Energy Strategy

Charlie Ratchford Extra-Care Scheme

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EXECUTIVE SUMMARY

This Energy Strategy has been prepared by URS on behalf of London Borough of Camden (LBC) in support of a full planning application for the Charlie Ratchford Extra-Care Scheme (herein referred to as the 'Proposed Development'), in LBC.

The Proposed Development will include the construction of a new extra-care residential building (five storeys plus ground), with 38 self-contained residential units at the upper floors and approximately 850 m^2 of leisure and day centre floor space at ground floor. The basement level will include provision for enclosed plant space.

In compliance with the Greater London Authority (GLA) guidance, the energy consumption and carbon dioxide (CO_2) emissions associated with the Proposed Development will be reduced by following the Mayor's Energy Hierarchy:

- passive design and energy efficiency (i.e. 'Be Lean');
- energy efficient supply of services (i.e. 'Be Clean'); and
- on-site renewable energy technologies to provide energy (i.e. 'Be Green').

The energy consumption and associated CO_2 emissions of the extra-care residential and commercial spaces of the Proposed Development have been estimated using approved software compliant with the Building Regulations Approved Document L (ADL) A 2013.

The baseline scheme is defined as that meeting the requirements of the Building Regulations ADL A 2013. The Proposed Development's baseline CO_2 emissions for regulated and non-regulated energy uses are presented in Table 1.

It is proposed to reduce the energy demand of the Proposed Development by incorporating passive design and energy efficiency measures where possible (i.e. 'Be Lean' scheme). The achievable savings in regulated CO_2 emissions are estimated to be 3% over the baseline.

On-site Combined Heat and Power (CHP) systems were considered but the low heat demand precludes viability on this site. The potential for connection to nearby existing low carbon heat distribution networks and CHP installations was investigated and is not considered viable at this time.

An analysis of the feasibility of on-site renewable energy technologies has been undertaken and Air Source Heat Pump (ASHP) systems as well as Photovoltaic (PV) panels have been identified as feasible for on-site heat and electricity generation respectively. The proposed ASHP and PV panels of circa 223 m^2 area (42.4 kW_p) could provide circa 30% reduction in regulated CO_2 emissions over the 'Be Lean' scheme.

In total, a 32% reduction in regulated CO_2 emissions over the baseline is estimated to be achievable.

Figure 1 presents the estimated regulated CO_2 emissions after each stage of the Mayor's Energy Hierarchy and Table 1 shows the total regulated and unregulated CO_2 emissions. Table 2 demonstrates the regulated CO_2 emissions savings and the percentage of reduction over the baseline. Table 3 shows the annual and cumulative shortfall of CO_2 emissions over the London Plan target savings.

The individual percentage savings shown in Table 2 and Figure 1 are a reduction from each stage of the Mayor's Energy Hierarchy. The total cumulative savings for the Proposed

Development represent the total reduction over the baseline (21 tonnes of CO_2 savings against the baseline of 65 tonnes CO_2 per year equating to 32%).

Table 1: CO_2 Emissions after Each Stage of the Mayor's Energy Hierarchy

CO_2 EMISSIONS (TONNES CO_2 ANNUALLY)		
Assessment	**Regulated**	**Unregulated**
Building Regulations ADL A 2013 Compliant Baseline	65	37
After energy demand reduction	63	37
After low carbon technology	63	37
After renewables	44	37

Table 2: Regulated CO_2 Savings from Each Stage of the Mayor's Energy Hierarchy

REGULATED CO_2 SAVINGS		
Assessment	**(Tonnes CO_2 Annually)**	**(%)**
Savings from energy demand reduction (over Baseline)	2	3%
Savings from low carbon technology (DH) (Over 'Be Lean')	0	0%
Savings from renewable technology (Over 'Be Clean')	19	30%
Total cumulative savings for the site (Over Baseline)	**21**	**32%**
Total Target Savings	23	35%
Annual Shortfall	2	-

Table 3: Shortfall in Regulated CO_2 Savings

CO_2 EMISSIONS (TONNES CO_2 ANNUALLY)		
	Annual Shortfall (Tonnes CO_2)	**Cumulative Shortfall (over a 30-year period) (Tonnes CO_2)**
Shortfall	2	60

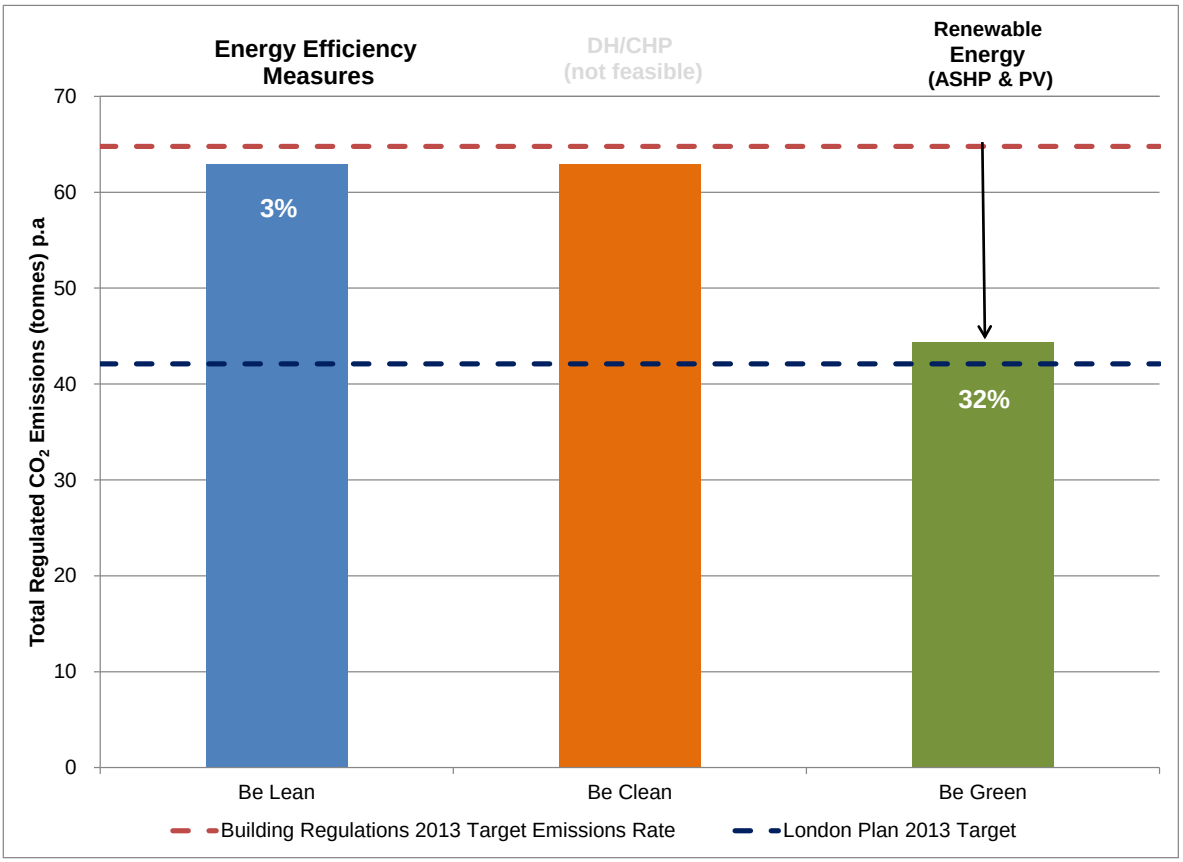

Figure 1: Estimated Proposed Development Regulated CO_2 Reduction

1 INTRODUCTION

This Energy Strategy has been prepared on behalf of London Borough of Camden (LBC) in support of a full planning application for the construction of the Charlie Ratchford Extra-Care development (herein referred to as the Proposed Development) in the LBC.

