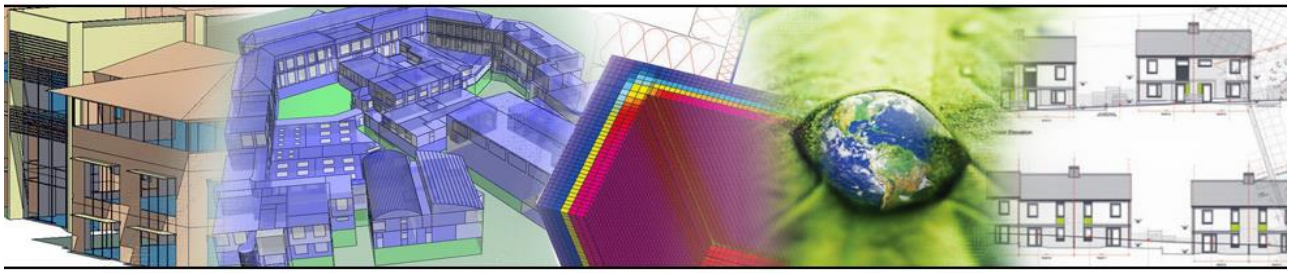

Energy Strategy & LZC Feasibility Assessment

Better Barnsley Buildings Phase 1: Library and Met Centre, Barnsley

Prepared for: NPS Barnsley

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1. Executive Summary

This Energy Statement has been produced to address Planning Condition CSP 5 issued by the Barnsley Metropolitan Borough Council for the proposed redevelopment of the Library and Markets in Barnsley.

In accordance with Part L2a: 2013, predicted Carbon Dioxide (CO_2) emissions have been determined by Stroma using Government approved IES 2016 software. Results of this assessment demonstrate that the required CO_2 savings can be achieved through a combination of passive design measures and low carbon and renewable energy technology. Savings have been expressed against each stage of the hierarchy.

This statement and LZC study has set out how the proposed development incorporating a fabric-first design approach, energy efficient fixed services and renewable energy technology can achieve a 15.12% reduction in CO_2 emissions as required by policy CSP 5 of Barnsley Core Strategy.

	Predicted Annual CO_2 Emissions (kg.CO_2/year)	CO_2 Reduction (%)	Cumulative CO_2 Reduction (%)
Baseline	607,828	-	-
Be Lean	603,063	0.78%	0.78%
Be Clean	595,272	1.29%	2.07%
Be Green ASHP	574,342	3.52%	5.51%
Be Green PV	515,905	10.17%	15.12%
Target	516,653	15%	**Target Achieved**

