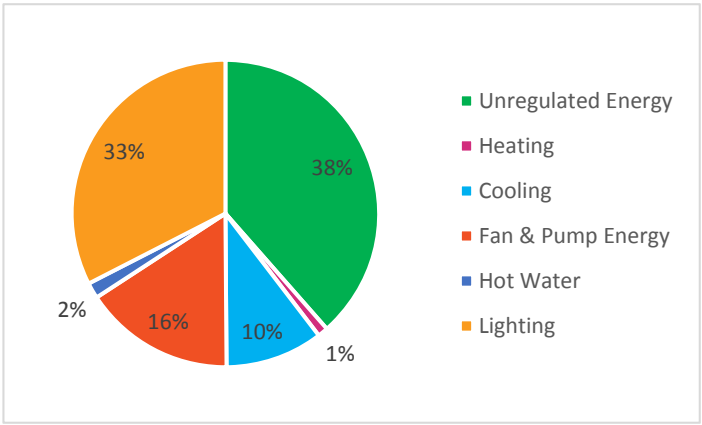

Figure 4: Commercial Office Baseline Total Carbon Emissions by Use

3.1.2 Retail Component

3.1.2.1 Methodology

A similar methodology to that used in Section 3.1.1.1 is adopted here.

3.1.2.2 Regulated Energy

Table 3 summarises the 'baseline' (TER) regulated energy consumptions and carbon emissions for the retail element.

	Electricity Consumption *(kWh/m2/yr)*	**Gas Consumption** *(kWh/m²/yr)*	**Carbon Emissions**[2] *(tonnes of CO_2/yr)*
Heating		3.94	1.3
Cooling	13.89		11.2
Fan & Pump Energy	24.02		19.3
Hot water		26.66	21.4
Lighting	54.21		43.5
TOTAL (TER)	**92.12**	**30.6**	**96.7**

Table 3: Baseline Regulated Energy Consumption and Carbon Emissions for Retail Element

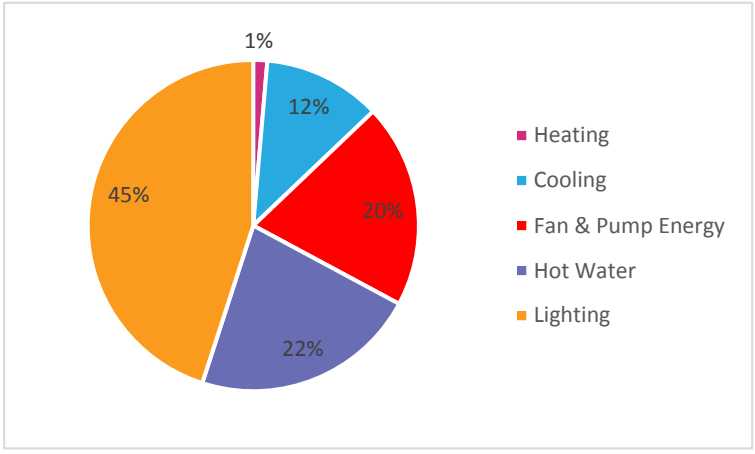

Figure 5: Retail Baseline Regulated Carbon Emission by Use (TER)

3.1.2.3 Unregulated Energy

Table 24 summarises the estimated 'baseline' unregulated energy consumptions and carbon emissions for the commercial retail section of the amended

[2] The carbon emission figure taken for gas and electricity is 0.216 and 0.519kg.CO_2/kWh respectively (SAP 2012).

development. The figures used are based on TM46 energy benchmarks for general retail and restaurant.

	Electricity Consumption *(kWh/m²/yr)*	**Gas Consumption** *(kWh/m²/yr)*	**Carbon Emissions**[1] *(tonnes of CO_2/yr)*
Miscellaneous	35.4		28.4
		154.4	51.4
TOTAL	**35.4**	**154.4**	**79.8**

Table 4: Baseline Un-Regulated Energy Consumption and Carbon Emissions for Commercial Retail

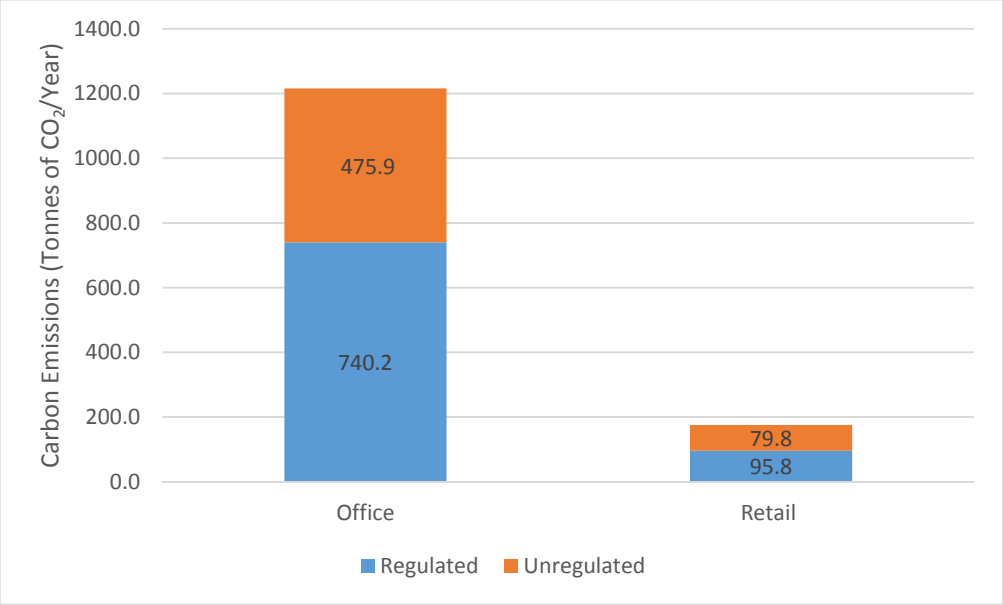

Figure 4: Baseline Carbon Emissions Regulated and Unregulated for Office and Retail Elements

It is clear from the graph above that retail represents a small component of the overall carbon emissions across the SITE.

4 Reducing Energy Demand-Be Lean

The first stage of the Mayor's energy hierarchy set out in The London Plan is to reduce the building's energy demand – Be Lean.

Optimising passive design is the most effective means, both in carbon and financial terms, of ensuring the buildings are inherently low in energy usage.

There are a range of passive designs and energy-efficiency measures that will be applied to the retail and commercial elements as an integral part of the design process, described further in this section.

4.1 Site Weather

The site is located in central London. A building of this nature is appropriate with the building massing and orientation suitable to its context and the planning guidance of the area.

The form of the building is such that the orientation of the building tries to respond to the demand for quality public needs by providing a pocket park to the south where a better microclimate can be created whilst also being sensitive to reducing building energy and efficient layout.

4.2 Thermal Envelope Performance

Improving the U-values of the external surfaces i.e. the walls, floors, roofs and glazing of a building reduces the transfer of heat from within a room to the outside, hence reducing the associated heating or cooling energy. Where practical, it is proposed to increase insulation levels above the minimum requirements given in the Building Regulations for all aspects of the amended development.