The designers seek to mitigate the Proposed Development's impact on climate change and to reduce its carbon dioxide (CO_2) emissions by following the principles set out in the Mayor's Energy Hierarchy described in *Policy 5.2 – Climate Change Mitigation* of The London Plan.

The Energy Strategy will take into account environmental, architectural, and spatial constraints and identify how the design of the Proposed Development will achieve CO_2 emissions reduction through the consideration of potential passive design measures, energy efficiency, and Low and Zero Carbon (LZC) technologies.

2 PROPOSED DEVELOPMENT DESCRIPTION

The Proposed Development is situated at Crogsland Road, Camden, and will involve the construction of a six-story multi-residential building (five storeys plus ground), with 38 extra-care residential units at the upper floors and approximately 850 m^2 of day centre floorspace at ground floor.

The residential units are intended for sheltered occupancy by the elderly, providing secure and supported independent living.

Figure 2-1 shows the visual representation of the Proposed Development.

Figure 2-1: Visual Representation of the Proposed Development

3 PLANNING CONTEXT

This assessment was carried out in line with local, regional and national planning requirements which encourage that passive design, energy efficiency measures, low carbon and renewable energy technologies be incorporated into the building design of all new developments.

3.1 National Policy

Rising international and national aspirations have led to the strengthening of national planning policies and building control processes that contribute to the Government's long-term commitment to support sustainable development.

The Government has launched a raft of measures to combat global warming and climate change. The following publications demonstrate a timeline for the measures that have been implemented within the development of national policy:

- The Department of Transport and Industry *White Paper* entitled *Our Energy Future – Creating a Low Carbon Economy, 2003*, sets a target for 10% of electricity to be produced from renewable sources nationally by 2010 and twice this by 2020, with a 60% reduction in CO_2 emissions by 2050;
- *Sustainable and Secure Buildings Act 2004* sets out the purposes for which Building Regulations may be made to further the conservation of fuel and power, ensure water use efficiency, protect and enhance the environment, and prevent/detect non-compliance with the Building Regulations;
- *Climate Change and Sustainable Energy Act 2006*, enhances the contribution of the UK to combating climate change, alleviating fuel poverty and securing a diverse and viable long-term energy supply;
- *The department for Communities and Local Government (CLG)'s Building A Greener Future: Towards Zero Carbon Development, 2006*, demonstrates the step change required in the Building Regulations to achieve zero carbon housing in order to ensure energy security, which is a risk of climate change;
- *The Department of Transport and Industry White Paper entitled Meeting the Energy Challenge, 2007*, sets out the UK strategy, which recognises the need to tackle climate change and energy security;
- *The Climate Change Act 2008* sets up a framework for the UK to achieve its long-term goals of reducing greenhouse gas emissions by 34% over the 1990s baseline by 2020 and by 80% by 2050 and to ensure steps are taken towards adapting to the impact of climate change. The Act introduces a system of carbon budgeting which constrains the total amount of emissions in a given time period, and sets out a procedure for assessing the risks of the impact of climate change for the UK, and a requirement on the Government to develop an adaptation programme;
- *The Planning and Energy Act 2008* enables local planning authorities to set requirements for energy use and energy efficiency in local plans;
- *The Energy Act 2013* makes a provision for the setting of a decarbonisation target range and duties in relation to it and for the reforming of the electricity market for purposes of encouraging low carbon electricity generation and ensuring security of supply;

- *The Carbon Plan, 2011,* sets out the Government's plans for achieving the emissions reductions committed to in *the Climate Change Act*, on a pathway consistent with meeting the 2050 target. This publication brings together the Government's strategy to curb greenhouse gas emissions and deliver our climate change targets, as well as the updated version of actions and milestones for the next five years; and
- *The National Planning Policy Framework, 2012,* sets out the Government's planning policies for England and how these are expected to be applied. It must be taken into account in the preparation of local and neighbourhood plans, and is a material consideration in planning decisions. The document presents a series of policies that constitute the Government's view of what sustainable development in England means in practice for the planning system. At the heart of *the National Planning Policy Framework* is a presumption in favour of sustainable development. Policies in Local Plans should follow the approach of the presumption in favour of sustainable development so that it is clear that development which is sustainable can be approved without delay.

3.2 Regional Policy

The London Plan 2011 (Early Minor Alterations, October 2013)

The London Plan, which establishes policy over the next 20 – 25 years, retains the fundamental objective of accommodating London's population and economic growth through sustainable development.

In terms of Climate Change Mitigation, *Policy 5.1* of The London Plan includes a strategic target to achieve an overall reduction in London's CO_2 emissions of 60% by 2025.

Policy 5.2: Minimising CO_2 emissions sets out that the Mayor expects that all new developments will fully contribute towards the reduction of CO_2 emissions.

Specifically, *Policy 5.2 (A)* requires developments to make the fullest contribution to minimising emissions of CO_2 in accordance with the Mayor's Energy Hierarchy:

- Be Lean: use less energy;
- Be Clean: supply energy efficiently; and
- Be Green: use renewable energy.

Policy 5.2 (B) includes targets for CO_2 emissions reduction which all major developments are expected to meet. The previous target was a 40% reduction compared to 2010 Building Regulations requirements. The current target (2013-2016) is a 35% reduction compared to 2013 Building Regulations requirements. Note that this is an updated target in relation to the new 2013 Building Regulations. Further information can be found in the *Sustainable Design and Construction Supplementary Planning Guidance (2014)* and the *Energy Planning – Greater London Authority Guidance on Preparing Energy Assessment* (2014) documents detailed in the following sections.

Policy 5.2(C) states that all major development proposals are expected to include a detailed energy assessment to demonstrate how these targets are to be met within the framework of the Mayor's Energy Hierarchy (guidance is also given in *Policy 5.2(D)* on the content of Energy Assessments).

Policy 5.3: Sustainable Design and Construction, seeks to ensure future developments meet the highest standards of sustainable design and construction including construction and operation, and ensure that they are considered at the beginning of the design process.

Policy 5.6 Decentralised Energy states that development proposals must evaluate the feasibility of installing a Combined Heat and Power (CHP) system, and where a new CHP system is appropriate also examine opportunities to extend the system beyond the site boundary to adjacent sites.

Policy 5.6 (B) also requires the developments to select the energy systems in accordance with the following hierarchy:

- Connection to existing heating or cooling networks;
- Site-wide CHP network; and
- Communal heating and cooling.

Policy 5.6 (C) states that where future network opportunities are identified, proposals should be designed to connect to these networks.

Policy 5.7: Renewable Energy expects that within the framework of the energy hierarchy, major development proposals will provide a reduction in CO_2 emissions through the use of on-site renewable energy generation. The London Plan also includes a presumption that all major development proposals will seek to reduce CO_2 emissions by at least 20% through the use of on-site renewable energy generation, wherever feasible.

Policy 5.8 Innovative Energy Technologies supports the use of alternative energy technologies.

