Sustainability & Energy Statement

Proposed Hotel, Bath Road, Harlington. UB3 5AY

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Executive Summary

This Sustainability and Energy Statement considers the sustainability issues relating to the proposed development of a hotel on land at Bath Road, Harlington. The hotel will provide a total of 157 rooms and associated facilities.

The Statement sets out the commitments of the applicant to the site and the targets that will be applied to the development. The site is located in a sustainable location close to existing facilities and infrastructure and will provide hotel rooms to meet local need.

Throughout the design process, the applicant and design team members have given careful consideration to the sustainability issues relating to the site, and how these can be enhanced in a marketable and feasible manner. As a result, this Statement demonstrates that the development meets relevant sustainability criteria and in a number of areas exceeds them.

The fabric standards of the building exceed the requirements of the Building Regulations.

The methodology used has been based upon the emerging policy in the London Plan (and provided in 'Energy Assessment Guidance' published by the Mayor of London) and uses the carbon factors for gas and electricity proposed for SAP 10.

In order to demonstrate the energy efficiency of the building a BRUKL calculation has been prepared for the 'Be Lean' scenario based on the use of gas boilers providing space heating and hot water to the hotel. This is not the proposed strategy but purely demonstrates the reduction from the 'Be Lean' condition.

The Regulations Compliance Reports for this option are attached as Appendix 1 and the 'Be Lean' SAP 10 spreadsheet based on the SAP 10 carbon factors is attached as Appendix 2.

It is proposed to provide space heating and hot water to the hotel using air source heat pumps.

The outdoor units for the heat pumps will be located on the roof of the building. The 'Be Clean' SAP 10 spreadsheet is attached as Appendix 4, which uses the energy demand calculations from the BRUKL calculation attached as Appendix 3 to calculate the actual total site emissions.

A connection from the system will be provided to connect to an external heat network, should one become available.

In addition to the energy efficiency measures incorporated into the building and the installation of heat pumps it is also proposed to install a photovoltaic array on the roof of the building. The building can accommodate the installation of 100 panels and assuming these have an output of 400W the total array would be 40 kW. A Roof Plan showing the indicative location of the panels is attached as Appendix 5.

The reductions in emissions can be summarised as follows:

	Total Emissions	% Reduction
	T CO_2 per year	
Be Lean		
Baseline (Building Regulations TER) – based on gas	376.489	
Be Lean - after energy efficiency (BER) – based on gas	335.370	**10.92%**
Be Clean		
Emissions – based on the use of ASHPs	128.253	**65.93%**
Be Green		
Emissions – after renewable technologies (Be Green)	119.738	**68.20%**

The residual emissions are 119.738 tonnes and therefore, using the carbon offset charge the payment should be **£341,253** (119.738 x £2,850).

1.0 Introduction

This report has been commissioned by the Westcombe Group and provides a Sustainability and Energy Statement for the development of a hotel on land at Bath Road, Harlington. The hotel will provide a total of 157 rooms and associated accommodation.

The report describes the methodology used in assessing the development and the initiatives proposed.

The building has been designed and will be constructed to reduce energy demand and carbon dioxide emissions.

The objective is to reduce the energy demand to an economic minimum by making investments in the parts of the building that has the greatest impact on energy demand and are the most difficult and costly to change in the future, namely the building fabric.

Once a cost-effective structure has been designed, low-carbon and renewable technologies have been considered for installation to provide heat and/or electricity.

The following hierarchy has been followed:

- Lean reduce demand and consumption
- Clean increase energy efficiency
- Green provide low carbon renewable energy sources

The report has been prepared by Ivan Ball of Bluesky Unlimited who are sustainability consultants.

2.0 Planning Policy Context

National Policy

The UK Government published its sustainable development strategy in 1999 entitled "A better quality of life: A strategy for sustainable development in the UK". This sets out four main objectives for sustainable development in the UK:

- Social progress that recognises the needs of everyone.
- Effective protection of the environment.
- Prudent use of natural resources.
- Maintenance of high stable levels of economic growth and employment.

Sustainable Communities: Building for the Future, known colloquially as the Communities Plan was published in 2003. The Plan sets out a long-term programme of action for delivering sustainable communities in both urban and rural areas. It aims to tackle housing supply issues in parts of the country, low demand in other parts and the quality of our public spaces. The Communities Plan describes sustainable communities as: Active, inclusive and safe, well run, environmentally sensitive, well designed and built, well connected, thriving, well served and fair for everyone.

The most relevant national planning policy guidance on sustainability is set out in:

- National Planning Policy Framework - 2021

Paragraph 152 states;

"The planning system should support the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change. It should help to: shape places in ways that contribute to radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience; encourage the reuse of existing resources, including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure."

Regional and Local Policies

The Development Plan comprises the London Plan (2021) and the London Borough of Hillingdon Local Plan Part 1 (2012) and Part 2 (2020).

London Plan, published March 2021 **–** the following policies are relevant to the application:

Policy SI 1 Improving air quality

A Development Plans, through relevant strategic, site-specific and area-based policies, should seek opportunities to identify and deliver further improvements to air quality and should not reduce air quality benefits that result from the Mayor's or boroughs' activities to improve air quality.

B To tackle poor air quality, protect health and meet legal obligations the following criteria should be addressed:

1) Development proposals should not:

a) lead to further deterioration of existing poor air quality

b) create any new areas that exceed air quality limits, or delay the date at which compliance will be achieved in areas that are currently in exceedance of legal limits

c) create unacceptable risk of high levels of exposure to poor air quality.

2) In order to meet the requirements in Part 1, as a minimum:

a) development proposals must be at least Air Quality Neutral

b) development proposals should use design solutions to prevent or minimise increased exposure to existing air pollution and make provision to address local problems of air quality in preference to post-design or retro-fitted mitigation measures

c) major development proposals must be submitted with an Air Quality Assessment. Air quality assessments should show how the development will meet the requirements of B1

d) development proposals in Air Quality Focus Areas or that are likely to be used by large numbers of people particularly vulnerable to poor air quality, such as children or older people should demonstrate that design measures have been used to minimise exposure.

C Masterplans and development briefs for large-scale development proposals subject to an Environmental Impact Assessment should consider how local air quality can be improved across the area of the proposal as part of an air quality positive approach. To achieve this a statement should be submitted demonstrating:

1) how proposals have considered ways to maximise benefits to local air quality, and

2) what measures or design features will be put in place to reduce exposure to pollution, and how they will achieve this.

D In order to reduce the impact on air quality during the construction and demolition phase development proposals must demonstrate how they plan to comply with the Non-Road Mobile Machinery Low Emission Zone and reduce emissions from the demolition and construction of buildings following best practice guidance.

E *Development proposals should ensure that where emissions need to be reduced to meet the requirements of Air Quality Neutral or to make the impact of development on local air quality acceptable, this is done on-site. Where it can be demonstrated that emissions cannot be further reduced by on-site measures, off-site measures to improve local air quality may be acceptable, provided that equivalent air quality benefits can be demonstrated within the area affected by the development.*

Policy SI 2 Minimising greenhouse gas emissions

A *Major development should be net zero-carbon. This means reducing greenhouse gas emissions in operation and minimising both annual and peak energy demand in accordance with the following energy hierarchy:*

1) *be lean: use less energy and manage demand during operation*
2) *be clean: exploit local energy resources (such as secondary heat) and supply energy efficiently and cleanly*
3) *be green: maximise opportunities for renewable energy by producing, storing and using renewable energy on-site*
4) *be seen: monitor, verify and report on energy performance.*

B *Major development proposals should include a detailed energy strategy to demonstrate how the zero-carbon target will be met within the framework of the energy hierarchy.*

C *A minimum on-site reduction of at least 35 per cent beyond Building Regulations is required for major development. Residential development should achieve 10 per cent, and non-residential development should achieve 15 per cent through energy efficiency measures. Where it is clearly demonstrated that the zero-carbon target cannot be fully achieved on-site, any shortfall should be provided, in agreement with the borough, either:*

1) *through a cash in lieu contribution to the borough's carbon offset fund, or*
2) *off-site provided that an alternative proposal is identified and delivery is certain.*

D *Boroughs must establish and administer a carbon offset fund. Offset fund payments must be ring-fenced to implement projects that deliver carbon reductions. The operation of offset funds should be monitored and reported on annually.*

E *Major development proposals should calculate and minimise carbon emissions from any other part of the development, including plant or equipment, that are not covered by Building Regulations, i.e. unregulated emissions.*

F *Development proposals referable to the Mayor should calculate whole life-cycle carbon emissions through a nationally recognised Whole Life-Cycle Carbon Assessment and demonstrate actions taken to reduce life-cycle carbon emissions.*

Policy SI 4 Managing heat risk

A *Development proposals should minimise adverse impacts on the urban heat island through design, layout, orientation, materials and the incorporation of green infrastructure.*

B *Major development proposals should demonstrate through an energy strategy how they will reduce the potential for internal overheating and reliance on air conditioning systems in accordance with the following cooling hierarchy:*

1) *reduce the amount of heat entering a building through orientation, shading, high albedo materials, fenestration, insulation and the provision of green infrastructure*
2) *minimise internal heat generation through energy efficient design*
3) *manage the heat within the building through exposed internal thermal mass and high ceilings*
4) *provide passive ventilation*
5) *provide mechanical ventilation*
6) *provide active cooling systems.*

Policy SI 5 Water infrastructure

A *In order to minimise the use of mains water, water supplies and resources should be protected and conserved in a sustainable manner.*

B *Development Plans should promote improvements to water supply infrastructure to contribute to security of supply. This should be done in a timely, efficient and sustainable manner taking energy consumption into account.*

C *Development proposals should:*

1) *through the use of Planning Conditions minimise the use of mains water in line with the Optional Requirement of the Building Regulations (residential development), achieving mains water consumption of 105 litres or less per head per day (excluding allowance of up to five litres for external water consumption)*
2) *achieve at least the BREEAM excellent standard for the 'Wat 01' water category or equivalent (commercial development)*
3) *incorporate measures such as smart metering, water saving and recycling measures, including retrofitting, to help to achieve lower water consumption rates and to maximise future-proofing.*

D *In terms of water quality, Development Plans should:*

1) *promote the protection and improvement of the water environment in line with the Thames River Basin Management Plan, and should take account of Catchment Plans*
2) *support wastewater treatment infrastructure investment to accommodate London's growth and climate change impacts. Such infrastructure should be constructed in a timely and sustainable manner taking account of new, smart technologies, intensification opportunities on existing sites, and energy implications. Boroughs should work with Thames Water in relation to local wastewater infrastructure requirements.*

E *Development proposals should:*

1) *seek to improve the water environment and ensure that adequate wastewater infrastructure capacity is provided*
2) *take action to minimise the potential for misconnections between foul and surface water networks. F Development Plans and proposals for strategically or locally defined growth locations with particular flood risk constraints or where there is insufficient water infrastructure capacity should be informed by Integrated Water Management Strategies at an early stage.*

The energy strategy within the Statement has been prepared in accordance with **Energy Assessment Guidance** published by the Mayor of London.