For the refurbished elements of the commercial building, the thermal performance will be updated to modern standards by upgrading the retained façade. New glazing is proposed, having a significantly better thermal performance compared to the current windows. Internal insulation will also be added for improved thermal performance.

In addition to reducing the U-values of specific elements, careful detailed design of the façade will be made to ensure that thermal bridging will be minimised.

4.3 Thermal Mass

Exposed concrete slabs are proposed which will provide an opportunity to activate the building mass. The thermal mass of a building acts as a store of heating and cooling energy. The thermal inertia that results is effective in dampening the peaks of the daily external temperature swing. This reduces the energy required to maintain comfortable internal conditions.

4.4 Envelope Air Tightness

As previously submitted, the façade will be specified to achieve very good air tightness levels and careful design of the vertical and horizontal interfaces within the building envelope will be made. Good practice construction techniques will be employed and air tightness tests will be made on completion to ensure that finished construction achieves the design values.

Air tightness targets that are better than the Building Regulations will be adopted. $5.0 m^3/hr/m^2$ @ 50Pa is targeted.

4.5 Façade Optimisation

A chief aim with the façade was to optimise performance to achieve good balance between high levels of natural daylight reaches the occupied spaces whilst limiting high solar gains, especially in peak conditions.

The façade is largely unchanged from the approved development. The use of highly efficient solar control glazing to maximise solar protection remains in the scheme. The glazing shall include low-e coatings to minimise heat loss in cold external weather, and special attention paid to light transmission to maximize natural daylight penetration.

4.6 Natural Ventilation and Mixed Mode Operation

Natural ventilation will be utilised through the atria and also opening windows around the perimeter to enable natural ventilation, as previously intended.

As well as providing energy savings, this has the added advantage of improving the internal environment giving occupants a sense of connection with the outside. This may lead to a greater tolerance of higher internal temperatures, reducing cooling loads as well as giving occupants control over their surroundings as they have the possibility to open or close a window.

For the commercial building, a mixed mode strategy combines the benefits of a natural ventilation system with the benefits of a mechanical ventilation system (waste heat recovery). It is proposed that the perimeter zone of the commercial building will be designed such that it can be operated in a mixed mode strategy if the tenants require. In the winter months the perimeter zone will be provided with mechanical supply and extract ventilation as well as in the summer months, when the external conditions are favourable. During optimal days, tenants will have the opportunity of benefiting from natural ventilation through a smart building control system.

4.7 Creating a Sustainable Legacy

The demolition of the existing structure will also allow for other opportunities, including the ability to design a longer lasting building, increasing an aspect of the scheme's sustainability credentials. One aspect of the new design is the additional height per floor, which may facilitate change of use in the future when compared to a more restricted floor-to-floor height.

All in all, this allows the design to provide flexibility, and adaption for future needs, scenarios and economic climates.

4.8 Adaption to Climate Change

Current predictions are showing a likely increase in temperatures from 2 to 4°C over the next 20 to 30 years. Passive design measures aim to reduce the overall energy loads on the building for the present and future.

Future flexibility, plant replacement and upgrades should allow the amended development to adapt to future climate conditions. Further possible adaption measures shall be considered as the design develops.

4.9 Energy Efficient Building Systems

Following the incorporation of the passive design measures described above, the building systems proposed for the amended development will have their energy consumption reduced by the use of energy saving devices and good practice control systems.

4.9.1 Energy Efficiency Measures for Commercial Building Systems

The proposed energy efficiency measures for the commercial building include the following:

- Reduced lighting load of 6.5W/m^2
- Daylight linked and dimmable lighting control for perimeter zone together with presence detection control
- Presence detection to control lighting within the central zone
- Minimised specific fan power at central ventilation plant
- High efficiency air source heat pumps (Section 6)
- Air cooled chillers with a proposed Seasonal Energy Efficiency Ratio (SEER) of 5.0
- Efficient waste heat recovery in central ventilation plant with an efficiency of 65%
- CoP Optimisers on central plant systems for heating and cooling

4.9.2 Energy Efficiency Measures for Retail Element's Systems

The proposed energy efficiency measures for the retail area include the following:

- High efficiency air source heat pumps (Section 6)
- Low specific fan power from ventilation plant
- Reduced lighting load of 30W/m^2
- Efficient waste heat recovery in central ventilation plant with an efficiency of 65%

4.10 Results

4.10.1 Reduction in Energy Emissions for Commercial Element

4.10.1.1 Office Component

Table 55 illustrates the predicted reduction in energy consumption and associated emissions reductions following the implementation lean energy efficiency measures. These figures represent a possible saving of **9.7%** from the baseline (regulated) energy emissions for Table 5.

	Electricity Consumption *(kWh/m²/yr)*	**Gas Consumption** *(kWh/m²/yr)*	**Carbon Emissions[3]** *(tonnes of CO_2/yr)*
Heating		10.91	77.2
Cooling	3.9		66.3
Fan & Pump Energy	14.48		246.1
Hot Water		5.55	39.3
Lighting	15		255
TOTAL	33.38	16.46	**683.9**

Table 5: Regulated Energy Consumption and Carbon Emissions for Commercial Office after Implementation of Passive Design and Energy Efficiency Measures

The figures shown in Table 5 do not include any potential emissions savings that may be achievable through operating the perimeter zone of the building in a 'mixed mode' scenario. As the operation of the mixed mode scenario is dependent upon the choice of individual tenants it is not appropriate to include within the overall emission savings stated above.

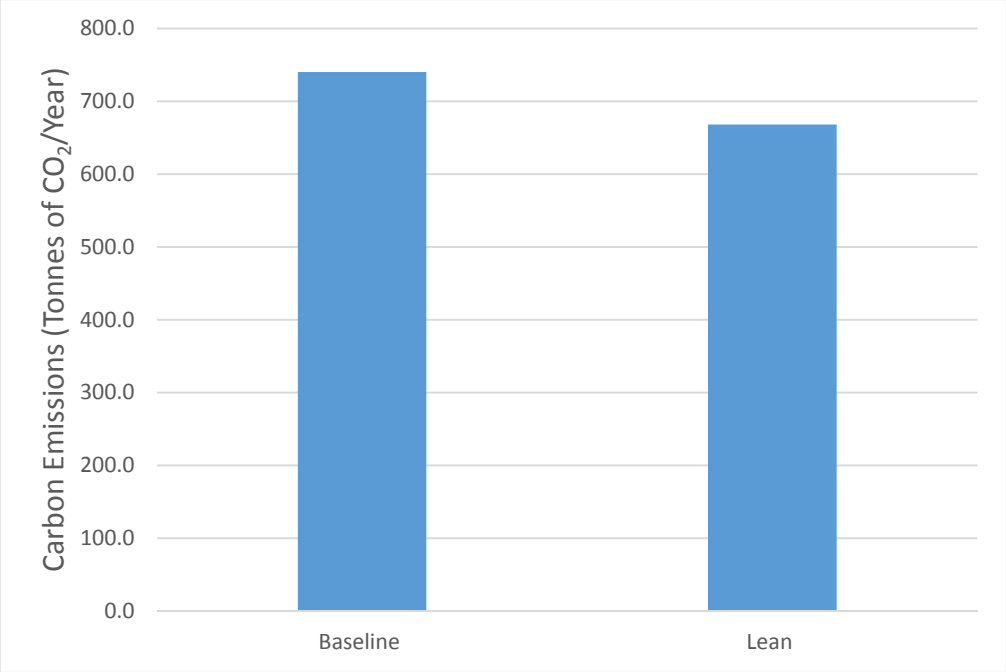

Figure 5: Carbon Emissions post Lean Strategy (BER) for Office Element

4.10.1.2 Retail Component

Table 6 illustrates the predicted reduction in energy consumption and associated emissions reductions in the retail element following the implementation of passive design features and energy efficiency measures. As can be displayed, these

[3] The carbon emission figure taken for gas and electricity is 0.216 and 0.519kg.CO_2/kWh respectively (SAP 2012).

figures illustrate that there may be a possible saving of **7.0%** from the baseline (regulated) energy emissions.