Policy 5.9: Overheating and Cooling expects major development proposals to reduce potential overheating and reliance on air conditioning systems and demonstrate this in accordance with the recommended cooling hierarchy:

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

Sustainable Design and Construction Supplementary Planning Guidance (2014)

In April 2014 the Mayor published the Sustainable Design and Construction Supplementary Planning Guidance (SPG) to provide guidance to developers. This SPG details the Mayor's standards, covering a wide range of sustainability measures that major developments are expected and encouraged to meet.

Notably, the SPG responds to the introduction of the new Building Regulations Approved Document L (ADL) 2013, which requires an overall 6% reduction in CO_2 emissions from new residential buildings and an average 9% reduction in CO_2 emissions from new non-residential buildings compared to ADL of the Building Regulations 2010. To avoid complexity and extra costs

for developers, the Mayor adopted a flat CO_2 improvement target beyond ADL 2013 of 35% for both residential and non-residential developments. This target replaces the previous targets set out under the London Plan Policy 5.2 (B) against ADL 2010.

Delivering London's Energy Future: The Mayor's Climate Change Mitigation and Energy Strategy (2011)

The Strategy sets out the Mayor's strategic approach to limiting further climate change and securing a low carbon energy supply for London.

To limit further climate change impacts the Mayor has set a target to reduce London's CO_2 emissions by 60% on 1990 levels by 2025. The Strategy details the programmes and activities that are on-going across London to achieve this.

Energy Planning – Greater London Authority Guidance on Preparing Energy Assessment (2014)

This guidance provides details on how to address the Mayor's Energy Hierarchy through the provision of an energy assessment to accompany strategic planning applications. This Energy Statement report follows the methodology outlined in this guidance.

As also outlined in the Sustainable Design and Construction SPG, from 6 April 2014 the Mayor will apply a 35% reduction target beyond ADL 2013 of the Building Regulations.

London Heat Network Manual (2014)

The London Heat Network Manual was published in April 2014 and provides guidance for developers, network designers and planners with the aim of creating a consistent framework for delivering efficient, interconnecting, District Heating (DH) networks. The document supports a range of initiatives provided by City Hall to promote the Mayor's target to achieve 25% of London's energy supply from decentralised energy sources by 2025.

Integrating Renewable Energy into New Developments: Toolkit for Planners, Developers and Consultants (2004)

New developments are expected to be assessed using procedures set out in this publication. This document provides a review of the planning context, guidance on feasibility studies, case studies and cost models for a wide range of applications.

3.3 Local Planning Policy

London Borough of Camden (LBC) aims to be one of the most environmentally friendly boroughs in London. A key part of this goal is to secure the highest standards of sustainability in the design, construction and use of buildings and the wider built environment. The adopted Camden Local Plan for LBC (September 2013) consists of the Camden *Core Strategy* and *Development Policies.* In addition to planning documentation, LBC has issued a guidance document (2013) to assist in the preparation of energy strategies titled *Camden Planning Guidance.*

Camden Core Strategy 2010 – 2025 (2010)

The Camden Core Strategy is a central part of Camden Local Development Framework (LDF) prepared by the Council.

According to *Policy CS13 Tackling climate change through promoting higher environmental standards* and in terms of energy, the Council will require all developments to take measures to

minimise the effects of, and adapt to, climate change and encourage all developments to meet the highest feasible environmental standards that are financially viable during construction and occupation by:

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

   1. ensuring developments use less energy;
   2. making use of energy from efficient sources, such as the King's Cross, Gower Street, Bloomsbury and proposed Euston Road decentralised energy networks;
   3. generating renewable energy on-site; and

The Council will have regard to the cost of installing measures to tackle climate change as well as the cumulative future costs of delaying reductions in carbon dioxide emissions. The Council will also promote local energy generation and networks.

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

b) Taking measures to reduce its own carbon emissions;

c) Trialling new energy efficient technologies, where feasible; and

d) Raising awareness on mitigation and adaptation measures.

Camden Development Policies 2010 – 2025 (2010)

Policy DP22 Promoting sustainable design and construction used a stepped approach to the requirements for achieving higher levels of the Code for Sustainable Homes (CfSH). Buildings built or refurbished today will be competing with low and 'zero-carbon' buildings in the near future.

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

a) Demonstrate how sustainable development principles, including the relevant measures set out in Policy CS13 of the Core Strategy, have been incorporated into the design and proposed implementation; and

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

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

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

b) Expecting developments (except new build) of 500 m^2 of residential floor space or above or 5 or more dwellings to achieve "very good" in EcoHomes assessments prior to 2013 and encouraging "excellent" from 2013;

c) Expecting non-domestic developments of 500 m^2 of floor space or above to achieve "very good" in Building Research Establishment Environmental Assessment Methodology (BREEAM) assessments and "excellent" from 2016 and encouraging zero carbon from 2019.

Camden Planning Guidance (CPG) Sustainability (2013)

Camden Planning Guidance provides advice and information on how to apply planning policies. It is prepared by Council to support the policies in the LDF. The Strategy sets locally specific standards built on those in the London Plan through the key sustainable design polices including:

CPG3 The energy hierarchy states that all developments are to be designed to reduce CO_2 emissions and that all energy strategies are to be designed following the steps set out by the Energy Hierarchy.

CPG 3 Energy Efficient: New Buildings requires that all new developments are to be designed to minimise CO_2 emissions. The most cost-effective ways to minimise energy demand are through good design and high levels of insulation and air tightness.

The council will require an integrated approach to solar gain, access to daylight, insulation, thermal materials, ventilation, heating and control systems, such as:

- A full model of the building should be carried out to ensure the building design optimises solar gain and daylight without resulting in overheating for developments comprising 5 dwellings or more or 500 m^2 or more of any floorspace;

- Any development proposing electric heating (including heat pumps) will need to demonstrate the carbon efficiency of the proposed heating system. Specifications of the electric heating system and calculations will need to be provided to demonstrate that the proposed electric heating system would result in lower CO_2 emissions than an efficient gas fuelled heating system; and

- Developments will be expected to achieve 60% of the un-weighted credits in the Energy category of their BREEAM assessment.

CPG 3 Decentralised Energy Networks and Combined Heat and Power states that developments will be required to connect to a decentralised energy (DE) network or include CHP where it is feasible and viable.

When demonstrating the feasibility and viability of not connecting to a DE network or including a CHP plant developers will be required to address the relevant considerations listed in Section 5.22 of the document.

Where a development is not connecting immediately to a network the following measures are required to be included in the scheme:

- Space in the plant room for a heat exchanger, any other plant and pipe and electricity connections; and

- Pipes from the plant room to the property boundary where the decentralised energy pipe is most likely to be located.

CPG 3 Renewable Energy states that all developments are required to achieve a 20% carbon dioxide emissions reduction target rom on-site renewable energy technologies.

4 ASSESSMENT METHODOLOGY

The overall strategy and measures identified to reduce the regulated energy consumption and associated CO_2 emissions of the Proposed Development reflect the Greater London Authority's (GLA's) energy hierarchy and include the following:

- Passive design and energy efficiency (i.e. 'Be Lean');
- Energy efficient supply of services (i.e. 'Be Clean'); and
- On-site renewable energy technologies to provide energy where appropriate (i.e. 'Be Green').

