The Hoxton (Holborn) Limited

Hoxton Hotel Holborn Extension, London
Energy Assessment
09/01/17 Revision P2
SUSTAINABILITY

Audit sheet

Rev.	Date	Description	Prepared	Verified
P1	12/12/16	Issue for Comments	JH	PK
P2	09/01/17	For Planning Issue	JH	IH / PK

Contents

1. Executive Summary

This document summarises the pertinent national and local regulatory and planning policies applicable to the proposed extension to the Hoxton Holborn Hotel, namely:

- Compliance with the energy efficiency and fabric performance in Building Regulations Part L2B 2013
- London Plan – Achieve a 35% improvement on 2013 Building Regulations.
- 20% reduction in carbon dioxide emissions from on-site renewable energy technologies (Camden)
- BREEAM – a requirement of London Borough of Camden for 'Excellent' where feasible
- Consequential improvements to be considered to the existing building

Building Regulations Part L

The proposed extension will need to comply as a minimum with Building Regulations Part L2B. This document requires the new-build extension to comply with a set of building fabric performance and systems efficiency requirements.

Suitable consequential improvements are typically carried out to an existing building associated with extension projects. However, given that the existing building was very recently completed, the energy efficiency measures that should be considered would have a payback period of more than 15 years and therefore any consequential improvements are not expected to be deemed necessary (Section 7).

Low & Zero Carbon (LZC) Technologies

London Borough of Camden's *CPG3 – Sustainability* requires new developments to target a 20% reduction in carbon dioxide emissions from on-site renewable energy technologies. Combined Heat and Power (CHP) is not considered a renewable energy technology in CPG:3 and therefore may not be included in the carbon emission reduction through on-site renewable technology calculations in order to meet the 20% target.

Other than the existing CHP engine, air source heat pumps serving a VRF heating & cooling system will provide low carbon heating for the scheme. Waste heat that would otherwise be rejected to atmosphere when the VRF systems are in cooling mode will be recovered and used as a substantial pre-heat for the domestic hot water system. This low-energy technology can provide a significant reduction in associated energy use. Whilst not able to achieve the above target, this has the largest impact of any feasible LZC technology.

There is very limited scope for additional LZC technology on this scheme. A small area of photovoltaic cells (PV) may be viable but the output would be reduced by the overshadowing from adjacent buildings. It could potentially be positioned above roof plant to shield views by neighbours but has not been included in any analysis within this report.

BREEAM

Camden's local planning policy DP22 states a requirement for non-domestic developments of 500m^2 floor-space or above to achieve BREEAM 'Excellent' rating, with additional condition for obtaining at least 60% of the credits in the energy and water sections and 40% of the credits in the materials section. A BREEAM New Construction 2014 assessment is the most appropriate scheme for this project covering solely the extension, excluding any refurbished areas.

An onerous element of achieving 'Excellent' relates to the mandatory minimum energy/CO_2 performance (credit Ene01) which does not apply to a 'Very Good' rating. Meeting the minimum Ene01 credits for a BREEAM Excellent rating requires enhanced fabric performance standards significantly beyond typical Part L2A requirements for a 'notional' building, as well as clean energy technology and the consideration of renewable energy generation where feasible. It is confirmed that the hotel extension can exceed the minimum standard required to achieve 'Excellent' for this credit.

Despite this, the BREEAM Assessor would suggest that a 'Very Good' rating is a more appropriate overall target for the scheme, in line with both the applicable UK Building Regulations targets, the lower certified sustainability performance of the existing building and the substantial limitations of the existing site.

A BREEAM pre-assessment report has been produced in order to identify the most appropriate credits to be targeted which satisfy this lower BREEAM target for the project. Please refer to the BREEAM pre-assessment report *REP-1520565-08-JP-20170104-Hoxton - Holborn Extension - Pre-assessment Report-Rev01* and associated executive summary *DOC-1520565-08-JP-20161215-Hoxton - Holborn Hotel - BREEAM Executive Summary-Rev01* which discuss the proposed strategy with further detail of feasibility and applicability of each of the credits individually.

Resulting overall carbon emissions

The overall regulated CO_2 savings after applying the principles of the Energy Hierarchy are summarised in Table 1 below. This demonstrates a potential cumulative CO_2 emission rate 38% less than the baseline target. This result proposes a recommended small amount of buffer which aims to ensure the target of 35% can be safely reached if minor changes must be made to the overall design.

	Regulated Emissions		
	Total CO_2 (tonnes/yr)	Reduction CO_2 (tonnes, yr)	(%)
Baseline: 2013 Part L Compliant	135.6	n/a	n/a
Be Lean	124.2	11.4	8.4
Be Clean	93.2	30.9	22.8
Be Green	83.5	9.8	7.2
Total Cumulative Savings	-	**52.1**	**38.4**
Total Target Savings	-	47.4	-
Annual Surplus	-	4.6	-
Cumulative Surplus (30 yrs)	-	138.9	-

Table 1: Summary of Regulated CO_2 Emissions Reductions.

The following chart illustrates the stages of the energy hierarchy to reduce the emissions of CO_2 associated with regulated end uses. With a combination of passive energy reduction measures, extending the existing CHP, new VRF using air source heat pumps and a small amount of renewables the 35% emissions reduction target to satisfy London Plan can be achieved.