	Electricity Consumption *(kWh/m²/yr)*	**Carbon Emissions**[4] *(tonnes of CO_2/yr)*
Heating	3.04	2.4
Cooling	15.74	12.6
Fan & Pump Energy	25.22	20.2
Hot Water	28.16	22.6
Lighting	42.07	33.8
TOTAL	**114.23**	**91.6**

Table 6: Regulated Energy Consumption and Carbon Emissions for Retail Element after Implementation of Passive Design and Energy Efficiency Measures

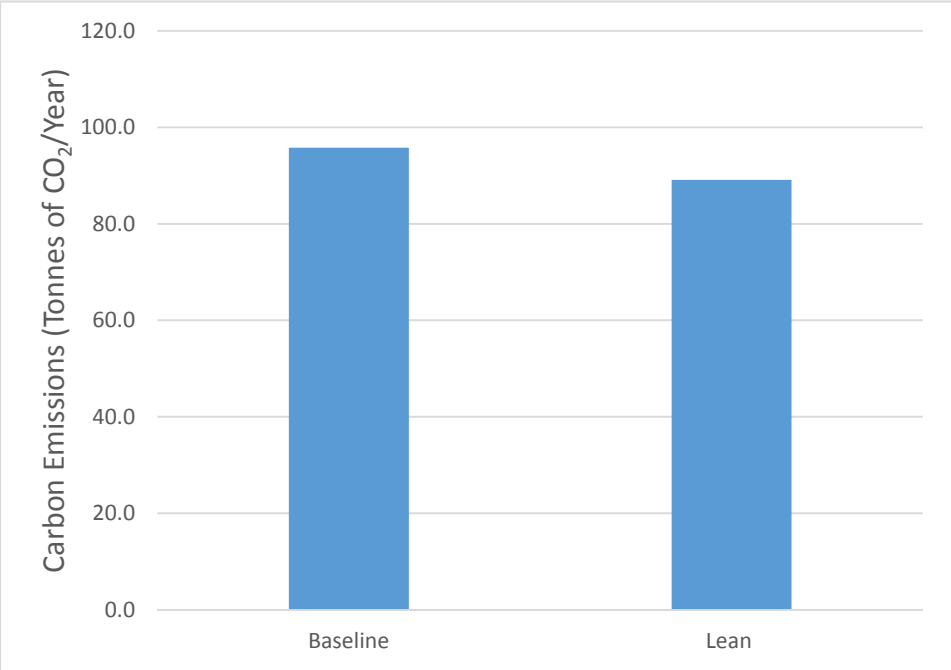

Figure 6: Carbon Emissions post Lean Strategy (BER) for Retail Element

[4] The carbon emission figure ta ken for gas and electricity is 0.216 and 0.519kg.CO_2/kWh respectively.

4.11 Un-Regulated Energy Emissions

4.11.1 Commercial Element

4.11.1.1 Office Component

The office component is being developed speculatively, the final occupying tenants are not yet known.

The proposed design of computer systems, computer servers, catering facilities and similar will all be undertaken by the incoming tenants and as such they will control the un-regulated energy emissions. The landlord systems will provide an electrical provision of 15W/m^2, and additional 10 W/m^2 as spare for the tenants use. Separate meters will be provided for each individual tenancy and this will allow the tenants to monitor their own energy consumption.

4.11.1.2 Retail Component

The retail units are shell only, which is reflected here. Each individual tenant will be provided an electrical connection, the remainder will be fitted out by tenants in self-contained units.

5 Reducing Energy Demands-Be Clean

This is the second stage of the Mayor's energy hierarchy set out in The London Plan – Be Clean.

5.1 Connection to Existing Low Carbon Heat Distribution Networks

In order for a connection to a district heating network to be beneficial, its efficiency would need to exceed that of an alternative heating method. The scheme includes the use of high efficiency heat pumps which is favourable over a connection to a common network.

As well as this, there are currently no networks that would be possible to connect to. Figure 9 illustrates the current and proposed district heating networks in the vicinity of the proposed development.

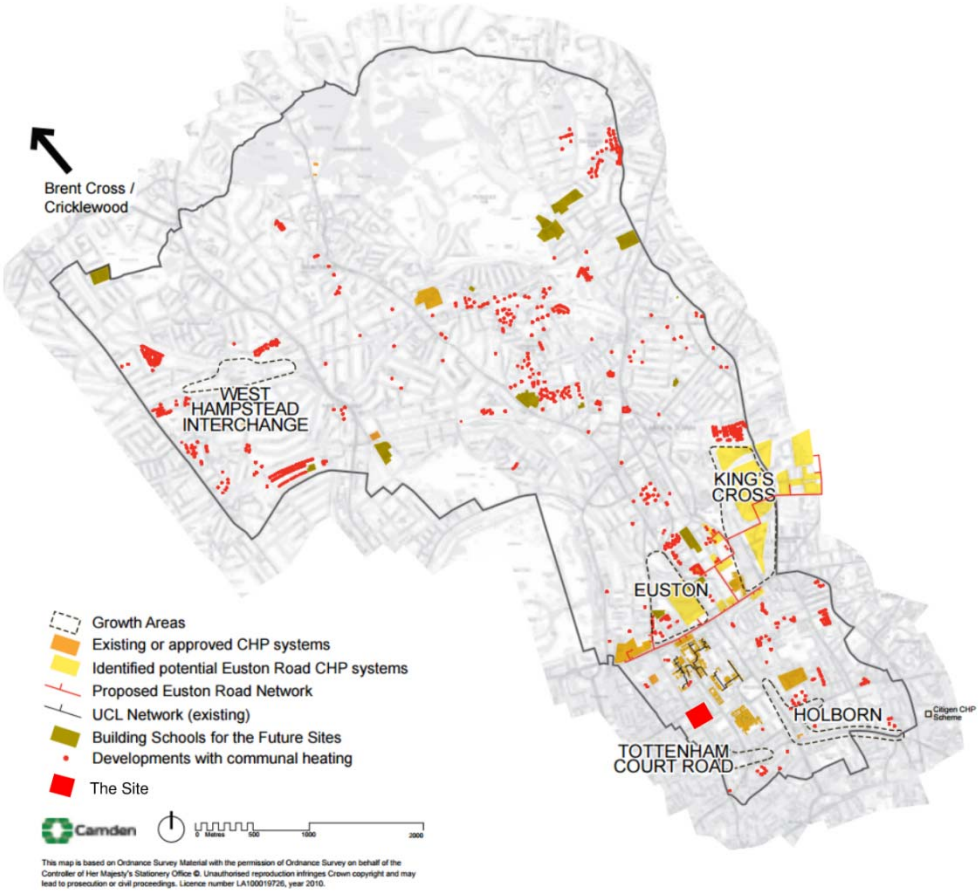

Figure 9: Existing and proposed CHP Networks (Map extracted from Camden Core Strategy)

It is understood that the proposed Euston Road network shown on this map currently does not extend in a southerly direction beyond Euston Station. It is not possible to connect to the existing UCL network and there are no other proposed systems nearby.