Table 1. **CO_2 reduction summary**

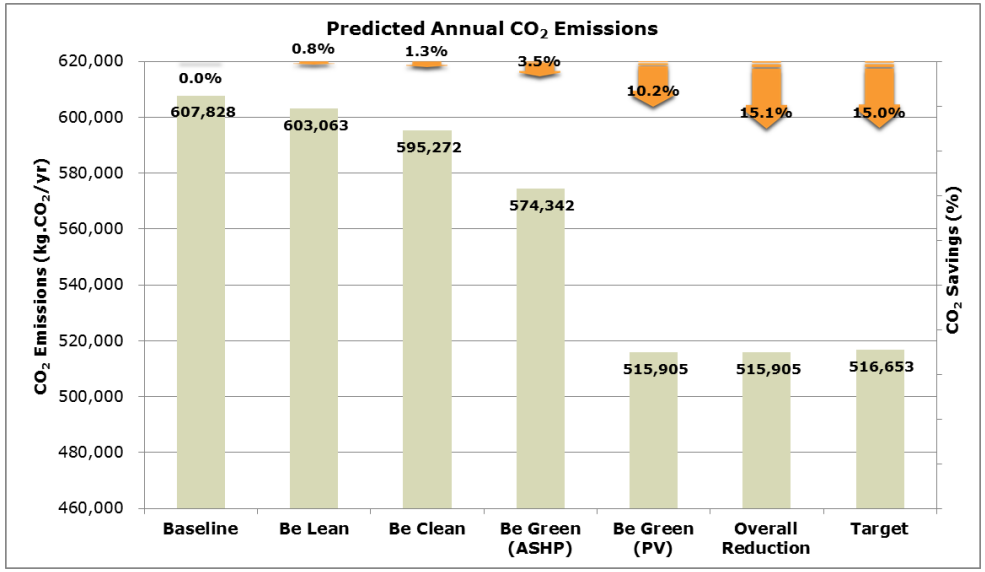

Figure 1. **Predicted annual CO_2 emissions**

2. Introduction

Stroma Technology has been commissioned by NPS Barnsley to prepare a Low and Zero Carbon (LZC) feasibility study for the proposed redevelopment the Library and Market in Barnsley. This LZC intends to address the requirements imposed by CSP 5 planning policy or Barnsley's Local Core Plan

The proposed development is located within town centre of Barnsley and will therefore need to meet the requirements of the Barnsley Core Strategy and policy CSP 5 which call for a 15% CO_2 saving for all new non-domestic buildings submitted up to 2015.

Policy CSP 5 states major developments above 1000 m^2 are required to achieve 15% CO_2 savings against a 2013 Part L2a compliant baseline for the period 2013-2016. The proposed development has a total floor area just over 20,000 m^2 and is therefore considered to be a 'major development'.

In accordance with the national energy hierarchy, a fabric-first approach has been followed prior to the consideration of connected heat and renewable energy technologies.

Figure 2. **Energy hierarchy**

3. Development Site

The development site is located within the town centre of Barnsley between Market Street and Cheapside. This forms one of the two Phases of Barnsley Better Buildings town centre development. Phase 1 includes two buildings, the Met Centre and Library block. The redevelopment of the Met Centre comprises of a redeveloped market and food hall, new retail units, restaurant, leisure unit and a management office suite. The 2nd building is the new town centre library replacing the old building, with a new café adjoining it with access from the new square as well as from the ground floor of the library. Phase 2, registered under a separate planning application comprises of retail, leisure, cinema and office space.