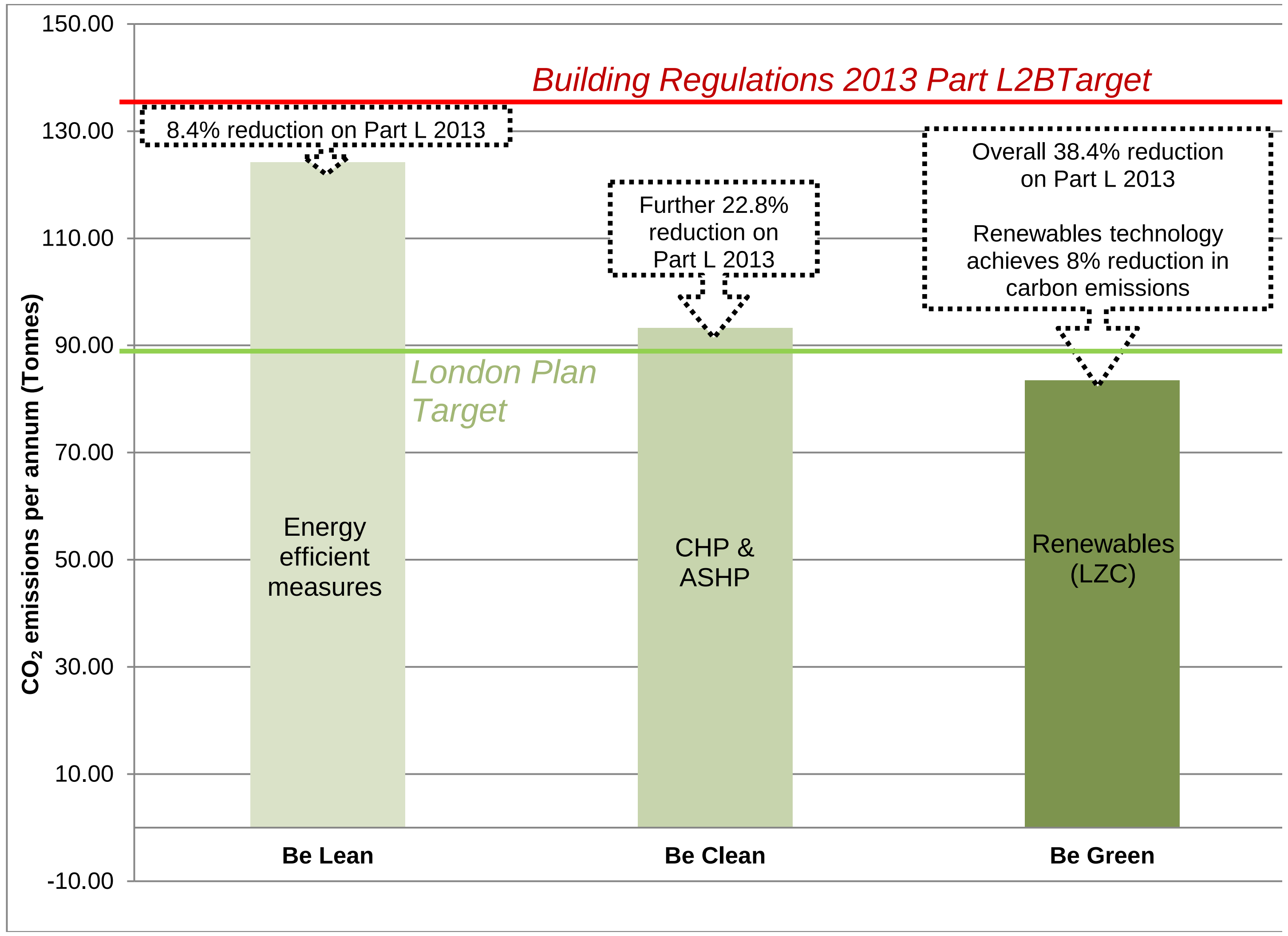


Figure 1: Summary of Regulated CO_2 Emissions Reductions (tonnes/ year)

It is important to consider that the carbon emissions target of the existing hotel building was set at a more onerous level than the simple regulatory target through a Section 106 agreement.

2. Introduction

This report outlines the development of the Energy Strategy for the proposed extension to the Hoxton Hotel, Holborn. The purpose of the report is to establish the design criteria that will form the basis of the detailed design beyond Stage 3. The design criteria and proposals are based on Hoare Lea's previous relevant experience, industry design guidance and statutory regulations.

The project consists of a new build six storey extension to the existing hotel above the existing service yard and a single storey extension to the existing south wing. The project will provide a net additional 46 guest bedrooms to the hotel, four of which will be accessible.

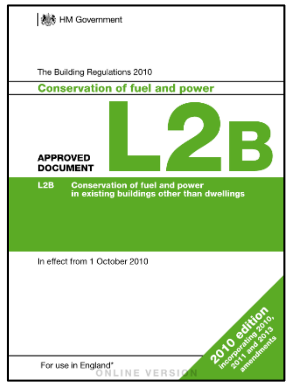
It is understood that should the scheme proceed beyond the planning stages, the works will be procured under a design and build type contract and as such the Contractor will be responsible for the design of the MEP engineering systems in their entirety.

The existing building is understood to have been refurbished within the last five years, with all services being replaced and upgraded to suit the new building. Some record information has been made available to Hoare Lea by the facilities management team, although this should be treated with caution as it has not been verified against the actual installed services.

3. Regulatory and Planning Policy context

3.1 The Building Regulations

Approved Document Part L (2013)



Part L of UK Building Regulations is split into two parts L1 (residential) and L2 (non-residential, including student accommodation). Part L2 is then subsequently split into new-build (L2A) and refurbishment (L2B) elements. There is a substantial difference between these two regulatory documents.
In summary, new-build developments require full compliance thermal modelling to meet onerous CO_2 emissions targets, whereas extension and refurbishment projects are normally only required to meet minimum fabric and system requirements. Thermal modelling would therefore be required for internal temperature analysis but not for compliance analysis.

In order to be designated a new-build project (Part L2A), the following applies;

1. The total useful floor area (GIA) is greater than 100m²

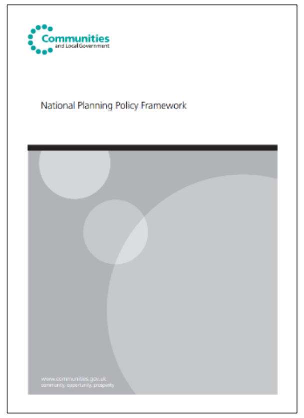
AND

2. The total useful floor area (GIA) is greater than 25% of the total useful floor area (GIA) of the existing building

Should either of these not be the case, the project would be classed as an extension project under Part L2B and would therefore be exempt from CO_2 emissions targets and would need to meet fabric performance targets instead.

Although the total useful floor area of the new-build extension is approximately 1,150m², it is less than 25% of the existing building, therefore Part L2B applies to the extension and any refurbishment works carried out in the existing building.

3.2 The National Planning Policy Framework (March 2012)



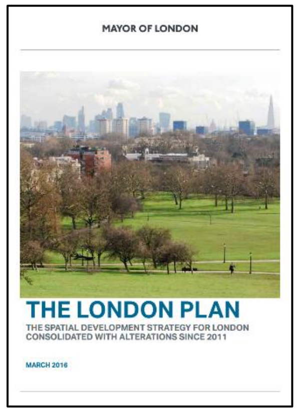
The National Planning Policy Framework (NPPF) was published on 27th March 2012 and superseded all Planning Policy Statements (PPS) and Planning Policy Guidance (PPG) documents. The National Planning Policy Framework sets out the Government's economic, environmental and social planning policies for England. In combination, these policies articulate the Government's vision of sustainable development, which should be interpreted and applied locally to meet local aspirations.

It provides a framework within which local people and their accountable councils can produce their own distinctive local and neighbourhood plans, which reflect the needs and priorities of their communities. The NPPF states that: "*Proposed redevelopment that accords with an up-to-date Local Plan should be approved and proposed redevelopment that conflicts should be refused unless other material considerations indicate otherwise.*"

3.3 Local Policies and Supplementary Planning Documents

London Plan (March 2016)

The London Plan has been revised on numerous occasions, with March 2016 as the current version. The main objectives of the London Plan are to:



Improve the environment and tackle climate change by:

- reducing CO_2 emissions and heat loss from new developments;
- increasing renewable energy;
- ensuring water supply and quality;
- improving sewerage systems; managing flood risk,
- improving London's recycling performance and waste management;
- and protecting open spaces making London a green and more pleasant place to live and visit

This document is the overall strategic plan for London, and it sets out a fully integrated economic, environmental, transport and social framework for the development of the capital to 2031. It forms part of the development plan for Greater London. London boroughs' local plans need to be in general conformity with the London Plan, and its policies guide decisions on planning applications by councils and the Mayor.