No provision has been made for a future connection to such a system due to scheme already including high efficiency, low carbon air source heat pumps.

5.2 Site Wide Heating Networks

It is proposed that central heating and cooling plant will be provided for the entire commercial building development. This will allow the benefits of diversity between individual tenants to reduce peak plant capacity and allow more efficient plant operation.

As previously submitted, the residential and commercial schemes are not connected to a common heating system due to the differing usage profiles of both of the developments (i.e. the commercial being un-occupied in the evenings and weekends).

5.3 Combined Heat and Power (CHP)

5.3.1 Provision of CHP

CHP systems operate most efficiently when there is a large base heating demand across the year which can provide a use for the generated heat. In commercial developments, the annual base heating demand is the domestic hot water load. Typical commercial developments have a relatively low domestic hot water usage and therefore the available base heat demand for CHP systems is relatively low.

The requirements of the new Part L 2013 is that if a CHP is provided then it should provide 45% of the annual heating demand for the development. This would not be achievable in the amended development.

As well as this, in the commercial, residential and retail sections of the development, heating is currently provided by the use of high efficiency, low carbon air source heat pumps which are more efficient than implementing CHP. Therefore, it is not considered feasible to provide a CHP system for the amended development.

5.3.2 Provision of Trigeneration (CCHP)

Trigeneration uses heat from a CHP system to provide heating and cooling.

As it is not considered beneficial to use a CHP system, this also discounts the use of trigeneration. However, as described within Section 4, the passive design measures that have been incorporated into the scheme - in particular the use of exposed thermal mass, elevated temperatures, adaptive comfort and the use of mixed-mode in the perimeter zone – have significantly reduced the anticipated cooling demand for the building. Therefore the potential benefits of a trigeneration system are further reduced.

Since the adoption of the EU directive on co-generation in February 2010 there is no longer any carbon benefit from running combined cooling and power systems.

5.4 Results

5.4.1 Reduction in Energy Demands for Commercial Element- Be Clean

5.4.1.1 Office Element

Following the discussion above, none of the proposed options were practical or applicable for the development i.e.no application of clean technologies. This leads to the same results of the Be Lean Strategy. Thus, **9.7%** reduction is still achieved in comparison to the baseline model.

Table 7 illustrates the results of the Be Clean approach.

	Electricity Consumption *(kWh/m²/yr)*	**Gas Consumption** *(kWh/m²/yr)*	**Carbon Emissions[3]** *(tonnes of CO_2/yr)*
Heating		10.91	77.2
Cooling	3.9		66.3
Fan & Pump Energy	14.48		246.1
Hot Water		5.55	39.3
Lighting	15		255
TOTAL	33.38	16.46	**683.9**

Table 7: Regulated Energy Consumption and Carbon Emissions for Commercial Office after Implementation of the Be Lean and Be Clean Strategies

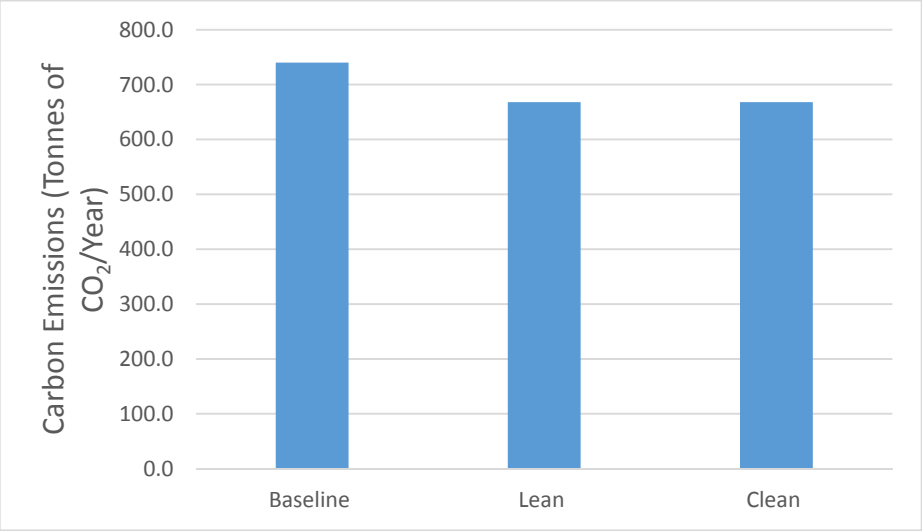

Figure 10: Carbon Emissions post Clean Strategy (BER) for Office Element

5.4.1.2 Retail Element

Similarly the results for the retail element are the same as the results found in Section 4.10.1.2 for the Lean strategy. Thus, a **7%** reduction from the baseline is maintained.

Table 8 illustrates the results of the Be Clean approach.

	Electricity Consumption *(kWh/m²/yr)*	**Carbon Emissions[4]** *(tonnes of CO_2/yr)*

[3] The carbon emission figure taken for gas and electricity is 0.216 and 0.519kg.CO_2/kWh respectively (SAP 2012).
[4] The carbon emission figure ta ken for gas and electricity is 0.216 and 0.519kg.CO_2/kWh respectively (SAP 2012).