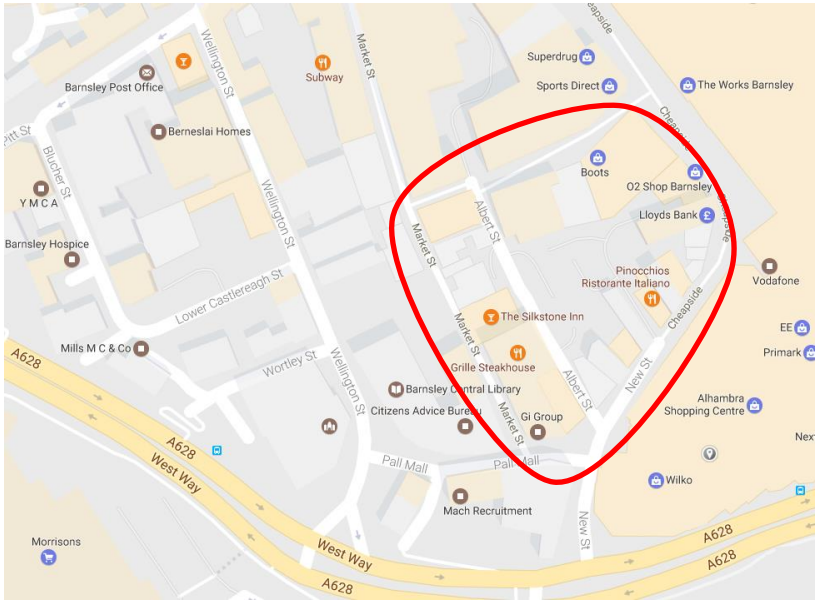

Figure 3. **Aerial view of the development site**

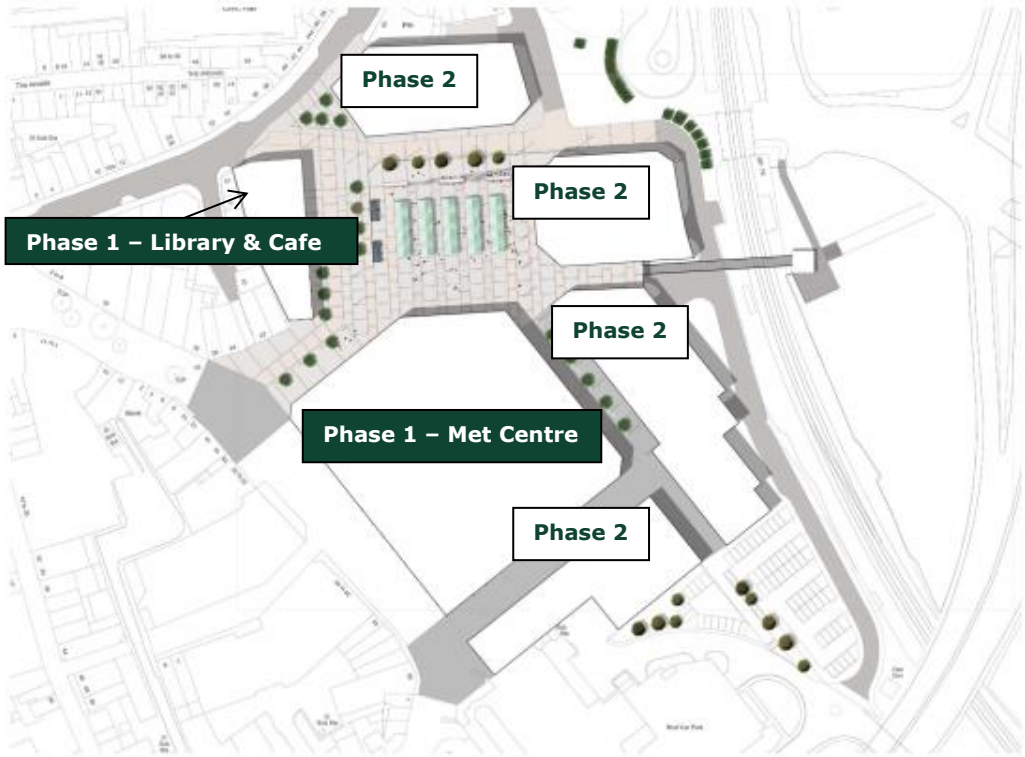

Figure 4. **Site plan of the development site**

4. Planning Policy

4.1. National Policy

The Department for Communities and Local Government (DCLG) released the National Planning Policy Framework (NPPF) in March 2012. In revising this framework, the Government's objective is to streamline the process encouraging sustainable development and promoting the needs and priorities of local communities.

This framework is to be used as the base by councils to develop their own local planning policy. Section 10 of the framework addresses climate change, flooding and costal change. Considerations include;

- Minimising CO_2 emissions
- Vulnerability of fuel supply
- A promotion of decentralised, low carbon and renewable energy sources wherever viable
- Convergence towards existing 'zero carbon' policy targets (postponed)

4.1.1. Barnsley Core Strategy

The core strategy plan for Barnsley was revised and adopted in September 2011. The main policy covering carbon emissions of new developments is covered by section 9.2 which detailed over leaf;

9.2 Renewables

The Challenge

- Meeting the government's carbon-cutting ambitions by promoting both higher levels of energy efficiency and much greater use of renewable energy
- wider housing and economic objectives to contribute to the government's ambitions

The Current Position

- Renewable energy is an integral part of the governments longer-term aim of reducing
- Planning Policy Statement 22 requires the inclusion on the Local Development Framework (LDF) which promotes renewable energy, low carbon and micro generation technology within major developments.
- The Regional Spatial Strategy set local targets for installed grid-connected renewable energy and the figures for Barnsley were 15 MW by 2010 and 34 MW by 2021