Generally, this is applied to a development as follows:

- Calculation of the ADL compliant regulated baseline energy demand and associated CO_2 emissions;
- Determination of the most appropriate energy efficiency and passive design measures. These are then incorporated into the energy calculations, representing an enhanced baseline ('Be Lean') scheme. The 'Be Lean' scheme represents one of the most effective ways of reducing the energy consumption;
- Identification of clean energy supply technologies (e.g. CHP and/or DH network) and incorporation to the energy calculations, representing a 'Be Clean' scheme;
- Identification of the most appropriate 'Be Green' renewable energy technologies, where feasible, to reduce the CO_2 emissions of the development and contributing towards wider CO_2 emission reduction targets through on-site renewable sources.

The regulated energy consumption and associated CO_2 emissions of the non-domestic areas of the Proposed Development have been estimated using the Dynamic Simulation Modelling (DSM) software Environmental Design Solutions Limited (EDSL) Thermal Analysis Software (TAS) v.9.3 to conduct preliminary Building Regulations ADL 2A 2013 compliance testing.

The regulated energy consumption and associated CO_2 emissions of the extra-care residential areas have been estimated for the different stages of the Energy Hierarchy using Standard Assessment Procedure (SAP) software compliant with the Building Regulations ADL 1A 2013.

The whole energy use of the Proposed Development is considered in this energy strategy. This includes Building Regulations ADL energy uses (i.e. hot water, space heating, space cooling, auxiliary energy and lighting) and in addition non-regulated energy uses such as appliances, computers, etc. Estimates of energy uses, which fall outside the remit of the Building Regulations, were taken from the national calculation methodology (NCM) DSM modelling and using BRE Domestic Energy Modelling (BREDEM) 2012.

5 BASELINE ASSESSMENT

In order to assess the potential CO_2 emissions reductions achievable at the site through the implementation of passive design, energy efficiency measures and on-site LZC technologies, the baseline CO_2 emissions of the Proposed Development designed without such undertakings must be estimated.

This Energy Strategy considers, as the starting point, a baseline development that meets the requirements of Building Regulations ADL A 2013 in relation to CO_2 emissions (i.e. for the residential elements, the Building Emissions Rate (BER) and Dwelling Emissions Rate (DER) of the baseline are equal to the Target Emissions Rate (TER), which is the maximum emission rate permitted by the Building Regulations).

The BRUKL report and TER worksheet of a sample unit from the approved software used are included in Appendix A.

A summary of the estimated baseline energy consumption for regulated and unregulated energy uses is shown in Table 5-1.

Table 5-1: Estimated Baseline Energy Consumption and CO_2 emissions of the Proposed Development

ESTIMATED BASELINE ENERGY CONSUMPTION		
Baseline Scheme	**Total Regulated Energy Uses (MWh/year)**	**Total Unregulated Energy Uses (MWh/year)**
Residential	167	24
Non-residential	72	48
Proposed Development	**239**	**72**

A summary of estimated baseline CO_2 emissions for regulated and unregulated energy uses is shown in Table 5-2.

Table 5-2: Estimated Baseline CO_2 Emissions of the Proposed Development

ESTIMATED BASELINE CO_2 EMISSIONS		
Baseline Scheme	**Total Regulated Energy Uses (Tonnes CO_2/year)**	**Total Unregulated Energy Uses (Tonnes CO_2/year)**
Residential	40	12
Non-residential	25	25
Proposed Development	**65**	**37**

6 BE LEAN – PASSIVE DESIGN AND ENERGY EFFICIENCY APPRAISAL

The objective of this section is to identify and consider potential opportunities to reduce the CO_2 footprint of the Proposed Development through identification of passive design and energy efficiency measures.

6.1 Minimising solar gains

In line with *Policy 5.9* of the London Plan, potential for overheating and reliance on air conditioning systems will be reduced in accordance with the Mayor's cooling hierarchy, i.e.:

1. minimise internal heat generation through energy efficient design
2. reduce the amount of heat entering the buildings in summer
3. manage the heat within the building
4. use passive ventilation
5. use mechanical ventilation
6. provide energy efficient cooling system

The following measures were introduced in order to limit the effects of solar gains in summer:

- specifying low energy lighting to reduce internal heat generation;
- specifying dual aspect dwellings to allow for cross ventilation where possible and allowing fully opened windows at upper floor flats;
- incorporation of high performance glass throughout the scheme to minimise solar gains in summer whilst providing adequate daylighting levels for occupants;
- designing balconies/winter gardens that work as overhangs to provide shading to the units below during the summer months without altering the daylight penetration in the mid-season and heating period; and
- using thermal mass efficiently to manage the risk of overheating.

The dwellings have been modelled under the SAP methodology and tested against criteria set in SAP Appendix P: Assessment of internal temperature in summer. The tested dwellings have shown to comply with the criteria as described in Appendix P, achieving a low propensity for high internal temperatures.

Due to high levels of traffic resulting in high ambient noise and air quality issues, the use of natural ventilation via openable windows is constrained. Therefore, mechanical ventilation with heat recovery (MVHR) will be introduced in the extra-care residential areas and the majority of the ground floor areas. Variable speed drives and best practice values of Specific Fan Power (SFP) will be specified.

Active cooling will be specified for the café and restaurant areas as well as the staff rooms, lounges, activity room and meeting rooms located in the ground floor of the Proposed Development. The high efficiency cooling system will allow for enhanced thermal comfort in the form of Variable Refrigerant Flow (VRF) units.

6.2 Proposed Passive Design and Energy Efficiency Measures

Table 6-1 lists the passive design and energy efficiency measures which have been incorporated in the design of the building.

Table 6-1: Proposed Passive Design and Energy Efficiency Measures

PROPOSED PASSIVE DESIGN AND ENERGY EFFICIENCY MEASURES	
Technology	**Method of CO_2 Reduction**
Fabric Design	Improved U-values of the thermal elements (wall, floor and roof) where feasible and controlled fittings (windows and doors) over the minimum *Building Regulations ADL A 2013* requirements. The improved U-values are included in Appendix A. Further improvements on the building fabric are considered unlikely to yield significant reductions in regulated energy usage and associated CO_2 emissions.
Building Envelope	Improved building air-tightness beyond the *Building Regulations ADL A 2013* minimum requirements.
Promoting Natural Daylight	Natural lighting will be promoted through the design to reduce the energy use and CO_2 emissions of the building by minimising the use of artificial lighting.
Building User Guide	Provide separate Building User Guides to the staff and residents advising on how to use the building efficiently (in line with the BREEAM requirements).
Efficient Lighting	The following measures will be introduced to reduce energy consumption associated with lighting: • use of energy efficient lights; • Passive Infrared Sensor (PIR) activated lighting for selected appropriate areas (e.g. corridors and WC areas) to minimise energy use in unoccupied areas; and • dimmable and zoned lighting, where feasible.
Efficient Heating, Ventilation and Air Conditioning (HVAC) Systems	Fan speed control will be specified to match air supply rates, where feasible alongside improved SFP for mechanically ventilated areas. Thermal comfort in the flats will be maintained via high efficiency MVHR units. Thermal comfort in the non-residential elements during summer months will be maintained via high efficiency cooling system, more specifically through VRF heat pump systems. Efficient gas fired boilers will provide domestic hot water to the whole of the building. Space heating from gas boilers will be supplied only to the dwellings. The space heating demand of the communal ground floor areas will be supplied by efficient VRF units.
Monitoring and efficient management of energy usage	A central Building Management System (BMS) will be provided. The BMS will allow optimised management of the landlord services and mechanical plant.
Metering	Energy metering of all major plant equipment and primary landlord services will be provided. This data would be collated via the BMS.

