



Sustainability and Energy Statement



St Paul's
Church,
Whitley Wood
Lane, Reading,
RG2 8PN

January 2020

Ref: 19-6409

Quality Standards Control

The signatories below verify that this document has been prepared in accordance with our quality control requirements. These procedures do not affect the content and views expressed by the originator.

<i>Revision</i>	-	<i>Rev A</i>	<i>Rev B</i>	<i>Rev C</i>
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1. Executive Summary

This Energy and Sustainability Statement demonstrates the predicted energy performance and carbon dioxide emissions of the proposed development at **St Paul's Church, Whitley Wood Lane, Reading, RG2 8PN**, based on the information provided by the design team. The development is **comprised of a church, health centre and 2 flats of 1 bedroom** at the above location.

1.1. Policy Requirements

Reading Council requires new developments to incorporate sustainable design and construction measures. The table below summarises the local policy requirements for the proposed development.

Policies	Requirements	Compliance Check
Policy CC2 & CC3	All major non-residential developments or conversions to residential are required to meet the most up-to-date BREEAM 'Excellent' standards, where possible	The Church and Health centre buildings achieved BREEAM 'Excellent' standards, Pre-assessment is in Appendix C.
	Minor New-build residential development is required to achieve 19% improvement in the dwelling emission rate over the target emission rate, as defined in the 2013 Building Regulations	The proposed residential units achieved the 20% carbon reduction through energy efficiency measures and PVs.
	All non-residential development or conversions to residential should incorporate water conservation measures so that predicted per capita consumption does not exceed the appropriate levels set out in the applicable BREEAM standard. Both residential and nonresidential development should include recycling greywater and rainwater harvesting where systems are energy and cost effective.	High standards of sustainable design and construction measures including water consumption of 105 litres/person/day have been incorporated. Details are in Section 4.
Policy CC4	Considering the use of Combined heat and Power (CHP) systems where appropriate.	The CHP system is not feasible on the site due to the small size of the development.
	All major developments are required to be designed to be able to connect to a Decentralised Energy Network (DEN).	No existing and future decentralised energy networks are present near the site. Details are in section 8 of this report.

Table 1 Policy Requirements

1.2. Methodology and Strategies

The methodology used to determine the CO₂ emissions is in accordance with the three-stages Energy Hierarchy. The below table shows the Energy Hierarchy and suggested strategies for the proposed development.

Stages	Strategies
Stage 1 Energy efficient design	- U-values and air permeability better than Building Regulations Part L 2013. - The use of Accredited Construction Details for residential flats at all thermal bridging junctions. - Natural ventilation with extract fans in wet rooms 100% Low energy lights - Low water consumption
Stage 2 District heat networks or communal heating systems	Not feasible on the site – Details are in Section 8.
Stage 3 On-site renewable technologies	- High efficient communal Air Source Heat Pumps (ASHPs) for heating and hot water. - PV panels of 1.0 kWp on the roof (approximate 4 panels with 250 w/p are required).

Table 2 Energy Hierarchy and suggested strategies

1.3. Assessment Results

After the application of all strategies based on the Energy Hierarchy, the regulated carbon dioxide emissions have been reduced as follows;

Energy Hierarchy		Regulated Carbon Emissions (Tonnes CO ₂ /yr)	
		Residential	Non-residential
BASELINE	TER set by Building Regulations Part L 2013	2.96	40.86
STAGE 1 - 3	After energy efficient measures and renewable technologies	2.36	26.23
TOTAL CARBON SAVINGS		20.16 %	35.79 %
TARGET SAVINGS		19 %	-

Table 3 Carbon Emissions after each stage of the proposed strategy

- **Residential Units**

The targeted carbon saving for the residential unit is a 19% reduction over the Building Regulations Part L 2013 baseline. Given the total cumulative savings below, the residential area meets the 20.16% reduction after the application of all energy strategies.

Energy Hierarchy		Regulated Carbon Savings	
		Tonnes CO ₂ /yr	%
Stage 1-3	After energy efficient measures and renewable technologies	0.6	20.16%
Total Cumulative Savings		0.6	20.16%
Shortfall		0	-

Table 4 Carbon dioxide Emissions after each stage of the Energy Hierarchy

- **Non-residential Units**

Given the total cumulative savings below, the non-residential area achieve the 35.79% reduction after the application of aforementioned energy strategies.

Energy Hierarchy		Regulated Carbon Savings	
		Tonnes CO ₂ /yr	%
Stage 1-3	After energy efficient measures and renewable technologies	14.62	35.79%
Total Cumulative Savings		14.62	35.79%
Shortfall		0	-

Table 5 Carbon dioxide Emissions after each stage of the Energy Hierarchy

2. Introduction

This Energy Statement will be included as part of the planning application that addresses the environmental impact of the development. This report focuses on the energy strategy for the proposed scheme and how energy consumption and carbon emissions will be minimised and to meet the targeted carbon emissions in accordance with Local planning policy.

This development is to be located in the **Reading Borough** and it is in close to Reading Station (approx. 2.8 miles to North), Earley Station (approx. 3.3 miles to North-East) and Reading West (3.3 miles to North-West). The proposal consists of a church, health centre and 4 houses and 2 flats of 1 to 4 bedrooms at **St Paul's Church, Whitley Wood Lane, Reading, RG2 8PN**.



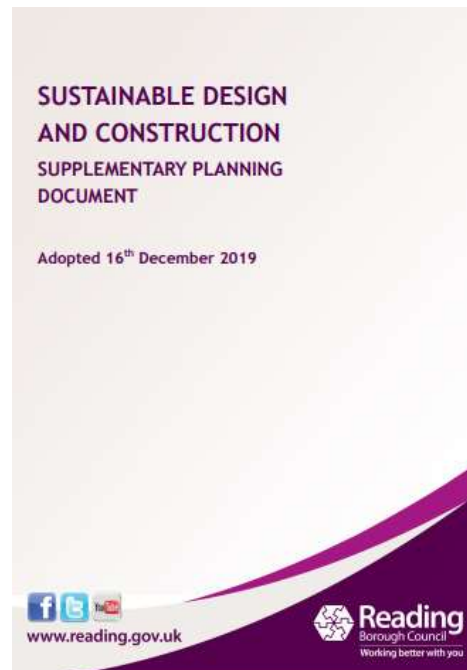
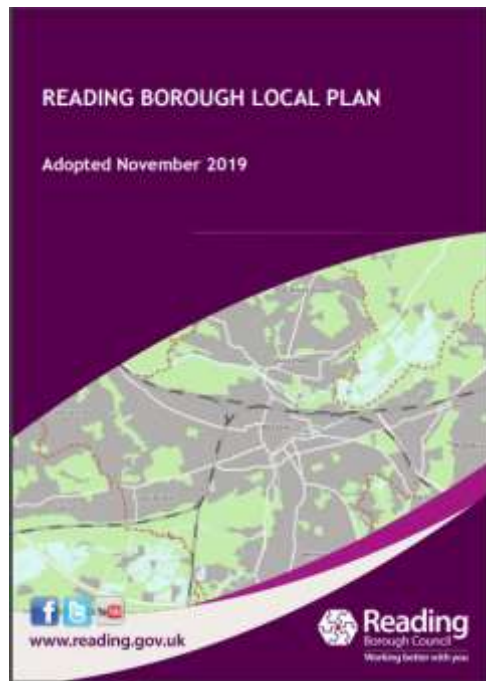
Figure 1 Site Location

3. Planning Policy

3.1. National Planning Policy Framework (February 2019)

The National Planning Policy Framework is a key part of our reforms to make the planning system less complex and more accessible, to protect the environment and to promote sustainable growth.

3.2. Reading Borough



READING BOROUGH LOCAL PLAN (Adopted November 2019)

Policy CC2: 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 major non-residential developments or conversions to residential are required to meet the most up-to-date BREEAM 'Excellent' standards, where possible
- All minor non-residential developments or conversions to residential are required to meet the most up-to-date BREEAM 'Very Good' standard as a minimum;
- All non-residential development or conversions to residential should incorporate water conservation measures so that predicted per capita consumption does not exceed the appropriate levels set out in the applicable BREEAM standard. Both residential and non-residential development should include recycling greywater and rainwater harvesting where

systems are energy and cost effective.

Policy CC3: Adaption 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:

- Wherever possible, 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, thermal mass, heating and ventilation of the building and appropriately coloured materials in areas exposed to direct sunlight, green and brown roofs, green walls, etc;
- Use of trees and other planting, where appropriate as part of a landscape scheme, to provide shading of amenity areas, buildings and streets and to help to connect habitat, designed with native 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, and where possible incorporate mitigation and resilience measures for any increases in river flooding levels as a result of climate change.

Policy CC4: Decentralised Energy

- Any development of more than 20 dwellings and/ or non-residential development of over 1,000 sq m shall consider the inclusion of decentralised energy provision, within the site, unless it can be demonstrated that the scheme is not suitable, feasible or viable for this form of energy provision.
- Where there is existing decentralised energy provision present within the vicinity of an application site, further developments of 10 dwellings or more or non-residential development of 1,000 sq m or more will be expected to link into the existing decentralised energy network or demonstrate why this is not feasible.