Heating	3.04	2.4
Cooling	15.74	12.6
Fan & Pump Energy	25.22	20.2
Hot Water	28.16	22.6
Lighting	42.07	33.8
TOTAL	**114.23**	**91.6**

Table 8: Regulated Energy Consumption and Carbon Emissions for Retail Element after Implementation of Passive Design and Energy Efficiency Measures

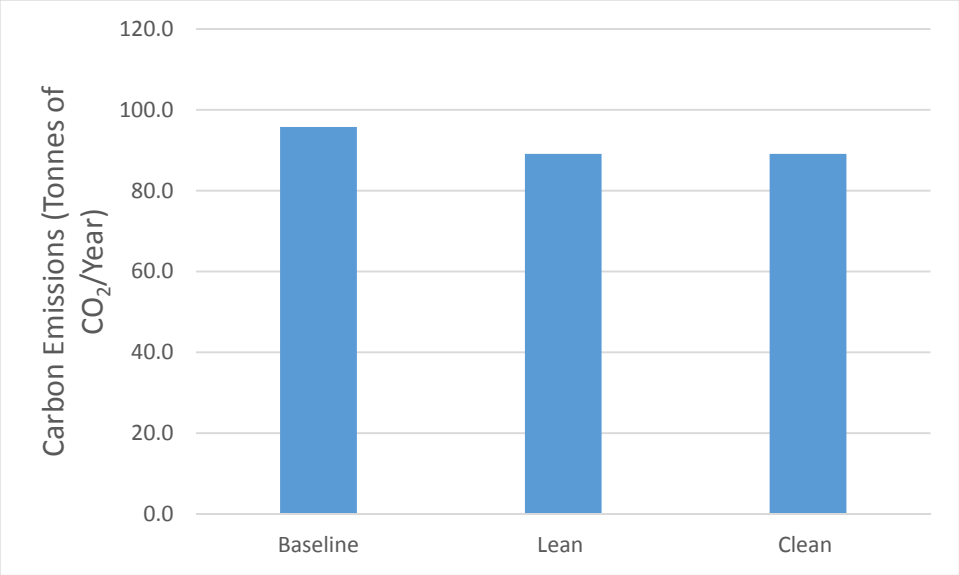

Figure 11: Carbon Emissions post Clean Strategy (BER) for Retail Element

6 Renewable Energy-Be Green

The third stage of the Mayor's energy hierarchy set out in The London Plan is to target 20% of the base energy demand to be generated from renewable sources where feasible – Be Green.

6.1 Renewable technologies shortlist

The following section summarises the available renewable technologies that were considered previously. These include:

- Wind generators
- Biomass heating
- Ground source heating and cooling
- Air source heat pumps
- Photovoltaic (PV) panels
- Solar hot water heating

Air source heat pumps, and the opportunity for either PV or solar hot water will be taken forward. The remainder were, and continue to be dis-counted for the reasons cited below. This strategy is unchanged from the approved development.

6.1.1 Wind generators

As previously agreed as part of the approved development wind turbines are not considered appropriate.

This is a result of the insufficient area on the roof due to the space requirements for other essential plant equipment, as well as turbines located on the roof would be an obstruction to the sightlines around the building. Wind turbines also generate a considerable amount of noise which is not suitable in an urban area.

6.1.2 Biomass Heating

As previously agreed as part of the approved development biomass heating would not be practical because of the DP32 requirements.

6.1.3 Ground Source Heating and Cooling

The use of ground source heating and cooling comprises a number of different options including open and closed loop bore holes, energy piles and horizontal pipe arrays.

For the new build elements of the foundations, ground source heating and cooling is deemed to be unfeasible. This is due to the limited pile depth and space limitations, combined with more appropriate renewable technologies for the site.

6.1.4 Air Source Heat Pumps

Heat pumps use of electricity, rather than gas, is proposed to take advantage of future decarbonisation of the national grid. This is of importance so that the building

can meet the government aspiration for zero carbon buildings, if the grid is sufficiently decarbonised in the future. For these reasons, air source heat pumps have been incorporated into the space heating and cooling design throughout the development.

Additionally, it is proposed that four pipe heat pumps are utilised in the amended development. These have the advantage of utilising waste heat rejection to service a building heating load, when cooling and heating is required in the amended development. This results in greatly improved efficiencies in the building.

6.1.5 Photovoltaic (PV) Panels

The approved development included an option for PV panels to be installed, subject to the greatest energy reduction from this or solar technology.

The energy output of photovoltaic (PV) cells depends greatly on their orientation and is a maximum for south facing arrays not subjected to overshadowing from nearby buildings. The potential gain by locating solar panels on the roof of the building has been calculated.

Space is available to mount PV panels on top of other plant equipment located on the roof of the development, as previously proposed. In total, the available area for PV is approximately 150m^2 for the commercial element, panel active area available would be approximately 85m^2.

Three types of photovoltaic cell have been considered for this analysis.

6.1.5.1 Polycrystalline PV

PV cells made from polycrystalline silicon have now become popular as they are less expensive to produce, although slightly less efficient than monocrystalline cells.

6.1.5.2 Thin Film PV

Thin film modules are constructed by depositing extremely thin layers of photovoltaic materials on a low cost support such as glass, stainless steel or plastic. The efficiency of commercial amorphous silicon modules has improved from around 3.5% in the early 1980s to over 7% currently.

6.1.5.3 Hybrid PV

Hybrid modules incorporate a combination of amorphous thin film and single-crystalline technologies. This results in a higher efficiency than either of the cell types individually with a marginal increase in cost.

Table 9 is a summary of the energy analysis for each type of PV cell, based on 85m² panel area. Note that the comparison is done with respect to the regulated energy emissions of the commercial office development after the clean strategy is applied.

PV Type	PV Output (annual)	PV area	Energy produced	Reduction in carbon emissions	Percentage reduction in carbon emissions
	kWh/m²	*m²*	*kWh/year*	*kgCO₂/year*	
Polycrystalline	116	85	9,860	5,117	0.7%
Hybrid	138	85	11,730	6,088	0.9%
Thin Film	54	85	4,590	2,382	0.3%

Table 9: Carbon savings of different PV Panel types

Using PV panels would reduce carbon emissions from the building, however the space allocated on the roof is the same space that would be required for solar thermal hot water.

6.1.6 Solar Hot Water Heating

The development presents a year round domestic hot water demand which could be partially met by a solar water system. A study has been carried out to investigate the potential carbon savings by using solar water heating in the building.

Assumptions relating to demand for hot water and the carbon emissions reduction calculation for this system are outlined in Table 10 below. The calculation was based on 85m² solar collectors, derived from the available area on the roof of the development.

Calculation Steps		Units
Heating system efficiency	90%	
Flat plate collector energy per sqm	550	*kWh/m²*
Active area of solar panel required to meet solar water heating demand	85	*m²*
Solar water heating Capacity	46,750	*kWh/yr*
Total *delivered* gas energy	539081.5	*kWh/yr*
Demand met by solar water heating	51,944.5	*kWh/yr*
Remaining gas requirement	487,137	*kWh/yr*
Carbon emissions due to delivered gas	105,222[5]	*kg CO₂/yr*
Carbon emissions due to electricity	567,386[5]	*kg CO₂/yr*
Total carbon emissions in building with solar water heating	**672,607**	***kg CO₂/yr***
Base building carbon emissions	683,827	*kg CO₂/yr*
Reduction in carbon emissions due to solar water heating application	11,220	*kg CO₂/yr*
Percentage reduction in carbon emissions due to solar water heating application	**1.6%**	

Table 10: Carbon emissions reduction due to the use of a solar thermal heating system

[5] The carbon emission figure ta ken for gas and electricity is 0.216 and 0.519kg.CO_2/kWh respectively (SAP 2012).

Based on the assumptions and calculations outlined above, approximately 28.6% of the hot water demand can be met by solar water heating by installing 85m² evacuated tube collectors on the roof. This results in 11,220 kgCO_2/yr reduction in carbon emissions which is equivalent to a 1.6% overall reduction in carbon emissions compared to the clean building model. However, this is only for the commercial office section of the development. As noted above, a solar water heating system would compete for the same area as PV panels.

