Energy and Sustainable Design Statement

182-184 High Holborn

117366/AP/160902
Revision 03

Report Prepared For: Covent Garden Investment S.A.R.L.

SWECO

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1.

Executive Summary

This report has been prepared on behalf of Covent Garden Investment S.A.R.L. for inclusion in the detailed planning submission for the 182-184 High Holborn development in London.

The proposed 182-184 High Holborn building comprises of 8 floors of office (Class B1) use ground plus 7 and retail use (Class A1/A3) on ground floor.

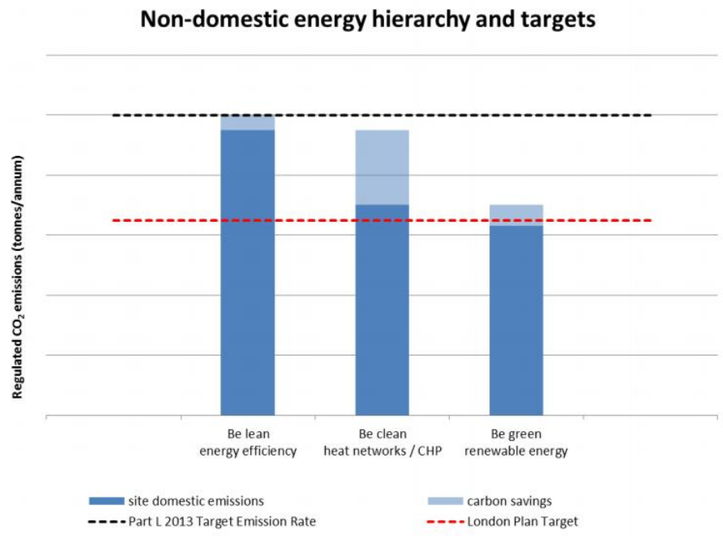
Following the energy and carbon evaluation it is proposed that extensive energy efficiency measures along with Low and Zero Carbon (LZC) applications will be incorporated into the designs for the 182-184 High Holborn building. Energy and Carbon Calculations have confirmed that the proposed energy efficiency design and LZC application will achieve:

1) 182-184 High Holborn:

- *Regulated carbon dioxide savings of 19.6% relative to a New-Build Part L2A 2013 compliant development*
- *BREEAM – 'Excellent' Rating assessed under BREEAM 2014 New Construction for Offices*

The energy assessment has been carried out using the methodology outlined in the GLA Energy Planning GLA Guidance on preparing energy assessments: March 2016 and The Further Alternations to London Plan (FALP), Chapter 5: London's Response to Climate Change from March 2015, which is as follows:

1. Using less energy 'being lean'
2. Supply energy efficiently 'being clean'
3. Using renewable energy 'being green'



The tables below outline the carbon breakdown as detailed within the "Energy Planning" GLA guidance on preparing energy assessments Table 1, 2 & 3.

The assessment has considered the whole site boundary and addresses both planning policies and Building Regulations that will influence the solutions adopted for the development.

The combination of the optimised passive design measures, energy efficient plant selection result in an overall annual carbon reduction of 19.6% which is below the aspiration of 35% relative to the current 2013 Part-L target emission rate (TER) on the building for which offset payment contribution will be made towards Camden Council's wider Sustainability initiative.

The scheme has also been designed to achieve a high standard of sustainability. The various part of the building will be assessed with suitable Building Research Establishment (BRE) schemes.

- BREEAM NC 2014 for Office Areas

Using the sustainability framework set by the above BRE assessments has allowed a complete analysis of the environmental credentials of the whole development (Refer to Appendix A).

Table 1: Carbon dioxide emissions after each stage of the energy hierarchy

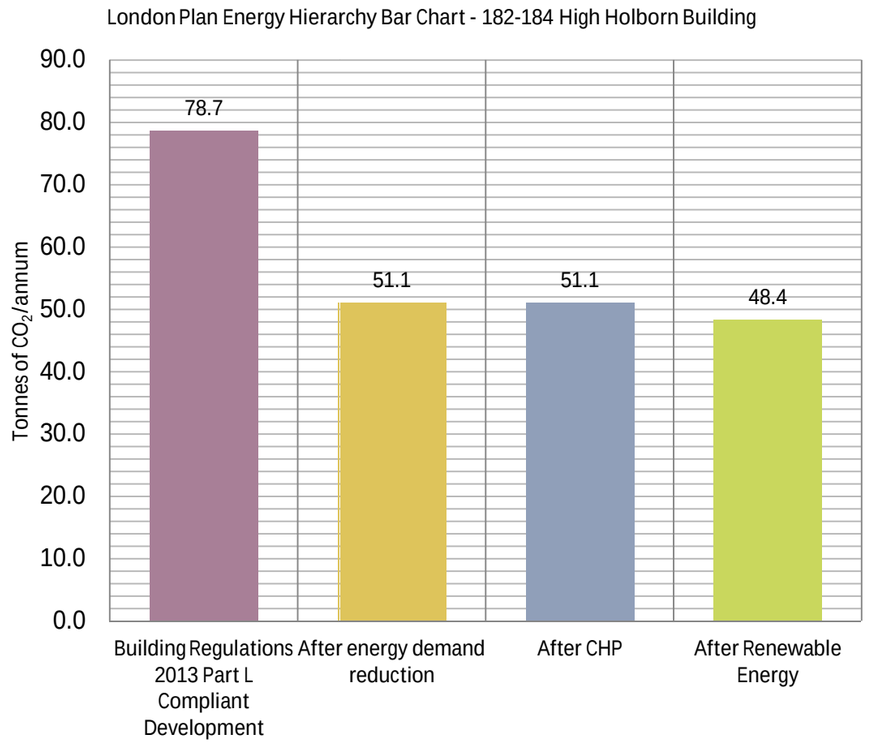
Energy Planning – Greater London Authority guidance on preparing energy assessment	Carbon Dioxide Emissions (Tonnes CO_2 per Annum)	
	Regulated Energy	Unregulated Energy
Building Regulations 2013 Part L Compliant Development	102.2	125.3
After energy demand reduction	82.1	98.3
After CHP	82.1	98.3
After renewable energy	82.1	98.3

Table 2: Regulated carbon dioxide savings from each stage of the energy hierarchy

	Regulated Carbon Dioxide Savings	
	(Tonnes CO_2 per annum)	(%)
Savings from reduced energy demand	20.03	19.6%
Saving from CHP	0.00	0.0%
Savings from renewable energy	0.00	0.0%
Total Cumulative Savings	20.03	19.6%
Total Target Savings - GLA's Target	35.76	35.0%
Regulated Annual Surplus	-15.73	

Table 3: Shortfall in regulated carbon dioxide savings

	Annual Shortfall Tonnes CO_2 (Regulated)	Carbon Offset Payment as per GLA Guidance per Ton of CO_2	Total Carbon Offset Payment
Shortfall	-15.73	£2,700	-£42,468



2. Introduction

2.1 Purpose of the Report

This report describes the various options for energy and carbon reduction at the 182-184 High Holborn development.

The figures presented in this report are calculated for the purposes of initial estimates, using the preliminary information currently available. Hence whilst they can be used to gain an understanding of the benefits of each technology, they must not be taken out of context; establishing the best economic and energy efficient operation will require more complex analysis of the building projected load profiles when it is developed.

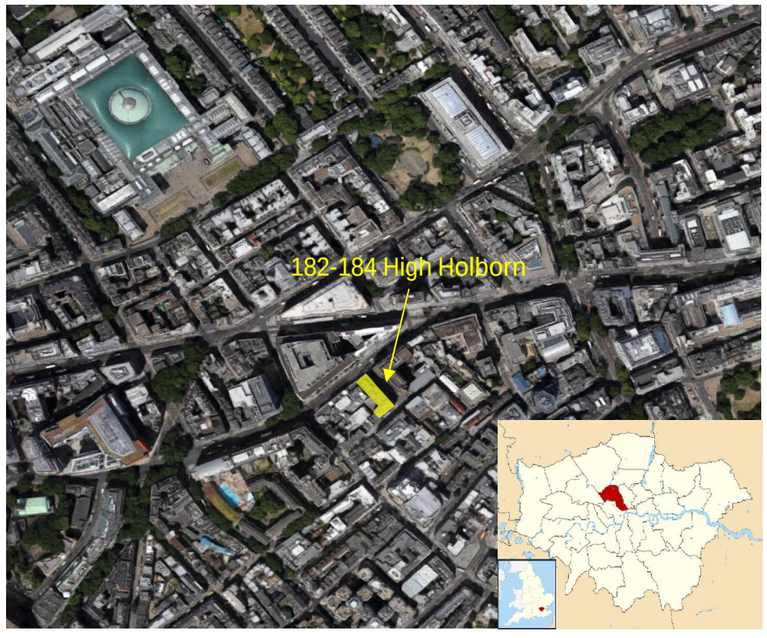
2.2 Development Description

The site is located on the southern side of High Holborn (A40), nearby Holborn underground station.

The Building design strategy consists of remodelling the facade into the existing urban context whilst retaining the existing structural frame.

The proposed development consists of circa 4,960m^2 GIA of ground level retail and office areas. Office use (Class B1) is spread across ground plus 7 storeys and has ground level retail space. (Class A1/A3).

The opposite images illustrate the architectural concept of 182-184 High Holborn (from SPPARC Architecture) and the location within the London Borough of Camden.



2.3 Planning Application Boundary

The 182-184 High Holborn site sits on the corners of High Holborn, Smart's Place and Stukeley Street, in London.

The image below outlines the 182-184 High Holborn building site boundary in red.

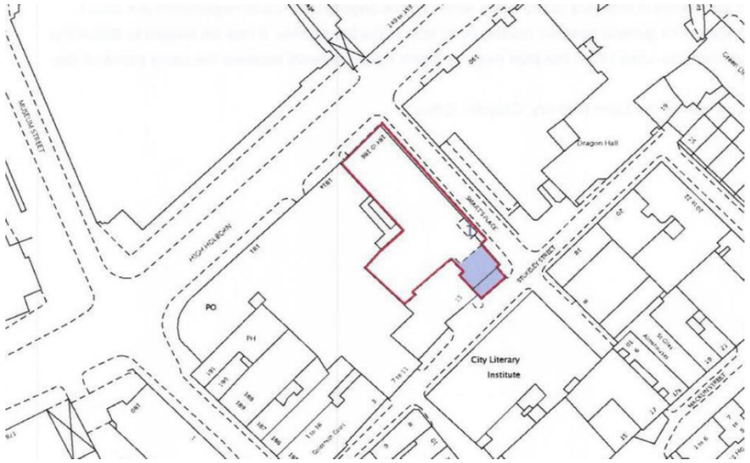


Figure 2-1 182-184 High Holborn Site Boundary, extract from SPPARC's parameter plan drawings

2.4 Planning Policies

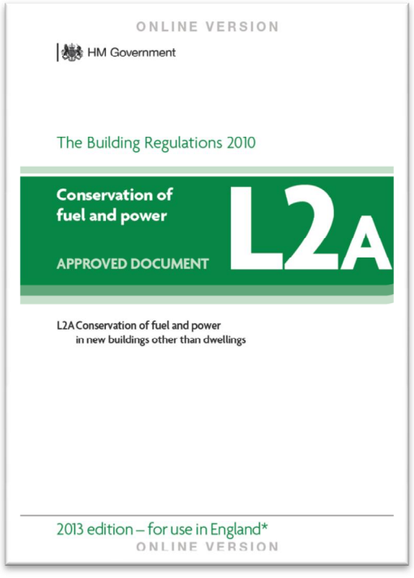
2.4.1 National Policies – Building Regulations:

The 182-184 High Holborn development will need to conform to the requirements set out in Part L2A (Conservation of Fuel and Power) and not L2B (Conservation of fuel and power in existing buildings other than dwellings) of the Building Regulations 2013 due to the extents of modifications being carried out on the existing building..