The Supplementary Planning Document (Adopted December 2019):

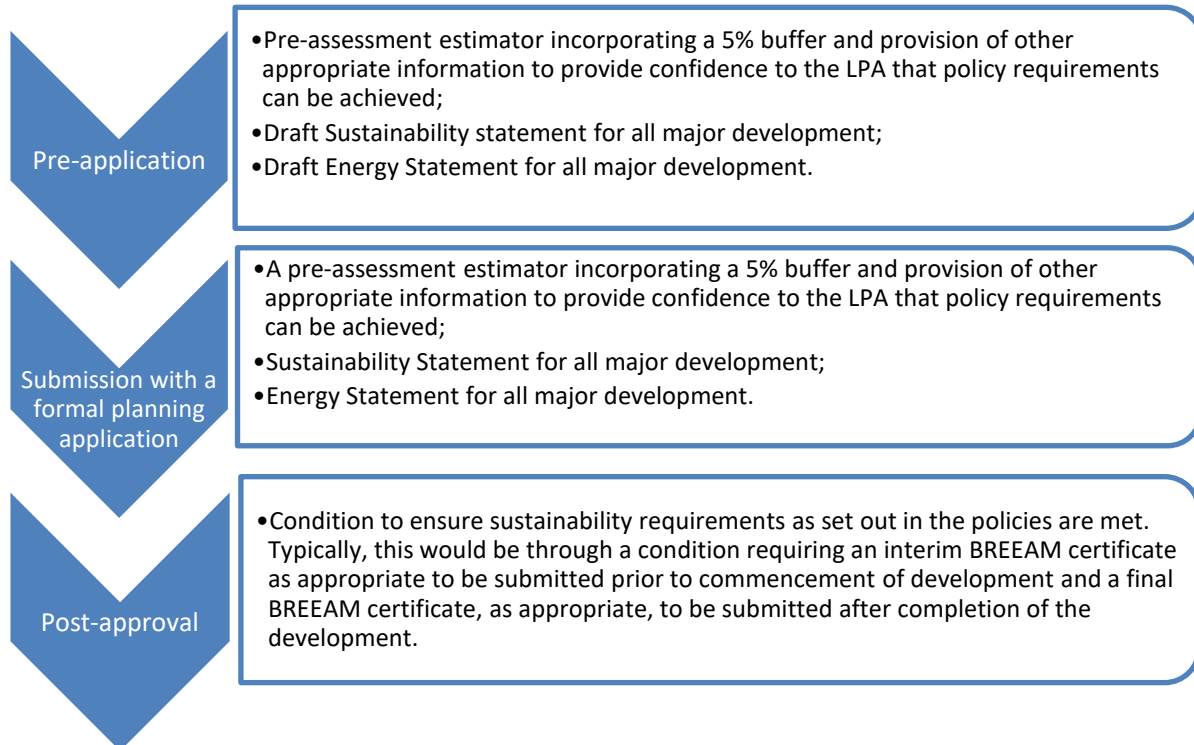
Provides more detailed information for Reading Borough Local Plan policies.

Table 3.1: Required level of relevant sustainability standard

	Size of development	Required Level of which standard
New build residential	Minor (fewer than 10 dwellings)	19% improvement in the dwelling emission rate over the target emission rate, as defined in the 2013 Building Regulation
	Major (10 dwellings or more)	Zero Carbon (or if unachievable, a minimum 35% improvement in the dwelling emission rate over the target emission rate, as defined in the 2013 Building Regulations and planning

		contribution to offset remaining carbon emissions to zero)
Creation of new residential units through conversion from other uses and/or	Minor (less than 1,000 sq. m of floorspace)	BREEAM 'Very Good'
	Major (1,000 sq. m of floorspace or more) BREEAM 'Excellent'	BREEAM 'Excellent'
Non-residential development (including development for non-C3 residential)	Minor (less than 1,000 sq. m of floorspace)	BREEAM level 'Very Good'
	Major (1,000 sq. m of floorspace or more) BREEAM 'Excellent'	BREEAM 'Excellent'
Non-residential BREEAM 'Very Good' refurbishment (including refurbishment for non-C3 residential)	Minor (less than 1,000 sq. m of floorspace)	BREEAM 'Very Good'
	Major (1,000 sq. m of floorspace or more) BREEAM 'Excellent'	BREEAM 'Excellent'

Table 3.2: Summary of BREEAM submission requirements at each stage of application process



4. Sustainability Statement

4.1. Materials

The development will utilise **low embodied materials** - at least three of the key elements of the building envelope are to achieve a rating of A+ to D in the BRE's The Green Guide of specification. At least 50% of timber and timber products will be sourced from accredited Forest Stewardship Council (**FSC**) or Programme for the Endorsement of forestry certification (**PEFC**) where feasible. All material used will be durable to cater for their level of use and exposure and will not release toxins into the internal and external environment where feasible.

4.2. Nature conservation and biodiversity

There will be **no loss in the quality and quantity of biodiversity** by this development as the site was previously developed, **planting trees and making communal garden**. And, the development will make a contribution to biodiversity on the site in the course of design development.

4.3. Waste

The construction waste will be considered **to minimise, recycle and reuse** on site where possible, this will reduce the overall construction cost and at the same time minimise the amount of waste diverting to landfill. **Site Waste Management Plan (SWMP)** will be formalised before the construction works start and updated as the works continue on the site.

The proposed development will adopt the best waste management procedures to reduce the amount of waste going to landfill. This will be established by creating provisions for recycling and also waste segregation from general to recyclable waste. This development has **separated bin storages**, and the storages include refuse, recycling, composting bins with enough sizes in accordance with borough requirements.

4.4. Management

The construction will be managed in an environmentally and socially considerate manner, mitigating environmental impacts. As measures, the best practice under a nationally or locally recognised certification scheme such as the **Considerate Constructors Scheme** would be pursued.

4.5. Water Efficiency

The development will be based upon the specification of water efficient fittings including low volume dual flush WCs, and low flow taps/ showers/ bath. These measures will result in the internal water consumption rate of **105 litres/person/day** or less, excluding an allowance 5 litres per person per day for external water consumption. The design stage water use calculations is below.

Installation Type	Unit of Measure	Capacity/ flow rate (1)	Use factor (2)	Fixed use (litres/head/d ay) (3)	Total Consumption Litres/head/day (1)x(2)+(3) =(4)
WC (dual flush)	Full Flush Volume (litres)	6	1.46	0	8.76
	Part flush Volume (litres)	4	2.96	0	11.85
Taps (excluding kitchen/ utility room taps)	Flow rate (litres/minute)	6.5	1.58	1.58	11.85
Bath (where shower also present)	Capacity to overflow (litres)	120	0.11	0	13.20
Shower (where bath also present)	Flow rate (litres/minute)	7.5	4.37	0	32.78
Kitchen / utility room sink taps	Flow rate (litres/minute)	6.5	0.44	10.36	13.22
Washing machine	Litres/kg dry load	9	2.1	0	18.90
Dishwasher	Litres/place setting	1.2	3.6	0	4.32
Waste disposal unit	Litres/use	If present = 1 If absent = 0	3.08	0.00	0
Water Softener	Litres/person/day	-	1.00	0.00	-
(5)	Total calculated use (litres/person/day) = Sum column 4				114.9
(6)	Contribution from greywater (litres/person/day)				0
(7)	Contribution from rainwater (litres/person/day)				0
(8)	Normalisation Factor				0.91
Total water consumption (litres/person/day)					104.5
	External water use				5

Table 6 Design stage water use calculations

4.6. Bicycle Storage

To promote exercise and help reduce congestion and carbon emissions, **cycle storages are provided on-site**. As each residential unit has their own shower facilities, additional showers are not necessary.

4.7. Flood Risk

The flood map for planning (<https://flood-map-for-planning.service.gov.uk/>) shows that the site surrounding area is **within zone 1 of the flood risk** (see below image). Therefore, the detailed flood risk assessment has not been carried out for the site. In order to protect the site for future climate change impacts the **Sustainable drainage strategy (SuDS)** will be developed to incorporate attenuation for surface water runoff as well as habitat, water quality and amenity benefits. Therefore, there will be a net decrease in both the volume and rate of run-off leaving the site. As part of this, **permeable paving materials** will be used on the ground floor to avoid, reduce and delay the discharge of rainfall to public sewers and watercourses. And also, rainwater collection and recycling systems would be considered at detailed design stage where feasible.