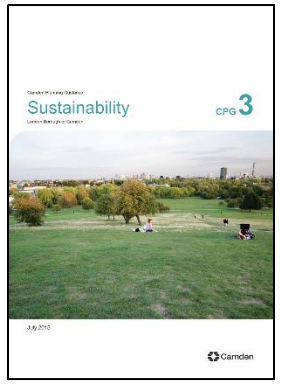
- Encourages the connection to district heating networks where possible and expects CHP to be used where feasible.
- Requires 35% reduction from a notional 2013 building regulations CO_2 emissions target.
- Ensure the challenges of economic and population growth is suitably met.
- To enable London to compete internationally as a successful city
- Facilitate the development of diverse, strong, secure and accessible neighbourhoods in London
- Promote London's environmental achievements so that London is a city that becomes a world leader in improving the environment
- Ensuring London is a city where it is easy, safe and convenient for everyone to access jobs, opportunities and facilities

Camden Planning Guidance 3 - Sustainability (July 2015)

The London Borough of Camden has developed the CPG 3 Sustainability to give guidance on ways to achieve carbon reductions and more sustainable developments, covering:

- Energy statements
- The energy hierarchy
- Water efficiency
- Sustainable use of materials
- Sustainability assessment tools - BREEAM
- Green roofs, brown roofs and green walls
- Flooding
- Climate change adaptation
- Biodiversity
- Urban food growing

This document complements the policies in the London plan and is in line with Camden's Core Strategy and Development Policies *DP22 – Promoting sustainable design and construction* and *DP23 - Water*. In line with Camden's aim to reduce carbon emissions, CPG3 Sustainability:



- Encourages the connection to district heating networks where possible and expects CHP to be used where feasible.
- Requires developments to target a 20% reduction in carbon dioxide emissions from on-site renewable energy technologies where feasible.
- Requires developments of 500m² or more of non-residential floor-space to be designed in line with BREEAM, aiming to target an overall 'Excellent' rating where feasible and achieving at least 60% of the credits in the Energy and Water sections and 40% of the credits in the materials section.

3.4 BREEAM

Camden's local planning policy DP22 requires non-domestic developments of 500m² floor-space or above to achieve BREEAM Excellent, obtaining at least 60% of the credits in the energy and water sections and 40% of the credits in the materials section. A BREEAM New Construction 2014 assessment is the most appropriate scheme for this project covering solely the extension, excluding any refurbished areas. There is no requirement for a bespoke assessment as the extension can be registered as a conventional scheme.

A BREEAM pre-assessment report has been produced in order to identify the most appropriate credits to be targeted to meet the BREEAM targets for the project.

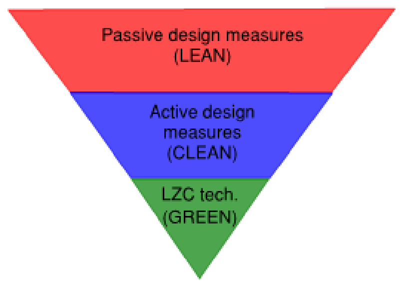
An onerous element of achieving 'Excellent' relates to the mandatory minimum energy/CO_2 performance (credit Ene01) which does not apply to a 'Very Good' rating. Meeting the minimum Ene01 credits for a BREEAM Excellent rating incurs the requirement for full thermal modelling and energy modelling calculations in line with a new build development. This supersedes the fact that the scheme is only required under UK Building Regulations to meet Part L2B which does not require energy modelling calculations, but instead meet limiting u-values and glazing percentage.

3.4.1 BREEAM Ene 01

In order to achieve BREEAM Excellent, a minimum of 5 credits must be obtained within the category *Energy 01 - Reduction of energy use and carbon emissions*.

In order to calculate the number of credits obtained, BREEAM uses an overall energy performance ratio (EPR_{NC}), which is the result of adding up:

- The heating & cooling demand energy performance ratio (EPR_{ED}), associated with the fabric performance.
- The primary consumption energy performance ratio (EPR_{PC}), which incorporates the benefits of using efficient services.
- The CO_2 energy performance ratio (EPR_{CO2}), which also takes into account the renewable energy used in the building.



This is in line with the energy hierarchy (referred in the London Plan as the 'Lean, Clean & Green' approach), concentrating first on improving building fabric to reduce energy demand, followed by improving system efficiencies, then finally considering low and zero carbon technologies.

Failing to adequately consider all of the 3 approaches above could result in the required credits being missed or becoming very difficult to compensate for by other methods.

Additionally, current UK Building Regulations addressed by BREEAM New Construction 2014 will ensure that the extension's CO_2 emissions and energy performance is a substantial improvement upon the existing building.

The Holborn Extension aims to achieve a minimum of 5 credits to meet the mandatory credits equivalent to a BREEAM 'Excellent' performance. Furthermore, based upon the current Stage 3 design, the scheme has potential to achieve the minimum 8 credits in line with the mandatory credits for BREEAM 'Outstanding' performance in Ene 01. As a result, the scheme will exceed the 60% target set by Camden Council in the Energy category.

3.4.2 BREEAM implications

Overall, the project is at a disadvantage in comparison to a new build development due to the technical complexity of achieving BREEAM 'Excellent'. If the extension is conditioned to achieve BREEAM 'Excellent', this would require incorporating further credits with additional costs, which are unlikely to offer significant benefits to the building or users/client and are purely incorporated to achieve a higher rating.

The assessor would suggest that a BREEAM 'Very Good' rating is a more appropriate target for the scheme, in line with both its associated UK Building Regulations targets and also the certified sustainability performance of the existing hotel building. The BREEAM pre-assessment report *REP-1520565-08-JP-20170104-Hoxton - Holborn Extension - Pre-assessment Report-Rev01* and associated executive summary *DOC-1520565-08-JP-20161215-Hoxton - Holborn Hotel - BREEAM Executive Summary-Rev01* cover the proposed strategy with further detail of the feasibility and applicability of each of the credits individually.

It would also be worth noting that due to the updates to both UK Building Regulations and other industry guidance between the design of the existing building and this project, achieving a BREEAM Very Good rating under the current 2014 scheme would still result in a more sustainable design solution than the existing building's Very Good certificate as this was achieved under a superseded version of BREEAM.

4. Energy Modelling - Approach and Methodology

4.1 Definitions and Limitations

Definitions

The following definitions should be understood throughout this statement:

- *Energy demand* – the 'room-side' amount of energy which must be input to a space to achieve comfortable conditions. In the context of space heating, this is the amount of heat which is emitted by a radiator, or other heat delivery mechanism.
- *Energy requirement* – the 'system-side' requirement for energy (fuel). In the context of a space heating system using a gas boiler, this is the amount of energy combusted (e.g. gas) to generate useful heat (i.e. the energy demand).
- *Regulated CO_2 emissions* – the CO_2 emissions emitted as a result of the combustion of fuel, or 'consumption' of electricity from the grid, associated with regulated sources (those controlled by Part L of the Building Regulations).

Limitations

The appraisals within this statement are based on Part L calculation methodology and should not be understood as a predictive assessment of future energy requirements or otherwise. Occupants will operate their systems differently, and the weather will be different from the assumptions made by Part L approved calculation methods, leading to differing energy requirements.