Hillingdon Local Plan: Part 1 Strategic Policies, adopted November 2012

The following policies have been edited for relevance to this application;

Policy BE1: Built Environment

The Council will require all new development to improve and maintain the quality of the built environment in order to create successful and sustainable neighbourhoods, where people enjoy living and working and that serve the long-term needs of all residents. All new development should:

1. *Achieve a high quality of design in all new buildings, alterations, extensions and the public realm which enhances the local distinctiveness of the area, contributes to community cohesion and a sense of place;*
2. *Be designed to be appropriate to the identity and context of Hillingdon's buildings, townscapes, landscapes and views, and make a positive contribution to the local area in terms of layout, form, scale and materials and seek to protect the amenity of surrounding land and buildings, particularly residential properties;*
3. *Be designed to include "Lifetime Homes" principles so that they can be readily adapted to meet the needs of those with disabilities and the elderly, 10% of these should be wheelchair accessible or easily adaptable to wheelchair accessibility encouraging places of work and leisure, streets, neighbourhoods, parks and open spaces to be designed to meet the needs of the community at all stages of people's lives;*
4. *In the case of 10 dwellings or over, achieve a satisfactory assessment rating in terms of the latest Building for Life standards (as amended or replaced from time to time);*
5. *Improve areas of poorer environmental quality, including within the areas of relative disadvantage of Hayes, Yiewsley and West Drayton. All regeneration schemes should ensure that they are appropriate to their historic context, make use of heritage assets and reinforce their significance;*
6. *Incorporate a clear network of routes that are easy to understand, inclusive, safe, secure and connect positively with interchanges, public transport, community facilities and services;*
7. *Improve the quality of the public realm and provide for public and private spaces that are attractive, safe, functional, diverse, sustainable, accessible to all, respect the local character and landscape, integrate with the development, enhance and protect biodiversity through the inclusion of living walls, roofs and areas for wildlife, encourage physical activity and where appropriate introduce public art;*
8. *Create safe and secure environments that reduce crime and fear of crime, anti-social behaviour and risks from fire and arson having regard to Secure by Design standards and address resilience to terrorism in major development proposals;*
9. *Not result in the inappropriate development of gardens and green spaces that erode the character and biodiversity of suburban areas and increase the risk of flooding through the loss of permeable areas;*

10. *Maximise the opportunities for all new homes to contribute to tackling and adapting to climate change and reducing emissions of local air quality pollutants. The Council will require all new development to achieve reductions in carbon dioxide emission in line with the London Plan targets through energy efficient design and effective use of low and zero carbon technologies. Where the required reduction from on-site renewable energy is not feasible within major developments, contributions off-site will be sought. The Council will seek to merge a suite of sustainable design goals, such as the use of SUDS, water efficiency, lifetime homes, and energy efficiency into a requirement measured against the Code for Sustainable Homes and BREEAM. These will be set out within the Hillingdon Local Plan: Part 2- Development Management Policies Local Development Document (LDD). All developments should be designed to make the most efficient use of natural resources whilst safeguarding historic assets, their settings and local amenity and include sustainable design and construction techniques to increase the re-use and recycling of construction, demolition and excavation waste and reduce the amount disposed to landfill;*
11. *In the case of tall buildings, not adversely affect their surroundings including the local character, cause harm to the significance of heritage assets or impact on important views. Appropriate locations for tall buildings will be defined on a Character Study and may include parts of Uxbridge and Hayes subject to considering the Obstacle Limitation Surfaces for Heathrow Airport. Outside of Uxbridge and Hayes town centres, tall buildings will not be supported. The height of all buildings should be based upon an understanding of the local character and be appropriate to the positive qualities of the surrounding townscape.*

Policy EM1: Climate Change Adaptation and Mitigation

The Council will ensure that climate change mitigation is addressed at every stage of the development process by:

1. *Prioritising higher density development in urban and town centres that are well served by sustainable forms of transport.*
2. *Promoting a modal shift away from private car use and requiring new development to include innovative initiatives to reduce car dependency.*
3. *Ensuring development meets the highest possible design standards whilst still retaining competitiveness within the market.*
4. *Working with developers of major schemes to identify the opportunities to help provide efficiency initiatives that can benefit the existing building stock.*
5. *Promoting the use of decentralised energy within large scale development whilst improving local air quality levels.*
6. *Targeting areas with high carbon emissions for additional reductions through low carbon strategies. These strategies will also have an objective to minimise other pollutants that impact on local air quality. Targeting areas of poor air quality for additional emissions reductions.*
7. *Encouraging sustainable techniques to land remediation to reduce the need to transport waste to landfill. In particular developers should consider bioremediation as part of their proposals.*
8. *Encouraging the installation of renewable energy for all new development in meeting the carbon reduction targets savings set out in the London Plan. Identify opportunities for new sources of electricity generation including anaerobic digestion, hydro electricty and a greater use of waste as a resource.*

9. *Promoting new development to contribute to the upgrading of existing housing stock where appropriate.*

The Borough will ensure that climate change adaptation is addressed at every stage of the development process by:

10. *Locating and designing development to minimise the probability and impacts of flooding.*
11. *Requiring major development proposals to consider the whole water cycle impact, which includes flood risk management, foul and surface water drainage and water consumption.*
12. *Giving preference to development of previously developed land to avoid the loss of further green areas.*
13. *Promoting the use of living walls and roofs, alongside sustainable forms of drainage to manage surface water run-off and increase the amount of carbon sinks.*
14. *Promoting the inclusion of passive design measures to reduce the impacts of urban heat effects.*

Local Plan: Part 2 Development Management Policies, adopted January 2020

Policy DMEI 2: Reducing Carbon Emissions

A) *All developments are required to make the fullest contribution to minimising carbon dioxide emissions in accordance with London Plan targets.* *

B) *All major development proposals must be accompanied by an energy assessment showing how these reductions will be achieved.*

C) *Proposals that fail to take reasonable steps to achieve the required savings will be resisted. However, where it is clearly demonstrated that the targets for carbon emissions cannot be met onsite, the Council may approve the application and seek an off-site contribution to make up for the shortfall.*

Policy DMEI 3: Decentralised Energy

A) *All major developments are required to be designed to be able to connect to a Decentralised Energy Network (DEN).*

B) *Major developments located within 500 metres of an existing DEN, and minor new-build developments located within 100 metres, will be required to connect to that network, including provision of the means to connect to that network and a reasonable financial contribution to the connection charge, unless a feasibility assessment demonstrates that connection is not reasonably possible.*

C) *Major developments located within 500 metres of a planned future DEN, which is considered by the Council likely to be operational within 3 years of a grant of planning permission, will be required to provide a means to connect to that network and developers shall provide a reasonable financial contribution for the future cost of connection and a commitment to connect via a legal agreement or contract, unless a feasibility assessment demonstrates that connection is not reasonably possible.*

D) *The Council will support the development of DENs and energy centres in principle, subject to meeting the wider policy requirements of this plan and in particular on design and air quality.*

Policy DMEI 10: Water Management, Efficiency, and Quality

A) Applications for all new build developments (not conversions, change of use, or refurbishment) are required to include a drainage assessment demonstrating that appropriate sustainable drainage systems (SuDS) have been incorporated in accordance with the London Plan Hierarchy (Policy 5.13: Sustainable drainage).

B) All major new build developments, as well as minor developments in Critical Drainage Areas or an area identified at risk from surface water flooding must be designed to reduce surface water run-off rates to no higher than the pre-development greenfield run-off rate in a 1:100-year storm scenario, plus an appropriate allowance for climate change for the worst storm duration. The assessment is required regardless of the changes in impermeable areas and the fact that a site has an existing high run-off rate will not constitute justification.

C) Rain Gardens and non-householder development should be designed to reduce surface water run-off rates to Greenfield run-off rates.

D) Schemes for the use of SuDS must be accompanied by adequate arrangements for the management and maintenance of the measures used, with appropriate contributions made to the Council where necessary.

E) Proposals that would fail to make adequate provision for the control and reduction of surface water run-off rates will be refused.

F) Developments should be drained by a SuDs system and must include appropriate methods to avoid pollution of the water environment. Preference should be given to utilising the drainage options in the SuDS hierarchy which remove the key pollutants that hinder improving water quality in Hillingdon. Major development should adopt a 'treatment train' approach where water flows through different SuDS to ensure resilience in the system.

<u>Water Efficiency</u>

G) All new development proposals (including refurbishments and conversions) will be required to include water efficiency measures, including the collection and reuse of rain water and grey water.

H) All new development should demonstrate water usage rates of no more than 105 litres/person/day.

<u>Water and Wastewater Infrastructure</u>

J) All new development proposals will be required to demonstrate that there is sufficient capacity in the water and wastewater infrastructure network to support the proposed development. Where there is a capacity constraint the Local Planning Authority will require the developer to provide a detailed water and/or drainage strategy to inform what infrastructure is required, where, when and how it will be delivered.