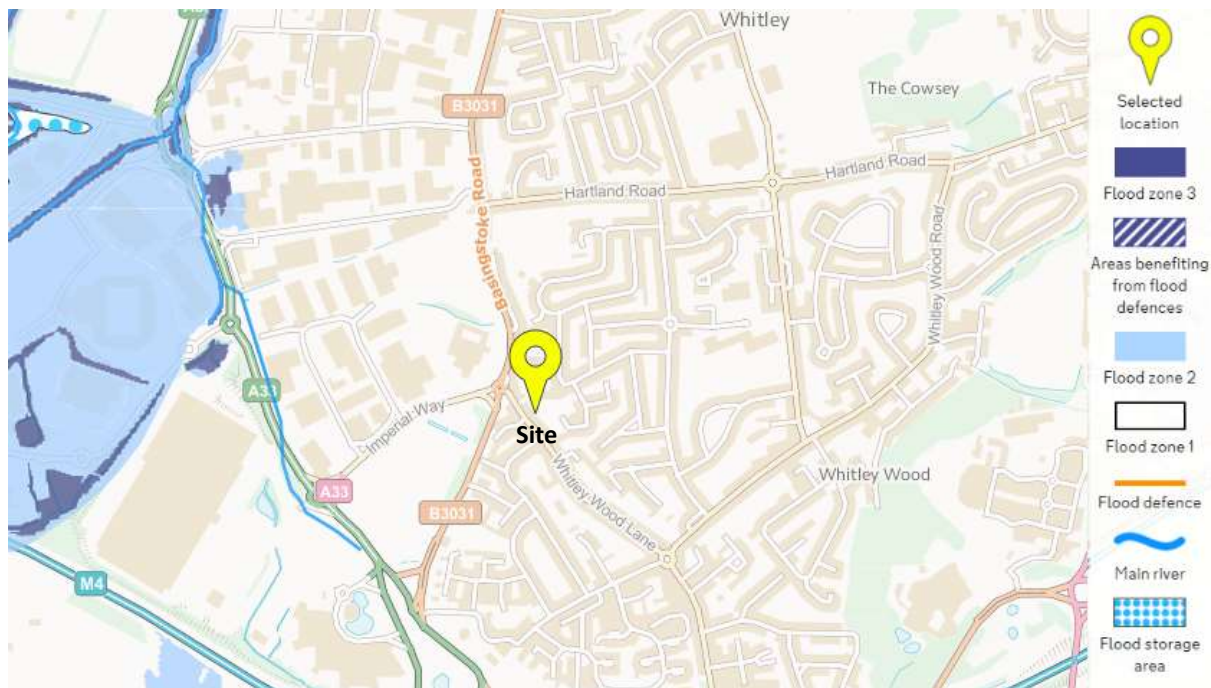


Figure 2 Development Location Flood Map

4.8. Pollution

- Air

The proposed scheme has been designed to minimise the generation of air pollution and mitigate against increased exposure to poor air quality. This will include **low NOx heating systems and non-toxic building materials** where feasible. Contractor will follow the guidance set out in the emerging Minimising dust and emissions from construction and demolition SPG when constructing their development.

- Noise

The mitigation measures will be incorporated to the proposed building at construction stage to reduce sources of noise – insulate and soundproofing doors, walls, windows, floors and ceilings, and seal air gaps around windows etc.

- Light

Lighting scheme will be designed to minimise light pollution where feasible. Guidance Notes for the Reduction of Obtrusive Light (2005) will be utilised to reduce obtrusive light.

4.9. Health and Wellbeing

The health and wellbeing of the building occupant has been considered in this development. The proposed scheme is designed to **maximise the opportunity for daylighting potential** in habitable areas. The proposed development will ensure to introduce the **occupant controlled and zoned space heating systems** in accordance with space requirements and window orientation. This will provide occupant thermal comfort but at the same time it will reduce the overall energy cost and the carbon footprint.

5. Energy Statement - Assessment Methodology

5.1. Energy Hierarchy

The energy hierarchy is a classification of different methods to improve energy performance in a parallel sequence. This includes primarily a focus on reducing energy use by avoiding unnecessary use, to then improving the efficiency of energy systems to minimise loss, this is followed by exploiting renewable energy sources and then low carbon energy solutions for energy needs and finally, any remaining demand can be catered for by conventional fuel sources.

The Energy Strategy adopts a set of principles to guide design development and decisions regarding energy, balanced with the need to optimise environmental and economic benefits. The following hierarchy should be used to assess applications:

- **1st Stage** – By using less energy and taking into account the further energy efficiency measure in comparison to the baseline building.
- **2nd Stage** – By supplying energy efficiently. The clean building looks at further carbon dioxide emission savings over the lean building by taking into consideration the use of decentralise energy via CHP.
- **3rd Stage** – By integrating renewable energy into the scheme which can further reduce the carbon dioxide emission rate.

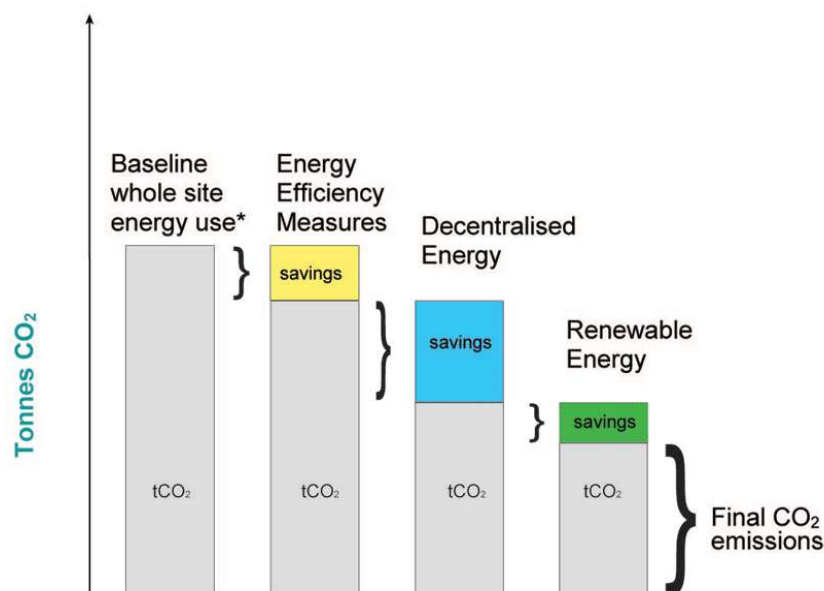


Figure 3 The Energy Hierarchy

5.2. Software and Input data

The Government approved software, i.e. **FSAP 2012**, have been utilised to carry out **Standard Assessment Procedure (SAP)** calculations. Syntegra received the architectural drawings and relevant documents, and they were used to undertake the energy assessments. The document references are listed in table below.

No.	Document Name	Format	Received Date
1	TOPO March 2018-2000	dwg	12-12-2019
2	PLANNING-2019 -28-240120	dwg	24-01-2020

Table 7 The document list

6. Energy Statement - Baseline

The baseline (known as Target Emission Rate), as calculated in line with the Building Regulation 2013, is the maximum amount of carbon dioxide a dwelling or non-residential unit is allowed to emit. The Target Emission Rate (TER) includes carbon dioxide emissions which are covered by Part L of the Building Regulations, known as regulated emissions (space and water heating, ventilation, lighting, pumps, fans & controls). The baseline energy uses and resulting CO₂ emissions rates of the development have been assessed using the Government approved software. The baseline regulated CO₂ emissions for the development are presented in the table below.

BASELINE: TER	Regulated CO₂ Emissions (Tonnes CO₂/yr.)
Residential	2.96
Non-residential	48.86

Table 8 Regulated Carbon Emissions at Baseline

7. Energy Statement – 1st Stage

This section outlines the energy efficient measures taken in order to minimise the building's energy demand and therefore reduce energy use and CO₂ emissions further than the Baseline requirements (Building Regulations 2013 Part L compliance).

7.1. Passive Design Measures

- Enhanced Building Elements

At the first stage of the energy hierarchy, energy efficient building elements have been incorporated into the build. The heat loss of different building element is dependent upon their U-value and air tightness. Therefore, better U-values and air permeability than the minimum values set in the Part L 2013 have been suggested in this development. And, Accredited Construction Detail for Part L was also applied at all thermal bridging junctions to reduce the heat loss from the thermal bridging. Therefore, the ACDs will be used during design development. Please see the proposed fabric specifications below.

		Part L 2013 min. required values		Proposed building values
		L1A	L2A	
U-value (W/m ² K)	Wall	0.30	0.35	0.12
	Window	2.0	2.2	1.2
	Floor	0.25	0.25	0.13
	Roof	0.20	0.25	0.13
	Door	1.0 (notional)	1.5 – 3.5	1.0
Air Permeability (m ³ /h.m ² at 50 Pa)		10	10	5
Thermal Bridging		-	-	Accredited Construction Details for Part L are applied to all thermal bridging junctions for the flats.

Table 9 Proposed Building Elements

- **Orientation & Natural Daylighting**

Passive solar gain reduces the amount of energy required for space heating during the winter months. The buildings are positioned having parking spaces and a communal garden, which can maximise the passive solar gains into the building throughout the day. Moreover, the internal layout, windows, and roof lights have been designed to improve daylighting in all habitable spaces, as a way of improving the health and wellbeing of occupants.

- **Solar Shading**

Each dwelling will incorporate internal blinds or curtains to reduce the solar heat coming into the dwelling, and thus can avoid installing cooling systems for summer.

- **Natural Ventilation**

A **natural ventilation strategy** will be adopted **with extract fans in wet rooms**; toilets, bathrooms, kitchens and utility rooms. Based on this, higher energy consumption and CO₂ emissions due to mechanical ventilation is avoided.

7.2. Active Design Measures

- **Heating and Hot Water System**

Communal Air Source Heat Pumps (ASHPs) have been proposed for heating and hot water to utilise renewable energy on the site. Hence, details of the proposed ASHPs will be demonstrated at Section 9 (Stage 3) of this report.

- **High Efficiency Lighting**

The proposed light fittings will be low energy efficient fittings. These can be **T5 fluorescent fittings or LED fittings**. The suggested specifications should be reviewed by electric engineers at detailed design stage.