4.2 Energy Hierarchy

This strategy outlines how the Proposed Development will have a reduced impact on climate change by reducing CO_2 emissions associated with energy use in buildings.

Figure 2 below outlines the route followed by the Proposed Development when reducing CO_2 emissions and defines the structure of this statement.

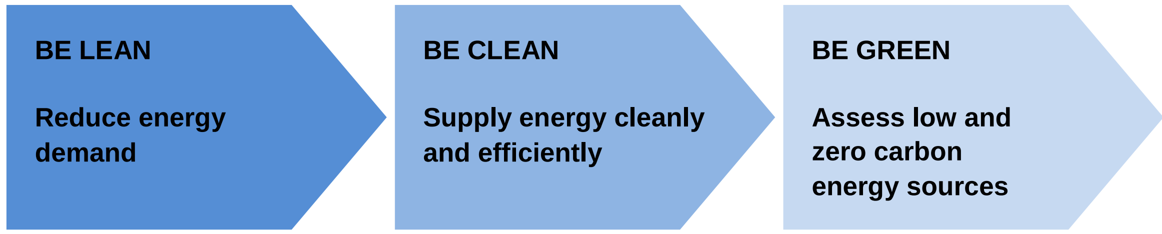


Figure 2: Energy Hierarchy.

The strategic approach to the design of the proposed extension has been to reduce demand for energy prior to the consideration of integrating Low or Zero Carbon (LZC) technologies, since controlling demand is the most effective way of reducing energy requirements and CO_2 emissions.

Further reductions are ensured through the specification of high-efficiency building services and controls to limit losses in energy supply, storage and distribution.

After the inclusion of passive design and energy efficiency measures, various options have been investigated to reduce CO_2 emissions associated with energy supply.

The feasibility of LZC technologies has been investigated in line with the policy aspirations and as part of the Energy Strategy submitted in support of the outline applications.

4.3 Methodology

A building energy model was generated and used to simulate the annual carbon emissions predicted by the standard compliance methodology. Only the proposed extension was recalculated to provide the energy and carbon outputs used in this report.

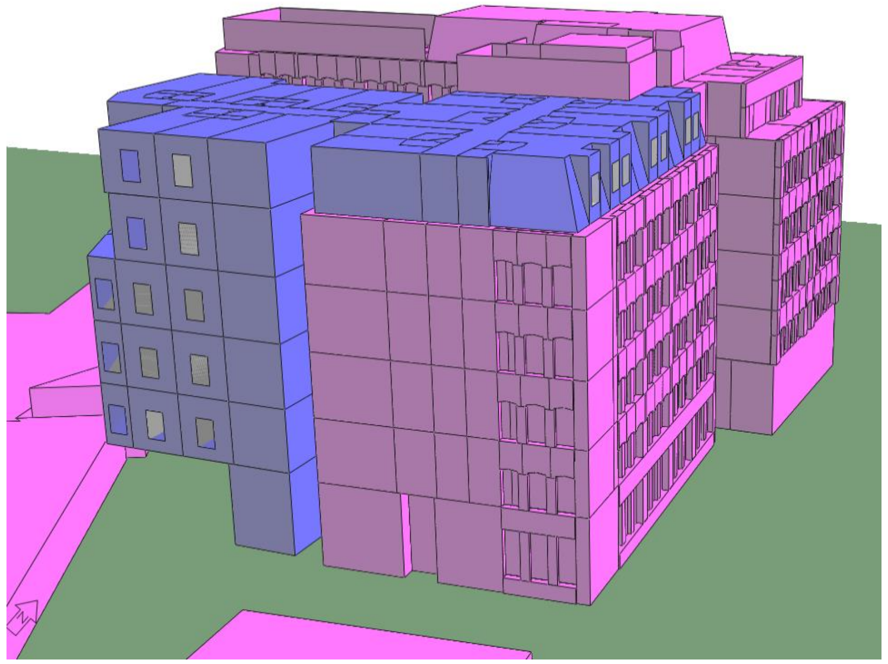


Fig 3 – Model view of extension (blue) from South

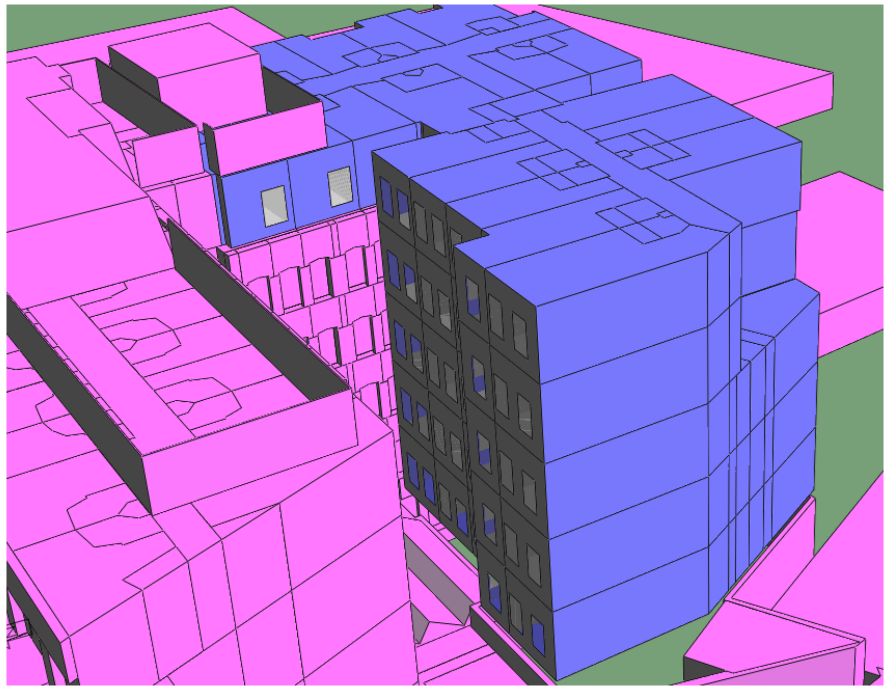


Fig 4 – Model view of extension (blue) from North

The standard carbon factors were used within approved software to convert the energy consumption figures into CO_2 emissions for the Proposed Development.

5. Energy Hierarchy Appraisal

5.1 Notional (baseline) development performance

A building compliant with Building Regulations should be used as a baseline to calculate the carbon emission reduction required by the London Plan. Therefore, the baseline building would have fabric U-values detailed in tables 3 and 4 of Part L2B, limiting heating & cooling system efficiencies outlined in the Non-domestic Building Services Compliance Guide and an air permeability of 10 $m^3/h.m^2$ at 50Pa, which is the limiting value to achieve compliance with Part L.

Regulated Sources

Regulated sources of energy requirement are those controlled by the Building Regulations, as follows:

- Space heating;
- Hot water;
- Space cooling;
- Lighting, and associated controls
- Auxiliary (combining fans, pumps and controls).