3.0 Assessment Methodology

The baseline carbon dioxide emissions from the building have been established using agreed building specifications and detailed planning drawings and BRUKL calculations have been prepared to test different scenarios for the fabric specification and mechanical and electrical installations.

Emission Factors

The CO_2 emission factors, where applicable, used throughout this report have been taken from the GLA Energy Assessment Guidance (colloquially known as SAP 10).

	kg CO_2/kWh
Mains gas	0.210
Grid supplied and displaced electricity	0.233

4.0 Proposal

The proposal is for the construction of a 7-storey building to provide 157 hotel bedrooms and associated facilities.

The accommodation schedule in detail is;

Unit Type	Area
	m^2
Ground-floor – Entrance/ Laundry/ Staff & Plant	
First-floor – Front of House/ Fitness/ Kitchen/ 12 rooms	
Second-floor – 34 rooms	
Third-floor – 34 rooms	
Fourth-floor – 27 rooms	
Fifth-floor – 25 rooms	
Sixth-floor – 25 rooms	
Total	**6,309**

5.0 Energy Efficiency

5.1 Demand Reduction (Be Lean)

Design

The energy performance of a building is affected by its design, construction and use and whilst occupant behaviour is beyond the remit of this statement, better design and construction methods can significantly reduce the life cycle emissions of a building and assist the occupant to reduce consumption.

Sustainable design is not just about incorporating renewable technologies; buildings should be designed at the outset to provide suitable environmental conditions for the occupants whilst also consuming as little energy as practical. It is possible to exceed Building Regulations requirements (Part L - 2013) through demand reduction measures alone, which typically include a combination of passive design measures (e.g. building design and efficient building fabric) and active design measures (e.g. variable speed motors).

Passive Design Measures

The passive design measures proposed include;

Passive Solar Gain

Passive measures include allowing for natural ventilation and exposed thermal mass coupled with high levels of insulation, air tightness and the control of solar gain.

The majority of the rooms will benefit from direct sunlight at some point throughout the day.

Natural Daylighting

The orientation and the size of the windows have been optimised to maximise the amount of natural daylight and therefore reduce the demand for artificial lighting.

Efficient Building Fabric

Building Envelope

U-values of the building envelope must meet Building Regulations Part L standards and further improvements to U-values will reduce the building's heating requirements.

The ground and exposed floor (over the undercroft car park) will be insulated with 150mm 'Kingspan' PIR insulation or similar.

The building is suited to either a framed structure with infill panels or a load bearing structure with external walls built in a traditional cavity wall construction. Whichever construction type is selected the U-value set out below can be achieved for both systems.

All windows and external doors will be double glazed with Low 'e' soft coat and argon filled.

It is proposed to set maximum limits for the elemental U-values as follows:

Element	Part L Limiting U-values	Proposed U-values	Proposed Improvement
	W/m^2K	W/m^2K	
Ground-Floor and Exposed-Floor	**0.20**	**0.13**	**35%**
External Walls	**0.30**	**0.18**	**40%**
Flat Roof	**0.20**	**0.13**	**35%**
Windows and Glazed Doors	**2.00**	**1.20**	**40%**

Air Leakage

Large amounts of heat are lost in winter through air leakage from a building (also referred to as infiltration or air permeability) often through poor sealing of joints and openings in the building

The Building Regulations set a minimum standard for air permeability of 10 m^3 of air per hour per m^2 of envelope area, at 50Pa.

It is proposed to achieve a 50% improvement over Building Regulations and the building will target a permeability of 5.0 $m^3/hr/m^2$.

Thermal Bridging

The significance of Thermal Bridging, as a potentially major source of fabric heat losses, is increasingly understood. Improving the U-values for the main building fabric without accurately addressing the Thermal Bridging is no longer an option and will not achieve the fabric energy efficiency and energy and CO_2 reduction targets set out in this strategy.

The building will use the Accredited Construction Details where applicable and bespoke details where ACDs do not exist.

The bridging losses have been based upon the use of the ACDs and calculated using SAP Appendix K Table 1.

Ventilation

As a result of increasing thermal efficiency and air tightness, Building Regulations Approved Document F was also revised in 2006 to address the possibility of overheating and poor air quality.

Active Design Measures will include;

Efficient Lighting and Controls

Throughout the scheme natural lighting will be optimised.

All internal lighting will be energy efficient and appropriate fittings will be fitted with passive detection controls.

External lighting will be fitted with time controls and light sensors to ensure illumination is restricted to required times. External lighting will be limited to a maximum fitting output of 150w.

Space Heating and Hot Water

The baseline SAP modelling has been based upon the use of gas boilers providing space heating and hot water to the hotel but the assessment considers other options for providing space heating and hot water.

5.2 Establishing Energy Demand and Carbon Dioxide Emissions (Be Lean)

The GLA Energy Assessment Guidance requires the energy efficiency of a building (Be Lean) to be expressed using a gas heating system as a baseline.

A set of calculations have therefore been prepared on this basis, which are not necessarily the proposed final option but are used to test the 'Be Lean' reductions only.

Baseline

The BRUKL Output Document is attached as Appendix 1 but the energy demand for the hotel can be summarised as follows;

C1 - Hotel	Energy Demand TER	Energy Demand BER
	kWh/m²	kWh/m²
Heating	56.47	33.09
Cooling	0.00	0.00
Auxiliary	18.29	18.44
Lighting	12.64	7.24
Hot Water	193.37	191.54
Total	**280.77**	**250.31**

The energy demand figures calculated above have been inputted into the SAP 10 spreadsheet, which is attached as Appendix 2 and provides the total site TER and BER emissions using the emerging carbon emissions factors and as required by the GLA Energy Assessment Guidance.

The maximum allowable carbon dioxide emissions from the site (TER) are assessed as **376,489 kg CO_2 per year**, with the actual carbon dioxide emissions (BER) assessed as **335,370 kg CO_2 per year.**

The reduction in emissions using from energy efficiency for the 'Be Lean' scenario and using the SAP 10 carbon factors is **41,119 kg CO_2 per year**, which equates to;

- **10.92%**

The GLA Guidance requires a 15% reduction in emissions in order to 'test' the efficiency of the construction specification. However, with a use such as a hotel the hot water demand is by far the greatest energy demand for the building and therefore a better indication of the efficiency of the fabric specification is to compare the space heating demand for the actual building against the target value.

From the table above it is demonstrated that the actual space heating demand is reduced by;

- **41.40%**

5.3 Low-Carbon and Renewable Technologies (Be Clean and Be Green)

The carbon dioxide emissions established above have been used to test the viability of various renewable and low carbon technologies as follows.

The Government's Renewable Obligation defines renewable energy in the UK. The identified technologies are;

- Small hydro-electric
- Landfill and sewage gas
- Onshore and offshore wind
- Biomass
- Tidal and wave power
- Geothermal power
- Solar

The use of landfill or sewage gas, offshore wind or any form of hydroelectric power is not suitable for the site due to its location. The remaining technologies are considered below;

Wind

Wind turbines are available in various sizes from large rotors able to supply whole communities to small roof or wall-mounted units for individual dwellings.

The Government wind speed database predicts local wind speeds at Bath Road to be 4.8 m/s at 10m above ground level and 5.6 m/s at 25m above ground level. This is below the level generally required for commercial investment in large wind turbines. In addition the land take, potential for noise and signal interference make a large wind turbine unsuitable for this development.

Roof mounted turbines could be used at the development to generate small but valuable amounts of renewable electricity but the small output and contribution to total emissions means any investment would be small and purely tokenism. In addition the use of wind turbines will have a detrimental aesthetic impact on the appearance of the development.

Combined Heat and Power and Community Heating

Combined heat and power (CHP) also called co-generation is a de-centralised method of producing electricity from a fuel and 'capturing' the heat generated for use in buildings. The plant is essentially a small-scale electrical power station. The production and transportation of electricity via the National Grid is very inefficient with over 65% of the energy produced at the power station being lost to the atmosphere and through transportation.

Consequently CHP can demonstrate significant CO_2 savings and although not necessary classed as renewable energy (depending on the fuel used) the technology is low carbon.

For a CHP plant to be economic it needs to operate for as much of the time as possible (usually deemed to be in excess of 14 hours per day) and therefore the size of the unit are usually based upon the hot water load of the building (s) with additional boilers meeting the peak space heating demand.

The use of CHP units is no longer appropriate because of the move towards low-carbon heating solutions.

However, a communal heating system will be provided and a connection will be available to allow the development to be connected to an external heat network at some point in the future.

Ground Source Heat Pumps

Sub soil temperatures are reasonably constant and predictable in the UK, providing a store of the sun's energy throughout the year. Below London the groundwater in the lower London aquifer is at a fairly constant temperature of 12° C. Ground source heat pumps (GSHP) extract this low-grade heat and convert it to usable heat for space heating.

GSHP operates on a similar principle to refrigerators, transferring heat from a cool place to a warmer place. They operate most efficiently when providing space heating at a low temperature, typically via under floor heating or with low temperature radiators.

There is insufficient external area to install a shallow, horizontal collection system and in order to use ground source heat pumps the collection system would need to include a number of boreholes. There are limited opportunities to place these away from the building and there is insufficient ground area to accommodate the required number.

The installation of ground source heat pumps into this site is not appropriate.

Solar

(i) Solar Water Heating

Solar hot water panels use the suns energy to directly heat water circulating through panels or pipes. The technology is simple and easily understood by purchasers.

Solar hot water heating panels are based generally around two types, which are available being 'flat plate collectors' and 'evacuated tubes'. Flat plate collectors can achieve an output of up to 1,124 kWh/annum (Schuco) and evacuated tubes can achieve outputs up to 1,365 kWh/annum (Riomay).