Policy Solutions

- Increasing renewable energy capacity and facilitating the delivery of schemes which lead to wider economic and environmental benefit, reduce greenhouse gas emissions, and provide a diverse energy supply

4.1.2. Policy CSP 5: Renewables

CSP 5 Including Renewable Energy in Developments

All development (either new build or conversion) of 10 or more dwellings or 1000 m^2 of non-residential floor space will be expected to incorporate decentralised, renewable or low carbon energy sources and other appreciate design measures sufficient to reduce the developments carbon dioxide emissions by at least 15% for applications submitted thereafter subject to such measures being practicable and not unacceptably prejudicing the viability of the development, where it is not appropriate to incorporate such provisions within the development, an off-site scheme, or contribution to such may be acceptable**.**

9.30 A proportion of the energy supply for new development should be secured from decentralised and renewable or low-carbon energy sources. The domestic and industrial sectors are responsible for a majority of Barnsley's total emissions and this policy aims to create a framework that both promotes and encourages the generation of energy from renewable and low-carbon sources.

9.31 The percentage reduction in carbon dioxide emissions achieved as a result of incorporating decentralised, renewable or low carbon energy sources will be measured against the carbon emission that would occur if the development had not incorporated such energy sources.

9.32 This policy will be applied flexibly if it can be demonstrated that such provision would not be technically or economically feasible.

9.33 Renewable sources include energy produced from the wind, sun, biomass, water and photovoltaic equipment. The proposals must accord with Policy CSP6.

9.34 We will prepare a Supplementary Planning Document to explain how we will apply this policy.

CSP 6 Development that Produces Renewable Energy

We will allow development that produces renewable energy as long as there is no significantly harmful effect on:

- the character of the landscape and appearance of the area
- living conditions
- biodiversity, geodiversity and water quality
- heritage assets, their settings and cultural features and areas
- highway safety, and
- infrastructure including radar

Proposals must be accompanied by information that shows how the local environment will be protected, and that the site will be restored when production ends.

5. Building Regulations and Planning Conditions

5.1. Building Regulations – Non-domestic

Approved Document Part L2a: 2013 Conservation of Fuel and Power sets the standard for Carbon emissions for new non-domestic buildings and came into force on 6th April 2014, superseding the former Part L2a: 2010.

Part L2a: 2013 document largely follows the same methodology as before with a number of key changes intended to reduce energy consumption and associated CO_2 emissions. The 2013 target emissions rate represents a 9% reduction in CO_2 emissions across an aggregated mix of non-domestic building types. The commercial unit will need to comply with the criteria set out in the document, as follows

1. **Criterion 1:** in accordance with regulation 26, the calculated CO_2 emission rate for the building (the Building CO_2 Emission Rate) must not be greater than the Target CO_2 Emission Rate (TER).

2. **Criterion 2:** the performance of the individual fabric elements and the fixed building services of the building should achieve reasonable overall standards of energy efficiency.

3. **Criterion 3:** demonstration that the building has appropriate passive control measures to limit solar gain.

4. **Criterion 4:** the performance of the building, as-built, should be consistent with the BER.

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

Compliance with the Approved Document Part L2a should be demonstrated at detailed design stage, prior to construction.

5.2. Methodology

Predicted annual energy consumption has been determined using Dynamic Simulation Modelling (DSM). In each case, calculations have been undertaken using Government approved software by a trained and accredited assessor. Results are derived in respect of floor area and consider energy use ($kWh/m^2.yr$) and associated CO_2 emissions ($kg.CO_2/m^2.yr$) from the following:

- Space heating
- Domestic hot water
- Ventilation
- Lighting
- Ancillary pumps and fans
- Energy generating technology

5.2.1. Energy Modelling – Met Centre

A Dynamic Simulation Model (DSM) model has been produced for the Met Centre using IES Virtual Environment software to determine the predicted annual energy consumption and CO_2 emissions. A specification has been provided by NPS Barnsley to demonstrate compliance with Approved Document Part L2a: 2013.