The Approved Documents are approved and issued by the Secretary of State to provide guidance on compliance with specific aspects of building regulations in common building situations. They set out what, in ordinary circumstances, may be accepted as a reasonable provision for compliance with the relevant requirement(s) of the Building Regulations to which they refer.

Approved Document Part L of the Building Regulations covers the carbon emissions that are attributable to buildings in use, resulting from lighting, heating, cooling and ventilation excluding small power. In summary:

- Non-domestic developments come under Part L2A of the Building Regulations for new buildings.
- A rigid calculation methodology is set out to show compliance. This is the government's Standard Assessment Procedure (SAP) for domestic buildings, and National Calculation Method (NCM) for non-domestic buildings.
- The reduction can be achieved by any mixture of passive design features (i.e. reducing energy demand) and energy efficiency measures, but minimum standards of thermal performance apply.
- In all cases, small power is excluded.
- In all cases, the reductions achieved are calculated by comparing the proposed design against a target which complies with Building Regulations values.



2.4.2 Regional Policies – London Plan

The Mayor of London published the current revision of the "London Plan" in March 2016. This is the Spatial Development Strategy for Greater London. The Development Plans of all London Boroughs must eventually comply with the general requirements of the London Plan.

To support borough planners, the Mayor has published a guidance document through London Renewables: "Integrating Renewable Energy into New Developments: A Toolkit for Planners, Developers and Consultants", and more recently the Supplementary Planning Guidance "Sustainable Design and Construction".

The London Plan includes planning policies both for reducing energy consumption within buildings and, significantly, promoting the use of decentralised electricity generation and renewable energy. These policies cover the role of boroughs in supporting the Mayor's Energy strategy and the requirements of planning applications.

Energy Planning document by GLA (March 2016) states the requirement to minimise carbon dioxide emissions. The document indicates that carbon dioxide emissions for non-residential developments should be reduced by at least 35% below those emissions targeted by the Building Regulations Part L 2013. These emissions should include those covered by the Building Regulations and those that are not covered by the Building Regulations.

The revised energy assessment guidance explains that the carbon reduction target for new development will change from 1 October 2016 as follows:

- Stage 1 schemes received by the Mayor up until 30 September 2016 – 35% below Part L 2013 for both residential and commercial/non-domestic development.

- Stage 1 schemes received by the Mayor on or after the 1st October 2016 – Zero carbon (as defined in section 5.2 of the Housing SPG) for residential development and 35% below Part L 2013 for commercial /non-domestic development

The London Plan recognises that energy efficiency should come before energy supply considerations and has suggested a simple strategy known as the Mayor's Energy Hierarchy. The process follows good practice in the design of low carbon buildings and comprises three distinct stages and order of application:

1) Use Less Energy (Be Lean)

2) Supply Energy Efficiently (Be Clean)

3) Use Renewable Energy (Be Green)

This strategy puts energy efficiency/conservation measures first in order to reduce the demand for energy, 'Be Lean'. Following this, consideration must be given to supplying the resultant reduced energy demand as efficiently as possible, including the use of combined heat and power (CHP), 'Be Clean'. Finally, sources of renewable energy should be examined, 'Be Green'.

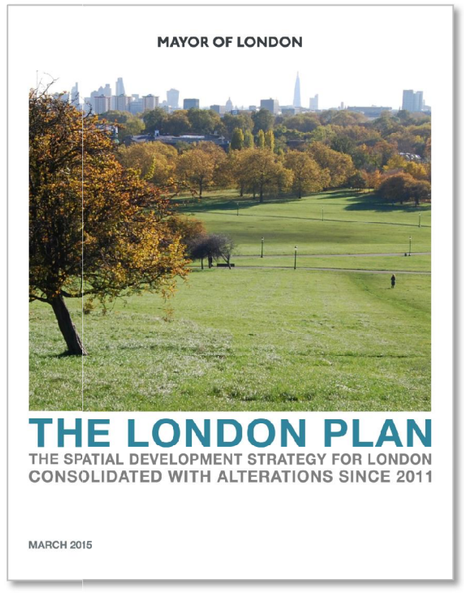
As stated in Policy 5.6, the mayor will expect all major developments to demonstrate that the proposed heating and cooling systems have been selected in accordance with the following order of preference:

- Connection to an existing C/CHP scheme
- Site-wide C/CHP
- Communal heating and cooling

Where C/CHP is to be installed in a new development, the feasibility of extending the system beyond the site should be investigated. In addition, provision will be made for the heating and cooling network for future connections to district heating networks.

As stated in Policy 5.7, the current London Plan includes a notional target for on-site renewable energy, unless it can be demonstrated that such provision is not feasible. This target is for renewable energy to achieve a 20% reduction in carbon dioxide emissions after any energy efficiency measures and (non-renewable) C/CHP schemes have been applied.

The Plan also states that provision must be made in some form for the future Hydrogen Economy. However, take up of these technologies is recognised to be unrealistic in the current Planning environment.



2.4.3 Local Policies – London Borough of Camden

As part of the Local Development Framework (LDF), London Borough of Camden has in place the following Development Plan Documents (DPDs) that together with the London Plan form the basis for planning policy in the borough and are relevant for sustainable design and energy strategy for major developments:

- Core Strategy (CS) adopted in November 2010
- Camden Development Policies (CDP) adopted in November 2010

Moreover, Camden Planning Guidance Supplementary Planning Document (SPD) adopted in September 2013 supports and details the policies within the CS 2010 and CDP 2010. Although not part of the development plan, the SPD will be a 'material consideration' of the planning decision by the borough.

182-184 High Holborn building is located just outside Tottenham Growth Area and outside of Holborn Growth Area on the west.

Figure 2-2 illustrates the Holborn Growth Area and 182-184 High Holborn sits outside the boundary marked in red.

The London Borough of Camden is also developing a Local Plan which is currently under consultation and may have a hearing in October 2016. Once adopted, the document would then supersede CS and CDP.

The policies relating to Energy and Sustainable Design are outlined in the section "Tackling climate change through promoting higher environmental standards" (CS13) from the CS, "Promoting sustainable design and construction" (DP22) and "Water" (DP23) from the CDP.

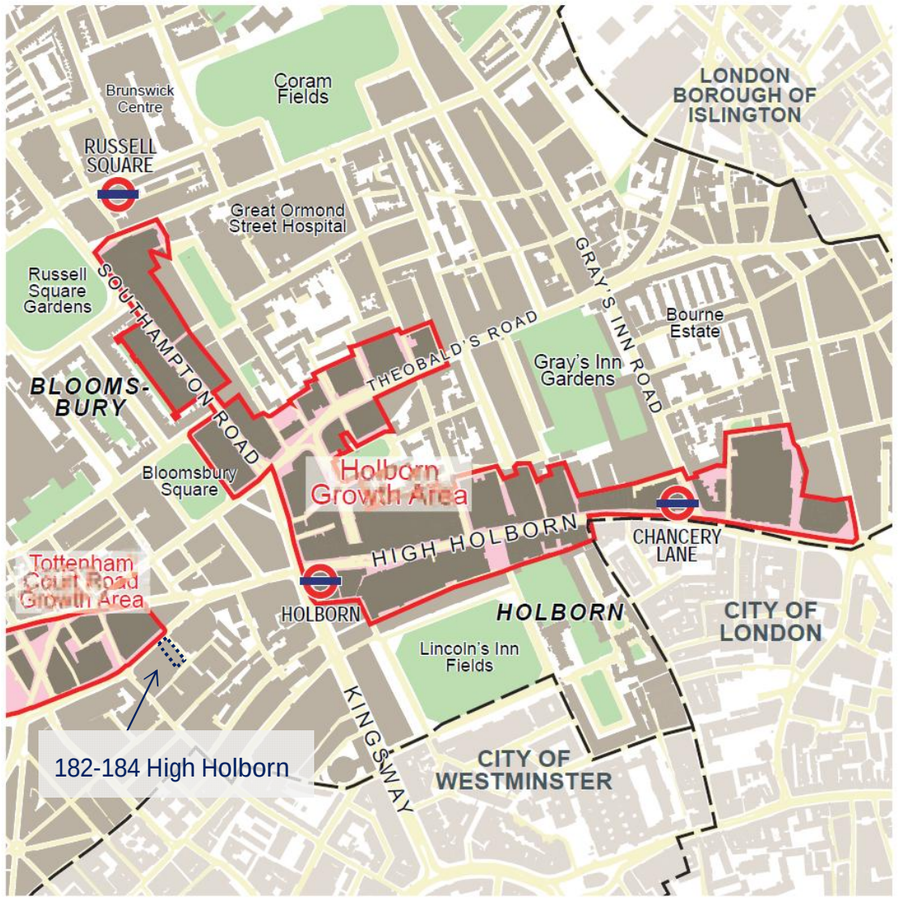


Figure 2-2 Holborn Growth Area and Tottenham Growth area marked in red boundary with 182-184 High Holborn highlighted in a dotted boundary

Borough Wide Development Policy – DP22: Promoting sustainable design and construction

POLICY

DP22 – Promoting sustainable design and construction

The Council will require development to incorporate sustainable design and construction measures. Schemes must:

a) demonstrate how sustainable development principles, including the relevant measures set out in paragraph 22.5 below, have been incorporated into the design and proposed implementation; and

b) incorporate green or brown roofs and green walls wherever suitable.

The Council will promote and measure sustainable design and construction by:

c) expecting new build housing to meet Code for Sustainable Homes Level 3 by 2010 and Code Level 4 by 2013 and encouraging Code Level 6 (zero carbon) by 2016.;

d) expecting developments (except new build) of 500 sq m of residential floorspace or above or 5 or more dwellings to achieve "very good" in EcoHomes assessments prior to 2013 and encouraging "excellent" from 2013;

e) expecting non-domestic developments of 500sqm of floorspace or above to achieve "very good" in BREEAM assessments and "excellent" from 2016 and encouraging zero carbon from 2019.

The Council will require development to be resilient to climate change by ensuring schemes include appropriate climate change adaptation measures, such as:

f) summer shading and planting;

g) limiting run-off;

h) reducing water consumption;

i) reducing air pollution; and

j) not locating vulnerable uses in basements in flood-prone areas.

Note: Measures set out in paragraph 22.5 refer to CS13

Refer to Appendix A showing compliance with Policy DP22.

Borough Wide Strategic Policy – DP23: Water

POLICY

DP23 – Water

The Council will require developments to reduce their water consumption, the pressure on the combined sewer network and the risk of flooding by:

a) incorporating water efficient features and equipment and capturing, retaining and re-using surface water and grey water on-site;

b) limiting the amount and rate of run-off and waste water entering the combined storm water and sewer network through the methods outlined in part a) and other sustainable urban drainage methods to reduce the risk of flooding;

c) reducing the pressure placed on the combined storm water and sewer network from foul water and surface water run-off and ensuring developments in the areas identified by the North London Strategic Flood Risk Assessment and shown on Map 2 as being at risk of surface water flooding are designed to cope with the potential flooding;

d) ensuring that developments are assessed for upstream and downstream groundwater flood risks in areas where historic underground streams are known to have been present; and

d) encouraging the provision of attractive and efficient water features.