Panels are traditionally roof mounted and for highest efficiencies should be mounted plus or minus 30 degrees of due south. Evacuated tubes can be laid horizontally on flat roofs but flat plate collectors are recommended for installation at an incline of 30 degrees

Solar hot water panels could be used to reduce emissions. However, their use could be challenging because of the length of flow and return pipework between any solar hot water heating panels placed on the upper roof of the building and the location of the hot water storage vessels.

Solar hot water heating is not proposed.

(ii) Photovoltaics

Photovoltaic panels (PV) provide clean silent electricity. They generate electricity during most daylight conditions although they are most efficient when exposed to direct sunlight or are orientated to face plus or minus 30 degrees of due south.

PV panels can be integrated into many different aspects of a development including roofs, walls, shading devices or architectural panels.

The panels typically have an electrical warranty of 20-25 years and an expected system lifespan of 25-40 years.

The building contains two flat roof areas, one over part of the 3rd floor and over the 6th floor. The lower roof is shaded but the taller parts of the building and is therefore not appropriate for solar panels. The upper roof could accommodate a number of panel and these are shown on the Roof Plan attached as Appendix 5.

Photovoltaic panels could be used.

Air Source Heat Pumps (ASHP)

Air sourced heat pumps operate using the same reverse refrigeration cycle as ground source heat pumps; however, the initial heat energy is extracted from the external air rather than the ground.

The specification for the heating system within the hotel includes the installation of a communal space heating and hot water heating system using air source heat pumps.

5.4 Establishing Energy Demand and Carbon Dioxide Emissions (Be Clean)

Using the methodology set out in the Mayor of London's 'Energy Assessment Guidance', the carbon emissions have been calculated using the new carbon factors proposed as part of the new Part L of the Building Regulations, which will be published in 2022 but using the existing SAP methodology (2012).

The planning policy requires the installation of a communal heating system to allow the development to connected to an external heat network if one becomes available. It is proposed to install a communal heat network to the building, which will be powered by air source heat pumps. The outdoor units will be located on the (upper) roof of the building.

The further BRUKL calculation has been prepared and the Output Document is attached as Appendix 3. The energy demand for the hotel using a communal system with air source heat pumps can be summarised as follows;

C1 - Hotel	Energy Demand BER
	kWh/m^2
Heating	10.47
Cooling	0.00
Auxiliary	18.44
Lighting	7.24
Hot Water	60.65
Total	**96.80**

The energy demand figures calculated above have been inputted into the SAP 10 spreadsheet, which is attached as Appendix 4 and provides the total site BER emissions using the emerging carbon emissions factors and as required by the GLA Energy Assessment Guidance.

The maximum allowable carbon dioxide emissions from the site (TER) and as calculated above are assessed as **376,489 kg CO_2 per year**, with the actual carbon dioxide emissions (BER) assessed as **142,300 kg CO_2 per year.**

The reduction in emissions using from energy efficiency and a communal heating system using air source heat pumps and using the SAP 10 carbon factors is **234,189 kg CO_2 per year**, which equates to;

- **62.20%**

5.5 Summary of Calculations and Proposals for Low-carbon and Renewable Technologies

Be Lean

A baseline calculation has been prepared using 2013 Building Regulations and the SAP 10 carbon factors. Using the current Regulations and based upon a gas heating system for the hotel the total site CO_2 emissions are calculated as **376,489 kg CO_2 per year** (TER) and **335,370 kg CO_2 per year** (BER)**.**

This equates to a reduction of **41,119 kg CO_2 per year** of the total TER emissions. The GLA Guidance requires a 15% reduction in emissions in order to 'test' the efficiency of the construction specification. However, with a use such as a hotel the hot water demand is by far the greatest energy demand for the building and therefore a better indication of the efficiency of the fabric specification is to compare the space heating demand for the actual building against the target value.

The actual space heating demand is reduced by **41.40%** through energy efficiency improvements within the building. The BRUKL Output Document is attached as Appendix 1 and the SAP 10 'Be Lean' spreadsheet is attached as Appendix 2.

Be Clean

A further set of calculations has been prepared for the proposed energy strategy.

This proposes the installation of a communal heating system using air source heat pumps. The communal outdoor units will be located on the roof of the building.

The calculations have been converted to SAP 10 emissions and the 'Be Clean' spreadsheet is attached as Appendix 4. The BRUKL Output Document for the proposed energy strategy (based on Part L – 2013) are attached as Appendix 3.

The actual carbon dioxide emissions (BER) for the proposed strategy are **142,300 kg CO_2 per year.**

The reduction in emissions using from energy efficiency and the communal heating system with air source heat pumps and using the SAP 10 carbon factors is therefore **234,189 kg CO_2 per year**, which equates to **62.20%.**

Be Green

Whilst parts of the roof are required for plant there is space available for the installation of photovoltaic panels. The Roof Plan attached as Appendix 5 shows an array of 100 x 400W panels could be accommodated. These will be installed on racks and gently inclined towards due south. The panels will reduce emissions by a further **8,515 kg CO_2 per year.**

Summary

The total reduction in emissions from energy efficiency, low-carbon and renewable technologies are calculated as; 256,751 kg CO_2 per year, which equates to a reduction of 68.20% (% of TER).

The residual emissions are **119.738 tonnes**, which requires a carbon offset payment of **£341,253** (based on the carbon offset payment of £2,850 per tonne).

6.0 Climate change adaption and Water resources

Sustainable Drainage Systems (SUDS)

The site lies within Flood Zone 1 and therefore has a low probability of flooding.

The existing site is mostly covered with hard surfacing.

Surface Water Management

Consideration has been given to the use of grey water recycling. However, customer's resistance to the appearance of the recycled water and the cost of the systems does not currently make them a viable option. They have therefore not been included in the proposals.

Water efficiency measures

In excess of 20% of the UK's water is used domestically with over 50% of this used for flushing WCs and washing (source: Environment Agency). The majority of this comes from drinking quality standard or potable water.

The water efficiency measures included will ensure that the water use target of 110 litres per person per day is achieved.

Water efficient devices will be fully evaluated, and installed, wherever possible. The specification of such devices will be considered at detailed design stage and each will be subject to an evaluation based on technical performance, cost and market appeal, together with compliance with the water use regulations.

The following devices will be incorporated within the hotel rooms:

- water efficient taps;
- water efficient toilets;
- low output showers;
- flow restrictors to manage water pressures to achieve optimum levels.
-

7.0 Materials and Waste

The BRE Green Guide to Specification is a simple guide for design professionals. The guide provides environmental impact, cost and replacement interval information for a wide range of commonly used building specifications over a notional 60-year building life. The construction specification will prioritise materials within ratings A+, A or B.

Preference will be given to the use of local materials & suppliers where viable to reduce the transport distances and to support the local economy. A full evaluation of these suppliers will be undertaken at the next stage of design.

In addition, timber would be sourced, where practical, certified by PEFC or an equivalent approved certification body and all site timber used within the construction process would be recycled.

All insulation materials to will have a zero ozone depleting potential

Construction waste

Targets will be set to promote resource efficiency in accordance with guidance from WRAP, Envirowise, BRE and DEFRA.

The overarching principle of waste management is that waste should be treated or disposed of within the region where it is produced.

Construction operations generate waste materials as a result of general handling losses and surpluses. These wastes can be reduced through appropriate selection of the construction method, good site management practices and spotting opportunities to avoid creating unnecessary waste.

The Construction Strategy will explore these issues, some of which are set out below:

- Proper handling and storage of all materials to avoid damage.
- Efficient purchasing arrangements to minimise over ordering.
- Segregation of construction waste to maximise potential for reuse/recycling.
- Suppliers who collect and reuse/recycle packaging materials.

Appendix 1 – BRUKL Output Document for Hotel using Baseline Gas

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Proposed Hampton by Hilton (GAS)

As designed

Date: Mon Aug 30 10:42:15 2021

Administrative information

Building Details

Address: Hampton by Hilton, Bath Rd, Harlington, HAYES, UB3 5AY

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.6.b.0

Interface to calculation engine: SBEM Online

Interface to calculation engine version: v4.03

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

Certifier details

Name: Paul Goddard

Telephone number: 01925 733942

Address: , Information not provided by the user,

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

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	69.6
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	69.6
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	61.5
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

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

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

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.18	0.18	"Wall3980154"
Floor	0.25	0.12	0.13	"Wall3980208"
Roof	0.25	0.13	0.13	"Wall3980809"
Windows***, roof windows, and rooflights	2.2	1	1	"Window397123"
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

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

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

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

Building services

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

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

1- HVAC118407

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.95	-	-	-	-
Standard value	0.91*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

1- HWSGenerator73515

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	Hot water provided by HVAC system	0
Standard value	N/A	N/A

Local mechanical ventilation, exhaust, and terminal units

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

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
ZoneWC	0.2	-	-	-	-	-	-	-	-	-	N/A
ZoneWC	0.2	-	-	-	-	-	-	-	-	-	N/A
ZoneLaundry	0.2	-	-	-	-	-	-	-	-	-	N/A
ZoneWC	0.2	-	-	-	-	-	-	-	-	-	N/A
ZoneFood Preparation	-	-	-	-	-	-	-	-	0.2	-	N/A
ZoneFood Preparation	-	-	-	-	-	-	-	-	0.2	-	N/A
Zone112	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone111	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone110	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone109	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone108	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone107	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone106	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone105	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone104	0.2	-	-	-	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
Zone103	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone101	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone102	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone201	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone204	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone205	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone206	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone207	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone208	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone209	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone210	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone211	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone212	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone213	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone214	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone215	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone216	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone217	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone218	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone202	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone203	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone226	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone231	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone233	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone227	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone225	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone224	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone223	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone221	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone220	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone219	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone228	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone229	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone230	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone232	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone234	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone328	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone329	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone302	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone330	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone332	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone334	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone301	0.2	-	-	-	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
Zone308	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone307	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone306	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone305	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone304	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone303	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone309	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone310	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone312	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone314	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone316	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone318	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone311	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone313	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone315	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone317	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone319	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone320	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone321	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone322	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone323	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone324	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone325	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone327	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone331	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone333	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone326	0.2	-	-	-	-	-	-	-	-	-	N/A
ZoneStore Room	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone420	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone418	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone419	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone408	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone407	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone406	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone405	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone404	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone416	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone414	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone412	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone410	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone409	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone421	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone422	0.2	-	-	-	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
Zone423	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone411	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone401	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone413	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone415	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone417	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone402	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone403	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone424	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone425	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone426	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone427	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone516	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone514	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone515	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone512	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone510	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone513	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone511	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone509	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone508	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone507	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone506	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone505	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone504	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone518	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone519	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone520	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone521	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone522	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone523	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone525	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone501	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone517	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone502	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone503	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone524	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone625	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone623	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone622	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone621	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone620	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone619	0.2	-	-	-	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
Zone618	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone607	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone606	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone605	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone604	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone601	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone617	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone615	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone613	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone611	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone609	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone608	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone610	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone612	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone614	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone616	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone624	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone602	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone603	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone222	0.2	-	-	-	-	-	-	-	-	-	N/A