Refence	Detail
BBTC_IBI_MC_A_F100_PL_B1_01	Basement layout
BBTC_IBI_MC_A_F100_PL_00_01	Ground Floor layout
BBTC_IBI_MC_A_F100_PL_01_01	First Floor layout
BBTC_IBI_MC_A_F100_PL_02_01	Second Floor layout
BBTC_IBI_MC_A_F100_EL_XX_01	Building Elevations
BBTC_IBI_MC_A_F100_SE_AD_01	Bulding Sections

Table 2. **Architectural drawings used for the Met Centre**

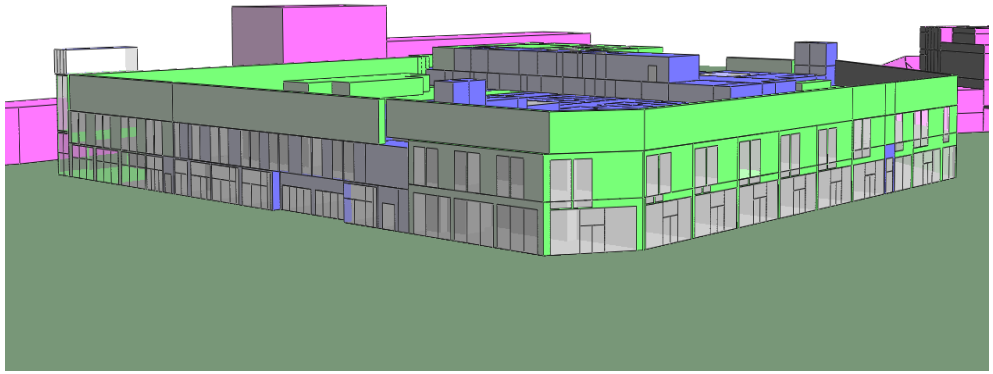

Figure 4. **South West and South East Elevation (Phase 2 & canopy not shown)**

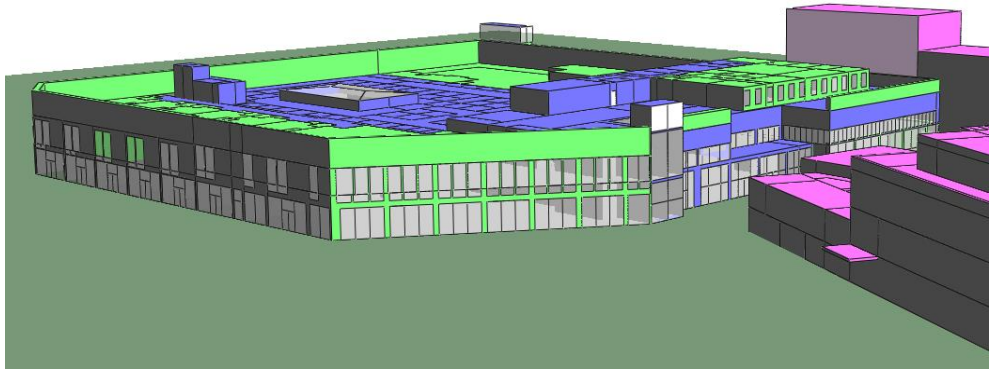

Figure 5. **North, North West and North Elevations**

5.2.2. Energy Modelling – Library & Cafe

A Dynamic Simulation Model (DSM) model has been produced for the Library and Cafe using IES Virtual Environment software to determine the predicted annual energy consumption and CO_2 emissions. A specification has been provided by NPS Barnsley to demonstrate compliance with Approved Document Part L2a: 2013.