8. Energy Statement – 2nd Stage

The Energy Hierarchy encourages the use of a CHP system and the connection to District Heating system to reduce CO₂ emissions further.

8.1. Decentralised Energy Network

Based on heat mapping and constraints analysis, four clusters were identified as potentially suitable for heat network schemes (see figure 6). A detailed technical and economic assessment identified several potentially deliverable heat network scheme options centred on the four clusters. These would reduce energy costs and carbon emissions, as well as improve air quality and increase inward investment, spurring local economic growth. Almost all scheme options in all four clusters were found to be viable, some with additional financial support and some without. At the time of writing, all four clusters are entering detailed feasibility analysis.

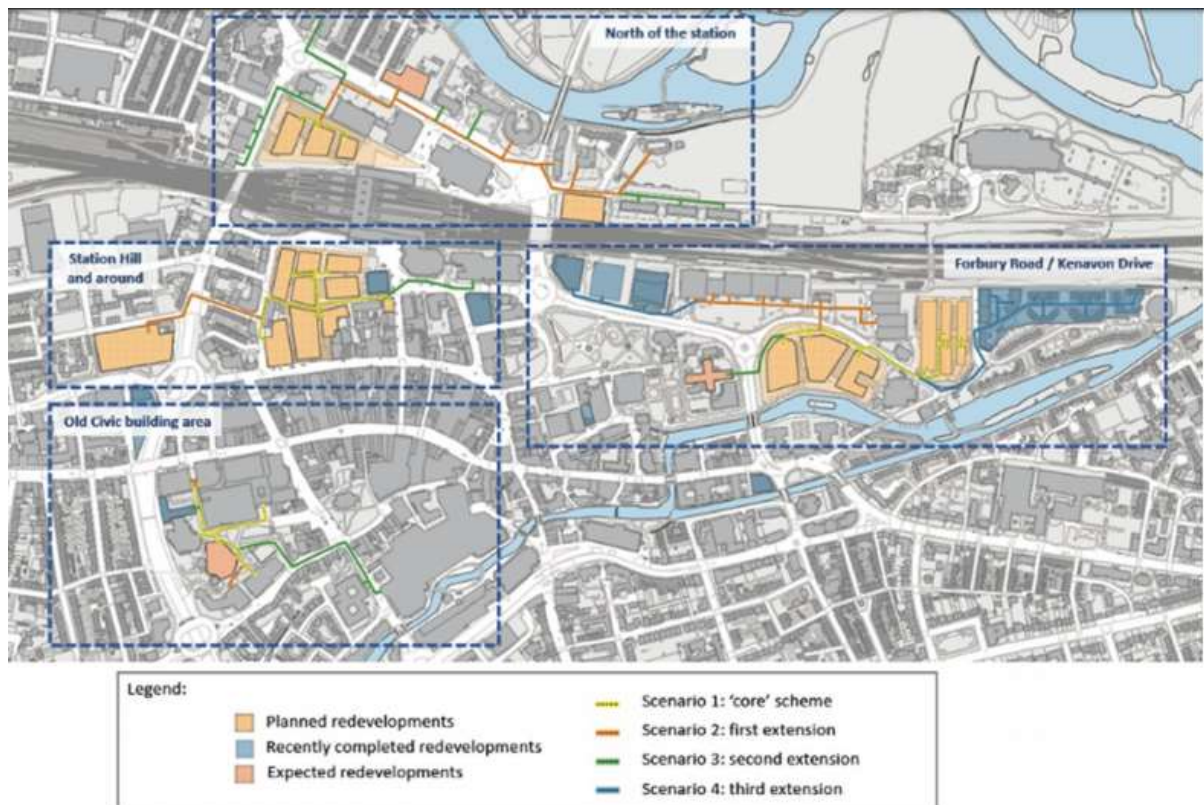


Figure 4 Overview of the four identified clusters

The map above identifies the areas which are potentially suitable for heat network schemes, and the proposed property is not within 1km radius from these areas. The costs involved in extending the DH networks would outweigh the advantages in this development. **Therefore, utilisation of the DH network has not been a feasible option for this development.**

8.2. CHP

The Energy Hierarchy identifies the **combined heat and power (CHP)** as a method of producing heat and electricity with much lower emissions than separate heat and power. Also, it encourages the creation of district heating systems supplied by CHP. The implementation of a CHP strategy should be decided according to good practice design. Key factors for the efficient implementation of the CHP system are:

- Development with high heating load for the majority of the year.
- CHP operation based on maximum heat load for minimum 10 hours per day.
- CHP operation at maximum capacity of 90% of its operating period.

To ensure that CHP is financially viable it is essential that the unit is selected to meet the base heat load and that this load is maintained over a large proportion of the day (a figure of 14 – 17 hours per day is often quoted subject to the load profiles and gas and electricity prices) to ensure that the additional costs (maintenance) associated with running a CHP unit can be recovered. This need to run the CHP plant, as far as possible continuously makes the building load profile of prime importance when reviewing the viability of such solutions and in particular the summertime heat load profile. To enable the CHP plant to run continuously when it is operating, a thermal store is often used so that excess CHP capacity can be used to generate hot water for use at a later time.

Since this development is only comprised of a church, a health centre, 2 flats of 1 bedroom that do not require high heating loads, installing the CHP system would not be beneficial given the cost. According to the GLA Guidance on preparing energy assessment (March 2016), the development consisting around 500 residential units or more would obtain the benefits of the CHP system. Hence the CHP system has not been considered for this development.

9. Energy Statement – 3rd Stage

In this section, the viable **renewable energy technologies** that could reduce the development's CO₂ emissions are examined. In determining the appropriate renewable technology for the site, the following factors were considered;

- Renewable energy resource or fuel availability of the LZC technology on the site.
- Space limitations due to building design and urban location of the site.
- Capital, operating and maintenance cost.
- Planning Permission
- Implementation with regards the overall M&E design strategy for building type
- Available Grants

The table below summarises the various low zero carbon technologies considered for the projects, and we have identified that Photovoltaic (PV) and Air Source Heat Pumps (ASHP) would be the most appropriate option in this development, and **communal ASHPs have been suggested to reduce the carbon emissions on the site.**

Technology	Local Planning Requirements	Carbon Payback	Grants/ Funding	Feasibility
Air Source Heat Pumps (ASHP)	Noise Issues from External units	High	Renewable Heat Incentive (RHI)	HIGH
Photovoltaic (PV)	Spatial and Shadowing	High	-	HIGH
Solar Thermal	Spatial and Shadowing	Low	Renewable Heat Incentive (RHI)	MEDIUM
Ground Source Heat Pumps (GSHP)	Spatial issues for Bore Holes and noise	Medium	Renewable Heat Incentive (RHI)	MEDIUM
Biomass	Spatial requirement for fuel storage and biomass odour	High	Renewable Heat Incentive (RHI)	LOW
Wind Power	Extensive planning requirements for noise and local biodiversity	Low	-	LOW
Hydro Power	Extensive planning requirements for noise and water quality	None	-	ZERO

Table 10 Feasibility Study of LZC Technologies

9.1. Other Technologies

- **Ground Source Heat Pumps (GSHP)**

Ground source heat pump would be a feasible option to meet the space heating requirements, however, it requires to bore ground holes to extract the ground heat to be utilised for space heating requirements. The costs involved in installing GSHP would outweigh the advantages in this minor development. Therefore, utilization of the GSHP has not been a feasible option for this development.

- **Solar Thermal**

The use of solar thermal for this development would be limited to domestic hot water only. The use of solar thermal for space heating would not be practical as it is not required when solar thermal is at its most effective during the summer months. Therefore, this system would require additional plumbing and space for hot water storage, incurring additional financial cost. Moreover, the amount of carbon offset from the system is generally lower than other technologies. Therefore, this technology is deemed to be unsuitable for this development.

- **Hydro power**

There is no river or lake within the development site boundaries. Therefore, small scale hydro-electric will not be studied any further because of the location and the spatial limitations of the development.

- **Wind Power**

Wind turbines need extensive planning requirements and they are only feasible at consistent wind speed. Moreover, since the development is located in an urban area, the site does not have sufficient wind speed to operate wind turbine at the height of 10 meters as shown below (<http://www.renew-reuse-recycle.com/noabl.pl?n=503>). Hence this option has been discounted.

Estimated average windspeeds around RG2 8..

Wind speed at 10m above ground level (m/s)			Wind speed at 25m above ground level (m/s)			Wind speed at 45m above ground level (m/s)		
4.7	5.1	5.3	5.5	5.9	6	6	6.3	6.4
4.7	5	5.1	5.4	5.7	5.8	6	6.2	6.3
4.7	4.7	4.8	5.5	5.5	5.5	6	6	6

Figure 5 Site Wind Speeds

Squares surrounding the central square correspond to wind speeds for surrounding grid squares. Power generated is related to windspeed by a cubic ratio. That means if you halve the windspeed, the power goes down by a factor of 8 (which is $2 \times 2 \times 2$). A quarter of the windspeed gives you a 64th of the power ($4 \times 4 \times 4$). As a rough guide, if your turbine is rated at producing 1KW at 12m/s then it will produce 125W at 6m/s and 15W at 3m/s.

