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Energy & Sustainability Report

553 Oxford Road, Reading, RG30 1HJ

20th August 2018

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We are an industry leader in delivering a professional, accredited and certified service to a wide range of clients including architects, developers, builders, housing associations, the public sector and private householders.

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MES Building Solutions maintains its position at the forefront of changes in planning, building regulations and neighbourly matters, as well as technological advances. Our clients, large or small are therefore assured of a cost effective, cohesive and fully integrated professional service.

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Section 1: Introduction

1.1 Executive Summary

To ensure compliance with Reading Borough Council 2008 (revised January 2015) Core Strategy a number of sustainable construction strategies will be incorporated in the design and construction of the development. These will include, amongst others, minimum standards relating to energy and water use which will reduce the developments environmental impact over its lifetime which assists in ensuring a sustainable development for both current and future users.

To ensure compliance with Reading Borough Council 2008 (revised January 2015) Core Strategy Policy CS1 and CS2 the energy strategy proposed for the development at 553 Oxford Road follows the energy hierarchy and promotes a 'fabric first' approach. This ensures an energy efficient building that is not totally reliant on renewable generation to achieve a reduction in emissions. This approach results in an overall reduction in emissions (when compared to a Building Regulations baseline) of 23%. The recommended LZC strategy specifies a total of 7.0kWp of solar PV on the main roof.

Table 1.a shows the reduction in tonnes of CO₂ and kWh per year through the recommended fabric improvements, energy efficiency measures and LZC technologies.

Table 1a: Anticipated contribution from renewables		
	kWh per year	Tonnes CO ₂ per year
Total 'Building Regulations' annual figures	58,040	13.42
Total baseline 'be lean, be clean' annual figures	55,309	13.41
Contribution from renewables	6,046	3.14
Resulting figures including renewable contribution	49,263	10.27
Reduction from renewables contribution	10.93%	23.42% (Policy CS1 target = 20%)
Total reduction over Part L 2013 TER	15.12%	23.47% (Planning target 10%)

The proposed strategy offsets a total of 3.15 tonnes CO₂ per year, a reduction of 23%. The proposal reduces the energy demand by 15% which ensures a sustainable development for now and the future.

1.2 Introduction

The purpose of this report is to provide an overview of how energy and sustainability will be promoted both during and after construction and to establish the predicted energy requirements for the proposed development 553 Oxford Road. It illustrates how energy efficiency measures, in conjunction with renewable generation, can be used to reduce the predicted energy consumption and associated carbon dioxide emissions.

The report is produced to accompany the detailed planning application to fulfil the current requirements of Reading Borough Council.

In line with the favoured approach of Reading Borough Council we will calculate the total energy requirement for the development and show how the energy hierarchy will be used to reduce energy demand and CO₂ emissions from the development.

We will demonstrate how the residential development will achieve at least a combined 10.0% reduction in energy demand when compared to building regulations, which includes a minimum 20% contribution from LZC technology.

Notwithstanding the recent government withdrawal of the mandatory application of the Code for Sustainable Homes, this report includes details of how the design team will address wider aspects of sustainability in order to target delivery of a high standard building.

A number of wider sustainability issues are addressed such as materials choice, health and wellbeing, water consumption and transport etc. with proposals intended to reduce the overall environmental impact and maximise the sustainability of the development throughout its lifecycle.

Planning Policy

Reading Core Strategy Policy CS1- Sustainable Construction and Design

Proposals for new development, including the construction of new buildings and the redevelopment and refurbishment of existing building stock, will be acceptable where the design of buildings and site layouts use energy, water, minerals, materials and other natural resources appropriately, efficiently and with care and take account of the effects of climate change.

To meet these requirements:

- All new housing is required to meet the most up to date Eco-Homes 'Very Good' as a minimum standard, and all new commercial developments are required to meet the most up to date BREEAM 'Very Good' as a minimum standard;
- On larger developments of more than 10 dwellings or 1,000 m² of floor space, ensure that 50% of the provision meets the most up to date Eco-Homes and BREEAM 'Excellent' standards;
- All new developments maximise the use of energy efficiency and energy conservation measures in their design, layout and orientation to reduce overall energy demand;
- All developments of more than 10 dwellings or 1000m² floor space incorporate on-site generation of energy from renewable sources and energy efficient design measures (including the use of CHP where appropriate) to off-set at least 20% of predicted carbon dioxide emissions from the estimated energy usage of the completed and occupied development;
- All developments reduce mains water use and demonstrate that water conservation measures are incorporated so that predicted per capita consumption does not exceed the appropriate levels set out in the Code for Sustainable Homes or BREEAM Standards
- Developments incorporate sustainable urban drainage facilities and techniques as part of the layout of a development as appropriate and as advised by the Environment Agency, including minimising the size of impermeable areas so that peak run-off and annual water run-off is reduced where possible and in any case is no greater than the original conditions of the site. Particular care will be needed in areas of flood risk where different solutions may be required.

Reading Core Strategy Policy CS2 – Waste Minimisation

Development should demonstrate measures to minimise the generation of waste in the construction, use and life of buildings and promote more sustainable approaches to waste management, including the reuse and recycling of construction waste and the promotion of layouts and designs that provide adequate space to facilitate waste storage, reuse, recycling and composting.

Reading Sites and Detailed Policies (Oct 2012) DM1 – Adaptation to Climate Change

All developments will demonstrate how they have been designed to incorporate measures to adapt to climate change. The following measures shall be incorporated into development:

- New buildings shall be orientated to maximise the opportunities for both natural heating and ventilation and reducing exposure to wind and other elements;
- Proposals involving both new and existing buildings shall demonstrate how they have been designed to maximise resistance and resilience to climate change for example by including measures such as solar shading, heating and ventilation of the building and appropriately coloured materials in areas exposed to direct sunlight, green and brown roofs, etc;
- Use of trees and other planting, where appropriate as part of a landscape scheme, to provide shading of amenity areas, buildings and streets, designed with plants that are carefully selected, managed and adaptable to meet the predicted changed climatic conditions; and
- All development shall minimise the impact of surface water runoff from the development in the design of the drainage system.

Reading Sites and Detailed Policies (Oct 2012) DM2 – Decentralised Energy

In meeting the most up to date Ecohomes (including Code for Sustainable Homes for new build residential) or BREEAM standard, developments of the sizes set out below shall demonstrate how consideration has been given to securing energy for the development from a decentralised energy source, including CHP.

Any development of more than 20 dwellings and/ or non-residential development of over 1,000 sq m shall consider the inclusion of a CHP plant, or biomass-fuelled heating scheme, or other form of decentralised energy provision, within the site, unless it can be demonstrated that the scheme is not suitable or feasible for this form of energy provision.

Where there is existing decentralised energy provision, including a CHP plant or a district energy network present within the vicinity of an application site, further developments of over 10 dwellings or non-residential development of 1,000 sq m will be expected to link into the existing decentralised energy network or demonstrate why this is not feasible.

Reading Revised Sustainable Design and Construction SPD (July 2011)

	Size of development	Required Level of which standard
New build residential development (including flats)	Minor	CfSH Level 3
	Larger developments of more than 10 dwellings	Minimum 50% CfSH Level 4 and remainder with CfSH Level 3
Creation of new residential units through conversion and/ or major refurbishment of residential buildings	Minor	BREEAM (EcoHomes) level 'Very Good'.
	Larger developments of more than 1,000sqm non-residential floorspace	Minimum 50% BREEAM (EcoHomes) level 'Excellent' and remainder BREEAM level 'Very Good'.
Non-residential development	Minor	BREEAM level 'Very Good'.
	Larger developments of more than 1,000sqm non-residential floorspace	Minimum 50% BREEAM level 'Excellent' and remainder BREEAM level 'Very Good'.
Non-residential refurbishment	Minor	BREEAM level 'Very Good'.
	Larger developments of more than 1,000sqm non-residential floorspace.	Minimum 50% BREEAM level 'Excellent' and remainder BREEAM level 'Very Good'.