6.2 Results

Table 11 illustrates the predicted reduction in energy consumption and associated emissions reductions following the implementation green energy efficiency measures. These figures represent a possible saving of **13.3%** from the baseline (regulated) energy emissions.

	Electricity Consumption *(kWh/m²/yr)*	**Gas Consumption** *(kWh/m²/yr)*	**Carbon Emissions** *(tonnes of CO_2/yr)*
Heating	3.34		56.8
Cooling	3.9		66.3
Fan & Pump Energy	14.48		246.1
Hot Water	1.98		33.7
Lighting	15		255
Total	**38.7**	**0**	**657.9**

Table 11: Regulated Energy Consumption and Carbon Emissions for Office Element after Implementation of Renewables.

With the addition of solar thermal panels this figure increases to **14.9%.**

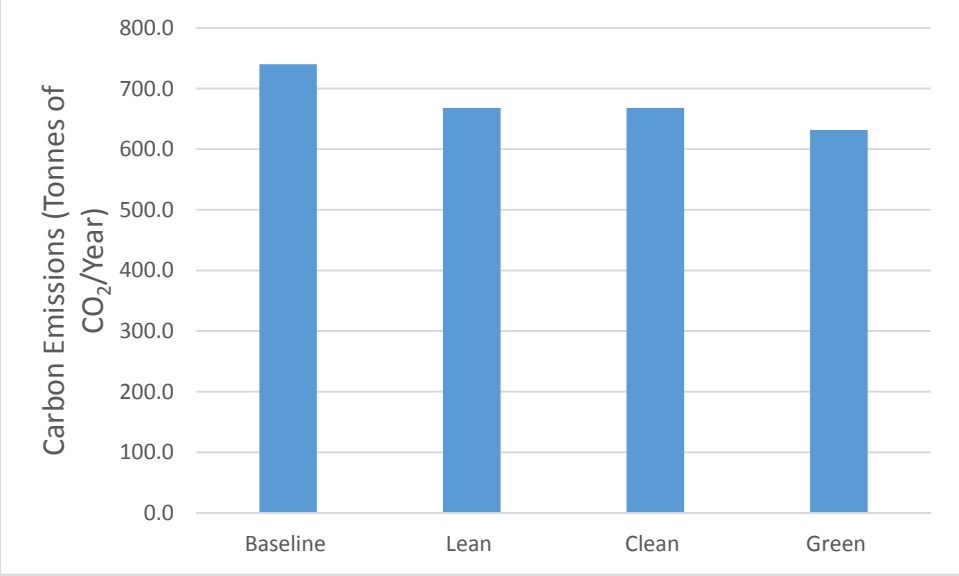

Figure 12: Carbon Emissions post Green Strategy (BER) for Office Element

6.3 Conclusions: Commercial Element

6.3.1 Office Component

Of the technologies considered it is proposed to implement solar hot water heating into the commercial scheme.

However, the use of solar hot water leads to greater reductions in carbon emissions when compared with PV, and hence it is more energy efficient to implement solar hot water at this point.

In addition, air source heat pumps already form an integral part of the heating and cooling scheme but the benefits gained from this are included in the energy efficiency and passive design measures.

The use of solar hot water heating is estimated to provide an additional 1.6% carbon emission reduction compared to the baseline levels.

6.3.2 Retail Component

None of the benefits gained from the use of renewable technologies will be specifically targeted at the retail component.

The holistic approach to the design of the whole development led to the decision that, at present, greater advantage can be found by targeting the use of these technologies in the commercial office and residential schemes which, by area, make up the majority of the development.

It should be noted that the high efficiency air source heat pumps are also assumed in the retail scheme and the carbon reductions due to this technology are incorporated in the energy efficient measures calculation.

7 Summary of Energy Proposals

7.1 Commercial Element

7.1.1 Office Component

An assessment has been undertaken, following the methodology set out in Part L 2013, to estimate the baseline regulated carbon emissions for the commercial office component.

Passive design and energy efficiency measures are proposed to reduce the emissions by approximately **9.7%** (based on regulated energy). It should be noted that no clean measure could be applied which means the **9.7%** reduction covers both lean and clean strategies for regulated energy.

Upon the application of the green measures the emissions are reduced by **13.3%** in comparison to the baseline model. It is proposed that solar hot water heating will provide an estimated additional **1.6%** reduction in carbon emissions. Thus, the end result would be **14.9%** reduction (based on regulated energy).

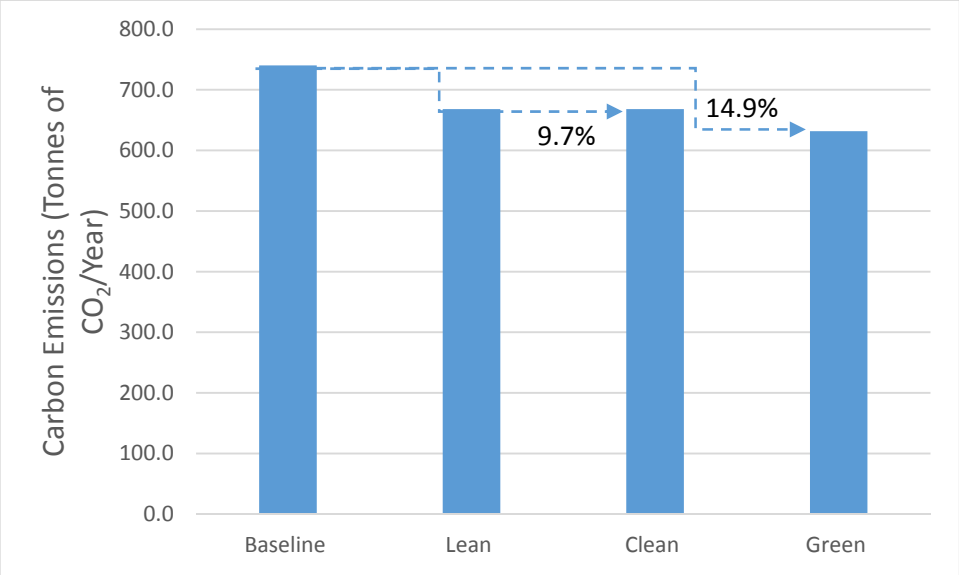

Figure 13: Summary of proposed Carbon Dioxide Emission Reductions for Office Component

7.1.2 Retail Component

An assessment has been undertaken, following the methodology set out in Part L 2013, to estimate the baseline regulated carbon emissions for the retail component.

Passive design and energy efficiency measures are proposed to reduce the emissions by approximately **7.0%** (based on regulated energy).