Please Note that the NOABL windspeed dataset used here is a model of windspeeds across the country, assuming completely flat terrain. It isn't a database of measured windspeeds. Other factors such as hills, houses, trees and other obstructions in your vicinity need to be considered as well as they can have a significant effect. If you're thinking about installing a wind turbine, you should

perform your own windspeed measurements using an anemometer to determine what the actual figures are.

- **Biomass**

A biomass system designed for this development would be fueled by wood pellets which have a high-energy content. However, a biomass system would not be an appropriate technology for the site for the following reasons:

- The burning of wood pellets releases substantially more NOx emissions when compared to similar gas boilers. As the development is situated within an urban area, the installation of a biomass boiler would further impact on the air quality in this area.
- the lack of spaces for pellet boiler and storage on the site.
- Pellets would need to be transported from local pellet suppliers, which causes carbon emissions to the air.

However, if the biomass system is considered at detailed design stage, local suppliers can be found near the site as shown in the map below (<http://biomass-suppliers-list.service.gov.uk>).

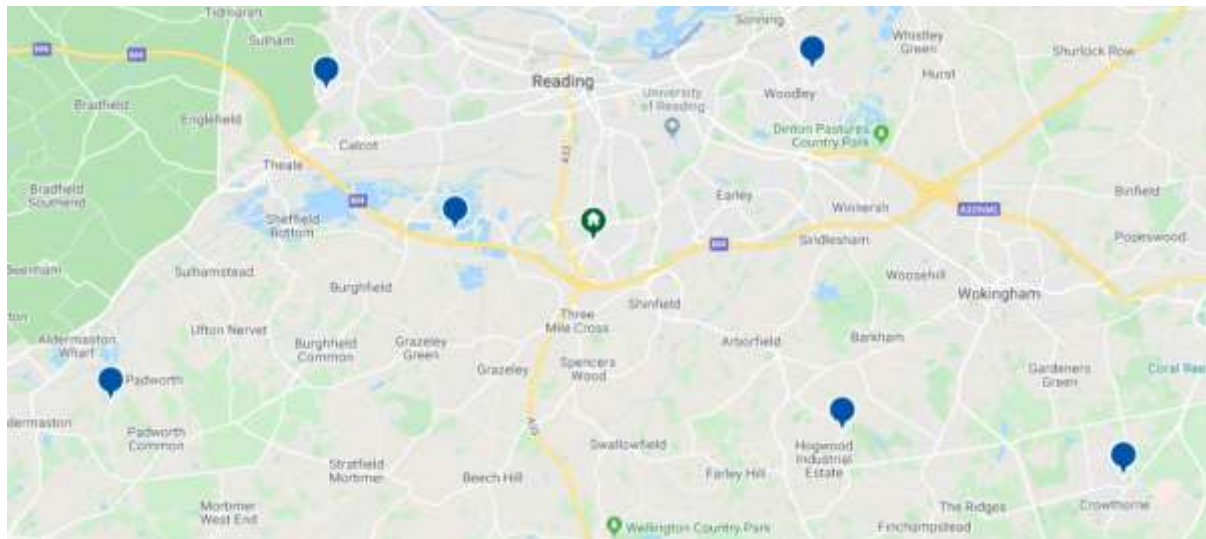


Figure 6 Biomass Suppliers Map

Company name	Postcode	Contact	Fuel Supplied	Telephone
J Mould (Reading) Limited	RG30 3XA	www.jmouldreading.co.uk will.fleming@jmouldreading.co.uk	Chips	01189512222
Travis Perkins Trading Co. Ltd	RG5 4QP	www.travisperkins.co.uk david.goodwin@travisperkins.co.uk	Pellets	0118 969 5959
Travis Perkins Trading Co. Ltd	RG4 9RD	www.travisperkins.co.uk richard.butler@travisperkins.co.uk	Pellets	01189 484588
Travis Perkins Trading Co. Ltd	RG31 5SD	www.travisperkins.co.uk sheun.breton@travisperkins.co.uk	Pellets	0118 9427437
Travis Perkins Trading Co. Ltd	RG40 4PT	www.travisperkins.co.uk steve.stokes@travisperkins.co.uk	Pellets	01189 761100
Oxford Renewables Limited	RG8 7RE	www.oxfordrenewables.co.uk jane.samamoto@oxfordrenewables.co.uk	Pellets	01189641753
Oxford Renewables Limited	RG8 7RE	www.oxfordrenewables.co.uk pellets@oxfordrenewables.co.uk	Pellets	01189641753
BPS Plus Ltd	RG7 4NU	www.berkshire-log-supplies.co.uk moli@bplus.co.uk	Firewood	01189 710201
Mole Valley Farmers Ltd	RG27 0HA	www.molecountrystores.co.uk basingstoke@molecountrystores.com	Pellets	01256 882776
Travis Perkins Trading Co. Ltd	RG45 6RG	www.travisperkins.co.uk paul.viney@travisperkins.co.uk	Pellets	01344 772020

Figure 7 Biomass Suppliers Details

9.2. Proposed Technology

• Air Source Heat Pumps (ASHP)

Communal ASHPs can meet the space heating demands on site efficiently in comparison with gas boilers. Although this low carbon technology consumes electricity to operate, due to the higher efficiency the heat output is much greater. Therefore, it has been suggested for the space heating and hot water. The system specifications used for energy assessment are as follows. Please note that all suggested specifications below are provisional at this early design stage and should be reviewed by mechanical engineers and contractors during design development.

Systems	General Specification	Controls/ Other inputs
Heating	ASHP (Heating efficiency 4.0, cooling EER4.5)	- Charging system linked to use of community heating, programmer and TRVs - Pipes pre-insulated - Distribution with low temperature and variable flow
Hot water	From main heating system	Charged link to use

Table 11 Heating and Hot water systems

Tariffs that apply for non-domestic Renewable Heat Incentive (RHI) are as shown in the table below based on the following link. <https://www.ofgem.gov.uk/environmental-programmes/non-domestic-renewable-heat-incentive-rhi/tariffs-apply-non-domestic-rhi-great-britain>.

Tariff name	Eligible technology	Eligible sizes	RHI
Air Source Heat Pumps (commissioned on or after 1 April 2016)	Air source heat pumps	All capacities	2.75 in pence per kWh

Table 12 Tariffs that apply for installations with an accreditation date on or after 1 April 2016

- **Photovoltaic (PV)**

Based on the feasibility study above, PV would also be suitable renewable Technology for the following reasons:

- The installation of PV is much simpler when compared to other renewable technologies
- There is sufficient roof space available to install enough PV modules to have a significant impact on carbon emissions of the development
- PV panels sited on the roof within an urban area are less visually intrusive when compared to wind turbines

The PV system capacity for the whole development depends upon the heating system selected. Therefore, the amount of PV relating to the proposed heating system option is outlined below:

The tables below illustrate the indicative PV panel's detail, should it be feasible to implement:

ASHPs + 1 kWp PV for 2 flats

Orientation	West	Number of Panels	Approximate 4
Panel Tilt	30°	Power Output	250 W/p
Overshading	Less than 20 percent	Type	Monocrystalline
Annual Output	Approximate 726.21 kWh	PV Area	Approximate 6.6 m ² (4 panels * 1.65 m ²)

Table 13 Suggested PV details

For the 1 kWp system, 4 high efficiency 250W monocrystalline PV panels would to be installed at 30°. The proposed PV panels are subject to further consideration at detailed design stage. In order to qualify both the installer and the equipment, the system must be certified under the Microgeneration Certification Scheme (MCS).

Given the proposed LZC technologies on the site (**ASHPs and PVs**), the overall CO₂ reduction at this stage can be calculated as shown below. And, it can be seen that the overall CO₂ reduction via on-site renewables is **20.16% for Residential units and 35.79% for Non-residential units.**

Stage 3

	Stage 3	Carbon Reduction (%)
Residential	2.36	20.16 %
Non-residential	26.23	35.79 %

Table 14 Regulated Carbon Emissions at Stage 3

10. Conclusion

This report demonstrates how the proposed development will incorporate sustainable design and construction measures, and assesses the carbon dioxide emissions of the proposed development, based on the information provided by the design team.

In line with the three-step energy hierarchy, **the development can achieve the CO₂ emissions reduction of 20.16% in the residential units and 35.79% in the non-residential units over Building Regulations Part L 2013.** once all measures in the table below are taken into account.

Stages	Strategies
Stage 1 Energy efficient design	- U-values and air permeability better than Building Regulations Part L 2013. - The use of Accredited Construction Details for residential flats at all thermal bridging junctions. - Natural ventilation with extract fans in wet rooms 100% Low energy lights - Low water consumption
Stage 2 District heat networks or communal heating systems	Not feasible on the site – Details are in Section 8.
Stage 3 On-site renewable technologies	- High efficient communal Air Source Heat Pumps (ASHPs) for heating and hot water. - PV panels of 1.0 kWp on the roof (approximate 4 panels with 250 w/p are required).

Table 15 Energy Hierarchy and suggested strategies

The carbon savings from energy efficient measures and renewable technology can be calculated as shown below. As can be seen the proposed development meets the local planning requirements.