Refer to section 4.4.3 showing compliance with Policy DP23.

Borough Wide Strategic Policy – DP32: Air Quality and Camden's Clear Zone

POLICY

DP32 – Air quality and Camden's Clear Zone

The Council will require air quality assessments where development could potentially cause significant harm to air quality. Mitigation measures will be expected in developments that are located in areas of poor air quality.

The Council will also only grant planning permission for development in the Clear Zone region that significantly increases travel demand where it considers that appropriate measures to minimise the transport impact of development are incorporated. We will use planning conditions and legal agreements to secure Clear Zone measures to avoid, remedy or mitigate the impacts of development schemes in the Central London Area.

Refer to Section 6 showing compliance with Policy DP32.

Borough Wide Strategic Policy – CS13: Tackling climate change through promoting higher environmental standards

CS POLICY

CS13 – Tackling climate change through promoting higher environmental standards

Reducing the effects of and adapting to climate change

The Council will require all development to take measures to minimise the effects of, and adapt to, climate change and encourage all development to meet the highest feasible environmental standards that are financially viable during construction and occupation by:

a) ensuring patterns of land use that minimise the need to travel by car and help support local energy networks;

b) promoting the efficient use of land and buildings;

c) minimising carbon emissions from the redevelopment, construction and occupation of buildings by implementing, in order, all of the elements of the following energy hierarchy:

1. ensuring developments use less energy,

2. making use of energy from efficient sources, such as the King's Cross, Gower Street, Bloomsbury and proposed Euston Road decentralised energy networks;

3. generating renewable energy on-site; and

d) ensuring buildings and spaces are designed to cope with, and minimise the effects of, climate change.

The Council will have regard to the cost of installing measures to tackle climate change as well as the cumulative future costs of delaying reductions in carbon dioxide emissions

Local energy generation

The Council will promote local energy generation and networks by:

e) working with our partners and developers to implement local energy networks in the parts of Camden most likely to support them, i.e. in the vicinity of:

– housing estates with community heating or the potential for community heating and other uses with large heating loads;

– the growth areas of King's Cross;

Euston; Tottenham Court Road; West Hampstead Interchange and Holborn;

– schools to be redeveloped as part of Building Schools for the Future programme;

– existing or approved combined heat and power/local energy networks (see Map 4);

and other locations where land ownership would facilitate their implementation.

f) protecting existing local energy networks where possible (e.g. at Gower Street and Bloomsbury) and safeguarding potential network routes (e.g. Euston Road);

Water and surface water flooding

We will make Camden a water efficient borough and minimise the potential for surface water flooding by:

g) protecting our existing drinking water and foul water infrastructure, including Barrow Hill Reservoir, Hampstead Heath Reservoir, Highgate Reservoir and Kidderpore Reservoir;

h) making sure development incorporates efficient water and foul water infrastructure;

i) requiring development to avoid harm to the water environment, water quality or drainage systems and prevents or mitigates local surface water and down-stream flooding, especially in areas up-hill from, and in, areas known to be at risk from surface water flooding such as South and West Hampstead, Gospel Oak and King's Cross (see Map 5).

Camden's carbon reduction measures

The Council will take a lead in tackling climate change by:

j) taking measures to reduce its own carbon emissions;

k) trialling new energy efficient technologies, where feasible; and

l) raising awareness on mitigation and adaptation measures.

2.5 Part L 2013

The 182-184 High Holborn building will be assessed under Part L2A 2013 and as such, it is a requirement that the buildings meet the minimum building regulations in terms of the maximum façade U-Values, minimum values for energy efficiencies and minimum values for CO_2 reductions as listed within the Part L requirements.

Fuel CO_2 emission factors based on the NCM document for Part L2A 2013 compliance have been applied to the model in order to calculate the CO_2 emissions that will be produced as a result of the running of the systems outlined within Table 2-1 below:

Table 2-1: Fuel Factors 2013 Part L.

System	Fuel Source	Emission Factor ($KgCO_2/kWh$)
LTHW Heating Energy	Natural Gas	0.216
Chiller Energy	Grid Electricity	0.519
Lighting Energy	Grid Electricity	0.519
Pump / Fan Energy	Grid Electricity	0.519
DHW Energy	Natural Gas	0.216

3. 'Baseline' Building Emission Rate (BER)

The 'Baseline' building represents a development which just meets the minimum standards of CO_2 emissions reduction (i.e. the Building Emissions Rate (BER) and is equal to the Target Emissions Rate (TER) as defined by Part L of the Building Regulations 2013).

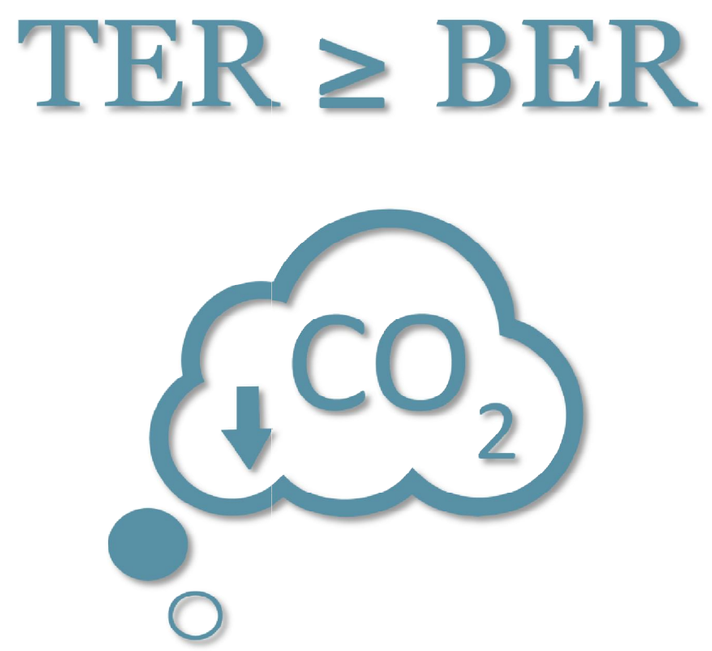
Allowances for energy consumption not included under Part L have been made by reference to published material or by calculation. These include small power (energy use for electrical appliances). The energy breakdown and carbon dioxide emissions by end use and area are shown in the table below.

As part of the study for the commercial areas of the building, a thermal model of the building was developed and analysed using the approved IES Virtual Environment Software (Version 7.0.5). This software models the carbon dioxide emission rates produced by a building in accordance with Part L2A of the Building Regulations (2013). The software is approved for use by the Department for Communities and Local Government (DGLG) as a Dynamic Building Simulation Modelling Package (DSM).

Unregulated energy use and the associated carbon dioxide emissions for the non-domestic buildings has been calculated using the BRUKL document, CIBSE publications for guidance, as well as evidence established through previous development work. Both sets of results, regulated and unregulated energy have been combined to form the tables below.

Table 3-1: Target Emission Part L 2013

Building Regulations 2013, Part L Compliant Development	Carbon Dioxide Emissions (Tonnes CO_2 per Annum)		
	Regulated Energy	Unregulated Energy	Total
182-184 High Holborn	102.2	125.3	227.5



4. Demand Reduction (Be Lean)

Energy efficient servicing strategies and equipment will be used throughout the development to *reduce energy demand*. Technologies employed include:

4.1 Passive Design Features: Regulated Energy Use

4.1.1 Building Envelope

The external envelope of a building can act as an important climatic modifier, with a well-designed façade significantly reducing the building's energy demand.

Table 4-1 below details the percentage improvement made to the proposed building construction elements in order to improve fabric efficiency to reduce heating loads and also increase comfort level within the spaces by even heat distribution within the occupancy space.

Table 4-1: Proposed Building Thermal Envelope U-values

Parameter		Part L2A Value	% Improvement over Part L2A	Applied Values
Building Air tightness		10m³/h/m² @ 50pa	70 %	3 m³/h/m² @ 50pa
U-Values	Opaque Wall/ Insulated spandrel	0.35W/m²K	43%	0.20 W/m²K
	Curtain Wall	2.00W/m²K	-	Glazing – 1.40W/m^2K Opaque – 0.80W/m^2K
	Roof	0.25 W/m²K	48%	0.13 W/m²K
	Floor	0.25W/m²K	40%	0.15 W/m²K
Glazing U-value		2.00W/m²K	30%	1.40 W/m²K
Glazing g-value (BS EN 410)		Clear Glazing		0.40-0.33
Glazing Lighting Transmittance		Clear Glazing		66-70%
Thermal Bridging		Calculation Required (Max. Limit)		0.05W/m^2.K

Notes:

1) The "Applied Values" are the construction parameters applied to the Actual Building simulation model. And are representative of average of various areas.
2) U-values listed above will be traded for achieving practicality of achieving insulation for various building elements.
3) Glazing g-value to vary based upon exposure to sunlight in order to balance day lighting against the cooling loads
4) U-values have been analysed against best practice U-values and are a balance between Heating and Cooling Loads against practical adaptability of the building design in lieu of specifying material with best green credentials to maximise the BREEAM material related credits.

The proposed characteristics for U-values and air permeability are significantly better than the minimum standards as set out by Part L 2013.

4.1.2 Façade Optimisation

Detailed thermal modelling analysis (using industry-recognised and DCLG Certified dynamic simulation software) has been used during the design process to optimise the glazing for balancing cooling loads against day lighting and thus ensure good levels of natural daylight penetration whilst limiting unwanted solar gain and heat loss.

The thermal modelling has informed the design of building façades to respond to its orientation and subsequent relationship to direct sun angles. The optimisation of the façade was achieved through balancing the performance specification of the solar-control glass and the actual proportions of glazing and opaque façade elements to reduce the risk of overheating in line with London Plan Cooling Hierarchy, Policy 5.9 (refer to Appendix D – Mitigating the risk of overheating).

4.1.3 Building Form/Massing

The building is designed such that its form and massing will provide passive control of solar gains. This will ensure that solar gains are maximised in winter months (when they are beneficial in reducing heating loads), while in summer months they are minimised (to reduce the effective cooling loads).

4.1.4 Daylight Analysis

As stated previously the external facades have been optimised to minimise direct solar gains whilst maximising daylight provision into the occupied areas.

The building has a narrow plan with close proximity to surrounding buildings, hence glazing spec with 70% Light transmittance has been recommended on the North East and North West facades to maximise daylight penetration. In addition to this, the design also incorporates roof lights on the top floor to allow for adequate daylight whilst minimising solar gain.

As well as improving occupant comfort by increasing natural daylight provision and visual stimulus, this will reduce the dependency on artificial lighting, thus resulting in energy consumption savings.

4.1.5 Cooling and Overheating

Policy 5.9 of the London Plan requires that major development proposals should reduce the potential of overheating and the reliance on air conditioning systems.

Building orientation, percentage of glass and shading devices on the façade have been designed with the aim to minimise solar heat gains entering the building. Due to the location of the site, to maintain indoor air quality along with maintaining noise levels, natural ventilation would not be effective in providing thermal comfort, therefore mechanical cooling is being considered.

The design principles of the scheme were analysed with the use of dynamic overheating modelling. Thermal comfort and cooling demand were assessed according to CIBSE TM 52 and TM49 guidance, respectively and a full assessment can be found in Appendix C.