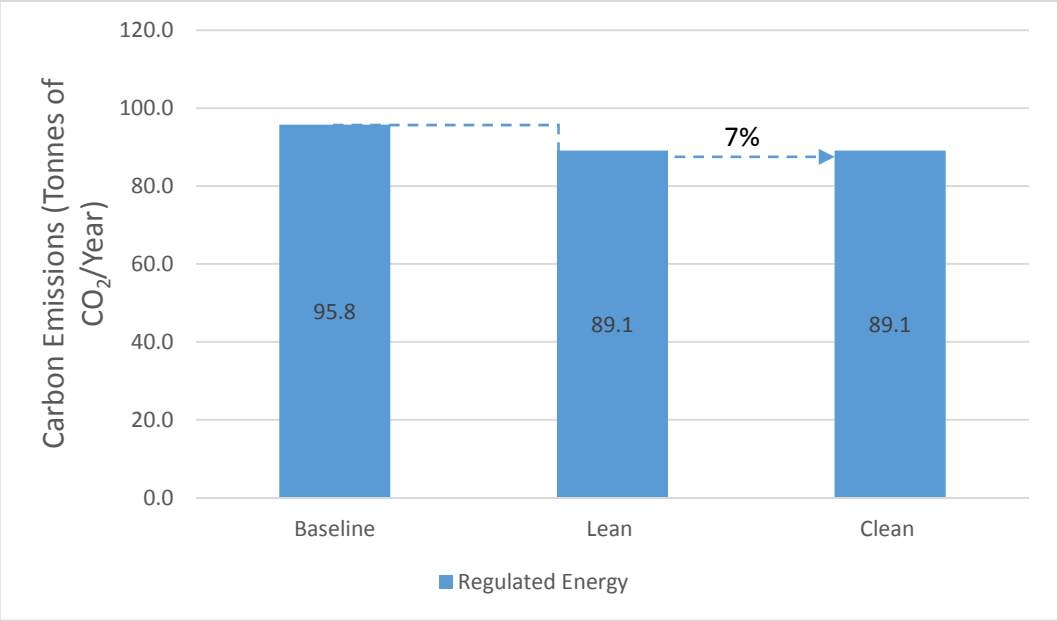

Figure 14: Summary of proposed Carbon Dioxide Emission Reduction for Retail Element

The consented assessment was conducted against Part L 2006, where an improvement of 46% was cited for the commercial element. The baseline for buildings since that time as tightened significantly (circa 33%, excluding changes to carbon factors). Despite this, the proposed development is still reporting a 15% improvement above current Building Regulations (Part L 2013). Against 2006, it is anticipated that the improvement would be better than that reported in the consented scheme, in excess of 46%. In overall terms, the energy strategy and associated reductions are in line with those previously approved.

Limitations:

This Energy Statement in support of planning has been generated at an early stage of design and therefore its findings are likely to change as the design progresses. All calculations and sizings are approximate and the result of software available at the time of publication. Although produced in compliance with current guidance, it is highly likely that the methodology for calculating carbon dioxide emissions for buildings will change in time, as will the CO_2 fuel factors.

Appendix A – BRUKL Commercial Office Modelling Report

The following pages contain the BRUKL report for the energy modelling that has been completed for the retail section.

Note that this BRUKL report represents the scheme with passive and energy efficient design measures incorporated, and renewable energy options in the form of air source heat pumps. Solar thermal savings have been evaluated separately.

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

80 Charlotte Street

As designed

Date: Wed Dec 02 11:16:01 2015

Administrative information

Building Details

Address: London, W1T 4BJ

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.4

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.4

BRUKL compliance check version: v5.2.d.2

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 should not exceed the target

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	22.4
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	22.4
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	19.6
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 the building services should achieve reasonable overall standards of energy efficiency

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

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	-	-	UNKNOWN
Floor	0.25	0.17	0.17	Z0000012:Surf[0]
Roof	0.25	0.14	0.14	Z0000012:Surf[1]
Windows***, roof windows, and rooflights	2.2	1.43	1.45	L0000000:Surf[1]
Personnel doors	2.2	-	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

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

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

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

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	>0.95

1- Heating/Cooling: FCU

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.1	4.87	0	2.2	0.65
Standard value	2.5*	2.55	N/A	1.6^	0.65
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.

^ Allowed SFP may be increased by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.

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

Local mechanical ventilation, exhaust, and terminal units

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

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
L01 entrance atrium	-	-	-	0.8	-	-	-	2.2	-	-	N/A
L01 T1 Corner	-	-	-	1.1	-	-	-	2.2	-	-	N/A
L01 T1 Corner	-	-	-	1.1	-	-	-	2.2	-	-	N/A
L01 T1 Perimeter	-	-	-	1.1	-	-	-	2.2	-	-	N/A
L01 T1 Perimeter	-	-	-	1.1	-	-	-	2.2	-	-	N/A
L01 T1 Perimeter	-	-	-	1.1	-	-	-	2.2	-	-	N/A
L01 T1 Perimeter	-	-	-	1.1	-	-	-	2.2	-	-	N/A
L01 T1 Perimeter	-	-	-	1.1	-	-	-	2.2	-	-	N/A
L01 T2 Corner	-	-	-	1.1	-	-	-	2.2	-	-	N/A
L01 T2 Perimeter	-	-	-	1.1	-	-	-	2.2	-	-	N/A
L01 T3 Corner	-	-	-	1.1	-	-	-	2.2	-	-	N/A
L01 T3 Perimeter	-	-	-	1.1	-	-	-	2.2	-	-	N/A
Z_00_02_10	-	-	-	1.1	-	-	-	2.2	-	-	N/A
Z_00_02_10	-	-	-	1.1	-	-	-	2.2	-	-	N/A
Z_00_02_10	-	-	-	1.1	-	-	-	2.2	-	-	N/A
Z_00_02_10	-	-	-	1.1	-	-	-	2.2	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
Z 00_02_10	-	-	-	1.1	-	-	-	2.2	-	-	N/A
Z_00_02_10	-	-	-	1.1	-	-	-	2.2	-	-	N/A
Z_00_02_10	-	-	-	1.1	-	-	-	2.2	-	-	N/A
Z_00_02_10	-	-	-	1.1	-	-	-	2.2	-	-	N/A
Z_00_02_10	-	-	-	1.1	-	-	-	2.2	-	-	N/A
Z_00_02_10	-	-	-	1.1	-	-	-	2.2	-	-	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	
L01 entrance atrium	-	147	15	273
L01 T1 Corner	36	-	-	186
L01 T1 Corner	38	-	-	140
L01 T1 Perimeter	34	-	-	642
L01 T1 Perimeter	34	-	-	465
L01 T1 Perimeter	35	-	-	243
L01 T1 Perimeter	34	-	-	176
L01 T1 Perimeter	33	-	-	653
L01 T2 Corner	36	-	-	190
L01 T2 Perimeter	33	-	-	948
L01 T3 Corner	36	-	-	197
L01 T3 Perimeter	33	-	-	663
L01_c_circulation	-	106	-	108
L01_c_circulation	-	86	-	355
L01_c_circulation	-	105	-	67
L01_c_circulation	-	100	-	76
L01_c_circulation	-	121	-	68
L01_c_circulation	-	100	-	78
L01_c_WCs	-	118	-	440
L01_c_WCs	-	121	-	323
Z_00_02_10	31	-	-	1879
Z_00_02_10	31	-	-	3023
Z_00_02_10	31	-	-	3362
Z_00_02_10	32	-	-	1745
Z 00_02_10	35	-	-	288
Z_00_02_10	31	-	-	2089
Z_00_02_10	31	-	-	4769
Z_00_02_10	33	-	-	891
Z_00_02_10	32	-	-	1322
Z_00_02_10	33	-	-	962