Table 1b: Reading Borough Council requirement checklist

Section 2: Description of development

2.1 Location

The application site is located on the junction of the A329, Oxford Road and Wilson Road in the centre of Reading. There is currently an existing brick built church and associated car park on the development site which is scheduled to be demolished and replaced with the proposed scheme.

The surrounding area is a mix of both commercial and residential properties. The area directly around the A329 would appear to have been traditionally residential in nature, however a number of refurbishments have created a section of light retail use.

2.2 Details of proposal

The application is for the proposed demolition of existing church and erection of a mixed-use development comprising 10 No. residential dwellings and 350m² (NIA) community floor space together with associated parking and landscaping.

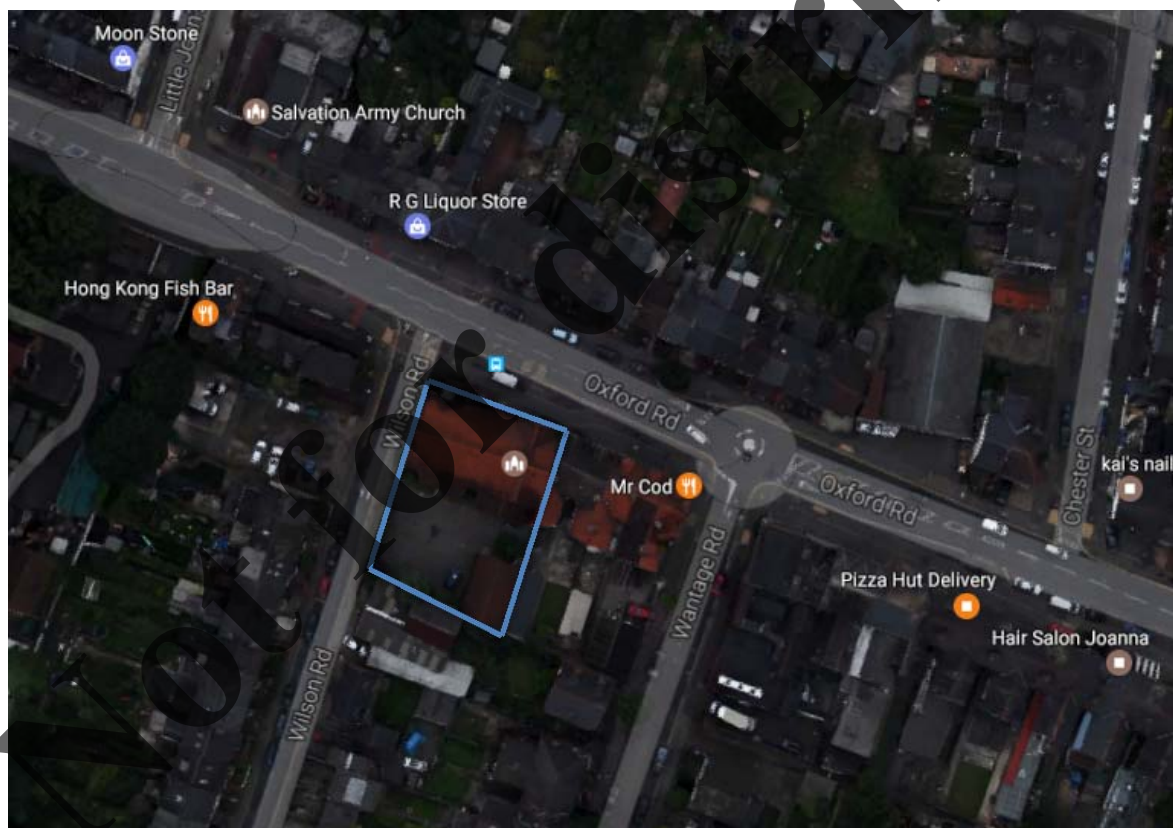


Figure 2.1: Proposed location plan (Google 2017)

Section 3: Energy

3.1 The Energy Hierarchy

In order to address climate change mitigation and adaptation and more specifically to address energy efficiency and the need to target 10% renewable energy provision the design team have adopted the energy hierarchy. The energy hierarchy is generally accepted as the most effective way of reducing a building's carbon emissions.

Development proposals should:

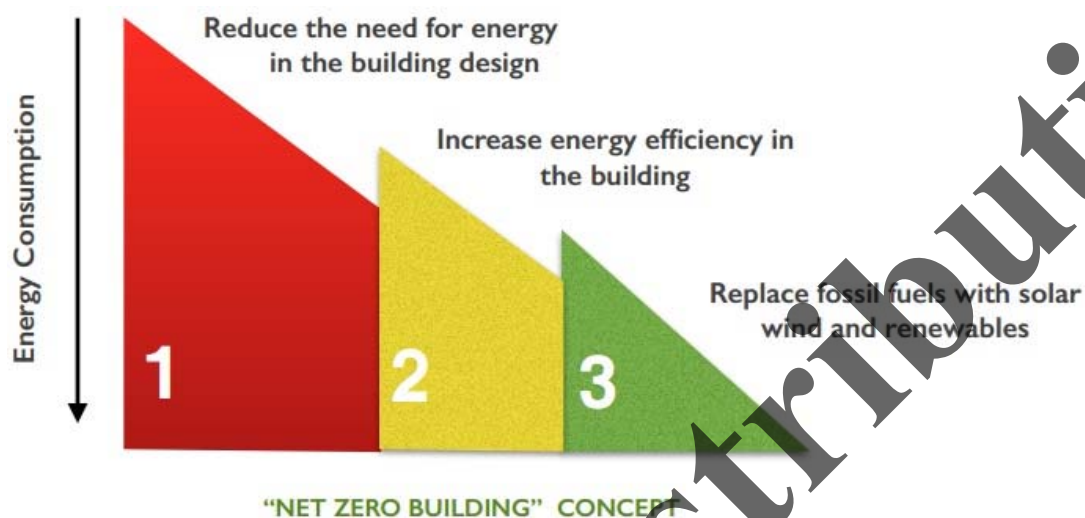


Figure 3.1: The Energy Hierarchy

- **Reducing energy demand**

The first step in the process of reducing the overall energy used and CO₂ produced by the building is to minimise the energy required to heat it. A well-insulated building envelope and passive design will reduce the energy requirement for heating and ventilating the building.

- **Energy efficient systems and appliances**

The second step is to specify services and controls, lighting and appliances that are energy efficient and which result in further reduction in energy requirements.

- **Making use of Low or zero-carbon (LZC) technologies**

When the energy demand has been reduced by implementing the processes of improving the fabric and energy efficiency, then LZC technologies can be employed to reduce the environmental impact of the remaining energy consumption.

3.2 Calculating Baseline Energy Demand

Energy used in a building is divided between that which is regulated (Heating, Cooling, Hot water, Ventilation & Lighting) and that which is said to be unregulated and associated with the building in use (Equipment and Appliances).

3a: Unregulated Energy Use and Emissions	
Emissions (Tonnes CO₂ per year)	13.6
Energy (kWh per year)	30,882

The first step is to calculate a Building Regulations Part L 2013 minimum standards compliant specification in order to establish baseline emissions for the development.

As the residential development will be required to achieve a 19% improvement on 50% of the units and a 0% improvement on the remaining 50% over 2013 Building Regulations, our proposed approach is to achieve 10% reduction across all residential units. Baseline figures are calculated using the most appropriate SAP model and indicative design stage SAP calculations have been undertaken on the government approved SAP2012 software and the 'notional building' (used to calculate the target emission rate or TER) has been used to establish baseline energy requirements which comply with the 2013 edition of Approver Document L1A.