4.2 Active Design Features: Regulated Energy Use

4.2.1 Building Energy Management System and Metering

A comprehensive Building Energy Management System (BMS) will be installed to monitor and report on the overall energy consumption of the building. The system will highlight any out of range consumption figures and readings, allowing a preventative approach through interrogation and resolution of potential problems.

The BMS will also provide intelligent control of the building services systems to ensure that occupant comfort is maintained throughout and that the systems are running to their peak 'as designed' efficiencies.

Metering of energy usage on all floors, per tenancy will allow building owners / occupiers to view and interrogate where potential energy savings can be made throughout the building.

4.2.2 EC/DC Motors for Fan Coil Units

The current Part L Building Regulations set stringent efficiencies for the fans used in all air conditioning/mechanical ventilation systems. Recent advances in fan motor technology have resulted in substantial reductions in energy consumption, an otherwise significant proportion of building energy use.

EC/DC (electronically commutated direct current) motors will be used in place of conventional AC motors. These will be of the variable air volume 'VAV' type whereby the flow rate, and hence energy consumption, are reduced to a minimum set back rate when possible.

4.2.3 Air Handling Heat Recovery

The energy required to heat or cool the incoming fresh air supply to the buildings will be significantly reduced by using an efficient heat recovery system. The heat recovery systems will utilise the thermal properties of the return air to transfer 'free' heat/cooling to the incoming fresh air supply. These will be controlled so as to minimise the demand for any heating and cooling of the fresh air supply.

4.2.4 Low Energy Lighting

4.2.4.1 Low Energy Lighting

Lighting is typically responsible for about one quarter of the carbon emissions from commercial buildings.

Lighting throughout the occupied areas of the building will be intelligently controlled according to the building/area usage. For instance, the WC/circulation areas will be controlled via PIR movement detectors which will monitor occupancy and switch off the lights when the area is vacant for a sustained length of time.

LED lighting will be specified for all the occupancy areas and also be timed control to ensure switching off to reduce energy consumption.

4.2.4.2 Efficient Lighting Control

Introducing presence detection and daylight dimming within spaces which have access to day light will reduce the lighting levels for times when the lux levels are available via natural daylight. Furthermore LED lighting will be required to achieve lighting levels listed in the table below

Table 4-2: Applied Lighting Specifications

System	Parameter	Applied Value
Lighting Efficiency	Office Areas	8 W/m²
	Retail Areas	15 W/m²
	Reception Areas	15 W/m²
	Transient Areas	10 W/m²
	Toilet Areas	8 W/m²
Lighting Controls	Occupancy Areas	Presence Detection on/off AND Day light Dimming Control
	Transient Areas with glazing	
	Retail Areas	No Lighting Control

4.2.5 High Efficiency Chillers

Mechanical cooling will be minimised through the use of passive design features as discussed earlier within this report. Having limited loads the intention is to provide a central system using high efficiency chillers to serve the development with the system designed to optimise performance in line with the differing load profiles.

High efficiency cooling will assist in meeting the required energy targets required for a BREEAM 'Excellent' rating.

The commercial office component within the development will be designed to achieve BREEAM 'Excellent' rating. The high energy consumption of absorption cooling generally precludes the award of 'Excellent' ratings under the current BREEAM scheme.

Also there is growing concern within the industry of the problems inherent in providing cooling through absorption technology driven by combined heat and power units (CHP). Utilising correctly sized high efficiency vapour compression chillers is shown to be a more energy efficient solution for cooling.

The on-floor cooling will be provided via a centralised cooling plant. An intelligent multiple chiller sequencing operation will be specified to ensure that each chiller will operate at peak efficiency, given the required cooling load. (For example, 2 no. chillers may operate at part-load instead of 1 no. at peak load to maximise the seasonal efficiency ratio (SEER).

4.2.6 High Efficiency Variable Speed Drives

By varying the fan and pump speeds for the water and air distribution systems to match the building load profiles, fan and pump energy consumption will be considerably reduced. This will be maintained and controlled through constant monitoring via the intelligent Building Management System (BMS).

4.2.7 Automatic Monitoring and Targeting

The Building Regulations Approved Document L2A identifies that the provision of automatic monitoring and targeting with alarms for out of range values, can provide significant savings in energy consumption of the building services systems. A saving in energy consumption of 5% is awarded for complete installations that measure, record, transmit, analyse, report and communicate meaningful energy management information to enable the operator to interrogate and manage energy usage.

4.3 Efficient HVAC Parameters

The following design parameters were assigned to the base building in order to establish its CO_2 emission rate over a year.

Table 4-3: Applied HVAC parameters for Main Central Plant – 182-184 High Holborn

System	Parameter	Applied Value
VRF System for Heating	Nominal Efficiency (COP)	3.18
	Seasonal Efficiency (SCOP)	4.36
VRF System for Cooling	Nominal Efficiency (EER)	4.63
	Seasonal Efficiency (SEER)	4.76
Centralised Fresh Air Unit (AHU)	SFP	1.49 W/ls^{-1}
	Heat Recovery Efficiency	80%
Local Cooling Units	SFP	0.2 W/ls^{-1}
WC Extract Fans	SFP	0.40 W/ls^{-1}
Pumps	Pump Type	Variable Speed Differential Sensor in System at multiple locations
Ductwork and AHU Leakage	Ductwork Leakage Testing	Class B
	AHU CEN Standards	Class L2
Domestic Hot Water	Central DHW Storage	600 L
	Storage Losses	0.004 (kWh/(L.day)
	Circulation Losses	Limited to 5 W/m
	Controls	Time Control
Lighting Efficiency	Office Areas	LED lighting – 8 W/m²
	Retail Areas	LED lighting - 15 W/m²
	Reception Areas	LED lighting – 15 W/m²
	Storage Area	LED lighting - 8 W/m²
	Toilet Areas	LED lighting - 8 W/m²
	Circulation Areas	LED lighting - 10 W/m²
	Plant Areas	LED lighting - 8 W/m²
General	Power Factor	Greater than 0.95
	Lighting system have provision for metering	Yes
	Automatic Monitoring of energy Data? i.e. Full BMS	Yes
	Controls	Central Start and Stop Optimum Start and Stop

Note:
*All installed Lighting will be LED and all day lighting areas to have daylight dimming controls with local sensors with presence detectors. All Transient areas to have on/off presence detectors.

4.3.1 Active cooling demand – Actual vs. notional building

The active cooling demand for the building as per BRUKL reports (HVAC Systems Performance) is summarized in the table below:

Building	Area weighted average building Cooling Demand (MJ/m^2)	
	Actual	Notional
182-184 High Holborn	111.14	98.69

4.3.2 Power Factor Correction

The Building Regulations Approved Document L identifies that the provision of power factor correction to the building electrical supply can provide significant savings in electrical consumption. A saving in electrical energy consumption of 1.5% is awarded for power factor correction to 0.9 and a saving of 2.5% awarded for power factor correction to 0.95 power factor. This development intends to have a power factor correction of 0.95 as a minimum.

4.4 Active Design Features – Unregulated Energy Use

4.4.1 High Efficiency Vertical Transportation

Vertical transportation can be fitted with a number of energy saving measures to reduce their energy use both whilst moving and when in standby mode. These include:

- Controls that ensure that no more lifts are in use than required and that as few stops as possible are made
- Energy efficient lighting
- Control that switches off the lighting when the car is not occupied

4.4.2 Low Energy Culture

Providing building users and operators with practical guidance on the importance and methods of energy efficiency can lead to effective, cost-free reductions in energy usage and carbon emissions. Savings can be expected in, for example:

- Operating comfort cooling systems efficiently
- Lighting Energy: a culture of 'Turn-It-Off'
- Small Power: avoiding monitors and PCs etc in stand-by mode
- Cooling/Heating Energy: widening 'acceptable' temperature range.

Training of operators and facility managers is particularly important to provide them with the skills and knowledge to implement and continue to improve an energy management programme.

The amount of energy that can be saved will be dependent upon the motivation of the occupants and the effectiveness of the awareness programmes. The Gate way East & west Building development will actively encourage a low energy culture as part of its commercial leasing strategy.

4.4.3 Low Water Usage

Camden's development policy DP23 outlines the reduction of water consumption by incorporating water efficient features and equipment and capturing, retaining and re-using surface water and grey-water on site.

Reduction in water usages will be measured against BREEAM 2014 – Water 01 targeting at least 40% of water consumption which equates to 3 credits. In order to reduce the consumption along with reduction in overall waste water the low flow sanitary appliance will be selected in order to gain the required BREEAM credits. List below outlines few of the water appliance considered for the project:

1. WC – 2.95 L (Dual Flush 4 L full & 2.6 L part)
2. Urinals – 0.5 L (Full Flush – Automatic)
3. Wash Hand Basin Taps – 4 L/min
4. Showers – 4 L/min
5. Integral irrigation for installed plants based on rainwater collection

If further reduction is required to target all the BREEAM 2014 – Water 01 credits, either rain water harvesting or grey water harvesting will be considered.

The aim to reduce net water consumption without top up from green systems like grey water or rain water harvesting system is:

1. Reduction in the energy required for water heating
2. Avoid cleaning processing energy to clean grey or rain water
3. Avoid additional pumps power consumption to supply grey or rain water
4. Divert rain water directly to the plantings instead of sanitary usage
5. Reduction in chemical usage for grey water cleaning & maintenance
6. Reduction in material usage for additional piping system for grey or rain water systems

4.5 Lean Carbon Dioxide Emissions

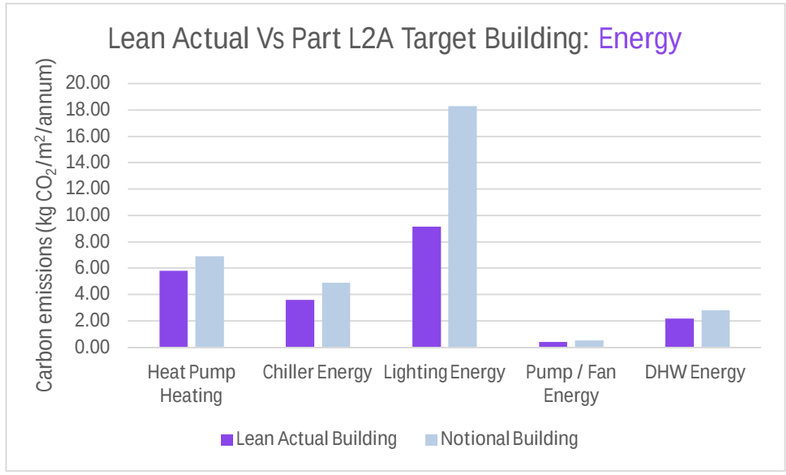
Based on the above design parameters, a summary of the energy consumption and CO_2 emissions rate for the 'Lean' buildings at 182-184 High Holborn can be seen in tables and figures below.

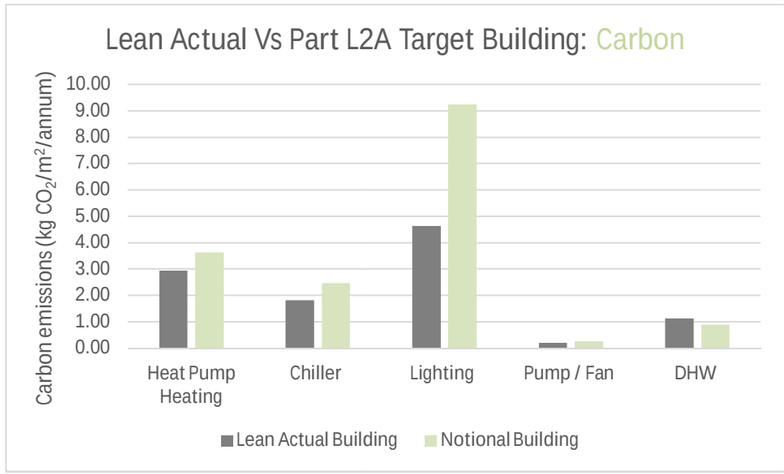
The 'LEAN' energy efficiency measures described here are calculated to reduce overall carbon dioxide emissions of the site by *19.6%*.