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
ZonePlant	110	-	-	208
ZoneStaff dinning	110	-	-	266
ZoneWC	-	110	-	49
ZoneWC	-	110	-	49
ZoneLaundry	-	110	-	321
ZoneCirculation	-	110	-	114
ZoneFoH	-	110	-	1969
ZoneCirculation	-	110	-	124
ZoneFitness	-	110	-	176
ZoneWC	-	110	-	119
ZoneOffice	110	-	-	309
ZoneFood Preparation	-	110	-	673
ZoneFood Preparation	-	110	-	421
Zone112	-	110	-	41
ZoneCirculation	-	110	-	82
Zone111	-	110	-	41
Zone110	-	110	-	41
Zone109	-	110	-	41
Zone108	-	110	-	41

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Zone107	-	110	-	41
Zone106	-	110	-	40
Zone105	-	110	-	41
Zone104	-	110	-	40
Zone103	-	110	-	41
Zone101	-	110	-	40
Zone102	-	110	-	40
ZoneCirculation	-	110	-	46
ZoneCirculation	-	110	-	567
Zone201	-	110	-	41
Zone204	-	110	-	41
Zone205	-	110	-	41
Zone206	-	110	-	41
Zone207	-	110	-	41
Zone208	-	110	-	40
Zone209	-	110	-	41
Zone210	-	110	-	41
Zone211	-	110	-	41
Zone212	-	110	-	41
Zone213	-	110	-	41
Zone214	-	110	-	41
Zone215	-	110	-	41
Zone216	-	110	-	41
Zone217	-	110	-	41
Zone218	-	110	-	41
Zone202	-	110	-	41
Zone203	-	110	-	41
Zone226	-	110	-	41
Zone231	-	110	-	41
Zone233	-	110	-	41
Zone227	-	110	-	41
Zone225	-	110	-	41
Zone224	-	110	-	41
Zone223	-	110	-	41
Zone221	-	110	-	41
Zone220	-	110	-	41
Zone219	-	110	-	40
Zone228	-	110	-	66
Zone229	-	110	-	41
Zone230	-	110	-	41
Zone232	-	110	-	41
Zone234	-	110	-	41
ZoneCirculation	-	110	-	582

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Zone328	-	110	-	66
Zone329	-	110	-	41
Zone302	-	110	-	41
Zone330	-	110	-	41
Zone332	-	110	-	41
Zone334	-	110	-	41
Zone301	-	110	-	41
Zone308	-	110	-	41
Zone307	-	110	-	41
Zone306	-	110	-	41
Zone305	-	110	-	41
Zone304	-	110	-	41
Zone303	-	110	-	41
Zone309	-	110	-	41
Zone310	-	110	-	41
Zone312	-	110	-	41
Zone314	-	110	-	41
Zone316	-	110	-	41
Zone318	-	110	-	41
Zone311	-	110	-	41
Zone313	-	110	-	41
Zone315	-	110	-	41
Zone317	-	110	-	40
Zone319	-	110	-	41
Zone320	-	110	-	41
Zone321	-	110	-	41
Zone322	-	110	-	41
Zone323	-	110	-	41
Zone324	-	110	-	41
Zone325	-	110	-	41
Zone327	-	110	-	40
Zone331	-	110	-	41
Zone333	-	110	-	41
Zone326	-	110	-	41
ZoneStore Room	110	-	-	10
ZoneCirculation	-	110	-	184
Zone420	-	110	-	41
Zone418	-	110	-	41
Zone419	-	110	-	41
Zone408	-	110	-	41
Zone407	-	110	-	41
Zone406	-	110	-	41
Zone405	-	110	-	41

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Zone404	-	110	-	41
Zone416	-	110	-	41
Zone414	-	110	-	41
Zone412	-	110	-	41
Zone410	-	110	-	41
Zone409	-	110	-	41
Zone421	-	110	-	41
Zone422	-	110	-	41
Zone423	-	110	-	41
Zone411	-	110	-	41
Zone401	-	110	-	41
Zone413	-	110	-	41
Zone415	-	110	-	41
Zone417	-	110	-	41
Zone402	-	110	-	41
Zone403	-	110	-	41
ZoneCirculation	-	110	-	99
ZoneCirculation	-	110	-	64
Zone424	-	110	-	41
Zone425	-	110	-	41
Zone426	-	110	-	41
Zone427	-	110	-	41
ZoneCirculation	-	110	-	236
ZoneCirculation	-	110	-	64
ZoneCirculation	-	110	-	99
Zone516	-	110	-	41
Zone514	-	110	-	41
Zone515	-	110	-	40
Zone512	-	110	-	40
Zone510	-	110	-	41
Zone513	-	110	-	41
Zone511	-	110	-	41
Zone509	-	110	-	40
Zone508	-	110	-	41
Zone507	-	110	-	41
Zone506	-	110	-	41
Zone505	-	110	-	41
Zone504	-	110	-	41
Zone518	-	110	-	41
Zone519	-	110	-	41
Zone520	-	110	-	41
Zone521	-	110	-	41
Zone522	-	110	-	41

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Zone523	-	110	-	41
Zone525	-	110	-	41
Zone501	-	110	-	41
Zone517	-	110	-	41
Zone502	-	110	-	41
Zone503	-	110	-	41
Zone524	-	110	-	41
ZoneCirculation	-	110	-	99
ZoneCirculation	-	110	-	235
ZoneCirculation	-	110	-	64
Zone625	-	110	-	41
Zone623	-	110	-	41
Zone622	-	110	-	40
Zone621	-	110	-	40
Zone620	-	110	-	40
Zone619	-	110	-	41
Zone618	-	110	-	41
Zone607	-	110	-	41
Zone606	-	110	-	41
Zone605	-	110	-	41
Zone604	-	110	-	40
Zone601	-	110	-	41
Zone617	-	110	-	41
Zone615	-	110	-	41
Zone613	-	110	-	41
Zone611	-	110	-	40
Zone609	-	110	-	41
Zone608	-	110	-	41
Zone610	-	110	-	40
Zone612	-	110	-	40
Zone614	-	110	-	41
Zone616	-	110	-	41
Zone624	-	110	-	41
Zone602	-	110	-	41
Zone603	-	110	-	41
Zone222	-	110	-	41