The M&E requirements for the ground floor community space are dealt with separately in section 3.7.

3b: Residential baseline specification	
Element	New Build Specification
Walls	0.24-0.25W/m ² K
Roof	0.12W/m ² K
Heat loss Floors	0.20W/m ² K
Openings	1.40W/m ² K
Windows	1.60W/m ² K
Air Permeability	4.5m ³ /m ² /hr
Ventilation	Decentralised mechanical extract
Thermal Bridging	Calculated with accredited details
Lighting	100% low energy lamps
Space Heating	Vaillant ecoTEC pro 24 gas combi boiler
Heating Controls	Time & temp zone control with delayed start stat
DHW	Via main boiler
Secondary Heating	None

3c: Baseline Emissions- 553 Oxford Road										
House Type	Multiplier	Carbon Emissions (tonnes CO ₂ per year)								Total Emissions (tonnes CO ₂ per year)
		Space Heating (1) SAP (261)	Space Heating (2) SAP (262)	Secondary Heating SAP (263)	Water Heating SAP (264)	Space Cooling SAP (266)	Pumps & Fans SAP (267)	Lighting SAP (268)	Additional Allowable Generation	
MF	5	3.33	0.00	0.00	2.06	0.00	0.44	0.82	0.00	6.64
TF	5	3.45	0.00	0.00	2.06	0.00	0.44	0.82	0.00	6.77
Total:	10	6.78	0.00	0.00	4.12	0.00	0.88	1.63	0.00	13.41
Total:										13.41

3d: Total annual baseline residential emissions & energy- 553 Oxford Road	
Emissions	13.41 Tonnes of CO₂
Energy	55,309

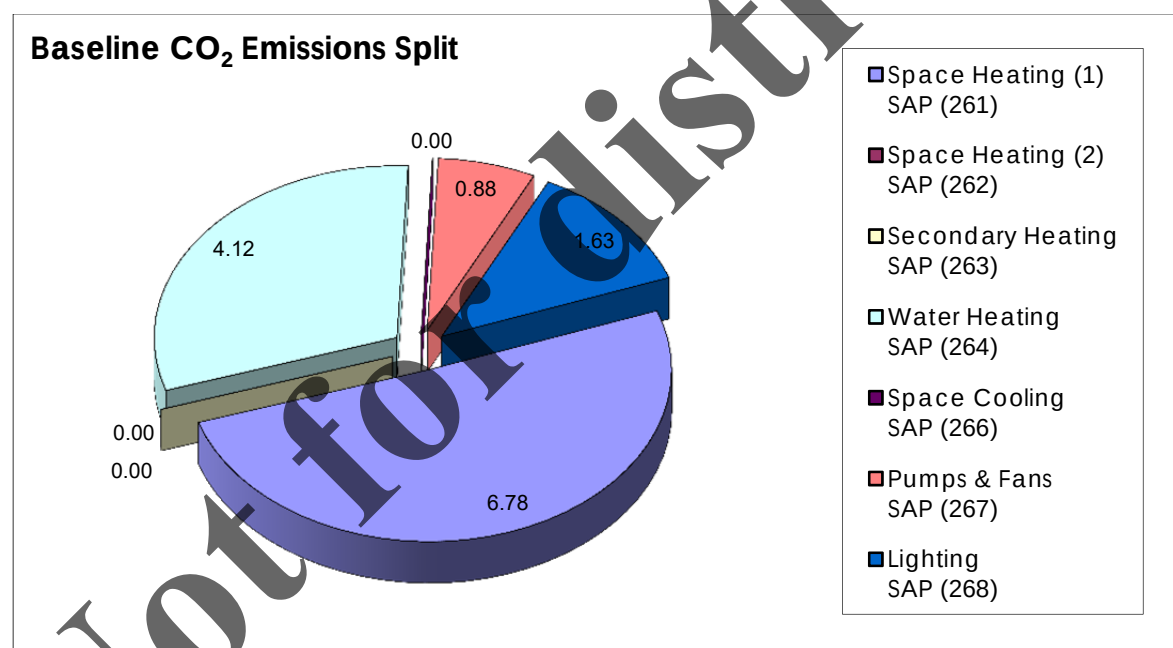


Figure 3.2: Estimated baseline carbon dioxide emissions (tonnes CO₂ per year) split.

Figure 3.2 shows how the CO₂ emissions are split between individual energy end uses.

3.3 Energy Efficiency Measures (Be lean & Be Clean)

The first two steps of the energy hierarchy require the reduction of energy consumption in the building through improvements to its fabric and by maximising the efficiency of the building services; to be 'lean'. This reduces the energy demand to run the building and thus the emissions associated with that energy use. The new 2013 Part L1A is already very stringent in terms of minimum fabric and mechanical services performance targets, but further improvements are possible by considering the following steps:

- Reduce elemental U-Values
- Reducing heat loss through uncontrolled ventilation (air leakage)
- Increased control of necessary ventilation
- Improving mechanical & electrical system efficiency

By implementing the steps outlined, residential emissions could be reduced further when compared to a Part L1A compliant baseline.

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3.4 CO₂ reduction through the use of renewable or low carbon technology (Be green)

Reading Core Strategy Policy CS1 aims to promote and secure greater use of decentralised and renewable or low-carbon energy in new development. A minimum target of 20% renewable energy provision on developments of more than 10 dwellings or 1,000m² should be secured.

Readings Core Strategy Policy CS1- Sustainable Construction and Design states that:

- All developments of more than 10 dwellings or 1000m² floorspace incorporate on-site generation of energy from renewable sources and energy efficient design measures (including the use of CHP where appropriate) to off-set at least 20% of predicted carbon dioxide emissions from the estimated energy usage of the completed and occupied development

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3e: Target contribution from renewables	
Total 'baseline' CO ₂ emissions for all units (Tonnes CO ₂ per year)	13.42
Target for on-site energy generation to achieve a 20% reduction in CO ₂ emissions (Tonnes CO ₂ per year)	10.74
Total 'building regulations compliant' CO ₂ emissions for all units (Tonnes CO ₂ per year)	16.90
Target for on-site energy generation to achieve a 10% improvement over building regulations	15.21

The renewable strategy proposed for the residential element is for installation of 7.0kWp of PV laid to a 30 degree pitch, orientated south, on the flat roof areas. An array of this size will generate a combined 6,045 kWh of electricity per year and offsets a total of 3.14 tonnes CO₂.

Based on a 250 watt PV panel, 28 panels would be required in total, assuming a south orientation. An array of this size would require approximately 45m² of roof area.

This would be reduced to 24 panels if 300W panels were used.

3f: Be Lean, be Clean & be Green Emissions- 553 Oxford Road										
House Type	Multiplier	Carbon Emissions (tonnes CO ₂ per year)								Total Emissions (tonnes CO ₂ per year)
		Space Heating (1) SAP (261)	Space Heating (2) SAP (262)	Secondary Heating SAP (263)	Water Heating SAP (264)	Space Cooling SAP (266)	Pumps & Fans SAP (267)	Lighting SAP (268)	Additional Allowable Generation	
MF	5	3.33	0.00	0.00	2.06	0.00	0.44	0.82	-1.57	5.08
TF	5	3.45	0.00	0.00	2.06	0.00	0.44	0.82	-1.57	5.20
Total:	10	6.78	0.00	0.00	4.12	0.00	0.88	1.63	-3.14	10.27
Total:										10.27

3g: Total Annual Be Lean, be Clean & be Green Emissions & Energy	
Emissions	10.27 Tonnes of CO₂
Energy	49,263 kWh

Table 3h: Anticipated contribution from renewables		
	kWh per year	Tonnes CO ₂ per year
Total 'Building Regulations' annual figures	58,040	13.42
Total baseline 'be lean, be clean' annual figures	55,309	13.41
Contribution from renewables	6,046	3.14
Resulting figures including renewable contribution	49,263	10.27
Reduction from renewables contribution	10.93%	23.42% (Policy CS1 target = 20%)
Total reduction over Part L 2013 TER	15.12%	23.47% (Planning target 10%)

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The approach we are proposing for the properties generates 23% of the energy demand onsite. We feel this strategy of 'fabric first' is a more holistic method of achieving the required result, whilst producing more sustainable buildings.