Table 4-4: Detailed Emission for the 'Lean' 182-184 High Holborn

	Carbon Dioxide Emissions (Tonnes CO_2 per Annum)				
	Regulated Energy	Unregulated Energy	Total CO_2 Reductions	Lean Regulated % Reduction	Lean Unregulated % Reduction
Building Regulations 2013, Part L Compliant Development	102.17	125.28	-	-	-
'Lean' Building after Energy Demand Reduction	82.14	98.29	20.03	19.6%	21.5%

Note: the 'Target' building is defined as a new building built to be compliant with Part L of the Building Regulations 2013.





5. Heating Infrastructure including CHP (Be Clean)

After careful selection of appropriate servicing strategies and plant selection, the emphasis is to meet the energy demand of the development using a low-carbon supply.

5.1 District Heating and Cooling Networks

The feasibility of connecting the proposed development to a district heating network has been assessed, making reference to the London Heat Map (refer to www.londonheatmap.org.uk).

The following image is an extract of the London Heat Map from the website. The development is located within the opportunities area of 'Decentralised Energy Potential' in purple, with no current imminent potential to connect to an existing DH network, although potential District Heating Network will expand adjacent to the site.

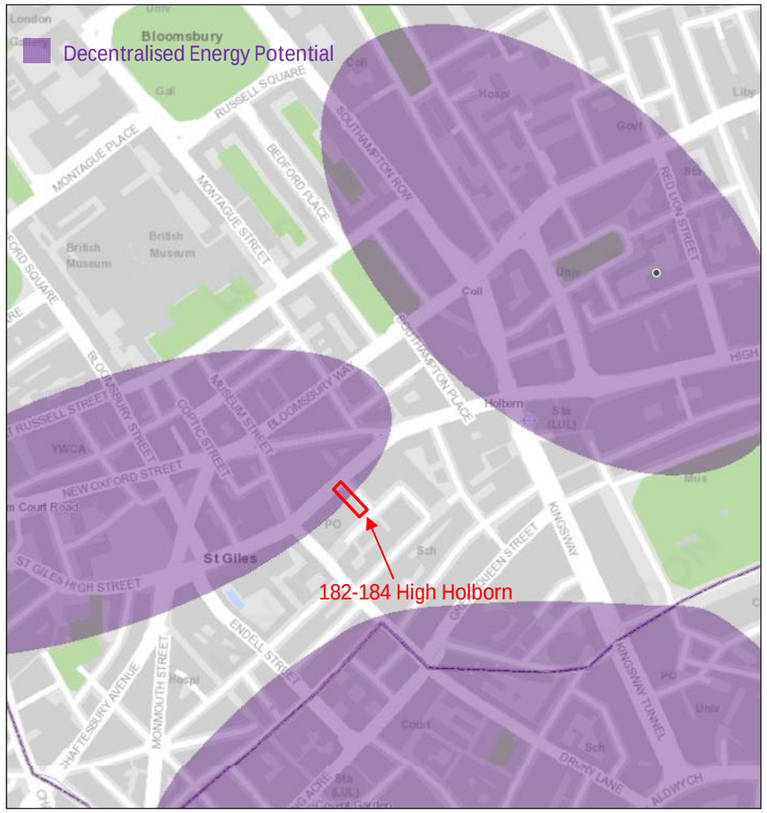


Figure 5-1 London Heat Map indicating decentralised energy potential and potential DH network adjacent to 182-184 High Holborn

(At the time of compiling this report, there is currently no district heating network to which the proposed development could connect to immediately.)

Camden Council has aspirations for developing a district heating system in the area and the aspiration would be for this development to be able to be connected in the future. This is in line with Policy 5.5 which prioritises the development of decentralised heating and cooling networks.

Due to nature of the proposed 182-184 High Holborn building which is office with highly sealed facade there is no scope of significant heat demand to the building and therefore low viability of future connection to DH network.

In order to increase the efficiency of the building, high efficiency heat pump system have been employed which provide significant improvement over carbon numbers. And DH network will require low temperature hot water based system which is in contradiction to the proposed system.

5.2 Combined Heat and Power (CHP)

182-184 High Holborn building s HVAC philosophy includes a high performance heat pump system for heating and cooling the building. With sealed façades and limited provision of showers within the building there is no scope of inclusion of CHP units.

6. Renewable Energy (Be Green)

Further energy and carbon dioxide emissions savings could in principle be made through the adoption of renewable technologies.

The suitability of available technologies is sensitive to a number of factors, including site constraints, development footprint, surrounding environment, access limitations and development type.

To this end, the following renewable energy technologies have been investigated to establish their suitability and feasibility.

6.1 Consideration of Low and Zero Carbon Technologies

6.2 Biomass

The types of biomass boilers that would potentially be suitable for this development would burn wood in the form of small chips which originate from forestry works. The boilers are equipped with high efficiency filters on the exhaust so that very low particulate emissions are achieved. Emissions from biomass boilers are designed to meet stringent regulations.

Although carbon dioxide is emitted in the exhaust gas, this originated from the atmosphere only in recent year, and is stored within the tree by photosynthesis. This short carbon cycle means therefore that this can be considered a carbon neutral fuel. However, some fossil fuel will be expended in producing and transporting biomass so that it has some associated carbon emissions. It is usual to assume a carbon intensity equivalent to 15% of natural gas (0.025kgCO_2/kWh).

Key issues with Biomass that could be of detriment to its feasibility are:

- Fuel handling and storage
- Fuel availability and reliability in sourcing
- Particulate emissions
- Ash disposal

Unlike natural gas, biomass has to be stored on-site in fuel silos. Typically, 2 to 3 weeks' supply is stored. The fuel is delivered using large lorries and tipped into the silo, requiring adequate vehicular access. The fuel is automatically fed into the boiler using a screw-drive, meaning the silo must be adjacent to the boiler. Therefore additional plant room space, when compared to a traditional gas-fired boiler, is required.

There is limited information available on fuel availability in the surrounding area. The government is encouraging the use and development of biomass through the creation of the Biomass Task Force. The biomass boiler is normally sized to meet only part of the peak heating demand with top-up provided by gas-fired boilers. As peak load is rarely required, the biomass boiler can still produce a large percentage of the annual heating energy. This analysis is based on the installation of a boiler sized at about 50% of the peak heating and hot water demand. This would ensure that it operates for most of the year, meeting the base load in summer.

Biomass boilers are often incorporated into developments requiring CO_2 reductions because they have a relatively low capital cost compared to other renewable technologies. However, an installed biomass boiler has ongoing maintenance, running and fuel delivery costs that are not required with other forms of renewable energy. These systems do require substantial and safe access for large delivery vehicles.

Biomass boilers are therefore not recommended for this development.

6.3 Photovoltaics

Photovoltaics are ideally located in a generally southern facing orientation at preferably 30° to the horizontal; if located vertically, the output is reduced by about 15%. PV panels provide a visible green label for the building.

Due to limited available roof space installation of PV will not result into any significant savings in overall energy strategy of the building and therefore the focus has been moved to reduce energy consumption by investing in energy efficiency HVAC system and lighting along with thermally efficient envelope.

6.4 Wind Turbines

Wind turbines produce electricity directly from the energy in wind. This is then fed into the building's electrical system via a control gear. Two types of wind turbine are available; horizontal axis and vertical axis. The former tend to be noisy and produce vibration. The latter are quieter in operation and more suited to installation on buildings but are generally less efficient and more expensive.

Although wind turbines are a highly visible form of renewable energy, they can normally provide only a very small contribution to the total electrical consumption of buildings in city and urban locations. Wind turbines potentially may be visually unacceptable in planning terms and there are also concerns that such a turbine would create unacceptable noise levels during day and night. As a consequence, wind turbines are not considered to be viable for this project.

6.5 Solar Hot Water

Solar hot water panels should ideally be located in a generally south facing position, preferably at about 30° to the horizontal. If located vertically, output is reduced by about 15%.

The scheme investigated is based on installing a nominal active area of high efficiency (evacuated tube) solar hot water panels, accommodated on the roof of the building. Such systems are relatively low maintenance, are a proven technology and are a visible indication of the development's green aspirations.

Although efficient and cost effective in implementation, solar hot water systems can only offset a fraction of the hot water demand for the site, which is quite small compared to other energy demands. Solar thermal panel target the same loads and would therefore be in conflict with heat pump – waste heat hot water system proposed as the basis of the clean technologies hence is not considered compatible. Solar hot water panels are therefore not recommended for this development.

6.5.1 Ground Source / Aquifer Heat Pumps

Ground Source Pumps

Due to the project size being limited, the payback period for the development would not be feasible. Moreover, ground source heat pumps require drilling of bores which might upset the immediate surroundings of the site. Hence, ground source heat pumps have not been proposed for this development.

Aquifer Heat Pumps

The use of the London aquifer to reject heat to (in cooling mode) and to draw heat from (in heating mode) can reduce emissions from a development, depending on the number of boreholes and the potential yield.

In an open loop aquifer based heat pump system, boreholes are sunk into the chalk strata. Aquifer water is pumped up to the surface and stored temporarily in a tank. This water is usually at 12-14°C year-round. The water is passed through a heat exchanger where it heats or cools the condenser water circuit serving the heat pumps. The water is then pumped back into the aquifer. Boreholes are normally sunk in pairs, one abstraction and one discharge. A licence from the Environment Agency is required to extract aquifer water.

The limitations imposed by the existing lower ground floor and difficulties of achieving acceptable separation on site would severely restrict the effectiveness of any aquifer system.

7. Energy and Sustainability Statement - Conclusion

7.1 Energy Reduction

A detailed Energy and Sustainability Strategy have been developed for the 182-184 High Holborn Buildings conforming to the guidelines set out in all relevant local, regional and national documents. The strategy has appropriately considered the full array of options and technologies available now and in the future.

It is proposed that extensive energy efficiency measures will be incorporated into the design along with proposed LZC measures will result in the following:

1. *Regulated carbon dioxide savings of 19.6% relative to a New-Build Part L2A 2013 compliant development on 182-184 High Holborn – Refer to Table 1 and 2 above.*

2. *BREEAM New Construction 2014 Office 'Excellent' Rating*

Regarding Policy 5.2 of the London Plan, the Mayor's Energy Hierarchy has been followed. Tables 1 and 2 related to the 182-184 High Holborn building summarise the performance relative to the London Plan in accordance with the GLA's Guidance on Preparing Energy Statements.