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

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
ZoneStaff dinning	YES (+48.4%)	NO
ZoneFitness	YES (+148.7%)	NO
ZoneOffice	N/A	N/A
Zone112	YES (+103.8%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Zone111	YES (+103.8%)	NO
Zone110	YES (+108.9%)	NO
Zone109	NO (-39.6%)	NO
Zone108	NO (-71.6%)	NO
Zone107	NO (-3.3%)	NO
Zone106	NO (-66%)	NO
Zone105	N/A	N/A
Zone104	NO (-66.1%)	NO
Zone103	NO (-64.9%)	NO
Zone101	NO (-24.3%)	NO
Zone102	N/A	N/A
Zone201	YES (+90.2%)	NO
Zone204	YES (+0.2%)	NO
Zone205	YES (+0.2%)	NO
Zone206	YES (+0.2%)	NO
Zone207	YES (+0.2%)	NO
Zone208	NO (-65.7%)	NO
Zone209	NO (-51.4%)	NO
Zone210	NO (-5.9%)	NO
Zone211	N/A	N/A
Zone212	NO (-5.9%)	NO
Zone213	N/A	N/A
Zone214	NO (-5.9%)	NO
Zone215	N/A	N/A
Zone216	NO (-5.9%)	NO
Zone217	N/A	N/A
Zone218	NO (-5.9%)	NO
Zone202	N/A	N/A
Zone203	N/A	N/A
Zone226	N/A	N/A
Zone231	N/A	N/A
Zone233	N/A	N/A
Zone227	NO (-6%)	NO
Zone225	NO (-6%)	NO
Zone224	NO (-6%)	NO
Zone223	NO (-6%)	NO
Zone221	NO (-6%)	NO
Zone220	NO (-6%)	NO
Zone219	NO (-4.9%)	NO
Zone228	NO (-86.8%)	NO
Zone229	N/A	N/A
Zone230	NO (-67.4%)	NO
Zone232	NO (-67.4%)	NO
Zone234	NO (-67.4%)	NO
Zone328	NO (-83%)	NO
Zone329	NO (-67.4%)	NO
Zone302	N/A	N/A
Zone330	NO (-67.4%)	NO
Zone332	NO (-67.4%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Zone334	NO (-67.4%)	NO
Zone301	YES (+98.3%)	NO
Zone308	NO (-65.9%)	NO
Zone307	YES (+0.2%)	NO
Zone306	YES (+0.2%)	NO
Zone305	YES (+0.2%)	NO
Zone304	YES (+0.2%)	NO
Zone303	N/A	N/A
Zone309	NO (-5.9%)	NO
Zone310	NO (-5.9%)	NO
Zone312	NO (-5.9%)	NO
Zone314	NO (-5.9%)	NO
Zone316	NO (-5.9%)	NO
Zone318	NO (-5.9%)	NO
Zone311	N/A	N/A
Zone313	N/A	N/A
Zone315	N/A	N/A
Zone317	N/A	N/A
Zone319	NO (-76.1%)	NO
Zone320	NO (-6%)	NO
Zone321	NO (-6%)	NO
Zone322	NO (-6%)	NO
Zone323	NO (-6%)	NO
Zone324	NO (-6%)	NO
Zone325	NO (-6%)	NO
Zone327	YES (+0.9%)	NO
Zone331	N/A	N/A
Zone333	N/A	N/A
Zone326	N/A	N/A
Zone420	NO (-5.7%)	NO
Zone418	NO (-5.9%)	NO
Zone419	NO (-76.1%)	NO
Zone408	NO (-74.5%)	NO
Zone407	YES (+0.6%)	NO
Zone406	YES (+0.2%)	NO
Zone405	YES (+0.2%)	NO
Zone404	YES (+0.2%)	NO
Zone416	NO (-5.9%)	NO
Zone414	NO (-5.9%)	NO
Zone412	NO (-5.9%)	NO
Zone410	NO (-5.9%)	NO
Zone409	NO (-5.9%)	NO
Zone421	NO (-6%)	NO
Zone422	NO (-6%)	NO
Zone423	NO (-6%)	NO
Zone411	NO (-36.8%)	NO
Zone401	NO (-32.5%)	NO
Zone413	NO (-36.8%)	NO
Zone415	NO (-36.8%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Zone417	NO (-18.1%)	NO
Zone402	NO (-36.7%)	NO
Zone403	NO (-3.9%)	NO
Zone424	NO (-5.7%)	NO
Zone425	NO (-6%)	NO
Zone426	NO (-68%)	NO
Zone427	YES (+2.4%)	NO
Zone516	NO (-18.1%)	NO
Zone514	NO (-36.8%)	NO
Zone515	YES (+3%)	NO
Zone512	NO (-30.9%)	NO
Zone510	NO (-36.8%)	NO
Zone513	NO (-5.8%)	NO
Zone511	NO (-5.9%)	NO
Zone509	YES (+3%)	NO
Zone508	NO (-5.8%)	NO
Zone507	NO (-32.4%)	NO
Zone506	YES (+98.3%)	NO
Zone505	YES (+98.3%)	NO
Zone504	YES (+98.3%)	NO
Zone518	NO (-35.9%)	NO
Zone519	YES (+86%)	NO
Zone520	YES (+86%)	NO
Zone521	YES (+86.1%)	NO
Zone522	YES (+86%)	NO
Zone523	YES (+86%)	NO
Zone525	NO (-36.6%)	NO
Zone501	YES (+11.3%)	NO
Zone517	NO (-5.9%)	NO
Zone502	NO (-3.9%)	NO
Zone503	NO (-36.7%)	NO
Zone524	YES (+2.4%)	NO
Zone625	NO (-36.7%)	NO
Zone623	YES (+86%)	NO
Zone622	YES (+86.6%)	NO
Zone621	YES (+98.6%)	NO
Zone620	YES (+97.9%)	NO
Zone619	YES (+86%)	NO
Zone618	NO (-36.7%)	NO
Zone607	NO (-32.5%)	NO
Zone606	YES (+98.3%)	NO
Zone605	YES (+98.3%)	NO
Zone604	YES (+99%)	NO
Zone601	YES (+10.6%)	NO
Zone617	NO (-5.9%)	NO
Zone615	NO (-5.9%)	NO
Zone613	NO (-5.9%)	NO
Zone611	YES (+3%)	NO
Zone609	NO (-5.8%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Zone608	NO (-5.9%)	NO
Zone610	NO (-27.7%)	NO
Zone612	NO (-34.9%)	NO
Zone614	NO (-36.8%)	NO
Zone616	NO (-36.8%)	NO
Zone624	YES (+2.4%)	NO
Zone602	NO (-68%)	NO
Zone603	NO (-51.5%)	NO
Zone222	NO (-76.1%)	NO

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	6309.2	6309.2
External area [m²]	5780.5	5780.5
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	5	3
Average conductance [W/K]	1792.18	3196.63
Average U-value [W/m²K]	0.31	0.55
Alpha value* [%]	3.13	14.94

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

Building Use

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

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	33.09	56.47
Cooling	0	0
Auxiliary	18.44	18.29
Lighting	7.24	12.64
Hot water	191.54	193.37
Equipment*	24.29	24.29
TOTAL**	**250.31**	**280.76**

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

Energy Production by Technology [kWh/m²]

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

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	213.09	284.64
Primary energy* [kWh/m²]	350.92	397.38
Total emissions [kg/m²]	61.5	69.6

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

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	106.2	106.8	33.1	0	18.4	0.89	0	0.95	0
	Notional	166.5	118.2	56.5	0	18.3	0.82	0	----	----

Key to terms

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

Key Features

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

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.18	"Wall3980154"
Floor	0.2	0.08	"Wall3980170"
Roof	0.15	0.13	"Wall3980809"
Windows, roof windows, and rooflights	1.5	1	"Window397123"
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"

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

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

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

Appendix 2 – 'Be Lean' GLA SAP 10 Spreadsheet

Be Lean - SBEM 2012 Methodology SAP 10 Carbon Factors

Project	Axis House, Bath Road, Harlington
Client	Westcombe Group
Date	Aug-21
Rev	A

SAP 2012	Carbon Factor	SAP 10	Carbon Factor
Gas	0.216	Gas	0.210
Grid Elec	0.519	Grid Elec	0.233

	Price	
Gas	£0.0392	per kW/hr
Electricity	£0.1696	per kW/hr

TER Energy Demand
kWh/m2

Plot	Bedrooms	Floor Area	Space Htg	Auxiliary	Lighting	Hot Water	Emissions
1		6309.2	56.47	18.29	12.64	193.37	376,489
		6309.2					**376,489**

BER Energy Demand - Based on Gas Heating with SAP 10 Carbon Factors
kWh/m2

Plot	Space Htg	Auxiliary	Lighting	Hot Water	Emissions
1	33.09	18.44	7.24	191.54	335,370
					335,370

Total Site Target Emissions	**376,489**	$kgCO_2$ per year
Total Site Design Emissions (Be Lean)	**335,370**	$kgCO_2$ per year
Total Reduction	**41,119**	$kgCO_2$ per year
% Reduction	**10.92%**	

Appendix 3 – BRUKL Output Document for Hotel using ASHPs

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Proposed Hampton by Hilton (ASHP) As designed

Date: Mon Aug 30 12:15:44 2021

Administrative information

Building Details

Address: Hampton by Hilton, Bath Rd, Harlington, HAYES, UB3 5AY

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.6.b.0

Interface to calculation engine: SBEM Online

Interface to calculation engine version: v4.03

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

Certifier details

Name: Paul Goddard

Telephone number: 01925 733942

Address: , Information not provided by the user,

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

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	58.3
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	58.3
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	49
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

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

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

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.18	0.18	"Wall3988360"
Floor	0.25	0.12	0.13	"Wall3988390"
Roof	0.25	0.13	0.13	"Wall3988844"
Windows***, roof windows, and rooflights	2.2	1	1	"Window398178"
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

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

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

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

Building services

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

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

1- HVAC118519

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3	-	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

1- HWSGenerator73559

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	Hot water provided by HVAC system	0
Standard value	N/A	N/A

Local mechanical ventilation, exhaust, and terminal units

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

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
ZoneWC	0.2	-	-	-	-	-	-	-	-	-	N/A
ZoneWC	0.2	-	-	-	-	-	-	-	-	-	N/A
ZoneLaundry	0.2	-	-	-	-	-	-	-	-	-	N/A
ZoneWC	0.2	-	-	-	-	-	-	-	-	-	N/A
ZoneFood Preparation	-	-	-	-	-	-	-	-	0.2	-	N/A
ZoneFood Preparation	-	-	-	-	-	-	-	-	0.2	-	N/A
Zone112	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone111	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone110	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone109	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone108	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone107	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone106	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone105	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone104	0.2	-	-	-	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
Zone103	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone101	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone102	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone201	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone204	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone205	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone206	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone207	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone208	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone209	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone210	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone211	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone212	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone213	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone214	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone215	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone216	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone217	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone218	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone202	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone203	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone226	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone231	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone233	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone227	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone225	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone224	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone223	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone221	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone220	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone219	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone228	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone229	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone230	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone232	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone234	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone328	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone329	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone302	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone330	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone332	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone334	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone301	0.2	-	-	-	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
Zone308	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone307	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone306	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone305	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone304	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone303	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone309	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone310	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone312	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone314	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone316	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone318	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone311	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone313	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone315	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone317	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone319	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone320	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone321	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone322	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone323	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone324	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone325	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone327	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone331	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone333	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone326	0.2	-	-	-	-	-	-	-	-	-	N/A
ZoneStore Room	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone420	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone418	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone419	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone408	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone407	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone406	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone405	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone404	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone416	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone414	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone412	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone410	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone409	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone421	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone422	0.2	-	-	-	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
Zone423	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone411	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone401	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone413	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone415	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone417	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone402	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone403	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone424	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone425	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone426	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone427	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone516	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone514	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone515	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone512	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone510	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone513	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone511	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone509	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone508	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone507	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone506	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone505	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone504	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone518	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone519	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone520	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone521	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone522	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone523	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone525	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone501	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone517	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone502	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone503	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone524	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone625	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone623	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone622	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone621	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone620	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone619	0.2	-	-	-	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
Zone618	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone607	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone606	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone605	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone604	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone601	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone617	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone615	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone613	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone611	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone609	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone608	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone610	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone612	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone614	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone616	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone624	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone602	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone603	0.2	-	-	-	-	-	-	-	-	-	N/A
Zone222	0.2	-	-	-	-	-	-	-	-	-	N/A