Energy Hierarchy		Regulated Carbon Emissions (Tonnes CO ₂ /yr)	
		Residential	Non-residential
BASELINE	TER set by Building Regulations Part L 2013	2.96	40.86
STAGE 1 - 3	After energy efficient measures and renewable technologies	2.36	26.23
TOTAL CARBON SAVINGS		20.16 %	35.79 %
TARGET SAVINGS		19 %	-

Table 16 Carbon savings from the residential units

11. Appendix A – SAP Reports

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.23
Printed on 30 January 2020 at 16:45:54

Project Information:

Assessed By: Jun Cao (STRO032897)

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 52.89m²

Site Reference : St Paul's Church

Plot Reference: Flat 1

Address : 23, Whitley Wood Lane, READING, RG2 8PN

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.

It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity

Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER) 27.51 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER) 21.79 kg/m² **OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 43.6 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE) 37.1 kWh/m² **OK**

2 Fabric U-values

Element	Average	Highest	
External wall	0.12 (max. 0.30)	0.12 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.13 (max. 0.20)	0.13 (max. 0.35)	OK
Openings	1.15 (max. 2.00)	1.20 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:

Heat pumps with radiators or underfloor heating - electric
Daikin Altherma ERHQ008BV3 + EKHBH008B

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:	Measured cylinder loss: 1.35 kWh/day	
	Permitted by DBSCG: 1.85 kWh/day	OK

Regulations Compliance Report

Primary pipework insulated: Yes

OK

6 Controls

Space heating controls: Programmer and at least two room thermostats

OK

Hot water controls: Cylinderstat

OK

Independent timer for DHW

OK

Boiler interlock: Yes

OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings 100.0%

Minimum 75.0%

OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (South England): Slight

OK

Based on:

Overshading: Average or unknown

Windows facing: East 1.74m²

Windows facing: South 3.48m²

Ventilation rate: 3.00

Blinds/curtains: None

10 Key features

Doors U-value 1 W/m²K

External Walls U-value 0.12 W/m²K

Party Walls U-value 0 W/m²K

Photovoltaic array

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.23
Printed on 30 January 2020 at 16:45:42

Project Information:

Assessed By: Jun Cao (STRO032897)

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 51.59m²

Site Reference : St Paul's Church

Plot Reference: Flat 2

Address : 23, Whitley Wood Lane, READING, RG2 8PN

Client Details:

Name:

Address :

This report covers items included within the SAP calculations.

It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating system: Electricity

Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)

29.2 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER)

23.49 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)

50.3 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE)

46.9 kWh/m²

OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.13 (max. 0.20)	0.13 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals

5.00 (design value)

Maximum

10.0

OK

4 Heating efficiency

Main Heating system:

Heat pumps with radiators or underfloor heating - electric
Daikin Altherma ERHQ008BV3 + EKHBH008B

Secondary heating system: None

5 Cylinder insulation

Hot water Storage:

Measured cylinder loss: 1.35 kWh/day
Permitted by DBSCG: 1.85 kWh/day

OK

Regulations Compliance Report

Primary pipework insulated: Yes OK

6 Controls

Space heating controls	Programmer and at least two room thermostats	OK
Hot water controls:	Cylinderstat	OK
	Independent timer for DHW	OK
Boiler interlock:	Yes	OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (South England):	Slight	OK
-----------------------------------	--------	----

Based on:

Overshading:	Average or unknown
Windows facing: East	1.74m ²
Windows facing: East	1.74m ²
Windows facing: North	5.22m ²
Ventilation rate:	4.00
Blinds/curtains:	None

10 Key features

Doors U-value	1 W/m ² K
Party Walls U-value	0 W/m ² K
Photovoltaic array	

12. Appendix B – BRUKL Reports

Project name

19-6409 - St Paul's Church - Church

As designed

Date: Thu Jan 30 15:47:19 2020

Administrative information

Building Details

Address: Whitley, Reading, RG2 8PN

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.6.a.2

Interface to calculation engine: Virtual Environment

Interface to calculation engine version: v7.0.12

BRUKL compliance check version: v5.6.a.1

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name:

Telephone number:

Address: , ,

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	25.4
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	25.4
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	16.5
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

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

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

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.12	0.12	CR000000_W30
Floor	0.25	0.13	0.13	MT000001_F
Roof	0.25	0.13	0.13	CR000000_C
Windows***, roof windows, and rooflights	2.2	1.2	1.2	MT000000_W2_OO
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)]				
* There might be more than one surface where the maximum U-value occurs. ** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows. *** Display windows and similar glazing are excluded from the U-value check. N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.				

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

Building services

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

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Main system

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	4.5	-	-	-
Standard value	2.5*	2.6	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 all types >12 kW output, except absorption and gas engine heat pumps. For types ≤12 kW output, refer to EN 14825 for limiting standards.					

2- NV system

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	-	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types ≤12 kW output, refer to EN 14825 for limiting standards.					

1- SYST0000-DHW

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

2- SYST0001-DHW

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

Local mechanical ventilation, exhaust, and terminal units

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

Zone name	SFP [W/(l/s)]										HR efficiency	
	ID of system type	A	B	C	D	E	F	G	H	I		
	Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
Kitchenette		0.3	-	-	-	-	-	-	-	-	-	N/A
Kitchen		0.3	-	-	-	-	-	-	-	-	-	N/A
Dis WC		0.3	-	-	-	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
Kitchen	0.3	-	-	-	-	-	-	-	-	-	N/A
WC	0.3	-	-	-	-	-	-	-	-	-	N/A
WC	0.3	-	-	-	-	-	-	-	-	-	N/A
WC	0.3	-	-	-	-	-	-	-	-	-	N/A
Kitchenette	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	
Corridor		-	125	-	73
Meeting Room 1		125	-	-	237
Meeting Room		125	-	-	126
Meeting Room 2		125	-	-	102
Office		125	-	-	139
Kitchenette		-	125	-	58
Kitchen		-	125	-	156
Hall		-	125	-	358
Dis WC		-	125	-	21
Office		125	-	-	100
Hall Entrance		-	125	75	34
Office		125	-	-	76
Kitchen		-	125	-	50
WC		-	125	-	52
WC		-	125	-	20
WC		-	125	-	25
Vestry (changing)		-	125	-	25
Kitchenette		-	125	-	131
Chapel		-	125	-	598
Foyer 03		-	125	-	10
Foyer 02		-	125	75	87
Foyer 01		-	125	-	21
Coffee area		-	125	-	88
Main Entrance		-	125	75	38
Stair		-	125	-	10
Lift		-	125	-	14
store		125	-	-	3
store		125	-	-	6
Store		125	-	-	6
Store		125	-	-	6
Store		125	-	-	5
Store		125	-	-	7

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?
Corridor	N/A	N/A
Meeting Room 1	NO (-97%)	NO
Meeting Room	N/A	N/A
Meeting Room 2	NO (-99.1%)	NO
Office	NO (-93.3%)	NO
Kitchenette	N/A	N/A
Kitchen	N/A	N/A
Hall	NO (-83.3%)	NO
Dis WC	N/A	N/A
Office	N/A	N/A
Hall Entrance	NO (-65.7%)	NO
Office	NO (-90.6%)	NO
Kitchen	NO (-89.5%)	NO
WC	NO (-87.7%)	NO
WC	NO (-93.7%)	NO
WC	NO (-92.1%)	NO
Vestry (changing)	NO (-93.6%)	NO
Kitchenette	NO (-80.5%)	NO
Chapel	NO (-81.8%)	NO
Foyer 03	N/A	N/A
Foyer 02	NO (-71.1%)	NO
Foyer 01	N/A	N/A
Coffee area	N/A	N/A
Main Entrance	NO (-74.6%)	NO
Stair	NO (-1%)	NO
Lift	N/A	N/A

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	666	666
External area [m ²]	1691.2	1691.2
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	5	3
Average conductance [W/K]	347.89	651.99
Average U-value [W/m ² K]	0.21	0.39
Alpha value* [%]	28.16	19.34

* 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 Institutions: Hospitals and Care Homes
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/m²]

	Actual	Notional
Heating	9.86	13.31
Cooling	2.92	7.26
Auxiliary	0.13	0.11
Lighting	8.47	14.09
Hot water	10.35	15.34
Equipment*	17.82	17.82
TOTAL **	31.73	50.1

* Energy used by equipment does not count towards the total for consumption or calculating emissions.

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

Energy Production by Technology [kWh/m²]

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

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	165.47	210.67
Primary energy* [kWh/m ²]	97.41	149.97
Total emissions [kg/m ²]	16.5	25.4

* 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] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	126	34.9	9.4	3	0.1	3.73	3.2	4	4.5
	Notional	111.1	97.7	12.7	7.5	0.1	2.43	3.6	----	----
[ST] Central heating using water: radiators, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	280.4	1.8	21.8	0	1.8	3.57	0	4	0
	Notional	250	6	28.6	0	0.9	2.43	0	----	----

Key to terms

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

Key Features

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

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.12	CR000000_W30
Floor	0.2	0.13	MT000001_F
Roof	0.15	0.13	CR000000_C
Windows, roof windows, and rooflights	1.5	1.2	MT000000_W2_O0
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{i-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	5

Project name

19-6409 - St Paul's Church - Healthcentre

As designed

Date: Thu Jan 30 15:39:49 2020

Administrative information

Building Details

Address: Whitley, Reading, RG2 8PN

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.6.a.2

Interface to calculation engine: Virtual Environment

Interface to calculation engine version: v7.0.12

BRUKL compliance check version: v5.6.a.1

Owner Details

Name:

Telephone number:

Address: , ,

Certifier details

Name:

Telephone number:

Address: , ,

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	22.3
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	22.3
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	14.2
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and 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	0.12	0.12	GF000000_W1
Floor	0.25	0.13	0.13	GF000000_F
Roof	0.25	0.13	0.13	GF000029_C
Windows***, roof windows, and rooflights	2.2	1.2	1.2	GF000000_W3_O0
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"
U _a -Limit = Limiting area-weighted average U-values [W/(m ² K)] U _a -Calc = Calculated area-weighted average U-values [W/(m ² K)] U _i -Calc = Calculated maximum individual element U-values [W/(m ² K)]				
* There might be more than one surface where the maximum U-value occurs.				
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.				
*** Display windows and similar glazing are excluded from the U-value check.				
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.				