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?
L01 entrance atrium	NO (-51.4%)	YES
L01 T1 Corner	NO (-56.5%)	YES
L01 T1 Corner	NO (-65.8%)	YES
L01 T1 Perimeter	NO (-65.9%)	YES
L01 T1 Perimeter	NO (-49.5%)	YES
L01 T1 Perimeter	NO (-83.3%)	YES
L01 T1 Perimeter	NO (-32.2%)	YES
L01 T1 Perimeter	NO (-56.4%)	YES
L01 T2 Corner	NO (-50.2%)	YES
L01 T2 Perimeter	NO (-42.8%)	YES
L01 T3 Corner	NO (-55.5%)	YES
L01 T3 Perimeter	NO (-53.1%)	YES
Z_00_02_10	N/A	N/A
Z_00_02_10	N/A	N/A
Z_00_02_10	NO (-100%)	NO
Z_00_02_10	N/A	N/A
Z 00_02_10	NO (-57.8%)	YES
Z_00_02_10	N/A	N/A
Z_00_02_10	NO (-98.5%)	YES
Z_00_02_10	NO (-58.2%)	YES
Z_00_02_10	NO (-74.7%)	YES
Z_00_02_10	NO (-60.1%)	YES

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	4253.1	4253.1
External area [m²]	987.8	987.8
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	3	3
Average conductance [W/K]	1409.44	786.2
Average U-value [W/m²K]	1.43	0.8
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 Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others - Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	3.34	0.63
Cooling	3.9	7.48
Auxiliary	14.48	11.57
Lighting	15	23.65
Hot water	1.98	0.98
Equipment*	38.8	38.8
TOTAL**	**38.7**	**44.32**

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

Energy Production by Technology [kWh/m²]

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

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	98.74	107.85
Primary energy* [kWh/m²]	131.78	137.48
Total emissions [kg/m²]	19.6	22.4

* 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] Fan coil systems, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	38.8	68.6	3.6	4.2	15.6	2.96	4.5	3.1	5
	Notional	6.3	110.9	0.7	8.1	12.6	2.56	3.79	----	----

Key to terms

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

Key Features

The BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	-	UNKNOWN
Floor	0.2	0.17	Z0000012:Surf[0]
Roof	0.15	0.14	Z0000012:Surf[1]
Windows, roof windows, and rooflights	1.5	1.4	L0000000:Surf[0]
Personnel doors	1.5	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	-	No High usage entrance doors in building

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

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

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	3

Appendix B – BRUKL Commercial Retail Modelling Report

The following pages contain the BRUKL report for the energy modelling that has been completed for the retail section.

Note that this BRUKL report represents the scheme with passive and energy efficient design measures incorporated, but not the renewable energy options.

BRUKL Output Document

HM Government

Compliance with England and Wales Building Regulations Part L 2010

Project name

80 Charlotte Street

As designed

Date: Mon Nov 30 19:07:53 2015

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 6.4.0.15

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 6.4.0.15

BRUKL compliance check version: v4.1.e.5

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 should not exceed the target

1.1	CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	61.9
1.2	Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	61.9
1.3	Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	57.6
1.4	Are emissions from the building less than or equal to the target?	BER =< TER
1.5	Are as built details the same as used in the BER calculations?	Separate submission

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

2.a Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.21	0.21	RTL10024:Surf[1]
Floor	0.25	-	-	UNKNOWN
Roof	0.25	-	-	UNKNOWN
Windows***, roof windows, and rooflights	2.2	-	-	No windows or rooflights in building
Personnel doors	2.2	-	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

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

2.b Building services

The building services parameters listed below are expected to be checked by the BCO against guidance. No automatic checking is performed by the tool.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	>0.95

1- dining

Heating seasonal efficiency	**Cooling nominal efficiency**	**SFP [W/(l/s)]**	**HR seasonal efficiency**
5.5	2.5	0	0.65
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system			YES

2- kitchen

Heating seasonal efficiency	**Cooling nominal efficiency**	**SFP [W/(l/s)]**	**HR seasonal efficiency**
3	4.15	1.8	-
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system			YES

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

Local mechanical ventilation and exhaust

Zone	**Supply/extract SFP [W/(l/s)]**	**HR seasonal efficiency**	**Exhaust SFP [W/(l/s)]**
W-H/circulation	0.68	-	0.68
W-H/perimeter 2	0.68	-	0.68
W-H/circulation	0.68	-	0.68
W-H/perimeter 1	0.68	-	0.68
W-H/internal 1	0.68	-	0.68
W-H/kitchen	-	-	0.68
W-H/store	0.68	-	0.68
W-H/plant	0.68	-	0.68

General lighting and display lighting

Zone	**General lighting [W]**	**Display lamps efficacy [lm/W]**
W-H/circulation	120	-
W-H/perimeter 2	240	24.2
W-H/circulation	70	-
W-H/perimeter 1	250	24.2
W-H/internal 1	430	24.2
W-H/kitchen	1040	-
W-H/store	130	-
W-H/plant	210	-

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?**
W-H/circulation	YES (+5.3%)	NO
W-H/perimeter 2	NO (-27.8%)	NO
W-H/circulation	N/A	N/A
W-H/perimeter 1	NO (-38.3%)	NO
W-H/internal 1	N/A	N/A
W-H/kitchen	N/A	N/A
W-H/store	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
W-H/plant	N/A	N/A

Criterion 4: The performance of the building, as built, should be consistent with the 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]	504.8	504.8
External area [m²]	262.8	262.8
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	5	5
Average conductance [W/K]	202.03	225.65
Average U-value [W/m²K]	0.77	0.86
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
100	**A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways**
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others - Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	3.04	3.94
Cooling	15.74	13.89
Auxiliary	25.22	24.02
Lighting	42.07	54.21
Hot water	28.16	26.66
Equipment*	134.14	134.14
TOTAL**	**114.24**	**122.71**

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

Energy Production by Technology [kWh/m²]

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

Energy & CO_2 Emissions Summary

	Actual	Indicative Target
Heating + cooling demand [MJ/m²]	248.29	225.71
Primary energy* [kWh/m²]	333.55	358.26
Total emissions [kg/m²]	57.6	61.9

* 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] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	65.4	142.6	3.4	8.8	14.5	5.39	4.48	5.5	6
	Notional	45.5	138	4.9	10.1	16	2.56	3.79	----	----
[ST] Constant volume system (fixed fresh air rate), [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	20.9	385.2	1.8	42.8	67.2	3.3	2.5	3	3
	Notional	0.1	391.2	0	28.7	55.5	2.56	3.79	----	----

Key to terms

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

Key Features

The BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.21	RTL10024:Surf[1]
Floor	0.2	-	UNKNOWN
Roof	0.15	-	UNKNOWN
Windows, roof windows, and rooflights	1.5	-	No windows or rooflights in building
Personnel doors	1.5	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	-	No High usage entrance doors in building

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

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

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