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
ZonePlant	110	-	-	208
ZoneStaff dinning	110	-	-	266
ZoneWC	-	110	-	49
ZoneWC	-	110	-	49
ZoneLaundry	-	110	-	321
ZoneCirculation	-	110	-	114
ZoneFoH	-	110	-	1969
ZoneCirculation	-	110	-	124
ZoneFitness	-	110	-	176
ZoneWC	-	110	-	119
ZoneOffice	110	-	-	309
ZoneFood Preparation	-	110	-	673
ZoneFood Preparation	-	110	-	421
Zone112	-	110	-	41
ZoneCirculation	-	110	-	82
Zone111	-	110	-	41
Zone110	-	110	-	41
Zone109	-	110	-	41
Zone108	-	110	-	41

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Zone107	-	110	-	41
Zone106	-	110	-	40
Zone105	-	110	-	41
Zone104	-	110	-	40
Zone103	-	110	-	41
Zone101	-	110	-	40
Zone102	-	110	-	40
ZoneCirculation	-	110	-	46
ZoneCirculation	-	110	-	567
Zone201	-	110	-	41
Zone204	-	110	-	41
Zone205	-	110	-	41
Zone206	-	110	-	41
Zone207	-	110	-	41
Zone208	-	110	-	40
Zone209	-	110	-	41
Zone210	-	110	-	41
Zone211	-	110	-	41
Zone212	-	110	-	41
Zone213	-	110	-	41
Zone214	-	110	-	41
Zone215	-	110	-	41
Zone216	-	110	-	41
Zone217	-	110	-	41
Zone218	-	110	-	41
Zone202	-	110	-	41
Zone203	-	110	-	41
Zone226	-	110	-	41
Zone231	-	110	-	41
Zone233	-	110	-	41
Zone227	-	110	-	41
Zone225	-	110	-	41
Zone224	-	110	-	41
Zone223	-	110	-	41
Zone221	-	110	-	41
Zone220	-	110	-	41
Zone219	-	110	-	40
Zone228	-	110	-	66
Zone229	-	110	-	41
Zone230	-	110	-	41
Zone232	-	110	-	41
Zone234	-	110	-	41
ZoneCirculation	-	110	-	582

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Zone328	-	110	-	66
Zone329	-	110	-	41
Zone302	-	110	-	41
Zone330	-	110	-	41
Zone332	-	110	-	41
Zone334	-	110	-	41
Zone301	-	110	-	41
Zone308	-	110	-	41
Zone307	-	110	-	41
Zone306	-	110	-	41
Zone305	-	110	-	41
Zone304	-	110	-	41
Zone303	-	110	-	41
Zone309	-	110	-	41
Zone310	-	110	-	41
Zone312	-	110	-	41
Zone314	-	110	-	41
Zone316	-	110	-	41
Zone318	-	110	-	41
Zone311	-	110	-	41
Zone313	-	110	-	41
Zone315	-	110	-	41
Zone317	-	110	-	40
Zone319	-	110	-	41
Zone320	-	110	-	41
Zone321	-	110	-	41
Zone322	-	110	-	41
Zone323	-	110	-	41
Zone324	-	110	-	41
Zone325	-	110	-	41
Zone327	-	110	-	40
Zone331	-	110	-	41
Zone333	-	110	-	41
Zone326	-	110	-	41
ZoneStore Room	110	-	-	10
ZoneCirculation	-	110	-	184
Zone420	-	110	-	41
Zone418	-	110	-	41
Zone419	-	110	-	41
Zone408	-	110	-	41
Zone407	-	110	-	41
Zone406	-	110	-	41
Zone405	-	110	-	41

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Zone404	-	110	-	41
Zone416	-	110	-	41
Zone414	-	110	-	41
Zone412	-	110	-	41
Zone410	-	110	-	41
Zone409	-	110	-	41
Zone421	-	110	-	41
Zone422	-	110	-	41
Zone423	-	110	-	41
Zone411	-	110	-	41
Zone401	-	110	-	41
Zone413	-	110	-	41
Zone415	-	110	-	41
Zone417	-	110	-	41
Zone402	-	110	-	41
Zone403	-	110	-	41
ZoneCirculation	-	110	-	99
ZoneCirculation	-	110	-	64
Zone424	-	110	-	41
Zone425	-	110	-	41
Zone426	-	110	-	41
Zone427	-	110	-	41
ZoneCirculation	-	110	-	236
ZoneCirculation	-	110	-	64
ZoneCirculation	-	110	-	99
Zone516	-	110	-	41
Zone514	-	110	-	41
Zone515	-	110	-	40
Zone512	-	110	-	40
Zone510	-	110	-	41
Zone513	-	110	-	41
Zone511	-	110	-	41
Zone509	-	110	-	40
Zone508	-	110	-	41
Zone507	-	110	-	41
Zone506	-	110	-	41
Zone505	-	110	-	41
Zone504	-	110	-	41
Zone518	-	110	-	41
Zone519	-	110	-	41
Zone520	-	110	-	41
Zone521	-	110	-	41
Zone522	-	110	-	41

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Zone523	-	110	-	41
Zone525	-	110	-	41
Zone501	-	110	-	41
Zone517	-	110	-	41
Zone502	-	110	-	41
Zone503	-	110	-	41
Zone524	-	110	-	41
ZoneCirculation	-	110	-	99
ZoneCirculation	-	110	-	235
ZoneCirculation	-	110	-	64
Zone625	-	110	-	41
Zone623	-	110	-	41
Zone622	-	110	-	40
Zone621	-	110	-	40
Zone620	-	110	-	40
Zone619	-	110	-	41
Zone618	-	110	-	41
Zone607	-	110	-	41
Zone606	-	110	-	41
Zone605	-	110	-	41
Zone604	-	110	-	40
Zone601	-	110	-	41
Zone617	-	110	-	41
Zone615	-	110	-	41
Zone613	-	110	-	41
Zone611	-	110	-	40
Zone609	-	110	-	41
Zone608	-	110	-	41
Zone610	-	110	-	40
Zone612	-	110	-	40
Zone614	-	110	-	41
Zone616	-	110	-	41
Zone624	-	110	-	41
Zone602	-	110	-	41
Zone603	-	110	-	41
Zone222	-	110	-	41

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

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
ZoneStaff dinning	YES (+48.4%)	NO
ZoneFitness	YES (+148.7%)	NO
ZoneOffice	N/A	N/A
Zone112	YES (+103.8%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Zone111	YES (+103.8%)	NO
Zone110	YES (+108.9%)	NO
Zone109	NO (-39.6%)	NO
Zone108	NO (-71.6%)	NO
Zone107	NO (-3.3%)	NO
Zone106	NO (-66%)	NO
Zone105	N/A	N/A
Zone104	NO (-66.1%)	NO
Zone103	NO (-64.9%)	NO
Zone101	NO (-24.3%)	NO
Zone102	N/A	N/A
Zone201	YES (+90.2%)	NO
Zone204	YES (+0.2%)	NO
Zone205	YES (+0.2%)	NO
Zone206	YES (+0.2%)	NO
Zone207	YES (+0.2%)	NO
Zone208	NO (-65.7%)	NO
Zone209	NO (-51.4%)	NO
Zone210	NO (-5.9%)	NO
Zone211	N/A	N/A
Zone212	NO (-5.9%)	NO
Zone213	N/A	N/A
Zone214	NO (-5.9%)	NO
Zone215	N/A	N/A
Zone216	NO (-5.9%)	NO
Zone217	N/A	N/A
Zone218	NO (-5.9%)	NO
Zone202	N/A	N/A
Zone203	N/A	N/A
Zone226	N/A	N/A
Zone231	N/A	N/A
Zone233	N/A	N/A
Zone227	NO (-6%)	NO
Zone225	NO (-6%)	NO
Zone224	NO (-6%)	NO
Zone223	NO (-6%)	NO
Zone221	NO (-6%)	NO
Zone220	NO (-6%)	NO
Zone219	NO (-4.9%)	NO
Zone228	NO (-86.8%)	NO
Zone229	N/A	N/A
Zone230	NO (-67.4%)	NO
Zone232	NO (-67.4%)	NO
Zone234	NO (-67.4%)	NO
Zone328	NO (-83%)	NO
Zone329	NO (-67.4%)	NO
Zone302	N/A	N/A
Zone330	NO (-67.4%)	NO
Zone332	NO (-67.4%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Zone334	NO (-67.4%)	NO
Zone301	YES (+98.3%)	NO
Zone308	NO (-65.9%)	NO
Zone307	YES (+0.2%)	NO
Zone306	YES (+0.2%)	NO
Zone305	YES (+0.2%)	NO
Zone304	YES (+0.2%)	NO
Zone303	N/A	N/A
Zone309	NO (-5.9%)	NO
Zone310	NO (-5.9%)	NO
Zone312	NO (-5.9%)	NO
Zone314	NO (-5.9%)	NO
Zone316	NO (-5.9%)	NO
Zone318	NO (-5.9%)	NO
Zone311	N/A	N/A
Zone313	N/A	N/A
Zone315	N/A	N/A
Zone317	N/A	N/A
Zone319	NO (-76.1%)	NO
Zone320	NO (-6%)	NO
Zone321	NO (-6%)	NO
Zone322	NO (-6%)	NO
Zone323	NO (-6%)	NO
Zone324	NO (-6%)	NO
Zone325	NO (-6%)	NO
Zone327	YES (+0.9%)	NO
Zone331	N/A	N/A
Zone333	N/A	N/A
Zone326	N/A	N/A
Zone420	NO (-5.7%)	NO
Zone418	NO (-5.9%)	NO
Zone419	NO (-76.1%)	NO
Zone408	NO (-74.5%)	NO
Zone407	YES (+0.6%)	NO
Zone406	YES (+0.2%)	NO
Zone405	YES (+0.2%)	NO
Zone404	YES (+0.2%)	NO
Zone416	NO (-5.9%)	NO
Zone414	NO (-5.9%)	NO
Zone412	NO (-5.9%)	NO
Zone410	NO (-5.9%)	NO
Zone409	NO (-5.9%)	NO
Zone421	NO (-6%)	NO
Zone422	NO (-6%)	NO
Zone423	NO (-6%)	NO
Zone411	NO (-36.8%)	NO
Zone401	NO (-32.5%)	NO
Zone413	NO (-36.8%)	NO
Zone415	NO (-36.8%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Zone417	NO (-18.1%)	NO
Zone402	NO (-36.7%)	NO
Zone403	NO (-3.9%)	NO
Zone424	NO (-5.7%)	NO
Zone425	NO (-6%)	NO
Zone426	NO (-68%)	NO
Zone427	YES (+2.4%)	NO
Zone516	NO (-18.1%)	NO
Zone514	NO (-36.8%)	NO
Zone515	YES (+3%)	NO
Zone512	NO (-30.9%)	NO
Zone510	NO (-36.8%)	NO
Zone513	NO (-5.8%)	NO
Zone511	NO (-5.9%)	NO
Zone509	YES (+3%)	NO
Zone508	NO (-5.8%)	NO
Zone507	NO (-32.4%)	NO
Zone506	YES (+98.3%)	NO
Zone505	YES (+98.3%)	NO
Zone504	YES (+98.3%)	NO
Zone518	NO (-35.9%)	NO
Zone519	YES (+86%)	NO
Zone520	YES (+86%)	NO
Zone521	YES (+86.1%)	NO
Zone522	YES (+86%)	NO
Zone523	YES (+86%)	NO
Zone525	NO (-36.6%)	NO
Zone501	YES (+11.3%)	NO
Zone517	NO (-5.9%)	NO
Zone502	NO (-3.9%)	NO
Zone503	NO (-36.7%)	NO
Zone524	YES (+2.4%)	NO
Zone625	NO (-36.7%)	NO
Zone623	YES (+86%)	NO
Zone622	YES (+86.6%)	NO
Zone621	YES (+98.6%)	NO
Zone620	YES (+97.9%)	NO
Zone619	YES (+86%)	NO
Zone618	NO (-36.7%)	NO
Zone607	NO (-32.5%)	NO
Zone606	YES (+98.3%)	NO
Zone605	YES (+98.3%)	NO
Zone604	YES (+99%)	NO
Zone601	YES (+10.6%)	NO
Zone617	NO (-5.9%)	NO
Zone615	NO (-5.9%)	NO
Zone613	NO (-5.9%)	NO
Zone611	YES (+3%)	NO
Zone609	NO (-5.8%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Zone608	NO (-5.9%)	NO
Zone610	NO (-27.7%)	NO
Zone612	NO (-34.9%)	NO
Zone614	NO (-36.8%)	NO
Zone616	NO (-36.8%)	NO
Zone624	YES (+2.4%)	NO
Zone602	NO (-68%)	NO
Zone603	NO (-51.5%)	NO
Zone222	NO (-76.1%)	NO