Refence	Detail
BBTC_IBI_LR_A_F100_PL_00_3	Ground Floor Layout
BBTC_IBI_LR_A_F100_PL_01_3	First Floor Layout
BBTC_IBI_LR_A_F100_PL_02_3	Second Floor Layout
BBTC_IBI_LR_A_F100_PL_03_3	Third Floor Layout
BBTC_IBI_LR_A_F100_PL_RF_3	Roof Layout
BBTC_IBI_LR_A_F100_SE_001_2	Section AA
BBTC_IBI_LR_A_F100_SE_002_2	Section BB
BBTC_IBI_LR_A_F100_EL_001_2	Front and Rear Elevations
BBTC_IBI_LR_A_F100_EL_002_2	Side Elevations

Table 3. **Architectural drawings used for the Library and Cafe**

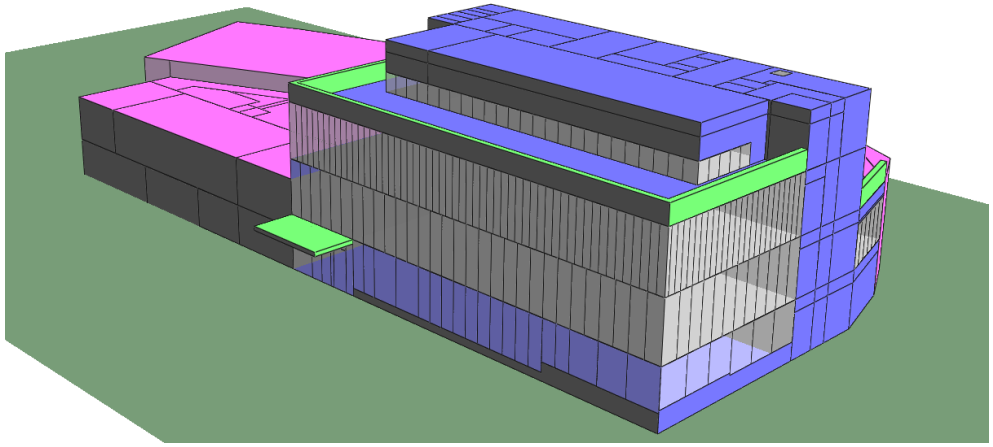

Figure 6. **Library East and North Elevations**

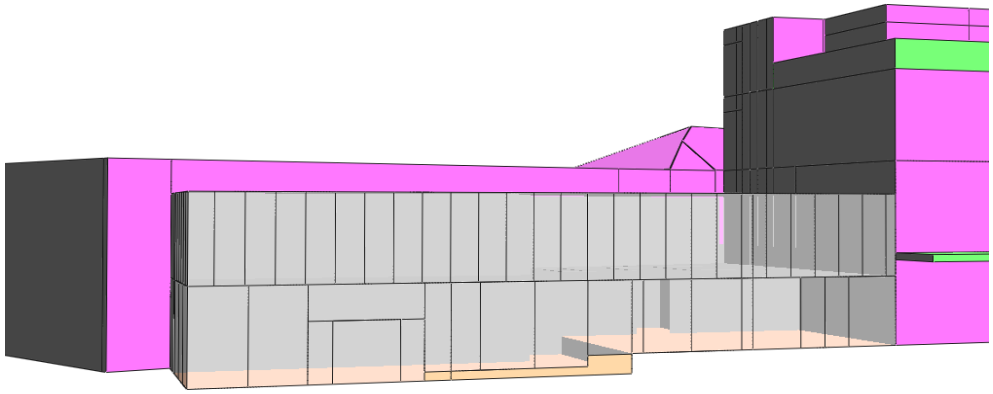

Figure 7. **Library Café East Elevation**

BE LEAN:
USE LESS ENERGY

6. Be Lean

This section outlines the proposals for specifying building fabric and services beyond the requirements of the current Building Regulations (the baseline).

Fundamental to achieving energy efficiency in any new building is the specification of a high performance thermal envelope. Passive design features such as **high levels of insulation**, designing to maximise **solar gain** and limiting heat loss through **air leakage** and **thermal bridging** are all proven

6.1. Building Fabric

6.1.1. Met Centre

The following table outlines the proposed fabric specification applied to the DSM calculation for the Met Centre. It can be seen that the values represent significant bettering of the mandatory requirements set out in the current Building Regulations.