7.2 Water Consumption

The water consumption within the building has been analysed along with the sanitaryware schedule and the following:

- Low Flow Basin Taps
- Low Flow Showers
- Dual Flush WC (6 l/4.5 l)

Appendices

Appendix A - BREEAM Pre-Assessments

117366/AP/160902 Issue 03

BREEAM 2014 NC (Non-Domestic)

Design & Procurement Assessment

182-184 High Holborn

117366
18/08/2016
Revision1

Issue	Date	Reason for Issue	Prepared		Checked		Approved	
1	18-Aug-16	For information	AP		KA		KA	

BREEAM 2014 NC (Non-Domestic) - Design & Procurement Assessment
117366
18/08/2016
Revision1

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What by When

Project Name:	**182-184 High Holborn**
BREEAM Scheme:	**BREEAM NC 2014**
Stage:	**Design & Procurement Assessment**
Target Score:	**74.00%**

Whilst it is important for the client and project team to consider sustainability and the BREEAM criteria at an early stage of design, several specialist appointments and the generation of subsequent reports are very important as they will affect the ability to award these credits in the future if these do not happen. Hence, we have listed here these credits and the necessary actions that the client needs to be aware of.

- Targeted
- Credit awarded
- N/A not targeted
- Potential

Issue	Name	1 (A/B)	2 (C)	3 (D)	4 (E/F)	5	6 (J/K)
MAN 01	Appointment of BREEAM AP						
MAT 06	Materials efficiency analysis						
WST 05 - 06	Analysis of adaptability - Climate/Functional adaptation strategy						
LE 01 - 05	Appointment of suitably qualified ecologist						
LE 01	Appointment of contaminated land specialist						
LE 02	Concept ecology report						
MAN 01	Have a schedule of responsibilities						
MAN 01	Agreement of BREEAM target						
MAN 01	Start public consultation						
MAN 02	Life cycle costing analysis - elemental						
HEA 06	Consultation with Security consultant						
ENE 04	Passive design analysis with energy specialist						
ENE 04	Appointment of energy specialist for LZC study						
HEA 05	Appointment of suitably qualified acoustician						
TRA 05	Production of travel plan						
WST 05	Conduct a climate change adaptability report for fabric						
MAN 03	Register site to considerate construction scheme						
MAN 01	Provide consultation feedback						
MAN 02	Life cycle costing analysis - component level						
MAN 04	Appointment of commissioning manager						
DS	BREEAM DESIGN STAGE CERTIFICATION						
MAN 03	Appointment of site based sustainability champion						
PCR	BREEAM FINAL CERTIFICATION						

Early Action

Project Name: **182-184 High Holborn**
BREEAM Scheme: **BREEAM NC 2014**
Stage: **Design & Procurement Assessment**
Target score: **74.00%**

Whilst it is important for the client and project team to consider sustainability and the BREEAM criteria at an early stage of design, several specialist appointments and the generation of subsequent reports are very important as they will affect the ability to award these credits in the future if these do not happen. Hence, we have listed here these credits and the necessary actions that the client needs to be aware of.

Ecological Consultant Appointment

Code	Credits	Title	Credit Criteria / Early Action Required
LE 03	2	Mitigating Ecological Impact	A suitably qualified Ecologist needs to be appointed to survey/assess the site for its current ecological value prior to any demolition etc.. If this is not done, LE03, LE04 & LE05 cannot be awarded in the final assessment. The ecologist will need to provide recommendations on any existing ecology which will need protection during the demolition and construction phases
LE 04	2	Enhancing Site Ecology	
LE 05	2	Long Term Impact on Biodiversity	

Contractor Considerations (further credit requirements to be aware of at RIBA Stage 2)

Code	Credits	Title	Credit Criteria / Early Action Required
Man 03	1	Sustainability Champion (Construction)	A Site Sustainability Manager / BREEAM AP should be appointed during the Construction, Handover & Close out stages (RIBA Stages 5 & 6).

Security Consultant / Officer Consultation

Code	Credits	Title	Credit Criteria / Early Action Required
Hea 06	2	Safety and Security	Provision of effective measures which support safe access to and from the building; Consultation with a suitably qualified security consultant should have taken place at RIBA Stage 2. The final design should reflect the recommendations/solutions and built to conform to either, Secured by Design and/or Safer Parking (SP) Scheme.

Transport Consultant Appointment

Code	Credits	Title	Credit Criteria / Early Action Required
Tra 05	1	Travel Plan	Travel Plan to be commissioned for the development clearly considering the impact onto the surrounding infrastructure etc. due to the site specific travel survey / assessment having been developed.

Specialists / Others

Code	Credits	Title	Credit Criteria / Early Action Required
Man 02	2	Life Cycle Cost & Service Life Planning	A Life Cycle Cost analysis should be undertaken at Stage 2 / 3 A strategic and system-level Life Cycle Cost analysis is undertaken A technical design Life Cycle Cost analysis is undertaken Stages 4 / 5
Hea 02	1	Indoor Air Quality	Appointment of a specialist to carry out an 'Indoor Air Quality Plan' assessment for the development considering neighbouring pollutants, any flue gases etc.. proposed and the locations of air intakes and exhausts
Ene 04 / Hea 04	2	Passive Design / Adaptability - for a projected climate change scenario	Appointment of a specialist to carry out the analysis for the passive design and energy strategy, projected climate change scenario should be considered as part of the thermal model
Pol 03	1	Surface Water Run-Off	The commission of a 'Flood Risk Assessment' for the site. This should include an analysis for the 1 in 100 year storm event and attenuation measure recommendations to adhere to adequate discharge flow rates and SUDS techniques

Client Considerations (further credit requirements to be aware of at RIBA Stage 1 to 3)

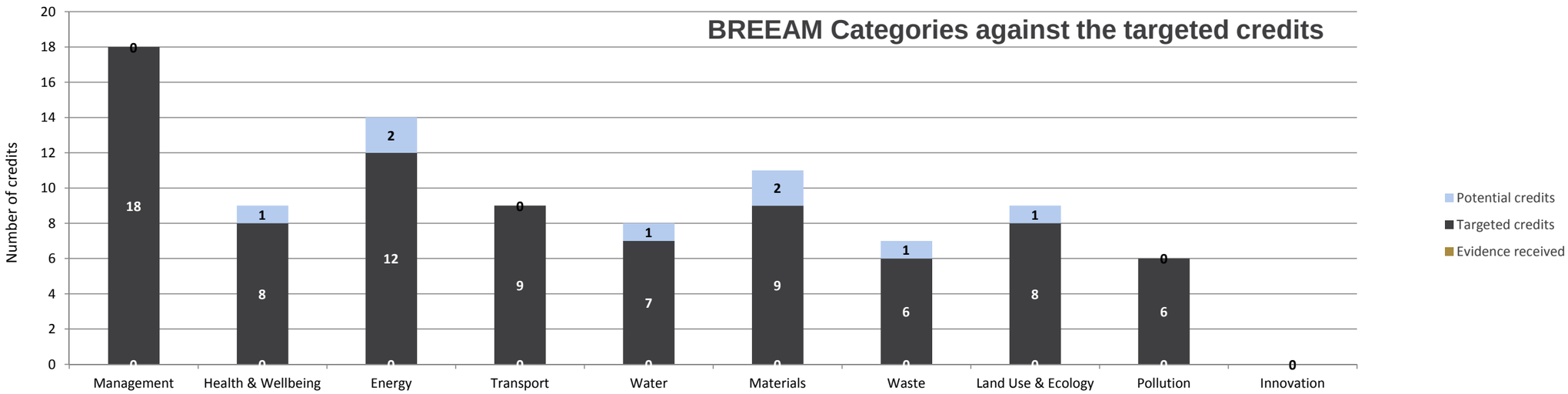
Code	Credits	Title	Credit Criteria / Early Action Required
Man 01	1	Project Brief and Design	To award the credit, the client needs to confirm that from RIBA Stage 1 or equivalent the client, building occupier, design team and contractor are involved in contributing to the decision making process for the project. As a minimum this includes meeting to identify and define their roles, responsbilities and contributions during design, construction, Commissioning and handover up to occupation (Stage 6)
Man 01	2	Stakeholder Consultation	During prepartion of the brief, all relevant partieis and relevant bodies are identified and consulted with by the design team. (Relevant bodies are - Actual intended building users, representative consultation group from the existing community, existing partnerships and networks that have knowledge and experience from existing buildings of the same type, potential users of any shared facilities e.g. operators of clubs and community groups). A consultation plan should have been prepared and includes a timescale and methods of consultation for all relevant parties/bodies and how the relevant parties will be kept informed about progress. Consultation feedback has been given with suggestions made, including how the results of the consultation process have influenced the proposed design. Through consultation and the resulting measures taken any areas of features of historic/heritage value are protected.

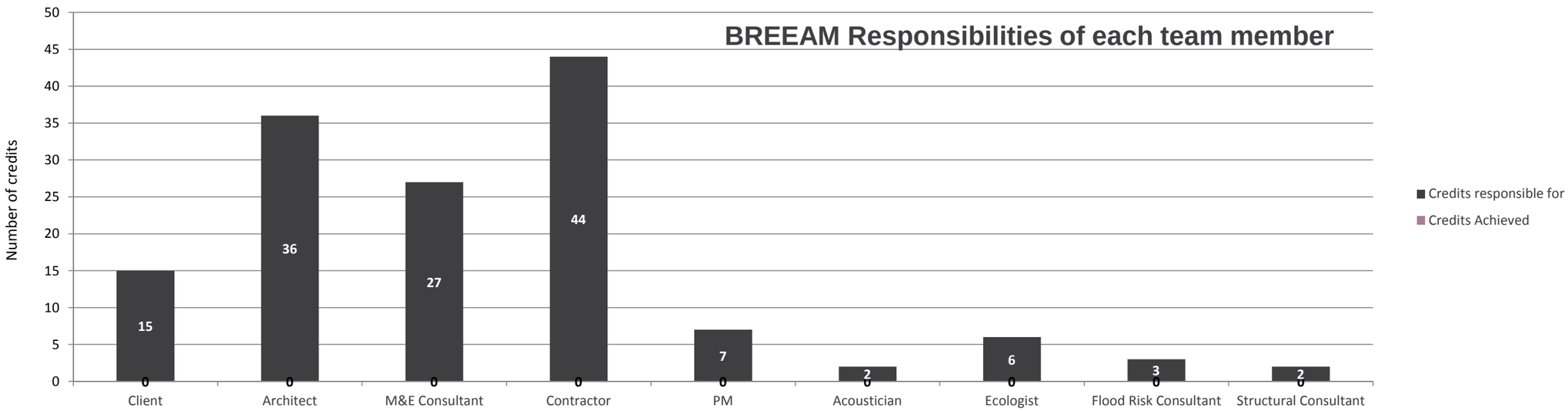
Design team Considerations (further credit requirements to be aware of at RIBA Stage 2)

Code	Credits	Title	Credit Criteria / Early Action Required
Man 03	1	Sustainability Champion (Construction)	A Site Sustainability Manager / BREEAM AP should be appointed during the Construction, Handover & Close out stages (RIBA Stages 5 & 6).
Mat 06	1	Material Efficiency	New credit under 2014 scheme. Pre-fabrication & WRAP compliance to be shown in minutes of meetings and/or drawings mark-ups.
Wst 05	1	Adaptation to Climate Change	New credit under 2014 scheme. Assessment of new & existing fabric and it's durability to deal with extremes in weather.
Wst 06	1	Functional Adaptability	New credit under 2014 scheme. Additional capacities & a well considered plant & fabric replacement strategy to be developed.