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	6309.2	6309.2
External area [m²]	5780.5	5780.5
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	5	3
Average conductance [W/K]	1792.18	3196.63
Average U-value [W/m²K]	0.31	0.55
Alpha value* [%]	3.13	14.94

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

Building Use

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

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	10.47	19.03
Cooling	0	0
Auxiliary	18.44	18.29
Lighting	7.24	12.64
Hot water	60.65	65.17
Equipment*	24.29	24.29
TOTAL**	**96.81**	**115.13**

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

Energy Production by Technology [kWh/m²]

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

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	213.09	284.64
Primary energy* [kWh/m²]	289.78	344.62
Total emissions [kg/m²]	49	58.3

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

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Central heating using water: radiators, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	106.2	106.8	10.5	0	18.4	2.82	0	3	0
	Notional	166.5	118.2	19	0	18.3	2.43	0	----	----

Key to terms

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

Key Features

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

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.18	"Wall3988360"
Floor	0.2	0.08	"Wall3988367"
Roof	0.15	0.13	"Wall3988844"
Windows, roof windows, and rooflights	1.5	1	"Window398178"
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"

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

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

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

Appendix 4 – 'Be Clean' GLA SAP 10 Spreadsheet

Be Clean - SBEM 2012 Methodology SAP 10 Carbon Factors

Project	Axis House, Bath Road, Harlington
Client	Westcombe Group
Date	Aug-21
Rev	A

SAP 2012	Carbon Factor	SAP 10	Carbon Factor
Gas	0.216	Gas	0.210
Grid Elec	0.519	Grid Elec	0.233

	Price	
Gas	£0.0392	per kW/hr
Electricity	£0.1696	per kW/hr

TER Energy Demand
kWh/m2

Plot	Bedrooms	Floor Area	Space Htg	Auxiliary	Lighting	Hot Water	Emissions
1	157	6309.2	N/A	N/A	N/A	N/A	N/A
		6309.2					-

BER Energy Demand - Based on ASHP with SAP 10 Carbon Factors
kWh/m2

Plot	Space Htg	Auxiliary	Lighting	Hot Water	Emissions
1	10.47	18.44	7.24	60.65	142,300
					142,300

Total Site Target Emissions	N/A	$kgCO_2$ per year
Total Site Design Emissions (Be Clean)	**142,300**	$kgCO_2$ per year

Appendix 5 – Roof Plan showing Indicative Location of Photovoltaic Panels

Ica Architects Ltd.
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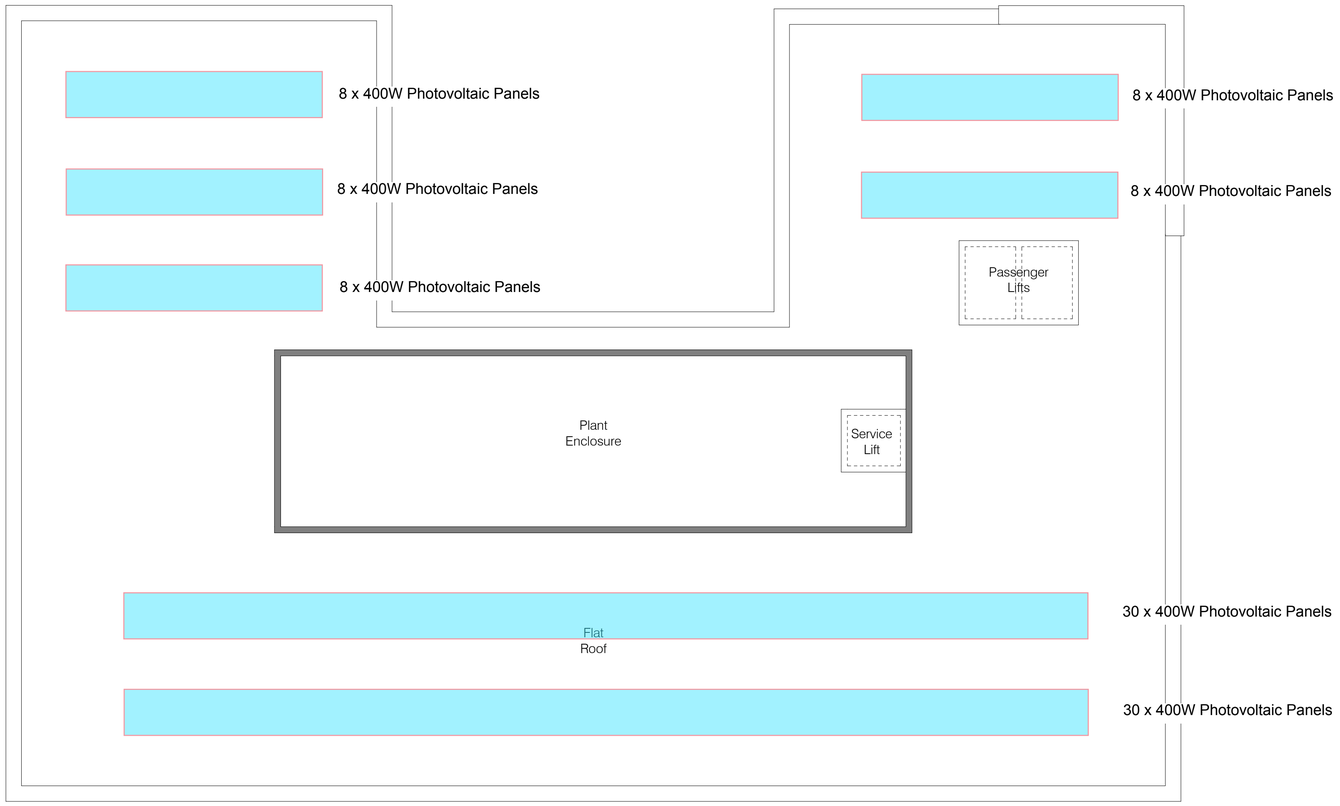

Roof Plan showing Approximate Location of Photovoltaic Panels

ACCOMMODATION SCHEDULE:

Level 00 -	Main Entrance, BoH Areas and Parking.
Level 01 -	11 Standard Rooms. 1 Accessible Room. Total 12 Rooms.
Levels 02 and 03 -	31 Standard Rooms. 3 Accessible Rooms. Total 34 Rooms per floor.
Level 04 -	25 Standard Rooms. 2 no Accessible Rooms. Total 27 Rooms.
Level 05 -	21 Standard Rooms. 4 no. Accessible Rooms. Total 25 Rooms.
Level 06 -	22 Standard Rooms. 3 no. Accessible Rooms. Total 25 Rooms.
Total -	141 Standard Rooms. 16 Accessible Rooms. Total 157 Rooms.

N

0 1 2 3 4 5
SCALE 1:100 m

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project title //
Proposed Hampton by Hilton
Bath Road, Heathrow

drawing title //
Roof Plan as Proposed

issue stage //
PLANNING ISSUE

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