Unregulated Sources

Unregulated sources of energy requirement include small power electricity use (computers, plug in devices) and cooking. Currently, unregulated energy is not included within the Building Regulations Part L assessment requirements. It is anticipated that the proportion of unregulated energy will gain in significance when compared to regulated energy as each revision of Building Regulations Part L comes into force and regulated energy is reduced.

Results

The energy modelling of the baseline development indicates that by incorporating the features above, the emissions in Table 2 below are calculated. This forms the baseline against which the further stages of the energy hierarchy will be compared

	Carbon Dioxide Emissions (Tonnes CO_2 per annum)	
	Regulated	Unregulated
Baseline: Building Regulations 2013 Part L Compliant Development	135.55	9.83

Table 2 - Carbon dioxide emissions of the baseline compliant building

5.2 Be Lean

The following section outlines considerations of the passive design and energy efficiency measures that have been considered, and those which will be implemented at the Proposed Development.

Passive Design Measures

Passive design measures are those which reduce the demand for energy within buildings, without consuming energy in the process. These are the most effective and robust measures for reducing CO_2 emissions as the performance of the solutions, for example greater wall insulation, is unlikely to deteriorate significantly with time, or be subject to change by future property owners. In this sense, we can be confident that the benefits of the measures will continue at a similar level for the duration of their installation.

Glazing Ratio

The proportion of glazing to solid wall has a significant effect on the thermal performance of a building. High ratios will increase the average U-value and can increase the amount of energy required for space conditioning. Glazing ratios within the proposed extension are lower and certainly less than the maximum 40% allowable by building regulations.

Glazing Energy & Light Transmittance

High specification glazing is proposed which will limit the requirement for heating and cooling. The site is not expected to have a significant solar gain and will not require very low g-value glass coatings.

Thermal Insulation

When designing an extension to a building in accordance with Part L2, there are backstop fabric performance targets that must be met, as shown in tables 3 and 5 from within the L2B document (see Appendix A). However, in order to meet the carbon emission targets for the project, particularly a 35% improvement on Building Regulations Part L (London Plan) and the minimum energy performance required by Ene01 mandatory for BREEAM Excellent, the new build extension is proposed to have the fabric performance standards beyond the Part L2B requirements for 'notional' building, as specified below. These are in line with the values proposed for a high performance new-build development.

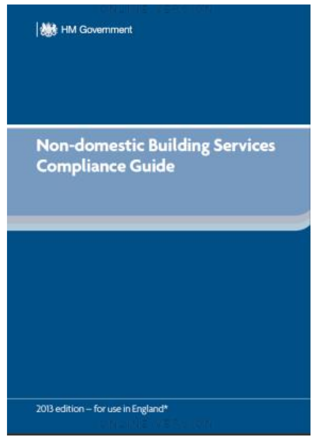
Parameter	Building Regulations Part L2A Limit	Notional building	Proposed Design
External Wall U-value ($W/m^2.K$)	0.35	0.28	**≤0.15**
Roof U-value ($W/m^2.K$)	0.25	0.18	**≤0.15**
Ground Floor U-value ($W/m^2.K$)	0.25	0.22	**≤0.18**
Window U-value (inc. frame) ($W/m^2.K$)	2.20	1.8	**≤1.40**
Entrance Door U-value ($W/m^2.K$)	2.20	1.60	**≤1.60**
Air Permeability ($m^3/h.m^2$ at 50Pa)	10	10	**≤3**

Table 4 - Limiting and proposed fabric performance

Thermal Mass

The thermal mass of the structure could have a small impact on the energy demand of the building but as rooms are mechanically ventilated, are expected to be in use at similar times but primarily overnight and are conditioned to similar temperatures, this has not been considered in further detail.

Energy Efficiency Measures



Energy efficiency measures are those which seek to service the demand for energy (i.e. the remaining demand after implementation of passive design measures) in the most efficient way. All works carried out to existing building services, and all new building services installed within the scheme will be required to comply with the 2013 version of the Non-domestic Building Services Compliance Guide.

This document details items such as minimum heating/cooling plant seasonal efficiencies, maximum ventilation specific fan powers, zoning and controls requirements etc. It is the responsibility of both the design team and contractor to ensure that the works proposed for the building are in compliance with this document.

Heating

Space heating is to be via zonal fan-coil units within each room. These are connected as a system to roof mounted high efficiency air source heat pumps (ASHPs). This system may recover heat or cool from connected areas to minimise energy consumption.

Space Cooling

Space cooling is to be via zonal fan-coil units within each room. These are connected as a system to roof mounted high efficiency heat recovery air source heat pumps (ASHPs). This system may recover heat or cool from connected areas to minimise energy consumption.

Hot Water

Large volumes of domestic hot water is required in a hotel which must be generated and stored for delivery at peak conditions. The existing system uses a CHP engine and condensing gas-fired boilers with insulated storage vessels. CHP will be covered in the 'Be Clean' section to follow and is not included within the 'Lean' results. A high efficiency gas-fired storage system is used at this stage to generate results which can be compared to the baseline.

Lighting

All lighting has been assumed to be using LED luminaires of increased minimum efficacy of 70 lm/w.

Ventilation

Supply and extract mechanical ventilation will be centralised and supplied to each bedroom and bathroom. These systems will have a specific fan power (SFP) of no more than 1.5 W/l/s and a heat recovery effectiveness of at least 75%.

Metering & Controls

Sub-metering and low energy local controls will be used where feasible. New meters are proposed to the new mechanical systems as indicated on the simplified metering schematic included within the drawings appendix to satisfy the requirements of Approved Document Part L and to allow monitoring of key energy and utility consumers within the building.

Results

The results following the 2nd stage of the energy hierarchy are shown below

	Carbon Dioxide Emissions (Tonnes CO_2 per annum)	
	Regulated	Unregulated
Baseline: Building Regulations 2013 Part L Compliant Development	135.55	9.83
After energy demand reduction (Be Lean)	124.16	9.83

Table 5 - Carbon dioxide emissions after the 'Lean' stage of the energy hierarchy

	Regulated Emissions		
	Total CO_2 (tonnes/yr)	Reduction CO_2 (tonnes, yr)	(%)
Baseline: 2013 Part L Compliant	135.6	n/a	n/a
Be Lean	124.2	11.4	8.4

Table 6 - Regulated carbon dioxide savings from the 'Lean' stage of the hierarchy

As shown above, an 8.4% reduction in CO_2 emissions is achieved using high performance fabric, high-efficiency plant and lighting.

5.3 Be Clean

The following sections detail considerations of the infrastructure and low-carbon energy supply measures that have been considered, and those which will be implemented at the proposed development.

Infrastructure

The existing hotel presently uses a CHP engine in the existing roof plant room that was installed as part of the recent refurbishments works. The proposed extension gives rise to an opportunity to increase its utilisation by virtue of the additional domestic hot water load. A new thermal store will be provided in the new extension plant room, connected to the existing CHP low temperature hot water (LTHW) pipework.

Technology Appraisal

Figure 4 below illustrates how these systems can work more efficiently than their traditional counterparts, i.e. grid supplied electricity and gas boilers. It is estimated that where thermal demand is adequate, CHP can achieve reductions in primary energy demand relative to traditional sources of up to approximately 30%.