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

Building services

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

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Main system

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	4.5	-	-	-
Standard value	2.5*	2.6	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 all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

1- SYST0000-DHW

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

"No zones in project where local mechanical ventilation, exhaust, or terminal unit is applicable"

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
GF- Lobby		-	125	-	18
GF- Private Interview Room		125	-	-	82
GF- Admin/ Secretaries		125	-	-	198
GF- Consultant 1 Room		125	-	-	122
GF- Consultant 2 Room		125	-	-	127
GF- Stairwell		-	125	-	22
GF-CLNR Store		125	-	-	5
GF- Lobby/ Corridor		-	125	-	23
GF-Treatment Room 1		125	-	-	131
GF- Phlebotomy		125	-	-	106
GF- Health Promotion/ Meeting/ Multipurpose Room		125	-	-	373
GF-Treatment Room 2		125	-	-	138
GF- Dis WC		-	125	-	21
GF- Utility		-	125	-	11
GF- Store		125	-	-	5
GF- Dis WC/BC		-	125	-	23
GF- Dis WC/BC		-	125	-	98
GF- Waiting Room/ Receptio		-	125	75	181
FF- Consultant 6 Room		125	-	-	122
FF- Consultant 5 Room		125	-	-	127
FF- Dis WC		-	125	-	21
FF- GP Trainer		125	-	-	122
FF- Consulting Room 8		125	-	-	127
FF- Consulting Room 7		125	-	-	130

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
FF- Registrar		125	-	-	123
FF- Admin Area		125	-	-	137
FF- Prep/ Recovery		125	-	-	106
FF- Utility		125	-	-	6
FF- Clean Store		125	-	-	10
FF- Consultant 3 Room		125	-	-	115
FF- Nurse Practitioner		125	-	-	115
FF- Minor OPS		125	-	-	131
FF- WC		-	125	-	20
FF- Stairwell		-	125	-	34
FF- Consultant 4 Room		125	-	-	134
FF- Waiting Room		125	-	-	179
FF- Clnrs Store		125	-	-	5
FF- Corridor Lobby		-	125	-	101
SF- Dis WC		-	125	-	21
SF- Meeting Room		125	-	-	382
SF- Staffroom		125	-	-	124
SF- Kitchen		125	-	-	92
SF- Locker Room		125	-	-	9
SF- Store		125	-	-	3
SF- Plant Room		125	-	-	36
SF- Stairwell		-	125	-	36
SF- Server Room		125	-	-	100
SF- Computer Input		125	-	-	108
SF- Store		125	-	-	5
SF-Clnrs St		125	-	-	4
SF- Scanning		125	-	-	96
SF- Secretaries		125	-	-	101
SF- Administration		125	-	-	111
SF- Secretaries		125	-	-	99
SF- Store		125	-	-	5
SF- Practice Manager		125	-	-	144
SF- Records		125	-	-	172
SF- Store		125	-	-	5
SF- Store		125	-	-	7
SF- WC		-	125	-	24
SF - Lobby		-	125	-	79

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?
GF- Lobby	NO (-52.1%)	NO
GF- Private Interview Room	NO (-71.2%)	NO
GF- Admin/ Secretaries	NO (-63.7%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
GF- Consultant 1 Room	NO (-80.3%)	NO
GF- Consultant 2 Room	NO (-92.5%)	NO
GF- Stairwell	NO (-75.5%)	NO
GF-CLNR Store	N/A	N/A
GF- Lobby/ Corridor	NO (-36.1%)	NO
GF-Treatment Room 1	NO (-77.2%)	NO
GF- Phlebotomy	NO (-72.3%)	NO
GF- Health Promotion/ Meeting/ Multipurpose Room	NO (-62%)	NO
GF-Treatment Room 2	NO (-71.5%)	NO
GF- Dis WC	N/A	N/A
GF- Utility	N/A	N/A
GF- Store	N/A	N/A
GF- Dis WC/BC	N/A	N/A
GF- Dis WC/BC	N/A	N/A
GF- Waiting Room/ Receptio	NO (-29.8%)	NO
FF- Consultant 6 Room	NO (-80.3%)	NO
FF- Consultant 5 Room	NO (-92.5%)	NO
FF- Dis WC	N/A	N/A
FF- GP Trainer	NO (-75.3%)	NO
FF- Consulting Room 8	NO (-88.3%)	NO
FF- Consulting Room 7	NO (-78.5%)	NO
FF- Registrar	NO (-72.6%)	NO
FF- Admin Area	NO (-65.8%)	NO
FF- Prep/ Recovery	NO (-86.6%)	NO
FF- Utility	N/A	N/A
FF- Clean Store	NO (-71.4%)	NO
FF- Consultant 3 Room	NO (-74.9%)	NO
FF- Nurse Practioner	NO (-74.9%)	NO
FF- Minor OPS	NO (-69.8%)	NO
FF- WC	NO (-84.1%)	NO
FF- Stairwell	NO (-75.5%)	NO
FF- Consultant 4 Room	NO (-83.3%)	NO
FF- Waiting Room	N/A	N/A
FF- Clnrs Store	N/A	N/A
FF- Corridor Lobby	N/A	N/A
SF- Dis WC	N/A	N/A
SF- Meeting Room	NO (-79.2%)	NO
SF- Staffroom	NO (-77.4%)	NO
SF- Kitchen	NO (-90.9%)	NO
SF- Locker Room	NO (-77.1%)	NO
SF- Store	N/A	N/A
SF- Plant Room	NO (-68.5%)	NO
SF- Stairwell	NO (-76.6%)	NO
SF- Server Room	NO (-91.5%)	NO
SF- Computer Input	NO (-77%)	NO
SF- Store	N/A	N/A
SF-Clnrs St	N/A	N/A
SF- Scanning	NO (-65.5%)	NO
SF- Secretaries	NO (-68.2%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
SF- Administration	NO (-87.8%)	NO
SF- Secretaries	NO (-67.1%)	NO
SF- Store	N/A	N/A
SF- Practice Manager	NO (-81.1%)	NO
SF- Records	N/A	N/A
SF- Store	N/A	N/A
SF- Store	N/A	N/A
SF- WC	N/A	N/A
SF - Lobby	N/A	N/A

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m ²]	1073.6	1073.6
External area [m ²]	1543.6	1543.6
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	5	3
Average conductance [W/K]	306.21	715.47
Average U-value [W/m ² K]	0.2	0.46
Alpha value* [%]	37.18	15.49

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

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	4.02	8.23
Cooling	7.04	10.32
Auxiliary	0	0
Lighting	15.73	24.61
Hot water	0.6	0.89
Equipment*	29	29
TOTAL **	27.39	44.06

* Energy used by equipment does not count towards the total for consumption or calculating emissions.

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

Energy Production by Technology [kWh/m²]

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

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	134.88	205.75
Primary energy* [kWh/m ²]	84.09	131.87
Total emissions [kg/m ²]	14.2	22.3

* 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] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	53.9	81	4	7	0	3.73	3.2	4	4.5
	Notional	72	133.8	8.2	10.3	0	2.43	3.6	----	----

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	0.12	GF000006_W3_A0
Floor	0.2	0.13	GF000000_F
Roof	0.15	0.13	FF000004_C_A0
Windows, roof windows, and rooflights	1.5	1.2	GF000000_W3_O0
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"
U _{i-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.			