As can be seen in Figure 3.3, the approach recommended exceeds the required 20% in on-site energy generation whilst also reducing the CO₂ emissions by 23.47% overall which equates to a reduction of 3.15 tonnes of CO₂ produced per year.

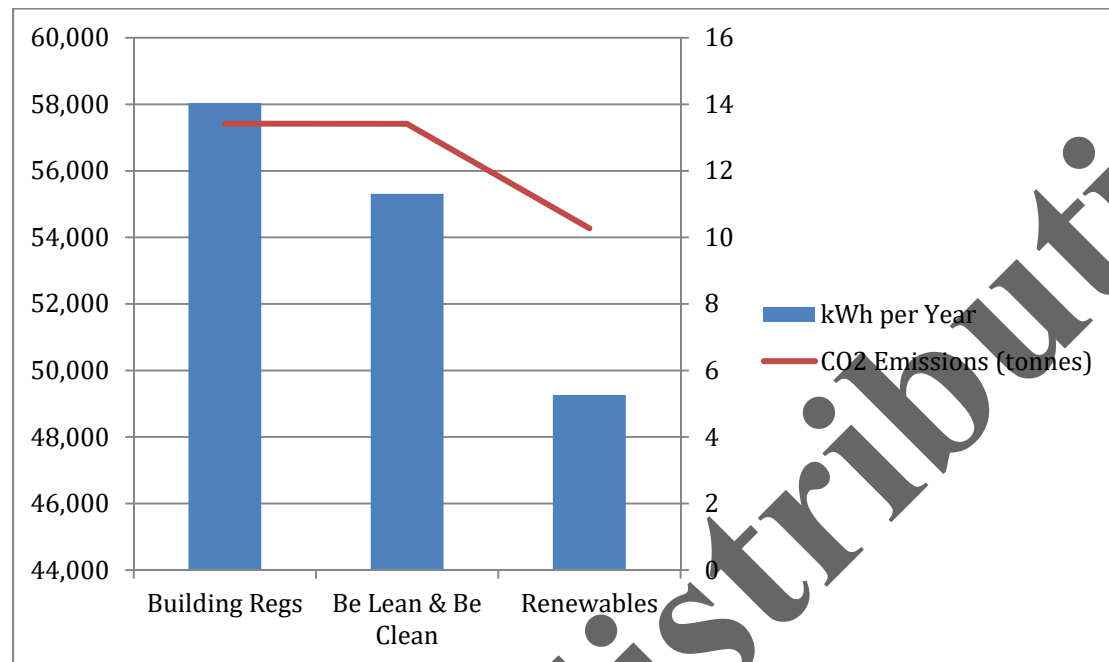


Figure 3.3: CO₂ emissions for each stage of the assessment

Energy resources accepted as renewable or low carbon technologies are defined by the Department of Energy & Climate Change Low Carbon Buildings Program as:

- Solar photovoltaics
- Wind turbines
- Small hydro
- Solar thermal hot water
- Ground source heat pumps
- Air source heat pumps
- Bio-energy
- Renewable CHP
- Micro CHP (Combined heat and power)

Solar Photovoltaics

Solar panel electricity systems, also known as solar photovoltaics (PV), capture the sun's energy using photovoltaic cells. These cells do not need direct sunlight to work – they can still generate some electricity on a cloudy day. The cells convert the sunlight into electricity, which can be used to run household appliances and lighting.



This is the chosen renewable technology on the site.

Wind Turbines

Wind turbines harness the power of the wind and use it to generate electricity. Forty percent of all the wind energy in Europe blows over the UK, making it an ideal country for domestic turbines. Suburban sites such as the location of this development can be considered for wind turbine installations. There are, however, possible issues with noise and 'flicker' for the neighbouring buildings which will need to be evaluated.

The NOABL wind resource database for the site location records average wind speeds as shown in Table 3n below. The British Wind Energy Association (BWEA) generally recommends an average wind speed of at least 7m/s for viable system performance.



Table 3i: Average wind speeds for the site

45m above ground level	5.9m/s
25m above ground level	5.4m/s
10m above ground level	4.7m/s

Due to low wind speeds we cannot recommend wind turbines as a viable option for this development. There are also general issues surrounding the use of building mounted turbines with the potential for excessive noise and vibration within the buildings should this approach be considered.

Small Hydro Generation

Hydroelectricity generation uses running water to generate electricity, whether it is a small stream or a larger river. All streams and rivers flow downhill. Before the water flows down the hill, it has potential energy because of its height. Hydro power systems convert this potential energy into kinetic energy in a turbine, which drives a generator to produce electricity. Small, or 'micro' hydro generation requires a reliable source of flowing water with a reasonably constant flow velocity. Systems of this nature are normally installed in locations with a natural moving water source such as a river, stream or spring where part of the flow can be diverted through a generator.



There is no such source of flowing water on this site small hydro generation is not an option for this development.

Solar Water heating



Solar water heating systems use free heat from the sun to warm domestic hot water. Solar hot water heating can generate a large proportion of a dwelling's annual DHW requirement. The displaced fuel would be mains gas meaning that the CO₂ savings of this type of system would be relatively low due to the low carbon intensity of the displaced fuel.

Consequently, solar thermal is not considered to be a suitable system for this development and the roof space would be better used for PV as it offsets electricity meaning the CO₂ saving is considerably more than solar thermal.

Heat Pumps

Heat pumps use similar technology as refrigerators but reversed. A refrigerant liquid is used as a medium to extract heat from a source and convert it into useful heat energy. The heat source used can be generally one of three types; the ground, the air or a body of water.



Both ground and water sourced heat pumps use a long circuitous pipe through which a refrigerant is pumped. In ground sourced heat pumps this can be either a coiled pipe or 'slinky' that is buried in a series of horizontal trenches or a loop inside a vertical bore hole to depths that can be up to 200m or deeper. Water sourced heat pumps generally use a similar system to the 'slinky' used for ground sourced systems but either floated on or submerged in a body of water (either a large pool or running water source). Air source heat pumps have a refrigerant coil mounted outside the building through which is passed air so that heat can be extracted. All three types of heat pump generally use the collected heat from the source to heat water. The heated water can then be used for space heating and DHW. Heat pumps require an input of energy to drive pumps, this is usually electricity and so they cannot be considered to be zero carbon unless the supplied electricity is from renewable sources; they do however have very good efficiencies; energy produced by heat pumps is typically in the region of 2.5 times that which is required to run them, giving efficiencies of 250%.

Because the 'fuel' for heat pumps is usually grid supplied electricity there is not necessarily any substantial reduction in carbon emissions when compared to an efficient gas condensing heating system where gas is available on site. We have also considered where the heat pumps would need to be sited, and feel that placing them on the exterior face of the building would be problematic from a maintenance point of view and placing them on the roof of the building, would cause efficiency losses which make this technology impractical.