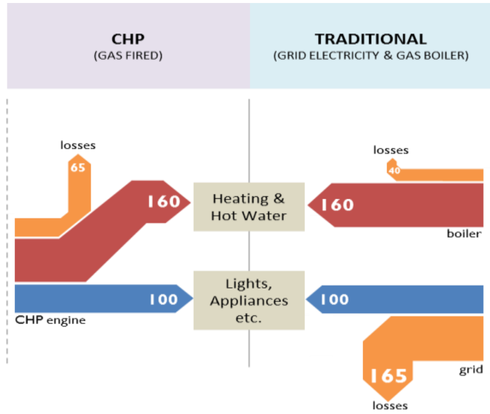


Figure 4 : CHP Efficiency

As the existing CHP system can be simply extended and will be expected to supply a large proportion of the hot water load, it is deemed unnecessary and unfeasible for any potential wider heat network connection to be explored at this stage.

Results

	Carbon Dioxide Emissions (Tonnes CO_2 per annum)	
	Regulated	Unregulated
Baseline: Building Regulations 2013 Part L Compliant Development	135.55	9.83
After energy demand reduction	124.16	9.83
After CHP & ASHP	93.23	9.83

Table 7 - Carbon dioxide emissions after the 'Clean' stage of the energy hierarchy

	Regulated Emissions		
	Total CO_2 (tonnes/yr)	Reduction CO_2 (tonnes, yr)	(%)
Baseline: 2013 Part L Compliant	135.6	n/a	n/a
Be Lean	124.2	11.4	8.4
Be Clean	93.2	30.9	22.8

Table 8 - Regulated carbon dioxide savings from the 'Clean' stage of the hierarchy

As shown above, a further 22.8% reduction in CO_2 emissions is achieved by utilising the existing CHP and incorporating air source heat pumps for space heating and cooling.

5.4 Be Green

The following section outlines considerations of the renewable energy generation measures that have been considered, and those which will be implemented at the proposed development.

Renewable Technology Appraisal

When addressing the third tier of the Energy Hierarchy, the aim is to integrate renewable energy technologies that are appropriate to the design of the buildings at the development. Furthermore the integration of renewables must not compromise or detract from the adoption of energy efficiency measures and decentralised energy infrastructure.

From the suggested renewable energy systems listed in the London Renewables Toolkit, a number of potential technologies were identified; in each case the site location and/or development design provided, in principle, is a key determinant for the selection of each technology.

Air / Water / Ground Source Heat Pumps

Air Source heat pumps are being proposed to provide space heating and cooling. In addition to the heat provided by the ASHP in winter, it is proposed to take advantage of the waste heat produced from the VRF equipment during net cooling periods by introducing a hot water module to preheat the return LTHW from the domestic hot water heating coils. This has the ability to raise the water temperature from 10˚C to approximately 45˚C and uses heat which would otherwise be rejected to atmosphere. This will be connected to a local smaller sized thermal store.

Given the technical difficulty in drilling and excavating a well through the retained building slab and amongst existing foundations, as well as its close proximity to nearby underground stations and lines within the vicinity of the site, ground source heat pumps have not been considered technically appropriate and have not been assessed further as part of this Energy Strategy.

Biomass Boilers

Biomass has not been considered further within this energy strategy for the proposed development at Hoxton Holborn on the basis that the application site is within an AQMA, as well as issues relating to the delivery and storage of biomass on-site.

Photovoltaic Panels

Generally, PV arrays can be integrated on the roof-space of buildings and can possibly also be integrated into building fabric, external shading devices and glazing, although preferences are usually to install separate panels that could be more easily replaced at the end of their service life. Shading from adjacent buildings will impact the overall performance of any installed system. Despite this, PV panels are a suitable method to generate renewable electricity but would likely only be used in small area, perhaps above the roof plant to form some visual barrier.

This technology has not currently been investigated in more detail but could form part of the energy strategy if required to assist in meeting specific renewables targets.

Solar Thermal Panels

Solar hot water systems could be installed on site, but are not advised given the proposed use of CHP to provide heat for the building. The potential use of low carbon heating inhibits the effective use of solar thermal panels as both technologies compete to serve the thermal load of the development, meaning that the use of both technologies would result in underperformance of the systems in both technical and economic assessment. Solar collectors are therefore not proposed for inclusion at Hoxton Hotel.

Micro Wind Turbines

Referring to the wind-speed database as adopted by the DECC the site experiences fairly low wind speeds in this area, averaging 4.8m/s assuming a rotor height at around 10m above ground level. Taking a roof mounted turbine with a rotor at 45m above ground level may increase wind speeds to 6m/s, but given the urban environment it is unlikely that average speeds will meet this estimate given the experience of urban installations

Though wind ‘turbines can be accommodated on the site technically, due to the status of the development and heights of surrounding buildings along High Holborn, the cultural heritage of the surrounding area, and the spatial challenges associated with the site, roof-mounted micro-wind turbines is not considered to be appropriate. Furthermore, the installation of wind turbines may result in visual and noise intrusion on neighbouring properties to the site. On this basis, wind turbines have not been considered any further in this assessment.

Results

	Carbon Dioxide Emissions (Tonnes CO_2 per annum)	
	Regulated	Unregulated
Baseline: Building Regulations 2013 Part L Compliant Development	135.6	9.83
After energy demand reduction	124.2	9.83
After CHP & ASHP	93.2	9.83
After renewable energy	83.5	9.83

Table 9 - Carbon dioxide emissions after the ‘Green’ stage of the energy hierarchy

	Regulated Emissions		
	Total CO_2 (tonnes/yr)	Reduction CO_2 (tonnes, yr)	(%)
Baseline: 2013 Part L Compliant	135.6	n/a	n/a
Be Lean	124.2	11.4	8.4
Be Clean	93.2	30.9	22.8
Be Green	83.5	9.8	7.2

Table 10 - Regulated carbon dioxide savings from the ‘Lean’ stage of the hierarchy

As shown above, a further 7.2% reduction in CO_2 emissions is possible by using renewable technology in the form of the hot water module attached to the heat pumps.

6. Summary

Preferred Strategy for Implementation

The Energy Statement has shown how the proposed development will be designed following the Energy Hierarchy and will deliver the required carbon dioxide savings as compared to a comparative Part L 2013 compliant building.

In response to the first tier of the Energy Hierarchy, it is projected that passive energy efficient design measures alone will improve on the TER by 8.4%.

Energy Hierarchy

Based upon the proposed energy efficiency measures alone, the extension is predicted to deliver significant carbon savings and improvements to the energy performance of the scheme, which is wholly in line with the Council's objectives on energy efficiency and sustainable development.

It is clear from the constraints of the existing building that the ability to provide a many potential services technologies is limited. Nonetheless, the design team is committed to maximise the energy conservation capacity of the project, primarily by utilising and extending the gas-fired CHP as the most suitable low carbon technology.

A high efficiency heating and cooling system which offers the potential to recycle waste space conditioning energy during much of the year for the generation of domestic hot water will then ensure that the target carbon emission savings required by the London plan can be achieved.