Vertical Transportation	Energy efficient lifts will be specified for the Proposed Development.
Energy Efficient Equipment	Energy efficient white goods and equipment will be provided to reduce CO_2 emissions associated with non-regulated energy uses where provided.

6.3 Proposed 'Be Lean' Scheme

The 'Be Lean' scheme includes the incorporation of energy efficiency and passive design measures into the baseline scheme. Appendix A includes BRUKL report and SAP worksheet taking into account passive design and energy efficiency measures.

Table 6-2 demonstrates the CO_2 emissions associated with regulated energy uses of the Proposed Development and the expected percentage CO_2 emissions savings achieved through the incorporation of the proposed passive design and energy efficiency measures.

The results of the calculations illustrate that the proposed energy efficiency and passive design measures alone would reduce the Proposed Development's regulated baseline CO_2 emissions by circa 3%.

Table 6-2: Estimated Baseline and Be Lean CO_2 Emissions

ESTIMATED REGULATED CO_2 EMISSIONS			
Use	**Baseline (Tonnes CO_2/year)**	**'Be Lean' (Tonnes CO_2/year)**	**Improvement over Baseline**
Proposed Development	65	63	3%

7 BE CLEAN – LOW CARBON TECHNOLOGY APPRAISAL

7.1 Introduction to Be Clean Technologies

This section considers the potential for connection to any existing or proposed DH network in the proximity of the site and the feasibility of incorporating a CHP/Combined Cooling Heat and Power (CCHP) plant on-site.

A DH network is a system for distributing heat generated in a centralised location. The energy centre serving the network often includes a CHP plant.

CHP technology effectively uses waste heat from the electricity generation process to provide useful heat for space and water heating; the advantage of this system is that it leads to higher system efficiencies when compared to a typical supply arrangement of grid-imported electricity and conventional gas fired boilers. CHP is considered a low carbon technology when fired by natural gas to generate electricity and provide heating and hot water.

The following three options have been considered for the Proposed Development:

1. connecting to existing heating or cooling networks;
2. site wide CHP network; and
3. combined heating, cooling and power (CCHP).

7.2 Applicability to the Proposed Development

Connection to Existing District Heating Schemes

Based on the data included in the London Heat Map[1] and the Department of Energy and Climate Change (DECC) CHP database[2], one energy centre serving a heat network (Denton Estate) and one potential CHP opportunity area (Kentish Town West) have been identified in the area. Please refer to Appendix B for the relevant extract from the London Heat Map.

Denton Estate

The nearest heat network to the Proposed Development is the one that serves the Denton Estate. The energy centre serving this network is owned and operated by Camden Council. Information received from the Council confirms that the energy centre provides heating through the provision of a number of gas-fired boilers. Initial calculations suggest that the installed capacity would be insufficient to meet the additional loads from the Proposed Development.

Furthermore, research indicates that the efficiency of the boilers at Denton Estate is no better than that of typical boilers currently available in today's commercial boiler market. Providing additional distribution network piping to the Proposed Development will therefore result in decreased overall efficiencies (plant to service) of the heat supply systems serving both the Proposed Development and the Denton Estate. Connecting the Proposed Development to the existing network at Denton will therefore produce a net efficiency penalty to both the Proposed Development and the Denton Estate. Added to this, are the potential difficulties regarding pipework routeing through the Denton Estate and into the Proposed Development.

Camden Borough Council has confirmed that the Denton Estate has been earmarked for heating renewal in 2017/18, through the Council's Capital Works Programme. This programme will

[1] London Heat Map available: http://www.londonheatmap.org.uk/Mapping.

[2] CHP database published by DECC: http://chpdb.chpfocus.co.uk/reporting/index/viewtable/token/2.

replace the existing plant, with capacity potentially increased. Although this is encouraged, the programme of works for the Proposed Development (with completion scheduled for early 2017) does not align with those for the Capital Works Programme at the Denton Estate. It is therefore considered unviable to connect to this scheme at this point in time.

The constraints mentioned above are such that a district heating connection with Denton Estate is not further considered for the Proposed Development.

Kentish Town West

The Council has confirmed that the Kentish Town West area has been identified in a recently commissioned report as a key area for energy network growth. The Council also confirms it has received funding to carry out a feasibility study for an energy network in the Kentish Town West area, and that this report will be completed in the first half of 2015.

As discussed above, the Proposed Development is scheduled for completion in early 2017; it is therefore considered unviable to proceed with the Proposed Development on the basis of connection to a potential energy network in the Kentish Town West area.

In summary, it is not considered viable to connect the Proposed Development to third party heat generating plant/networks.

However in order to support the future roll-out of heat networks in the area, the building will be future-proofed in order to ensure it is possible to connect to a network when it becomes economically and technically feasible in the future. Future proofing will be ensured by providing a single plant room, with space being made available for appropriate equipment and infrastructure. Namely, capped-off valves shall be provided to facilitate the future connection to an external district heating system.

Please refer to Appendix C for the plant room layout.

On-site site-wide CHP opportunities

An on-site CHP option has been considered for the Proposed Development. A CHP unit, together with necessary ancillary equipment located in a plant room, was considered to supply the space heating and domestic hot water (DHW) demand of the building.

CHP systems offer optimum CO_2 and cost savings only when matched to the site's electricity and heat load profiles; a building with high heat and electricity demand means a CHP system with a high utilisation and makes a realistic contribution to the site's annual energy demands and CO_2 savings.

Table 7-1 shows estimated heat and DHW demand of the Proposed Development.

Table 7-1: Estimated Heat and DHW Demand

ESTIMATED SPACE HEATING AND DHW DEMAND		
Use	**Heating demand (MWh)**	**DHW demand (MWh)**
Proposed Development	68	116

In line with the GLA guidance on preparing energy assessments a development of this scale and nature is considered to be too small (less than 300 units) for an on-site CHP to be viable.

This was corroborated by our own high level CHP viability analysis for the Proposed Development, which concluded that the minimal DHW and space heating loads would not ensure the stable operation of any significantly sized CHP system. A CHP unit would not operate for the optimal number of hours during the year and therefore a CHP system is not proposed.

Furthermore, the Proposed Development's plant room areas are significantly constrained for incorporation of a CHP unit and necessary auxiliary equipment (See Appendix C).

Therefore, an on-site CHP unit is not considered appropriate for the Proposed Development.

Combined Cooling, Heat and Power (CCHP) technology

A CCHP system is a CHP system with the inclusion of absorption chillers (i.e. chillers driven by heat) to provide space cooling from the CHP waste heat recovery system. This can allow the CHP system to function effectively through the summer period when space heating requirements are low. However, absorption chillers require extensive heat rejection and can significantly increase capital costs compared to a CHP system. In addition, the cooling loads of the Proposed Development are minimal and hence the installation of a CCHP is not considered appropriate for the Proposed Development.

7.3 Proposed 'Be Clean' Scheme

Based on the feasibility analysis described previously, none of the 'Be Clean' opportunities were found feasible for the Proposed Development. However, the Proposed Development will incorporate a centralised system providing heating and DHW via community boilers, which will enable compatibility with a future DH network, should one become available.

8 BE GREEN - RENEWABLE ENERGY TECHNOLOGIES

In line with the planning policies, consideration has been given to the inclusion of renewable energy technologies within the Proposed Development.