Bio Energy

The Low Carbon Buildings Program (LCBP) defines biomass as follows:

“Biomass is often called 'bioenergy' or 'biofuels'. These biofuels are produced from organic materials, either directly from plants or indirectly from industrial, commercial, domestic or agricultural products. Biofuels fall into two main categories:

- Woody biomass includes forest products, untreated wood products, energy crops, short rotation coppice (SRC), e.g. willow.*
- Non-woody biomass includes animal waste, industrial and biodegradable municipal products from food processing and high energy crops, e.g. rape, sugar cane, maize.”*

For small-scale domestic [and small scale commercial] applications of biomass the fuel usually takes the form of wood pellets, wood chips and logs. The LCBP goes on to state:

“There are two main ways of using biomass to heat a domestic property:

- Stand-alone stoves providing space heating for a single room. These can be fuelled by logs or pellets but only pellets are suitable for automatic feed. Generally they are 5-11 kW in output, and some models can be fitted with a back boiler to provide water heating.*
- Boilers connected to central heating and hot water systems. These are suitable for pellets, logs or chips, and are generally larger than 15 kW”*

(<http://www.lowcarbonbuildings.org.uk/micro/biomass>)

This technology is dismissed as the space requirements needed for the boiler and pellet store make this impractical along with complying with the clean air zone requirements.



3.5 Commercial assessment

The application includes an element of commercial space in the form of a 350m² unit on the ground floor. Full SBEM calculations have been undertaken to determine both the carbon emissions and energy requirement from this space. The full results of these calculations can be found in the appendix with a summary in Table 3i, below.

Table 3j: Annual commercial energy use & emissions		
	Energy (kWh/m ²)	Emissions (kgCO ₂ /m ²)
Non-residential space	114.92	20.1

The above results are based on the limited fabric and services specification that has been provided for the purpose of this application.

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Section 4: Sustainability

Reading Sites and Detailed Policies (Oct 2012) DM1 – Adaptation to Climate Change requires that:

All developments will demonstrate how they have been designed to incorporate measures to adapt to climate change. The following measures shall be incorporated into development:

- New buildings shall be orientated to maximise the opportunities for both natural heating and ventilation and reducing exposure to wind and other elements;
- Proposals involving both new and existing buildings shall demonstrate how they have been designed to maximise resistance and resilience to climate change for example by including measures such as solar shading, heating and ventilation of the building and appropriately coloured materials in areas exposed to direct sunlight, green and brown roofs, etc;
- Use of trees and other planting, where appropriate as part of a landscape scheme, to provide shading of amenity areas, buildings and streets, designed with plants that are carefully selected, managed and adaptable to meet the predicted changed climatic conditions; and
- All development shall minimise the impact of surface water runoff from the development in the design of the drainage system.

The non-residential element of the proposed scheme, including corridors and circulation space accounts for 29% of the approximately 1,200m² GIA. The commercial area will be completed by the final tenant, who will also be responsible for the fit-out specification. This will include specification and provision of fabric elements such as glazing to the public façade along with services and internal partitions and finishing.

A BREEAM assessment of the commercial space has been undertaken with the rating of 'Very Good' being achieved as required by Reading Revised Sustainable Design and Construction SPD (July 2011), the full assessment can be found in a separate BREEAM Pre-assessment document.

4.1 Management

Sustainability Objective:

To use sustainable construction methods and encourage best practice in building delivery.

Consultation between the stakeholders, including the architect, client and local authority has ensured that all key design needs have been met.

Best practice will be used during construction so as to reduce the impact of works on the surrounding environment and a commitment will be made to register the site with the Considerate Contractors Scheme.

The construction site will be managed so as to reduce resource use, energy for site operations, water consumption, waste and pollution.

A system of monitoring, target setting and reporting will be put in place to ensure standards are met.

A system of commissioning will be instigated by the design team to ensure that all installed M&E plant is fully commissioned on installation and that this is followed up by further seasonal commissioning of heating and cooling systems for at least the first 12 months after completion.

Home and building user guides will be provided to building end users if requested to ensure they are provided with adequate information to enable effective use of the building and its systems. These will be tailored for both building managers and occupiers to ensure all building users fully understand the buildings operation so as to encourage efficient use. A programme of aftercare support will be implemented upon handover.

4.2 Health & Wellbeing

Sustainability Objective:

To provide comfortable working and living spaces that promotes a healthy environment and which is adaptable to changing needs.

Health and wellbeing considers the environment provided for building users and how this promotes healthy happy lives.

Both the residential apartments and commercial space are designed and orientated wherever possible in such a way as to provide natural daylight, sunlight and external views to occupied spaces thus adding to the internal environment.

Finishing elements will be chosen which do not contain harmful chemicals such as VOCs and formaldehyde.

Every practical effort will be made to minimise sound transmission both from the external environment and between individual units. The measures employed will go beyond current Building Regulation standards for minimising sound transmission wherever practical.

Residential units have been designed to be adaptable and accessible in order to accommodate occupiers changing needs over time.

4.3 Energy

Sustainability Objective:

To ensure that the development is energy efficient in order to reduce running costs while maximising internal comfort for the building occupiers and ensure the emission of climate change gases is minimised.

Section 3 demonstrates how the development is designed to be energy efficient in terms of heating, cooling, lighting and ventilation.

In addition, all external lighting will be specified to be energy efficient and will be fitted with adequate controls to ensure optimum efficiency.

Where provided by the developers all equipment (white good for example), will be energy efficient.

4.4 Transport

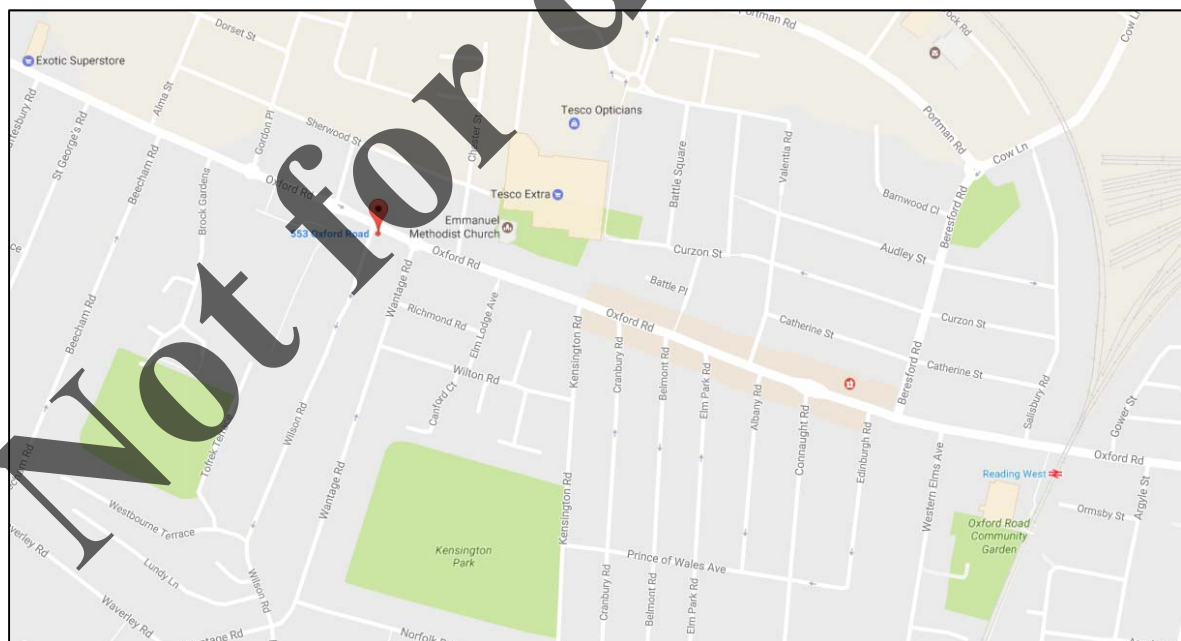
Sustainability Objective:

To reduce pollution and congestion levels. To encourage walking, cycling and the use of public transport.