The overall regulated CO_2 savings from applying the principles of the Energy Hierarchy are summarised in Table 11 below.

	Regulated Emissions		
	Total CO_2 (tonnes/yr)	Reduction CO_2 (tonnes, yr)	(%)
Baseline: 2013 Part L Compliant	135.6	n/a	n/a
Be Lean	124.2	11.4	8.4
Be Clean	93.2	30.9	22.8
Be Green	83.5	9.8	7.2
Total Cumulative Savings	-	**52.1**	**38.4**
Total Target Savings	-	47.4	-
Annual Surplus	-	4.6	-
Cumulative Surplus (30 yrs)	-	138.9	-

Table 11: Summary of Regulated CO_2 Emissions Reductions.

Figure 5 below illustrates that carbon savings are made at each stage of the Energy Hierarchy and together will result in a building emissions rate which is below the target set by the London Plan.

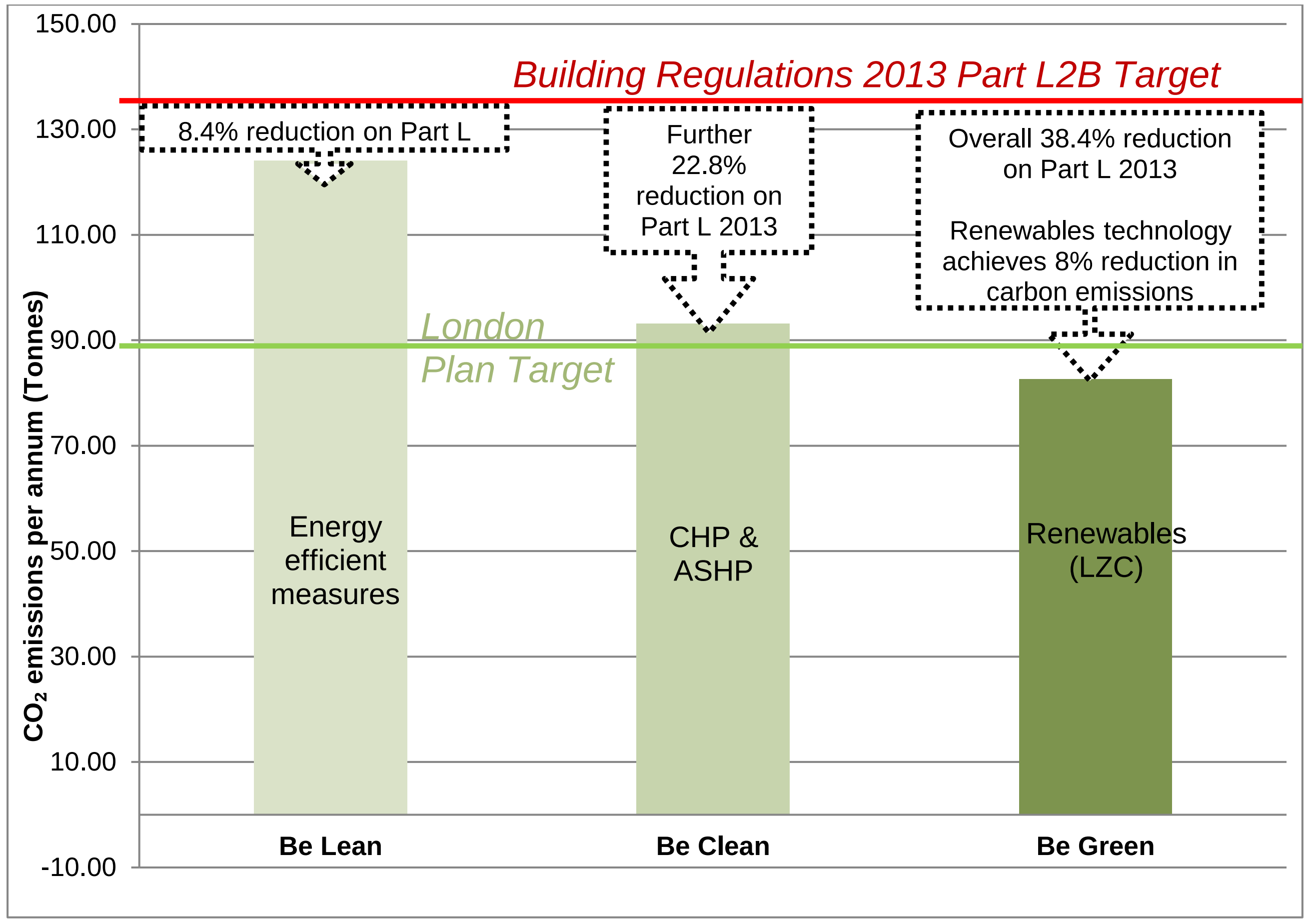


Figure 5: Summary of Regulated CO_2 Emissions Reductions (tonnes/ year)

To avoid excessive pages within this assessment, a BRUKL output statement for the final Green stage of the Energy Hierarchy is presented in an associated document: *Hoxton Holborn Green_brukl*. However this is for information only and not be used for analysis as the notional data included in the document is that for a Part L2A stand-alone building, not a Part L2B extension.

7. Consequential improvements

Consequential improvements to the existing hotel building would normally be required as they apply to extension works from any existing building with a total useful floor area over 1,000m². They require the following;

1. Consequential improvement works must be carried out in addition to the principal works of the extension
2. The cost of the consequential improvements should be at least 10% of the cost of the extension
3. Improvement measures must be technically, functionally and economically feasible, and provide a simple payback of less than 15 years

Approved Document L2B makes suggestions in table 6 for measures that typically fall within the acceptable limits of consequential improvements. The table on the following page assesses the feasibility of all measures suggested in table 6 of ADL2B to be implemented in this project.

As the existing building was completed approximately 2 years ago, it is demonstrated that none of the improvements included in that list is technically, functionally and economically feasible whilst also providing a simple payback of less than 15 years.