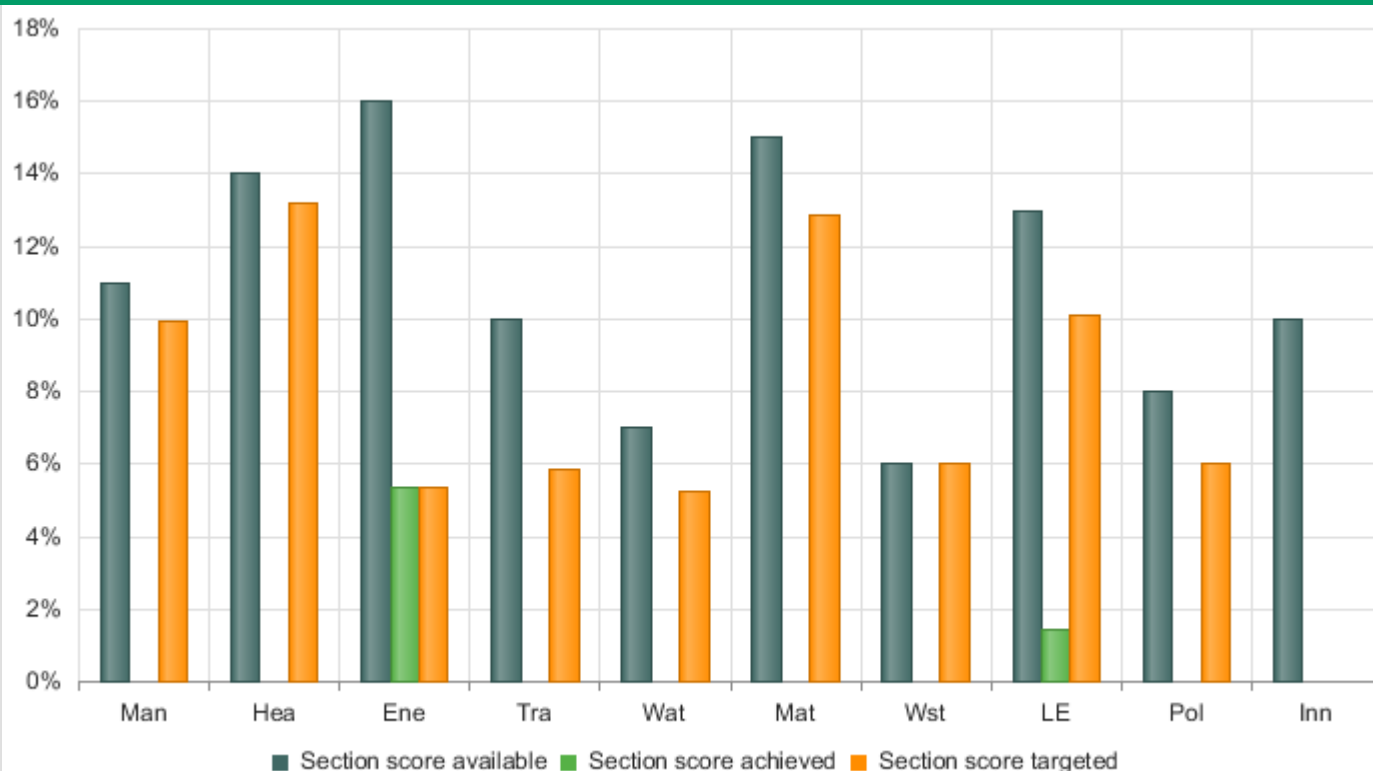
Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	5

13. Appendix C – BREEAM Reports

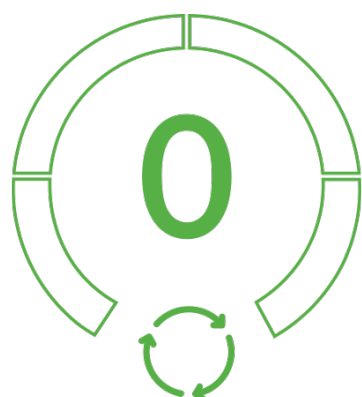
Pre-assessment : Design (Interim) : St Paul's Church, Whitley
Wood Lane, Reading, RG2 8PN (19-6409)

BREEAM Rating					
	Credits available	Credits achieved	% Credits achieved	Weighting	Category score
Man	21.0	0.0	0.00%	11.00%	0.00%
Hea	17.0	0.0	0.00%	14.00%	0.00%
Ene	21.0	7.0	33.33%	16.00%	5.33%
Tra	12.0	0.0	0.00%	10.00%	0.00%
Wat	8.0	0.0	0.00%	7.00%	0.00%
Mat	14.0	0.0	0.00%	15.00%	0.00%
Wst	10.0	0.0	0.00%	6.00%	0.00%
LE	9.0	1.0	11.11%	13.00%	1.44%
Pol	12.0	0.0	0.00%	8.00%	0.00%
Inn	10.0	0.0	0.00%	10.00%	0.00%
Total	134.0	8.0	5.97%	-	6.77%
Rating	-	-	-	-	Unclassified

Performance by environmental category



Indicator scores



Circularity



Wellbeing



Whole Life Carbon

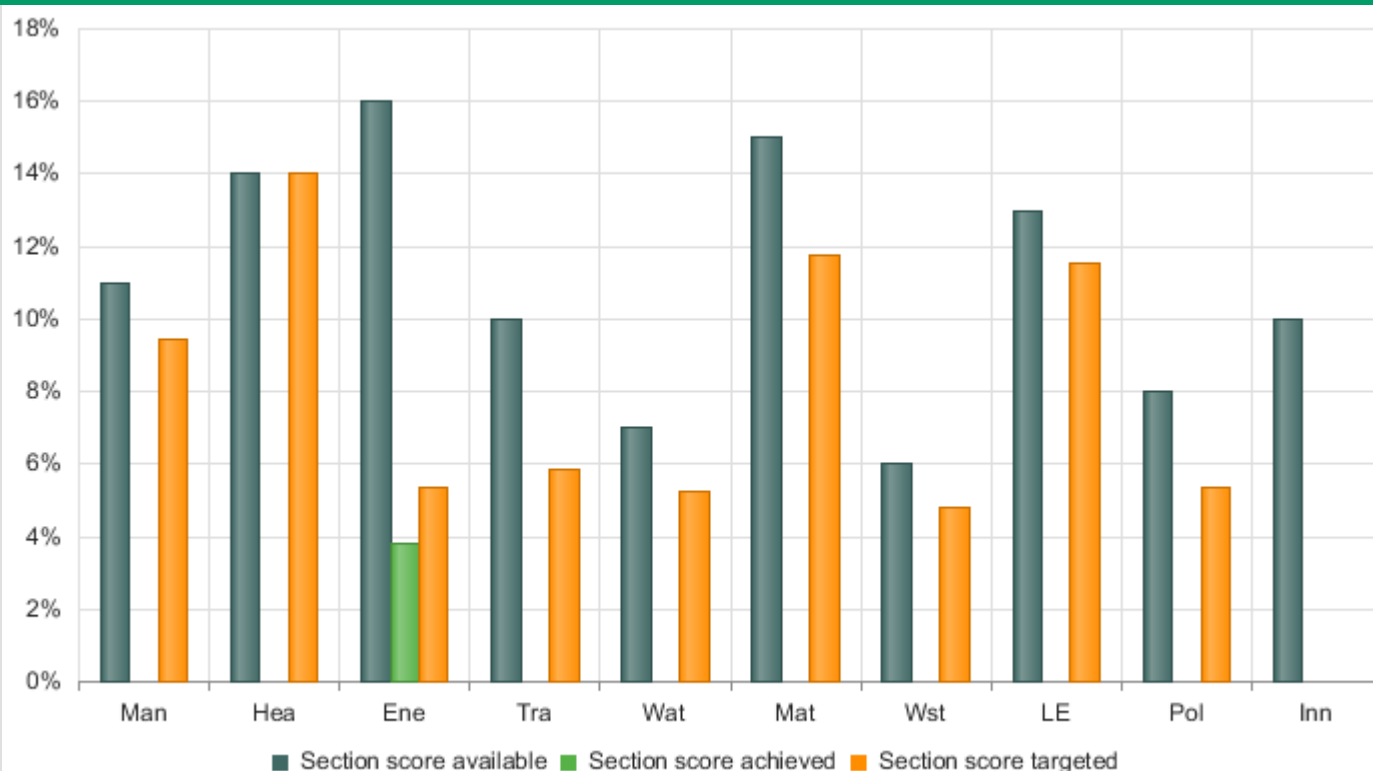
More information (<https://www.breeam.com/news/new-breeam-indicators-to-be-added-to-breeam/>) about the BREEAM indicator scores

Pre-assessment : Design (Interim) : St Paul Church - Healthcare Building (19-6409)

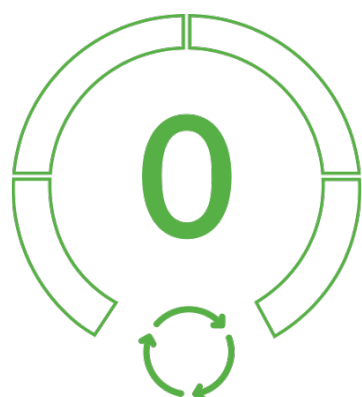
BREEAM Rating

	Credits available	Credits achieved	% Credits achieved	Weighting	Category score
Man	21.0	0.0	0.00%	11.00%	0.00%
Hea	18.0	0.0	0.00%	14.00%	0.00%
Ene	21.0	5.0	23.81%	16.00%	3.80%
Tra	12.0	0.0	0.00%	10.00%	0.00%
Wat	8.0	0.0	0.00%	7.00%	0.00%
Mat	14.0	0.0	0.00%	15.00%	0.00%
Wst	10.0	0.0	0.00%	6.00%	0.00%
LE	9.0	0.0	0.00%	13.00%	0.00%
Pol	12.0	0.0	0.00%	8.00%	0.00%
Inn	10.0	0.0	0.00%	10.00%	0.00%
Total	135.0	5.0	3.70%	-	3.80%
Rating	-	-	-	-	Unclassified

Performance by environmental category



Indicator scores



Circularity



Wellbeing



Whole Life Carbon

More information (<https://www.breeam.com/news/new-breeam-indicators-to-be-added-to-breeam/>) about the BREEAM indicator scores