As around 30% of UK energy use is associated with transport. Developments of this nature that can encourage a reduction in car use have a positive impact on the environment both through a reduced reliance on precious fossil fuel resources and a reduction in harmful emissions.

The central location of the development means that it is close to local amenities and has excellent public transport links, with regular bus services on Oxford Road and Reading West Railway Station within 500m.

Parking provision has been carefully assessed by Transport Consultants – for further details refer to the Transport Assessment prepared by others. Secure cycle storage will be provided for residents while parking will be limited to eleven spaces, including two disabled parking bays, in order to discourage car ownership greater than one car per household and encourage car sharing, along with more sustainable transport options. Safe pedestrian routes will further encourage walking and the use of public transport.



4.5 Water Use

Sustainability Objective:

*Conserve water through efficiency measures and recycling.
Mitigating against increases in flood risk due to reduction in permeable areas and climate change.*

Water is a precious commodity even in the UK and with ever increasing demand for clean drinking water measures need to be taken to safeguard future supplies.

Approximately 50% of the water consumed in domestic dwellings is not used for consumption, (the percentage is even higher in many commercial buildings) it is for washing, and flushing of toilets etc. Measures to reduce the amount of potable water used for these activities reduce the demand for potable water and make better use of this limited resource.

In line with the requirements of Level 3 and 4 of the CSH, water use in the residential units will be reduced to at least 105l/person/day. This is a 12% improvement over standard Building Regulations requirements.

This reduction in water use will be achieved through a combination of efficiency measures, including the specification of efficient fittings, lower capacity baths and dual flush toilets.

The following example specification demonstrates how the target of 105litres per person per day can be achieved without requiring rainwater or greywater harvesting:

Maximum design flow rates & capacities:

Taps (other than kitchen taps)	5.00(litres/min)
Kitchen and Utility Taps	7.00(litres/min)
Showers	7.00(litres/min)
Baths (with shower over)	170(litres to overflow)
WCs (Flush Volume)	Full Flush: 6.00(litres)
	Part Flush: 4.00(litres)
Washing Machine (Where specified)	8.17(litres/kg dry load)
Dishwasher (Where Specified)	1.25(litres/place setting)

For the commercial unit, the BREEAM requirement will dictate the minimum standards to be set for sanitary fittings. In addition measures will be taken to minimise the risks of leaks and identify them when they do occur.

4.6 Materials

Sustainability Objective:

To reduce the impact of construction on natural resources by using sustainable, legally sourced product.

Building materials have a significant impact when the embodied energy and resources used in their manufacture, transport and disposal are considered. Responsible sourcing of materials can have a real beneficial effect on the embodied impact of the final development.

All relevant materials in basic and finishing elements will be responsibly and legally sourced from certified suppliers using sustainable raw materials where possible.

Wherever possible reused and recycled materials will be sourced.

All materials will be sourced from local suppliers where possible to reduce transport miles and support the local supply chain.

Materials containing chemicals which are harmful to health or the environment will be avoided wherever possible.

4.7 Waste Management

Sustainability Objective:

To reduce waste going to landfill through material efficiency, recycling and sustainable construction methods.

A key part of sustainability is to manage resources efficiently. Reducing the amount of waste created and maximising resource efficiency during demolition, construction and during the building's lifetime is fundamental to providing sustainable developments.

Efforts to reduce construction waste generally will concentrate on reducing site waste together with increasing reuse and recycling of waste that cannot be avoided in an effort to reduce volumes going to

landfill. This will be implemented through a Site Waste Management Plan.

Adequate facilities will be provided for the storage and recycling of household and business waste and this in conjunction with the adoption of the Local Authority collection scheme for waste and recycling will encourage occupants to minimise waste going to landfill.

4.8 Land Use & Ecology

Sustainability Objective:

*To protect, maintain and enhance existing biodiversity and habitats.
To create new habitats to add value to the landscape in order to improve the urban environment.*

This is an urban location with an existing community use and as such it is assessed to have limited ecological value any undertaking to improve upon this will have a positive ecological impact.

4.9 Pollution

Sustainability Objective:

To reduce the environmental impact of atmospheric, watercourse, noise and sound pollution.

There are a variety of forms of environmental pollution that can potentially arise from the construction and use of buildings. A significant proportion is airborne in the form of dust, fumes and chemicals. Other forms of pollution include unwanted noise or light.

Best practice will be used during the construction phase to ensure that environmental pollution due to construction work will be minimised.

Efforts will be made to ensure the environmental impact of the materials used for the build will be reduced through responsible sourcing and reduced wastage.

The use of materials that's manufacture or installation requires the use of harmful global warming chemicals will be avoided.

Any cooling systems will be specified to either contain no potentially damaging chemicals, or where this is unavoidable to minimise the risk of environmental contamination due to accidental spillage.

Development of previously open land and climate change increases the chance of flash flooding and the management of surface water run-off is to be considered seriously in order to mitigate these effects.

Initial investigations of the Environment Agency Flood Map suggest that the site is in Zone 1 with a low risk of flooding.

As the site is previously developed with all areas not within the building footprint surfaced with impermeable materials it is not anticipated that redevelopment would cause any increase in run-off from the site. This is further enhanced with the architect proposing a Sustainable Urban Drainage solution (SUDs) to reduce surface water runoff compared with existing and to ease pressure on the public sewer.



Figure 4.1: Environment Agency Flood Map for the Oxford Road area.

Section 5: Summary

To ensure compliance with Reading Borough Council 2008 (revised January 2015) Core Strategy a number of sustainable construction strategies will be incorporated in the design and construction of the development. These will include, amongst others, minimum standards relating to energy and water use which will reduce the developments environmental impact over its lifetime which assists in ensuring a sustainable development for both current and future users.

To ensure compliance with Reading Borough Council 2008 (revised January 2015) Core Strategy Policy CS1 and CS2 the energy strategy proposed for the development at 553 Oxford Road follows the energy hierarchy and promotes a 'fabric first' approach. This ensures an energy efficient building that is not totally reliant on renewable generation to achieve a reduction in emissions. This approach results in an overall reduction in emissions (when compared to a Building Regulations baseline) of 23%. The recommended LZC strategy specifies a total of 7.0kWp of solar PV on the main roof, an array of this size would require approximately 45m² of roof area.

Table 5a shows the reduction in tonnes of CO₂ and kWh per year through the recommended fabric improvements, energy efficiency measures and LZC technologies.

Table 5a: Anticipated contribution from renewables		
	kWh per year	Tonnes CO ₂ per year
Total 'Building Regulations' annual figures	58,040	13.42
Total baseline 'be lean, be clean' annual figures	55,309	13.41
Contribution from renewables	6,046	3.14
Resulting figures including renewable contribution	49,263	10.27
Reduction from renewables contribution	10.93%	23.42% (Policy CS1 target = 20%)
Total reduction over Part L 2013 TER	15.12%	23.47% (Planning target 10%)

The proposed strategy offsets a total of 3.14 tonnes CO₂ per year, a reduction of 23%. The proposal reduces the energy demand by 15% which ensures a sustainable development for now and the future.

This development fully complies with National and Local Policy along with meeting all adopted policy and also delivering a sustainable scheme in all aspects through a fabric first holistic approach.