The renewable energy technologies which have been found feasible for the Proposed Development, are included in the following section. Site specific analysis for those technologies not considered feasible is included in Appendix D. In summary, the main constraints associated are as follows:

- high levels of traffic resulting in high ambient noise constraining the use of natural ventilation via openable windows;
- the location of the application site in a dense urban environment with low average wind speed constraining the installation of wind turbines; and
- the location of the application site in an air quality management area for NO_2 and Particulate Matter PM_{10}, limiting the possibilities of utilisation of biomass technologies.

Photovoltaic (PV) Arrays

Photovoltaic (PV) Cell technology involves the conversion of the sun's energy into electricity. Photovoltaic panels can be discrete roof-mounted units.

The PV technology is regarded as a viable opportunity for the Proposed Development. Based on the shading analysis completed for the Proposed Development, a total PV area of circa 223 m^2 (circa 42 kW_p) can be incorporated on the roof of the building to contribute towards the emission reduction requirements set in the local and regional policies.

The proposed PV panels would generate circa 32.8 MWh annually and would allow approximately 17 tonnes of CO_2 annual reduction in regulated CO_2 emissions to be achieved; estimated over the 'Be Lean' scheme. This is equal to circa 27% reduction in CO_2 emissions.

Appendix E includes the proposed roof layout of the development. Further information will be provided as the development's Design Stages progress regarding the layout of the roof-mounted PV panels, spacing arrangements, panel orientation, and any visual impact on townscape views.

Air Source Heat Pump (ASHP) Systems

A heat pump is a device for transferring heat from a lower temperature heat source to a higher temperature heat sink. Air Source Heat Pump (ASHP) systems have been improved in their efficiency over recent years and now Coefficient of Performance (CoP) of 4 – 5.4 in heating mode is realistic.

Apart from their high efficiency, the main advantages of heat pumps are that they do not require gas supply, ventilation and flue arrangements and therefore the installation is straightforward.

ASHP systems are considered feasible and are proposed for the Proposed Development. ASHPs are proposed to serve the heating demand for the meeting room, lounge, foyer, reception, café/restaurant, activity room and staff room of the ground floor.

The ASHP unit is anticipated to also contribute to the space cooling required for the ground floor spaces of the Proposed Development.

Based on the modelling results, it is estimated that the proposed heat pump system under heating mode would deliver circa 16.7 MWh of equivalent renewable heat annually to the Proposed Development. This energy contribution does not include the delivered energy under

cooling mode operation as it is not taken into account by the EU Directive calculation method. This is equal to circa 2% reduction in CO_2 emissions over the 'Be Lean' scheme.

8.1 Proposed 'Be Green' Scheme

The 'Be Green' scheme includes the incorporation of PVs and ASHPs into the 'Be Lean' scheme. The CO_2 emissions savings achievable through the incorporation of the renewable energy technologies are circa 19 tonnes per annum, which correspond to a 30% reduction over the 'Be Lean' scheme.

In total, the results of the assessment show that a reduction in regulated CO_2 emissions of 21 tonnes per annum over the Building Regulations ADL A 2013 compliant baseline can be achieved, representing a 32% reduction.

A summary of the estimated CO_2 emissions associated with each stage of the Mayor's Energy Hierarchy and the percentage improvement over the 'Be Lean' scheme is shown in Table 8-1.

Table 8-1: Estimated Baseline, Be Lean, Be Clean and Be Green CO_2 Emissions

	CUMULATIVE ESTIMATED REGULATED CO_2 EMISSIONS				
Use	**Baseline (Tonnes CO_2/year)**	**'Be Lean' (Tonnes CO_2/year)**	**'Be Clean' (Tonnes CO_2/year)**	**'Be Green' (Tonnes CO_2/year)**	**Improvement over 'Be Lean'**
Proposed Development	65	63	63	44	30%

9 CONCLUSIONS

Whilst reducing energy consumption and associated CO_2 emissions to the atmosphere, the heating, cooling and electrical demands of the Proposed Development will be met.

From the analysis above, the following energy strategy has been identified for the Proposed Development:

- specification of energy efficiency and passive design measures, with associated savings in CO_2 emissions of 2 tonnes over the baseline scheme (regulated energy);
- incorporation of ASHP systems to supply the heat demand of the ground floor areas, with further CO_2 emissions savings of circa 2 tonnes; and
- installation of approximately 223 m^2 of PV arrays, which will generate circa 32.8 MWh of electricity annually, achieving a further reduction in CO_2 emissions of 17 tonnes.

In total, the proposed strategy would reduce the regulated CO_2 emissions of the Proposed Development by circa 32% over the baseline.

The proposed LZC technology (i.e. ASHPs and PVs) can reduce the CO_2 emissions of the new building by 30% over the 'Be Lean' scheme.

The potential CO_2 emissions savings achievable by the Proposed Development have been maximised via incorporation of passive design and energy efficiency measures. In addition, the application site's potential for installation of renewable technologies has been fully utilised. It is therefore concluded that the 35% target in *Policy 5.2* of The London Plan cannot feasibly or viably be met on-site.

In summary, the main site constraints are as follows:

- high levels of traffic resulting in high ambient noise constraining the use of natural ventilation via openable windows;
- the location of the application site in a dense urban environment with low average wind speed constraining the installation of wind turbines;
- the location of the application site in an air quality management area for NO_2 and Particulate Matter PM_{10}, limiting the possibilities of utilisation of biomass technologies;
- the distance of the nearby energy centres in combination with the small number of apartments of the Proposed Development precluding connection to potential existing DH networks; and
- the minimal DHW and space heating loads of the Proposed Development that would prevent an on-site CHP unit from operating for the optimal number of hours during a year, limiting viability.

Table 9-1 and Figure 9-1 present the estimated regulated and unregulated CO_2 emissions after each stage of the Mayor's Energy Hierarchy.

Table 9-1: Estimated Regulated and Unregulated CO_2 Emissions after Each Stage of the Mayor's Energy Hierarchy

ESTIMATED CO_2 EMISSIONS (TONNES PER ANNUM)		
Assessment	**Regulated CO_2 Emissions**	**Unregulated CO_2 Emissions**
Building Regulations ADL A 2013 Compliant Baseline	65	37
After energy demand reduction	63	37
After low carbon technology	63	37
After renewables	44	37