Table 12 – Feasibility analysis of consequential improvement measures

<table>
<tr><th>No.</th><th>Improvement measure</th><th>Feasibility</th></tr>
<tr><td>1</td><td>Upgrading heating systems more than 15 years old by the provision of new plant or improved controls</td><td rowspan="3">The existing high-efficiency systems are less than 15 years old.
NOT APPLICABLE</td></tr>
<tr><td>2</td><td>Upgrading cooling systems more than 15 years old by the provision of new plant or improved controls</td></tr>
<tr><td>3</td><td>Upgrading air-handling systems more than 15 years old by the provision of new plant or improved controls</td></tr>
<tr><td>4</td><td>Upgrading general lighting systems that have an average lamp efficacy of less than 40 lamp-lumens per circuit-watt and that serve areas greater than 100 m2 by the provision of new luminaires or improved controls</td><td>The existing lighting efficacy is higher than 40 lamp-lumens per circuit-watt.
NOT APPLICABLE</td></tr>
<tr><td>5</td><td>Installing energy metering following the guidance given in CIBSE TM 39</td><td>The building is expected to be compliant with CIBSE TM 39.
NOT APPLICABLE</td></tr>
<tr><td>6</td><td>Upgrading thermal elements which have U-values worse than those set out in column (a) of Table 5 following the guidance in paragraphs 5.12 and 5.13</td><td>The existing fabric U-values are better than those in column (a) of Table 5 of the Approved Document L2B (see below).
<table>
<tr><th rowspan="2">Element</th><th colspan="2">U Values (W/m².K)</th></tr>
<tr><th>Existing building</th><th>Threshold</th></tr>
<tr><td>Roof</td><td>0.15</td><td>0.35</td></tr>
<tr><td>Walls</td><td>0.23</td><td>0.70</td></tr>
<tr><td>Floors</td><td>0.2</td><td>0.70</td></tr>
</table>
NOT APPLICABLE</td></tr>
<tr><td>7</td><td>Replacing existing windows, roof windows or rooflights or doors which have a U-value worse than 3.3 W/m².K following the guidance in paragraphs 4.23 to 4.28</td><td>The existing windows have a U value of 1.5 W/m².K.
NOT APPLICABLE</td></tr>
<tr><td>8</td><td>Increasing the on-site low and zero carbon (LZC) energy-generating systems if the existing on-site systems provide less than 10% of on-site energy demand, provided the increase would achieve a simple payback of 7 years or less</td><td>Installing new LZC technologies in the existing building is not suitable as a ‘consequential improvement’ as the simple payback will be greater than 7 years.
NOT APPLICABLE.</td></tr>
<tr><td>9</td><td>Measures specified in the recommendations report produced with a valid Energy Performance Certificate</td><td>There are no recommendations in the EPC which offer a simple payback of less than 15 years.
NOT APPLICABLE.</td></tr>
</table>

8. Cooling and overheating

The cooling hierarchy in Policy 5.9 of the London Plan has been applied to the development. Measures that are proposed to reduce the demand for cooling are set out below:

1. **Minimising internal heat generation through energy efficient design**: utilising VRF heating with internal refrigerant reduces the need for space heating pipework. Domestic hot water heat distribution infrastructure within the building will be contained within dedicated risers and be insulated to minimise heat transfer. Reduced pipe lengths, particularly lateral pipework in corridors of apartment blocks, and adopting pipe configurations which minimise heat loss. High efficiency lighting will be utilised throughout.
2. **Reducing the amount of heat entering the building in summer**: this has been considered in the design by proposing limited window openings to the south, east and west elevations with internal blinds. The new extension rooms are substantially over-shaded by taller adjacent buildings so the solar gain is not expected to be high.
3. **Use of thermal mass and high ceilings to manage the heat within the building**: It is not expected that a substantial amount of exposed thermal mass will be of significant benefit to the environment in each occupied spaces in the building. Due to the continuous potential occupancy of each bedroom, combined with limited scope for night-time purging when the benefit of cooler air would be available, a heavier-weight structure may actually limit the quick response required by the space conditioning systems.
4. **Mechanical ventilation**: Mechanical ventilation will make use of 'free-cooling' when the outside air temperature is substantially below that in the building during summer months. This will incorporate a by-pass on the heat recovery system for standard summer mode operation.

To provide a satisfactory environmental conditions for guests at any time, the use of mechanical cooling will be proposed. The new bedrooms would not receive adequate air flow through natural ventilation as the rooms will be significantly sheltered from any local wind flow by adjacent buildings. Mechanical ventilation would not be sufficient alone to ensure comfortable conditions, even with high flow rates which would cause excessive noise.

The active cooling strategy, as indicated previously, will consist of the following;

A new refrigerant based variable refrigerant flow (VRF) heating and cooling system will be provided to serve the new guest bedrooms, following the same principles employed in the existing bedrooms. The system will be based on the principle of heat recovery, meaning that simultaneous heating and cooling can be achieved throughout the buildings. The system will consist of a series of new outdoor condenser units, indoor horizontal chassis concealed fan coil units (FCUs), and interconnected pipework.

The outdoor units are to be located within a dedicated screened area on the roof of the new single storey extension, as indicated on the design drawings. The units will be mounted on a secondary support system comprising pedestals or similar to allow air flow underneath the units.

The FCU controls will be interlocked with the room energy saver to hold off the operation of the FCU during periods of absence from the room.

A master controller will be provided as part of the system to link all system controls and allow remote monitoring of the key system performance parameters from an agreed location.

The exact arrangement of FCUs in guest bedrooms will be developed and agreed in more detail in subsequent design stages with input from the architect and interior designer. However, the plant considered for this assessment has the efficiencies below.

	Efficiency
Heating SCOP	5.17
Cooling EER	3.85
Cooling EER	4.85

Table 13: Efficiencies of VRF heating and cooling plant

An additional benefit of the space cooling services will be the opportunity to recover waste heat via the proposed hot water module to generate a substantial proportion of the domestic hot water demand of the building.

	Area weighted average building cooling demand (MJ/m^2)
Actual	17.4
Notional	56.8

Table 14: cooling demand comparison of actual and a notional

It is shown above that the cooling demand of the proposed new buildings will result in an area-weighted building cooling demand, taken from the BRUKL document

9. Appendix A - Part L2B back-stop fabric performance standards

For any new ‘controlled fittings’ scheduled in Table 3 of ADL2B, minimum u-values apply.

Table 3 Standards for controlled fittings

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

Notes:

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

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

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

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

Part L2B also states minimum values for new thermal elements, which should comply with Table 4 within ADL2B.

Table 4 Standards for new *thermal elements*

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

Notes:

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

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

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

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

5 See paragraph 4.14.

Table 5 within ADL2B shows that if alterations are proposed to any existing fabric that has a u-value worse (higher) than column (a), the insulation levels should achieve the performance standards in column (b) within table 5. Alterations would include:

- The provision of a new layer or
- The replacement of an existing layer

Table 5 Upgrading retained thermal elements

Element[1]	U-value W/(m².K)	
	(a) Threshold	(b) Improved
Wall – cavity insulation	0.70	0.55[2]
Wall – external or internal insulation	0.70	0.30[3]
Floors[4,5]	0.70	0.25
Pitched roof – insulation at ceiling level	0.35	0.16
Pitched roof – insulation at rafter level[6]	0.35	0.18
Flat roof or roof with integral insulation[7]	0.35	0.18

Notes:

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

2 This applies only in the case of a cavity wall capable of accepting insulation. Where this is not the case it should be treated as for ‘wall – external or internal insulation’.

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

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

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

6 A lesser provision may be appropriate where meeting such a standard would create limitations on head room. In such cases, the depth of the insulation plus any required air gap should be at least to the depth of the rafters, and the thermal performance of the chosen insulant should be such as to achieve the best practicable U-value.

7 A lesser provision may be appropriate if there are particular problems associated with the load-bearing capacity of the frame or the upstand height.

10. Appendix B - Carbon emission factors

Fuel	Type	Factor ($kgCO_2/kWh$)
Gas	Mains gas	0.216
Electricity	Standard tariff	0.519

Table 15: Part L 2013 CO_2 Emission Rates.

The carbon emission factors associated with each utilised fuel type are confirmed in the table above. These have been used in the software for all energy models.

www.hoarelea.com