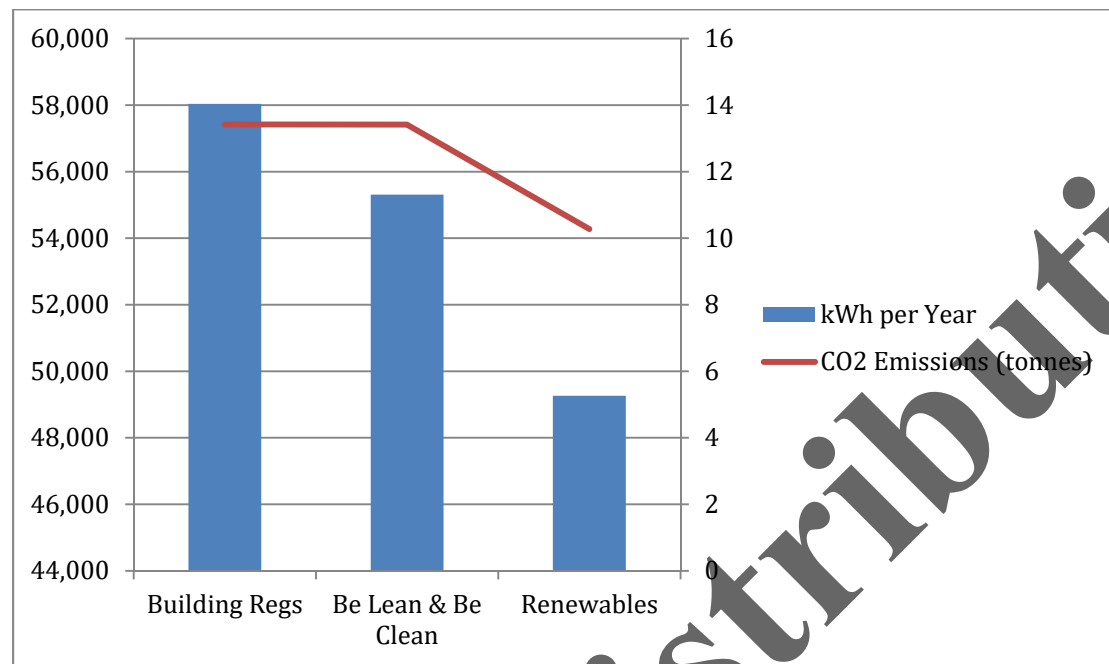


Figure 5.1: CO₂ emissions for each stage of the assessment

Appendix

Sample SAP Calculations BRUKL Document

Not for distribution



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BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)



Property Reference	0009-CPL-Reading-Comm-Church-2	Issued on Date	21/08/2018
Survey Reference	20% PV Target	Prop Type Ref	2nd Floor Flat - REV C
Property			

SAP Rating	87 B	DER	14.58	TER	18.32
Environmental	89 B	% DER<TER	20.41		
CO ₂ Emissions (t/year)	0.83	DFEE	50.36	TFEE	49.42
General Requirements Compliance	Fail	% DFEE<TFEE	-1.90		

Surveyor	Rachael Gardner, Tel: 01636653055	Surveyor ID	8440-0009
Client			

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.32	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	14.58	kgCO ₂ /m ²	Pass
	-3.74 (-20.4%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	49.42	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	50.36	kWh/m ² /yr	
Excess energy	1.0 (2.0%)	kWh/m ² /yr	Fail

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.25 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Roof	0.12 (max. 0.20)	0.12 (max. 0.35)	Pass
Openings	1.58 (max. 2.00)	1.60 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated using user-specified γ -value of 0.115

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Vaillant ecoTEC pro 24 VUW GB 246/5-3 Combi boiler Efficiency: 89.1% SEDBUK2009 Minimum: 88.0%	Pass
Secondary heating system	None	

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Time and temperature zone control

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

8 Mechanical ventilation

Continuous extract system (decentralised)

Specific fan power

0.3800 0.2900

Maximum

0.7

Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Thames Valley)

Slight

Pass

Based on:

Overshading

Average

Windows facing North

8.64 m², No overhang

Windows facing West

8.64 m², No overhang

Air change rate

6.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Solid Wall

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

4.50 (design value)

Maximum

10.0

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Roof U-value

0.12

W/m²K

Photovoltaic array

N/A

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)

Property Reference	0009-CPL-Reading-Comm-Church-1	Issued on Date	21/08/2018
Survey Reference	20% PV Target	Prop Type Ref	1st Floor Flat - REV C
Property			

SAP Rating	87 B	DER	14.26	TER	19.36
Environmental	90 B	% DER<TER	26.33		
CO ₂ Emissions (t/year)	0.81	DFEE	48.87	TFEE	54.70
General Requirements Compliance	Pass	% DFEE<TFEE	10.66		

Surveyor	Rachael Gardner, Tel: 01636653055	Surveyor ID	8440-0009
Client			

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	19.36	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	14.26	kgCO ₂ /m ²	Pass
	-5.10 (-26.3%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	54.70	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	48.87	kWh/m ² /yr	
	-5.8 (-10.6%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.25 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.10 (max. 0.25)	0.10 (max. 0.70)	Pass
Openings	1.58 (max. 2.00)	1.60 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated using user-specified γ -value of 0.109

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Vaillant ecoTEC pro 24 VUW GB 246/5-3 Combi boiler Efficiency: 89.1% SEDBUK2009 Minimum: 88.0%	Pass
Secondary heating system	None	

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Time and temperature zone control

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

8 Mechanical ventilation

Continuous extract system (decentralised)

Specific fan power

0.3800 0.2900

Maximum

0.7

Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Thames Valley)

Slight

Pass

Based on:

Overshading

Average

Windows facing North

8.64 m², No overhang

Windows facing West

8.64 m², No overhang

Air change rate

6.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Solid Wall

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

4.50 (design value)

Maximum

10.0

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Photovoltaic array

N/A

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)

Property Reference	0009-CPL-Reading-Comm-Church-2	Issued on Date	21/08/2018
Survey Reference	Baseline	Prop Type Ref	2nd Floor Flat - REV C
Property			

SAP Rating	83 B	DER	18.99	TER	18.32
Environmental	86 B	% DER<TER	-3.67		
CO ₂ Emissions (t/year)	1.16	DFEE	50.36	TFEE	49.42
General Requirements Compliance	Fail	% DFEE<TFEE	-1.90		

Surveyor	Rachael Gardner, Tel: 01636653055	Surveyor ID	8440-0009
Client			

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.32	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	18.99	kgCO ₂ /m ²	
Excess emissions	0.67 (3.7%)	kgCO ₂ /m ²	Fail

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	49.42	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	50.36	kWh/m ² /yr	
Excess energy	1.0 (2.0%)	kWh/m ² /yr	Fail

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.25 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Roof	0.12 (max. 0.20)	0.12 (max. 0.35)	Pass
Openings	1.58 (max. 2.00)	1.60 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated using user-specified γ -value of 0.115

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Vaillant ecoTEC pro 24 VUW GB 246/5-3 Combi boiler Efficiency: 89.1% SEDBUK2009 Minimum: 88.0%	Pass
Secondary heating system	None	

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Time and temperature zone control

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

8 Mechanical ventilation

Continuous extract system (decentralised)

Specific fan power

0.3800 0.2900

Maximum

0.7

Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Thames Valley)

Slight

Pass

Based on:

Overshading

Average

Windows facing North

8.64 m², No overhang

Windows facing West

8.64 m², No overhang

Air change rate

6.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Solid Wall

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

4.50 (design value)

Maximum

10.0

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Roof U-value

0.12

W/m²K

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)



Property Reference	0009-CPL-Reading-Comm-Church-1	Issued on Date	21/08/2018
Survey Reference	Baseline	Prop Type Ref	1st Floor Flat - REV C
Property			

SAP Rating	83 B	DER	18.66	TER	19.36
Environmental	86 B	% DER<TER	3.60		
CO ₂ Emissions (t/year)	1.14	DFEE	48.87	TFEE	54.70
General Requirements Compliance	Pass	% DFEE<TFEE	10.66		

Surveyor	Rachael Gardner, Tel: 01636653055	Surveyor ID	8440-0009
Client			

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	19.36	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	18.66	kgCO ₂ /m ²	Pass
	-0.70 (-3.6%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	54.70	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	48.87	kWh/m ² /yr	
	-5.8 (-10.6%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.25 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.10 (max. 0.25)	0.10 (max. 0.70)	Pass
Openings	1.58 (max. 2.00)	1.60 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated using user-specified ψ -value of 0.109