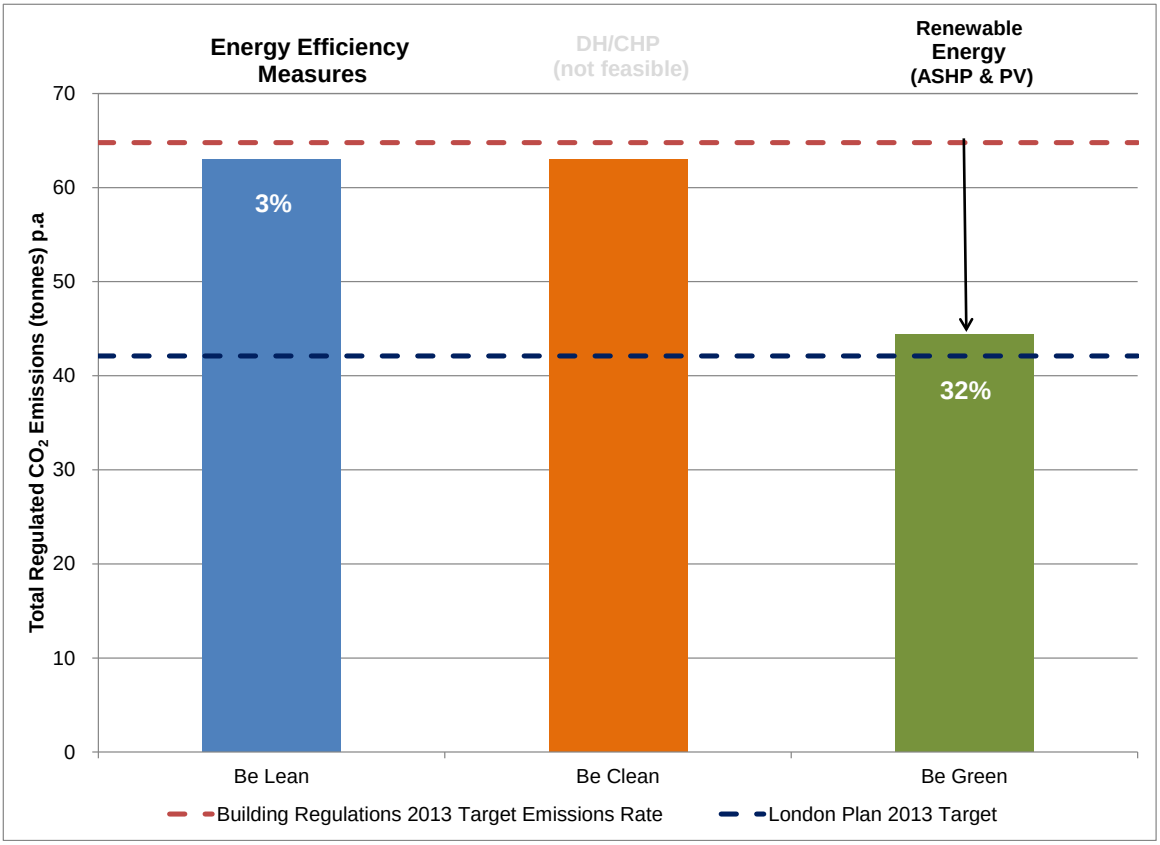

Figure 9-1: Summary of Estimated Site-wide Regulated CO_2 Reduction for Each Stage of the Mayor's Energy Hierarchy

Table 9-2 presents the summary of estimated regulated CO_2 savings achievable over the baseline for each stage of the Mayor's Energy Hierarchy.

Table 9-2: Estimated Regulated CO_2 Emission Savings from Each Stage of the Mayor's Energy Hierarchy

ESTIMATED REGULATED CO2 EMISSIONS SAVINGS		
Assessment	**Tonnes CO_2 Per Annum**	**(%)**
Savings from energy demand reduction (over Baseline)	2	3%
Savings from low carbon technology (CHP) (Over 'Be Lean')	0	0%
Savings from renewable technology (Over 'Be Clean')	19	30%
Total cumulative savings for the site (Over Baseline)	**21**	**32%**
Total Target Savings	23	35%
Annual Shortfall	2	-

The individual percentage savings shown in Table 9-2 and Figure 9-1 are a reduction from each stage of the Mayor's Energy Hierarchy. The total cumulative savings for the Proposed Development represent the total reduction over the baseline (21 tonnes of CO_2 savings against the baseline of 65 tonnes CO_2 per year equating to 32%).

APPENDIX A – ENERGY DEMAND ASSESSMENT

PROPOSED U-VALUES FOR THE PROPOSED DEVELOPMENT	
Element	**U-value (W/m^2K)**
Windows (Resi: g-value = 0.65) (Non-resi: g-value = 0.4)	1.40
Doors	1.00
Floors	0.12
External walls	0.18
Party walls (fully filled cavity)	0.00
Roofs	0.13

Output files included below:

- BRUKL after 'Be Lean'
- BRUKL after 'Be Green
- TER worksheet
- DER after 'Be Lean' worksheet
- DER after 'Be Green' worksheet

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Charlie Ratchford Extra Care

As designed

Date: Wed Jan 28 11:32:13 2015

Administrative information

Building Details

Address: Crogsland Road, London, NW1 8AY

Certification tool

Calculation engine: TAS

Calculation engine version: "v9.3"

Interface to calculation engine: TAS

Interface to calculation engine version: v9.3

BRUKL compliance check version: v5.2.b.1

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name: Antonino Saporito

Telephone number: 020 7798 5000

Address: 6-8 Greencoat Place, London, , London, SW1P 1PL

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

1.1	CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	18.3
1.2	Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	18.3
1.3	Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	17.6
1.4	Are emissions from the building less than or equal to the target?	BER =< TER
1.5	Are as built details the same as used in the BER calculations?	Separate submission

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

Values which do not meet standards in the 2013 Non-Domestic Building Services Compliance Guide are displayed in red.

2.a Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.18	0.18	External Wall
Floor	0.25	0.12	0.12	Ground Floor
Roof	0.25	0.13	0.13	Roof
Windows***, roof windows, and rooflights	2.2	1.48	1.57	Door window
Personnel doors	2.2	1.88	2.02	Door
Vehicle access & similar large doors	1.5	-	-	No vehicle doors in project
High usage entrance doors	3.5	-	-	No high usage entrance doors in project

$U_{a\text{-}Limit}$ = 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	3.38

2.b Building services

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

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

1- extract (3 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.5	-	-	-	-
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.

2- VRF with hot water heating (13 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.5	5.5	-	1.1	0.7
Standard value	0.91*	2.6	N/A	1.1	0.5
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.

3- VRF with hot water heating (restaurant)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.5	-	-	1.1	0.7
Standard value	0.91*	N/A	N/A	1.1	0.5
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.

4- upper floors (6 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	2.5	-	-	0.9	0.7
Standard value	0.91*	N/A	N/A	1.1	0.5
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- New DHW Circuit

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.95	0
Standard value	0.9*	N/A

* Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73.

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
shower	0.3	-	-	-	-	-	-	-	-	-	N/A
change	0.3	-	-	-	-	-	-	-	-	-	N/A
WC	0.3	-	-	-	-	-	-	-	-	-	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	
Plant	66	-	-	324
kitchen	-	66	-	481
shower	-	66	-	49
staff rest	-	66	-	120
chef desk lobby	-	66	-	21
store	66	-	-	12
corridor	-	66	-	52
laundry cupboard	66	-	-	11
change	-	66	-	23
electric	66	-	-	52
admin	66	-	-	232
meeting	66	-	-	294
Lounge	66	-	-	712
lobby g	-	66	-	44
WC	-	66	-	302
Foyer	-	66	60	410
Hair Therapy	66	-	-	256
Activity Room	66	-	-	380
north corridor	-	66	-	145
Lifts storage	66	-	-	112
Stairs storage	66	-	-	269
Store	66	-	-	90
DayCtr_Office 1	66	-	-	168
DayCtr_Plant refuse	66	-	-	223
restaurant	-	66	-	456
lobby 1	-	66	-	124
1 guest bed	-	66	-	148
lobby 2	-	66	-	124
lobby 3	-	66	-	124
lobby 4	-	66	-	124
lobby 5	-	66	-	124

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?
kitchen	NO (-86%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
staff rest	NO (-61%)	NO
chef desk lobby	N/A	N/A
corridor	N/A	N/A
admin	NO (-49%)	NO
meeting	NO (-21%)	NO
Lounge	NO (-65%)	NO
lobby g	NO (-55%)	NO
Foyer	NO (-95%)	NO
Hair Therapy	NO (-81%)	NO
Activity Room	NO (-36%)	NO
north corridor	N/A	N/A
DayCtr_Office 1	NO (-31%)	NO
restaurant	NO (-66%)	NO