Score Summary

Project Name:	**182-184 High Holborn**	
BREEAM Scheme:	**BREEAM NC 2014**	
Target Score:	**74.05%**	***Excellent***
Achieved score:	**0.00%**	***Unclassified***





SWECO

Credit Review

18/08/2016 Rev.1

SD5076 Issue 4.0

Project Name	**182-184 High Holborn**
Building Type	**Office**
Project Type	**Shell and Core**

Targeted BREEAM rating %	**74.05**	**Excellent**
Potential BREEAM rating %	**81.75**	**Excellent**
Achieved scoring %	**0.00**	**Unclassified**

Credit awarded
Credit not targeted
Potential additional credit
Further information required

Credit Ref.	Credit Title	Credit Name	Credits Available	Credits Targeted	Potential Additional	Credits Achieved	Mandatory Elements	Responsibilities	RIBA Stage Old	Status	Comments / Actions
			110.00%	**74.05%**	**81.75%**	**0.00%**	✕				
MANAGEMENT	0.61% per credit										
Man 01	**Project brief and design**	Stakeholder Consultation (Project Delivery)	1	1		0		Client*PM*Architect*	C		Design team meetings, scope of work & type of contract.
		Stakeholder Consultation (Third Party)	1	1		0		Client*PM*Architect*	C		All relevant third parties (planning consultation with local authority, local residents and any input from Office / Retail specialists) shall have been consulted prior to planning.
		Sustainability Champion (Design)	1	1		0		Client*PM*Architect*	A/B - C		BREEAM AP appointment letter.
		Sustainability Champion (Monitoring Process)	1	1		0		Client*PM*Architect*	J / K		BREEAM AP is appointed throughout the project up to PC Stage.
Man 02	**Life cycle cost and service life planning**	Elemental Life Cycle Cost (LCC)	2	2		0		Client*PM*Architect*	C		A Life Cycle Costing Analysis is required to be carried out at RIBA stage 2, then updated at stage 3. 20, 30, 50 or 60 years LCC analysis targeting - Facade, Services, Finishes & External spaces.
		Component Level LCC Plan	1	1		0		Client*PM*Architect*	E - F		
		Capital Cost Reporting	1	1		0		PM*Client*QS*	C		Report a capital cost in £/m2 for BRE purpose only.
Man 03	**Responsible construction practices**	Timber used on site to be responsibly sourced.					Yes/No?	Contractor*			This is minimum requirement - MANDATORY
		Environmental Management	1	1		0		Contractor*	J / K		Contractor operates EMS: certificate of ISO 14001 /EMAS
		Sustainability Champion (Construction)	1	1		0		Contractor*	J / K		A Site Sustainability Manager / BREEAM AP should be appointed during the Construction, Handover & Close out stages (RIBA Stages 5 & 6).
		Considerate Construction (Minimum Standard 1 credit for Excellent, 2 for Outstanding)	2	2		0	Yes/No?	Contractor*	D		Minimum Standard: E-1; O-2. Register site to considerate construction scheme. Letter confirming participation in CCS and targeted score higher than 35. Innovation credit targeted i.e. 40 points should be achieved.
		Monitoring of Construction Site Impacts - Utility Consumption	1	1		0		Contractor*	D		Site-based energy usage monitored. Display figures on site.
		Monitoring of Construction Site Impacts - Transport of Construction Materials & Waste	1	1		0		Contractor*	D		Vehicle monitoring to establish carbon figures. Display figures on site.
Man 04	**Commissioning & Handover**	Commissioning & Testing Schedule & Responsibilities	1	1		0		Contractor*	E - F		Third party commissioning manager to be appointed. Scope of work to be provided as evidence.
		Commissioning Building Services	1	1		0		Contractor*	E - F		Clauses to be included in the MEP specification
		Testing & Inspecting Building Fabric	1	1		0		Contractor*	E - F		Thermographic survey as well as an airtightness test and inspection required.
		Build User Guide					Yes/No?	Client*Contractor*			Minimum Standard: E/O - A Building user guide is developed
		Handover	1	1		0		Client*Contractor*	J / K		Building User Guide Contents - MANDATORY & Training Schedule for FM Team Required.
Man		**TOTAL:**	**18**	**18**	**0**	**0**					
		% of total score:	**11.00%**	**11.00%**	**0.00%**	**0.00%**					

Credit Ref.	Credit Title	Credit Name	Credits Available	Credits Targeted	Potential Additional	Credits Achieved	Mandatory Elements	Responsibilities	RIBA Stage Old	Status	Comments / Actions
HEALTH & WELLBEING 0.86% per credit											
Hea 01	**Visual comfort**	Daylighting	1	0		0		Architect*Contractor*	C		To be investigated by a daylighting study, i.e. 2% DF over 80% of the floor plate.
		View Out	1	1		0		Architect*	C		The architect to provide the calculations of room depth and glazing-wall ratio.
		Internal & External Lighting Levels, Zoning & Controls	1	1		0		Architect*Contractor*	D		To meet CIBSE requirements & zoning of no more than 4 workstations - specialist external lighting input required if appointed.
Hea 02	**Indoor air quality**	Minimising Sources of Air Pollution - Ventilation	1	1		0		M&E Consultant*	D		Design intakes and exhaust 10m apart and intakes over 20m from sources of external pollution.
		Adaptability - Potential for natural ventilation	1	0	1	0		M&E Consultant*	D		Occupied spaces of the building are designed to be capable of providing fresh air entirely via a natural ventilation strategy. Room depths are designed in accordance with CIBSE AM 10 (Section 2.4) to ensure effectiveness of any natural ventilation system.
Hea 04	**Thermal comfort**	Thermal modelling	1	1		0		M&E Consultant*	D		New 2014 credit - CIBSE TM 11 compliant (IES) software to be used.
		Adaptability - for a projected climate change scenario	1	1		0		M&E Consultant*	D		New 2014 credit - the building shall be designed to be adaptable for a projected climate change scenario.
Hea 05	**Acoustic performance**	Acoustic performance standards	1	1		0		Acoustician*	C		Appointment of suitably qualified acoustician calculation & testing requirements. The contractor to confirm that they will remediate any non-conformation.
Hea 06	**Safety & Security**	Safe Access	1	1		0		Architect*	C		Some clarification of external areas from the architect is required. Key criteria is pedestrian & cyclists not passing vehicle & goods access. Suitable lighting also required.
		Security of Site & Building	1	1		0		Architect*Contractor*	C		Qualified security specialist (ALO/CPDA) is required. Secure by Design to be provided with recommendations from the ALO. Will need design drawings/meeting minutes showing the ALO's recommendations have been incorporated within the final design.
Hea		**TOTAL:**	**10**	**8**	**1**	**0**					
		% of total score:	**10.50%**	**8.40%**	**1.05%**	**0.00%**					

Credit Ref.	Credit Title	Credit Name	Credits Available	Credits Targeted	Potential Additional	Credits Achieved	Mandatory Elements	Responsibilities	RIBA Stage Old	Status	Comments / Actions
ENERGY 0.71% per credit											
Ene 01	**Reduction of Emissions**	Reduction of Emissions	12	5	1	0	Yes/No?	M&E Consultant*Contractor*	D		Minimum Standard: E-5; O-8 Credits achieved through IES Modelling Tool.
Ene 02	**Energy Monitoring**	Sub-Metering of Major Energy Consuming Systems	1	1		0	Yes/No?	M&E Consultant*Contractor*	D		Minimum Standard: VG/E/O-1. Sub-metering of main plant systems. i.e. Space heating, CHP, LTHW.
		Sub-Metering of High Energy Load & Tenancy Areas	1	1		0		M&E Consultant*Contractor*	D		Sub-metering on a floor by floor basis and tenancy areas.
Ene 03	**External Lighting**	External Lighting	1	1		0		M&E Consultant*Contractor*	E - F		Input from specialist designer might be required if appointed. Any external lighting to have an efficacy > 60lm/circuit watt
Ene 04	**Low Carbon Design**	Passive Design Analysis	1	1		0		M&E Consultant*Contractor*	C		New 2014 credit - Facade and daylighting analysis produced.
		Free Cooling	1	0	1	0		M&E Consultant*	C		Not naturally ventilated.
		Low Zero Carbon Feasibility Study	1	0		0		M&E Consultant*	C		LZC Study to be produced.
Ene 06	**Energy Efficient Transportation Systems**	Energy Consumption	1	1		0		M&E Consultant*	C		Lift analysis report is required to determine compliance with BS EN ISO 25745 Energy performance of lifts, escalators and moving walks requirements.
		Energy Efficient Features	2	2		0		M&E Consultant*	C		Energy-efficient features offering the greatest potential energy savings will be part of the system.
Ene		**TOTAL:**	**21**	**12**	**2**	**0**					
		% of total score:	**15.00%**	**8.57%**	**1.43%**	**0.00%**					
TRANSPORT 1.00% per credit											
Tra 01	**Public Transport Accessibility**	Accessibility Index / Dedicated Bus Service	3	3		0		Client*Architect*	C		Assesses availability of transport links & frequency (London sites usually score well).
Tra 02	**Proximity to Amenities**	Proximity to Local Amenities	1	1	0	0		Client*Architect*	C		Food shop, post box, cash machine & a suitable outdoor open space are located within 500m.
Tra 03	**Cyclist Facilities**	Cycle Storage & Facilities	2	2		0		Client*Architect*	C		Based on NIA 1,000 sqm and BREEAM default occupancy - 11 cycle spaces required. Spec of cycle stands & location is required. Showers, changing facilities, lockers or drying space to be provided.
Tra 04	**Maximum Car Parking Capacity**	Car Parking Capacity	2	2		0		Client*Architect*	D		To be confirmed by the number of building users. i.e. 1 parking space for every 4 office staff, etc.
Tra 05	**Travel Plan**	Travel Plan	1	1		0		Client*Architect*	C		Travel Plan to be commissioned for the development clearly considering the impact onto the surrounding infrastructure etc.. due to the site specific travel survey / assessment having been developed.
Tra		**TOTAL:**	**9**	**9**	**0**	**0**					
		% of total score:	**10.00%**	**10.00%**	**0.00%**	**0.00%**					