3 Air permeability

Air permeability at 50 pascals	4.50 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Vaillant ecoTEC pro 24 VUW GB 246/5-3 Combi boiler Efficiency: 89.1% SEDBUK2009 Minimum: 88.0%	Pass
Secondary heating system	None	

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Designed)

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Time and temperature zone control

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

8 Mechanical ventilation

Continuous extract system (decentralised)

Specific fan power

0.3800 0.2900

Maximum

0.7

Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Thames Valley)

Slight

Pass

Based on:

Overshading

Average

Windows facing North

8.64 m², No overhang

Windows facing West

8.64 m², No overhang

Air change rate

6.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Solid Wall

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

4.50 (design value)

Maximum

10.0

Pass

10 Key features

Party wall U-value

0.00

W/m²K

BRUKL Output Document

Compliance with England Building Regulations Part L 2013



Project name

Reading Community Church

As designed

Date: Wed Jun 07 12:18:16 2017

Administrative information

Building Details

Address: 553 Oxford Road, READING, RG30 1HJ

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.7

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.7

BRUKL compliance check version: v5.3.a.0

Owner Details

Name: The Trustees of the Gate

Telephone number: ---

Address: 384 The Meadway, Tilehurst, READING, RG30 4NX

Certifier details

Name: MES Building Solutions

Telephone number: 01636 653 055

Address: Newark Beacon, Cafferata Way, NEWARK, NG24 2TN

Criterion 1: The calculated CO₂ emission rate for the building must not exceed the target

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	20.2
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	20.2
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	20.1
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-Limit}	U _{a-Calc}	U _{i-Calc}	Surface where the maximum value occurs*
Wall**	0.35	0.24	0.24	GN000002:Surf[1]
Floor	0.25	0.18	0.18	GN000002:Surf[5]
Roof	0.25	0.18	0.18	GN000006:Surf[4]
Windows***, roof windows, and rooflights	2.2	1.6	1.6	GN000002:Surf[0]
Personnel doors	2.2	2.2	2.2	1S000017:Surf[1]
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

U_{a-Limit} = Limiting area-weighted average U-values [W/(m²K)]

U_{a-Calc} = Calculated area-weighted average U-values [W/(m²K)]

U_{i-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	8

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- LPHW UF NG Nat Vent & DHW

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.95	-	0.2	0	-
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					NO
* 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- LPHW UF NG Mech Ext & DHW

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	-	0.2	0	-
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					NO
* 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.					

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

Local mechanical ventilation, exhaust, and terminal units

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

Zone name	SFP [W/(l/s)]										HR efficiency	
	ID of system type	A	B	C	D	E	F	G	H	I	Zone	Standard
	Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1		
Gnd_Kitchen		0.3	-	-	-	-	-	-	-	-	-	N/A
Gnd_Female WCs		0.3	-	-	-	-	-	-	-	-	-	N/A
Gnd_Male WCs		0.3	-	-	-	-	-	-	-	-	-	N/A
Gnd_Staff WC		0.3	-	-	-	-	-	-	-	-	-	N/A
Gnd_Accessible WC		0.3	-	-	-	-	-	-	-	-	-	N/A
Gnd_Servery Kitchen		0.3	-	-	-	-	-	-	-	-	-	N/A
Gnd_WCs		0.3	-	-	-	-	-	-	-	-	-	N/A
Gnd_Staff WC		0.3	-	-	-	-	-	-	-	-	-	N/A
1st_WC		0.3	-	-	-	-	-	-	-	-	-	N/A

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
Gnd_Entrance Lobby	-	90	-	-	57
Gnd_Centre Manager	90	-	-	-	98
Gnd_Kitchen	-	90	-	-	160
Gnd_Female WCs	-	90	-	-	51
Gnd_Male WCs	-	90	-	-	45
Gnd_Staff WC	-	90	-	-	22
Gnd_Accessible WC	-	90	-	-	34
Gnd_Hall 1	-	90	-	-	264
Gnd_Servery Kitchen	-	90	-	-	135
Gnd_WCs	-	90	-	-	109
Gnd_Cleaners	90	-	-	-	4
Gnd_Staff Room	-	90	-	-	33
Gnd_Staff WC	-	90	-	-	21
Gnd_Hall 2	-	90	-	-	292
Gnd_Nursery Store	90	-	-	-	10
Gnd_Store	90	-	-	-	4
Gnd_Store	90	-	-	-	8
Gnd_Store	90	-	-	-	8
Gnd_Store	90	-	-	-	3
Gnd_Foyer	-	90	-	-	160
Gnd_Hall 3	-	90	-	-	290
1st_Stair	-	90	-	-	43
1st_Protected Lobby	-	90	-	-	19
1st_WC	-	90	-	-	27
1st_Protected Corridor	-	90	-	-	45
2nd_Stair	-	90	-	-	43
2nd_Protected Lobby	-	90	-	-	19
2nd_Protected Corridor	-	90	-	-	45
3rd_Protected Corridor	-	90	-	-	23
3rd_Stair	-	90	-	-	42

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?
Gnd_Centre Manager	N/A	N/A
Gnd_Hall 1	NO (-56.3%)	NO
Gnd_Staff Room	NO (-67.7%)	NO
Gnd_Hall 2	YES (+47.2%)	NO
Gnd_Hall 3	YES (+47.2%)	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

Not for distribution

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters			Building Use	
	Actual	Notional	% Area	Building Type
Area [m ²]	493.3	493.3		A1/A2 Retail/Financial and Professional services
External area [m ²]	810.1	810.1		A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
Weather	SWI	SWI		B1 Offices and Workshop businesses
Infiltration [m ³ /hm ² @ 50Pa]	8	3		B2 to B7 General Industrial and Special Industrial Groups
Average conductance [W/K]	316.8	388.09		B8 Storage or Distribution
Average U-value [W/m ² K]	0.39	0.48		C1 Hotels
Alpha value* [%]	10.06	10		C2 Residential Institutions: Hospitals and Care Homes
* Percentage of the building's average heat transfer coefficient which is due to thermal bridging				C2 Residential Institutions: Residential schools
				C2 Residential Institutions: Universities and colleges
				C2A Secure Residential Institutions
				Residential spaces
			100	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/m ²]		
	Actual	Notional
Heating	59.91	56.07
Cooling	0	0
Auxiliary	1.18	1.16
Lighting	10.73	12.66
Hot water	5.07	5
Equipment*	12.09	12.09
TOTAL**	76.89	74.9

* 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/m ²]		
	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/m ²]	181.86	174.03
Primary energy* [kWh/m ²]	114.92	115.89
Total emissions [kg/m ²]	20.1	20.2

* 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 SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Central heating using water: floor heating, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	188.1	0	61.6	0	1.1	0.85	0	0.95	0
Notional	174.6	0	56.2	0	1	0.86	0	----	----
[ST] Central heating using water: floor heating, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	146.3	0	50	0	1.6	0.81	0	0.91	0
Notional	170.9	0	55.1	0	1.8	0.86	0	----	----
[ST] No Heating or Cooling									
Actual	0	0	0	0	0	0	0	0	0
Notional	0	0	0	0	0	0	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-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.24	GN000002:Surf[1]
Floor	0.2	0.18	GN000002:Surf[5]
Roof	0.15	0.18	GN000006:Surf[4]
Windows, roof windows, and rooflights	1.5	1.6	GN000002:Surf[0]
Personnel doors	1.5	2.2	1S000017:Surf[1]
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	-	No High usage entrance doors in building
U _{i-Typ} = Typical individual element U-values [W/(m²K)]			U _{i-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	8