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	1331	1331
External area [m²]	2470	2470
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	3	3
Average conductance [W/K]	998	1058
Average U-value [W/m²K]	0.4	0.43
Alpha value* [%]	20.83	20.83

* 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
	C1 Hotels
	C2 Residential Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
100	**D1 Non-residential Inst.: Community/Day Centre**
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others - Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	5.02	3.73
Cooling	3.84	5.78
Auxiliary	3.01	3.26
Lighting	9.58	10.11
Hot water	31.42	31.25
Equipment*	35.82	35.82
TOTAL**	**52.87**	**54.12**

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

Energy Production by Technology [kWh/m²]

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

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	121.43	113.11
Primary energy* [kWh/m²]	102.52	106.59
Total emissions [kg/m²]	17.6	18.3

* 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] LTHW boiler, [HFT] Electricity, [CFT] Electricity										
	Actual	78.3	0	9.2	0	2.6	2.38	0	2.5	0
	Notional	119.3	0	13.6	0	3.1	2.43	0	----	----
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Electricity, [CFT] Electricity										
	Actual	77.3	183.8	9	9.7	4.5	2.37	5.25	2.5	5.5
	Notional	60.2	189.9	6.9	14.7	3.8	2.43	3.6	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Electricity, [CFT] Electricity										
	Actual	42.4	0	5	0	5.2	2.37	0	2.5	0
	Notional	19.6	0	2.2	0	7.5	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 BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.18	External Wall
Floor	0.2	0.12	Ground Floor
Roof	0.15	0.13	Roof
Windows, roof windows, and rooflights	1.5	1.44	lounge east
Personnel doors	1.5	1.46	indoor 4
Vehicle access & similar large doors	1.5	-	No vehicle doors in project
High usage entrance doors	1.5	-	No high usage entrance doors in project

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

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

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	3.38

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Charlie Ratchford Extra Care

As designed

Date: Wed Jan 28 13:22:23 2015

Administrative information

Building Details

Address: Crogsland Road, London, NW1 8AY

Certification tool

Calculation engine: TAS

Calculation engine version: "v9.3"

Interface to calculation engine: TAS

Interface to calculation engine version: v9.3

BRUKL compliance check version: v5.2.b.1

Owner Details

Name:

Telephone number:

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Certifier details

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

1.1	CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	18.3
1.2	Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	18.3
1.3	Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	13.2
1.4	Are emissions from the building less than or equal to the target?	BER =< TER
1.5	Are as built details the same as used in the BER calculations?	Separate submission

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

Values which do not meet standards in the 2013 Non-Domestic Building Services Compliance Guide are displayed in red.

2.a Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.18	0.18	External Wall
Floor	0.25	0.12	0.12	Ground Floor
Roof	0.25	0.13	0.13	Roof
Windows***, roof windows, and rooflights	2.2	1.48	1.57	Door window
Personnel doors	2.2	1.88	2.02	Door
Vehicle access & similar large doors	1.5	-	-	No vehicle doors in project
High usage entrance doors	3.5	-	-	No high usage entrance doors in project

$U_{a\text{-}Limit}$ = 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	3.38

2.b Building services

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

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

1- extract (3 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.5	-	-	-	-
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.

2- VRF with hot water heating (13 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.5	5.5	-	1.1	0.7
Standard value	0.91*	2.6	N/A	1.1	0.5
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.

3- VRF with hot water heating (restaurant)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.5	-	-	1.1	0.7
Standard value	0.91*	N/A	N/A	1.1	0.5
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.

4- upper floors (6 Zones)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.5	-	-	0.9	0.7
Standard value	0.91*	N/A	N/A	1.1	0.5
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- New DHW Circuit

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.95	0
Standard value	0.9*	N/A

* Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73.

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
shower	0.3	-	-	-	-	-	-	-	-	-	N/A
change	0.3	-	-	-	-	-	-	-	-	-	N/A
WC	0.3	-	-	-	-	-	-	-	-	-	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	
Plant	66	-	-	324
kitchen	-	66	-	481
shower	-	66	-	49
staff rest	-	66	-	120
chef desk lobby	-	66	-	21
store	66	-	-	12
corridor	-	66	-	52
laundry cupboard	66	-	-	11
change	-	66	-	23
electric	66	-	-	52
admin	66	-	-	232
meeting	66	-	-	294
Lounge	66	-	-	712
lobby g	-	66	-	44
WC	-	66	-	302
Foyer	-	66	60	410
Hair Therapy	66	-	-	256
Activity Room	66	-	-	380
north corridor	-	66	-	145
Lifts storage	66	-	-	112
Stairs storage	66	-	-	269
Store	66	-	-	90
DayCtr_Office 1	66	-	-	168
DayCtr_Plant refuse	66	-	-	223
restaurant	-	66	-	456
lobby 1	-	66	-	124
1 guest bed	-	66	-	148
lobby 2	-	66	-	124
lobby 3	-	66	-	124
lobby 4	-	66	-	124
lobby 5	-	66	-	124

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?
kitchen	NO (-86%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
staff rest	NO (-61%)	NO
chef desk lobby	N/A	N/A
corridor	N/A	N/A
admin	NO (-49%)	NO
meeting	NO (-21%)	NO
Lounge	NO (-65%)	NO
lobby g	NO (-55%)	NO
Foyer	NO (-95%)	NO
Hair Therapy	NO (-81%)	NO
Activity Room	NO (-36%)	NO
north corridor	N/A	N/A
DayCtr_Office 1	NO (-31%)	NO
restaurant	NO (-66%)	NO

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	1331	1331
External area [m²]	2465	2465
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	3	3
Average conductance [W/K]	986	1057
Average U-value [W/m²K]	0.4	0.43
Alpha value* [%]	20.87	20.87

* 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
	C1 Hotels
	C2 Residential Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
100	**D1 Non-residential Inst.: Community/Day Centre**
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others - Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	2.79	3.73
Cooling	3.84	5.78
Auxiliary	3.01	3.26
Lighting	9.58	10.11
Hot water	31.42	31.25
Equipment*	35.82	35.82
TOTAL**	**50.64**	**54.12**

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

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	6.32	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]	121.43	113.11
Primary energy* [kWh/m²]	95.84	106.59
Total emissions [kg/m²]	13.2	18.3

* 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] LTHW boiler, [HFT] Electricity, [CFT] Electricity										
	Actual	78.3	0	5.1	0	2.6	4.27	0	4.5	0
	Notional	119.3	0	13.6	0	3.1	2.43	0	----	----
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Electricity, [CFT] Electricity										
	Actual	77.3	183.8	5	9.7	4.5	4.27	5.25	4.5	5.5
	Notional	60.2	189.9	6.9	14.7	3.8	2.43	3.6	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Electricity, [CFT] Electricity										
	Actual	42.4	0	2.8	0	5.2	4.27	0	4.5	0
	Notional	19.6	0	2.2	0	7.5	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 BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.18	External Wall
Floor	0.2	0.12	Ground Floor
Roof	0.15	0.13	Roof
Windows, roof windows, and rooflights	1.5	1.44	lounge east
Personnel doors	1.5	1.46	indoor 4
Vehicle access & similar large doors	1.5	-	No vehicle doors in project
High usage entrance doors	1.5	-	No high usage entrance doors in project

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

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

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	3.38