Credit Ref.	Credit Title	Credit Name	Credits Available	Credits Targeted	Potential Additional	Credits Achieved	Mandatory Elements	Responsibilities	RIBA Stage Old	Status	Comments / Actions
WATER 0.94% per credit											
Wat 01	**Water Consumption**	Water Consumption	5	3	1	0	Yes/No?	M&E Consultant*Architect*Contractor*	D		Minimum Standard: VG/E-1; O-2 The spec/manufacturers details confirming water fittings and their flush volumes & controls to be provided as evidence. i.e. Dual flush as a minimum.
Wat 02	**Water Monitoring**	Water Monitoring	1	1		0	Yes/No?	M&E Consultant*	D		Minimum Standard: VG/E/O-Criterion 1 only - water meter on mains. Water flow meter pulsed & BMS connected.
Wat 03	**Water Leak Detection**	Leak Detection System	1	1		0		M&E Consultant*	E - F		Leak detection via BMS with audible alarm.
		Flow Control Devices	1	1		0		M&E Consultant*	E - F		Sanitary supply shut-off valves specified to each toilet area.
Wat 04	**Water efficient equipment**	Large water consuming systems are designed to minimise unregulated consumption	1	1		0		M&E Consultant*	E - F		The planters will be watered only as and when required and does not fit into the definition of 'unregulated water usage' as defined in the BREEAM guide.
Wat		**TOTAL:**	**9**	**7**	**1**	**0**					
		% of total score:	**7.50%**	**5.83%**	**0.83%**	**0.00%**					
MATERIALS 1.04% per credit											
Mat 01	**Life Cycle Impacts**	Life Cycle Impacts	5	3	1	0		Architect*Contractor*	D		Will require architects spec, areas in m² of all elements and their types, the Green Guide rating & Green Guide element number for each material i.e. external walls, windows, roof, upper floor slab and floor finishes, etc.
Mat 02	**Hard Landscaping & Boundary Protection**	Hard Landscaping & Boundary Protection	1	1		0		Architect*Contractor*	D		80% of hard landscaping / boundary protection to be A or A+ rated as defined in the Green Guide.
Mat 03	**Responsible Sourcing of Materials**	Pre-requisite: Timber procurement details					Yes/No?	Architect*Contractor*			Pre-requisite: Responsible sourcing of timber.
		Sustainable Procurement Plan	1	1		0		Contractor*	E - F		New credit - Contractor to produce a Sustainable Procurement Plan.
		Responsible Sourcing of Materials	3	1	1	0		Architect*Contractor*	D		Material specified form manufacturers who can provide EMS Certification (ISO 14001 etc.)
Mat 04	**Insulation**	Embodied Impact	1	1		0		Architect*Contractor*	E - F		Majority of all insulation provided within the building needs to be "Green Guide A rated" and sourced from EMS Certified Suppliers.
Mat 05	**Designing for Durability & Resilience**	Designing for Durability & Resilience	1	1		0		Architect*Contractor*	D		Protecting vulnerable parts of the building from damage and exposed parts of the building from material degradation.
Mat 06	**Material Efficiency**	Material Efficiency	1	1				Architect*Contractor*	A-L		New credit under 2014 scheme. Pre-fabrication & WRAP compliance to be shown in minutes of meetings and/or drawings mark-ups.
Mat		**TOTAL:**	**13**	**9**	**2**	**0**					
		% of total score:	**14.50%**	**10.04%**	**2.23%**	**0.00%**					

Credit Ref.	Credit Title	Credit Name	Credits Available	Credits Targeted	Potential Additional	Credits Achieved	Mandatory Elements	Responsibilities	RIBA Stage Old	Status	Comments / Actions
WASTE 1.19% per credit											
Wst 01	**Construction Waste Management**	Construction Resource Efficiency	3	1	1	0		Contractor*	E - F		Minimum Standard: O-1 Pre-demolition audit must be done and included in SWMP.
		Diversion of Resources from Landfill	1	1		0		Contractor*	E - F		90% (tonnes) of demolition and 80% non-demolition waste to be diverted from landfill.
Wst 02	**Recycled Aggregates**	Recycled Aggregates	1	0		0		Architect*Contractor*Structural Consultant	D		Requires the total amount of recycled aggregates or secondary aggregate must meet the minimum % levels in Table-54.
Wst 03	**Operational Waste**	Operational Waste	1	1		0	Yes/No?	Architect*Contractor*	D		Minimum Standard: E/O-1 Based on NIA 1000 sqm - 2 sqm space for recycling bins is required, up to a minimum of 10 sqm for buildings > 5000 m².
Wst 04	**Speculative Floor and Ceiling Finishes**	Speculative Floor and Ceiling Finishes	1	1		0		Architect*Contractor*	D		If shell only specified, this issue is not applicable.
Wst 05	**Adaptation to Climate Change**	Adaptation to Climate Change - Structural & Fabric Resilience	1	1		0		Contractor*Architect*Structural Consultant	C		New credit under 2014. Assessment of new & existing fabric and it's durability to deal with extremes in weather.
Wst 06	**Functional Adaptability**	Functional Adaptability	1	1		0		Architect*M&E Consultant*Contractor*	C		New credit under 2014. Additional capacities & a well considered plant & fabric replacement strategy to be developed.
Wst		**TOTAL:**	**9**	**6**	**1**	**0**					
		% of total score:	**9.50%**	**6.33%**	**1.06%**	**0.00%**					
LAND USE & ECOLOGY 1.10% per credit											
LE 01	**Site Selection**	Previously Occupied Land	1	1		0		Architect*Contractor*	C		Drawing confirming that 75% of new development footprint is built on the previously occupied land.
		Contaminated Land	1	0	1	0		Contractor*specialist*	C		A copy of the specialist's land contamination report and summary details of the implementation plan of the remediation strategy to be provided as evidence.
LE 02	**Ecological Value of Site & Protection of Ecological Features**	Ecological Value of Site	1	1		0		Architect*Ecologist*	C		Ecologist to evaluate the site.
		Protection of Ecological Features	1	1		0		Contractor*Ecologist*	C		Any existing ecological features to be protected. Contractor to demonstrate that the protection measures were put in place per ecologist's recommendations.
LE 03	**Minimising Impact on Existing Site Ecology**	Change in Ecological Value	2	2		0	Yes/No?	Architect*Ecologist*	C		Minimum Standard: VG/E/O-1. Ecologist to calculate the plant species. Input from landscape designer may be required.
LE 04	**Enhancing Site Ecology**	Ecologist's Report & Recommendations	1	1		0		Architect*Ecologist*	C		Ecologist report with recommendations and calculation of increase in ecological value is required. The contractor and/or Client to confirm that the ecologist's general recommendations will be followed.
		Increase in Ecological Value	1	0		0		Architect*Ecologist*	C		
LE 05	**Long Term Impact on Biodiversity**	Long Term Impact on Biodiversity	2	2		0		Architect*Ecologist*Contractor*	C		EU and UK legislation to be adhere to. The client to confirm a 5-year landscape and habitat management plan will be produced once final Landscape design is issued. Main contractor to confirm that at least four additional requirements (i.e. train force appoint Biodiversity Champion etc.) will be met.
LE		**TOTAL:**	**10**	**8**	**1**	**0**					
		% of total score:	**11.00%**	**8.80%**	**1.10%**	**0.00%**					

Credit Ref.	Credit Title	Credit Name	Credits Available	Credits Targeted	Potential Additional	Credits Achieved	Mandatory Elements	Responsibilities	RIBA Stage Old	Status	Comments / Actions
POLLUTION 0.85% per credit											
Pol 01	**Impact of Refrigerants**	Pre-Requisite: systems with electric compressors					Yes/No?	M&E Consultant*			All systems (with electric compressors) must comply with the requirements of BS EN 378:2008.
		Impact of Refrigerants	2	1		0		M&E Consultant*	E - F		Refrigerant's Direct Effect Life Cycle CO2 equivalent emissions (DELC CO2e) of ≤ 1000 kgCO2e/kW cooling/heating capacity.
		Leak Detection	1	1		0		M&E Consultant*	E - F		Refrigerant leak detection system is required.
Pol 02	**NOx Emissions**	NOx Emissions	3	0		0		M&E Consultant*	E - F		Boilers specified with less than 40 mg/kWh NOx emissions. The technical specification of the boilers and/or the data sheet for CHP will be required when available.
Pol 03	**Surface Water Run Off**	Flood Resilience	2	2		0		Flood Risk Consultant*	D		Flood risk assessment prepared by Flood risk consultant to confirm that if the site is a low probability of flooding.
		Surface Water Run Off	2	0		0		Flood Risk Consultant*	D		Specialist hydrologist might be required to confirm the proposed attenuation measures, i.e. SUDs.
		Minimising Watercourse Pollution	1	0		0		Flood Risk Consultant*	D		A letter confirming the pollution prevention systems are in line with PPG3 and the SUDs requirements.
Pol 04	**Reduction of Night Time Light Pollution**	Reduction of Night Time Light Pollution	1	1		0		M&E Consultant*Contractor*	E - F		External lighting design in line with ILP guidance of obtrusive light.
Pol 05	**Reduction of Noise Pollution**	Reduction of Noise Pollution	1	1		0		Acoustician*	D		Acoustic report produced with attenuation requirements stated for principle plant items.
Pol		**TOTAL:**	**13**	**6**	**0**	**0**					
		% of total score:	**11.00%**	**5.08%**	**0.00%**	**0.00%**					
INNOVATION 1.00% per credit											
Inn 01	**Man 03**	Considerate Construction	1	0		0		Contractor*	E - F		40 points - CCS scheme.
Inn 02	**Man 05**	Aftercare	0	0		0		Client*	E - F		N/A
Inn 03	**Hea 01**	Visual Comfort	1	0		0		Architect*Contractor*	C		Not achievable.
Inn 04	**Hea 02**	Indoor Air Quality	0	0		0		M&E Consultant*Architect*Contractor*	D		N/A
Inn 05	**Ene 01**	Reduction of Energy Use & Carbon Emissions	5	0		0		M&E Consultant*	D		Not achievable.
Inn 06	**Wat 01**	Water consumption	0	0		0		M&E Consultant*Architect*Contractor*	E - F		Not achievable.
Inn 07	**Mat 01**	Life Cycle Impacts	1	0		0		Architect*Contractor*	C		Not achievable.
Inn 08	**Mat 03**	Responsible Sourcing of Materials	1	0		0		Architect*Contractor*	E - F		Not achievable.
Inn 09	**Wst 01**	Construction-site waste management	1	0		0		Contractor*	E - F		Not achievable.
Inn 10	**Wst 02**	Recycled aggregates	0	0		0		Architect*Contractor*	E - F		Not achievable.
Inn 11	**Wst 05**	Adaptation to Climate Change	0	0		0		Architect*Contractor*	E - F		Achieve certain credits in Hea 04, Ene 01, Ene 04, Wat 01, Mat 05 & Pol 03
Inn		**TOTAL:**	**10**	**0**	**0**	**0**					
		% of total score:	**10.00%**	**0.00%**	**0.00%**	**0.00%**					

Appendices

Appendix B - BRUKL Report

117366/AP/160902 Issue 03

Appendix B: BRUKL Reports

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

182 High holborn — As designed

Date: Fri Sep 02 13:00:04 2016

Administrative information

Building Details

Address: 182 High holborn, London, WC2B

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.6

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.6

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

Owner Details

Name: Covent Garden Investment S.A.R.L

Telephone number: 020 7003 1000.

Address: 9 Mansfield Street, London, W1G 9NY

Certifier details

Name: Kartik Amrania

Telephone number: 01628 623423

Address: 1 Bath Road, London, SL6 4AQ

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/m².annum	21.6
Target CO_2 emission rate (TER), kgCO_2/m².annum	21.6
Building CO_2 emission rate (BER), kgCO_2/m².annum	17.2
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and 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	0.24	0.35	B1000000:Surf[2]
Floor	0.25	0.22	0.22	00000000:Surf[0]
Roof	0.25	0.13	0.13	00000004:Surf[1]
Windows***, roof windows, and rooflights	2.2	1.39	1.4	00000001: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/(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
m³/(h.m²) at 50 Pa	10	3

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	4767.2	4767.2
External area [m²]	5407.7	5407.7
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	3	3
Average conductance [W/K]	3138.69	2743.38
Average U-value [W/m²K]	0.58	0.51
Alpha value* [%]	6.99	10

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

Building Use

% Area	Building Type
2	**A1/A2 Retail/Financial and Professional services**
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
98	**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	2.97	4.26
Cooling	5.78	5.23
Auxiliary	8.21	12.16
Lighting	13.3	18.28
Hot water	8.87	8.29
Equipment*	50.63	50.63
TOTAL**	39.14	48.23

* 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]	111.14	98.69
Primary energy* [kWh/m²]	107.16	132.89
Total emissions [kg/m²]	17.2	21.6

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

SWECO

Appendices

Appendix C - Mitigating the Risk of Overheating

117366/AP/160902 Issue 03