N.b. In accordance with information received; Market/Food Hall/Leisure/Office areas are taken to have a **solar g-value of 0.28** and a **Visible Light Transmittance (VLT) of 50%.** Retail glazing (both display and non-display) is taken to have a **solar g-value of 0.4** and a **Visible Light Transmittance (VLT) of 71%.** Roof lights are taken to have a **solar g-value of 0.55** and **a VLT of 70%**

Element	ADL2a: 2013 Limiting U-value ($W/m^2.K$)	Proposed U-value ($W/m^2.K$)	Improvement (%)
Ground Floor	0.25	0.15	40%
External Wall (brick slip)	0.35	0.20	43%
Curtain Wall	0.35	0.20	43%
Roof	0.25	0.15	40%
Market/Leisure/Food Hall Glazing	2.20	1.40	36%
Retail Glazing (display)	n/a	2.20	n/a
Retail Glazing (non-display)	2.2	1.60	27%
Roof windows and roof lights	2.20	1.40	36%
High usage entrance doors (retail)	3.50	2.20	37%
High usage entrance doors (market)	3.50	1.40	60%
Air permeability ($m^3/h.m^2$ @ 50 Pa)			
Entire building	10.0	5.0	50%

Table 4. **Met Centre - Proposed building fabric specification**

6.1.2. Library & Cafe

The following table outlines the proposed fabric specification applied to the DSM calculation for the Library and adjacent Cafe. It can be seen that the values represent significant bettering of the mandatory requirements set out in the current Building Regulations.

N.b. In accordance with information received; all areas are taken to have a **solar g-value of 0.22** and a **Visible Light Transmittance (VLT) of 40%.** Roof lights are taken to have a **solar g-value of 0.5** and **a VLT of 60%.**

Element	ADL2a: 2013 Limiting U-value ($W/m^2.K$)	Proposed U-value ($W/m^2.K$)	Improvement (%)
Ground floor	0.25	0.09	64%
External wall (Brick)	0.35	0.15	57%
External wall (Cladding)	0.35	0.15	57%
Roof	0.25	0.18	28%
Glazing	2.20	1.60	27%
Roof windows and roof lights	2.20	1.80	18%
High usage entrance doors	3.50	1.60	54%
Air permeability ($m^3/h.m^2$ @ 50 Pa)			
Library	10.0	4.0	60%
Library Cafe	10.0	5.0	50%

Table 5. **Library - Proposed building fabric specification**

6.2. Building Services

6.2.1. Met Centre – Market, Food Hall & Core Service Areas

The Market and Food Hall Areas as well of back of house service core areas (toilets, stores circulation areas) are to be fully installed and designed by NPS Barnsley property being occupied. A full BMS system has been applied for all building services including lighting with provision for monitoring and alarms for 'out of range' energy consumption. The building services as confirmed by NPS Barnsley are listed in the below table;

Element	Specification
Heating	**Market/Food Hall** Variable Refrigerant Flow (VRF) system SCOP =4.75 **Market Fish stalls** – VRF SCOP =4.0 **Service Toilets** – Electric panel heaters **Service Core Areas -** Unheated
Cooling	**Market/Food Hall** – Central Chillers SEER=5.0, EER=3.50 **Market Fish Stalls** – VRF SEER=4.5, EER=3.50
Hot Water	**Market** - Direct gas fired boiler 96% efficient with 1000 litres storage. Secondary circulation with time switch. **Food Hall** - Direct gas fired boiler 96% efficient with 1200 litres storage. Secondary circulation with time switch.
Background Lighting	90 luminaire lumens per circuit-Watt (minimum)
Display Lighting	65 lamp lumens per circuit-Watt (minimum) with photoelectric time switch
Lighting Controls	Occupancy sensors to all toilets, stores and service cores areas. Daylight sensors to all areas with access to daylight.
Ventilation	**Market and Food Hall** – Air Handling Units (AHU) units providing supply and extract. Specific Fan Power (SFP) – 1.6 W/l/s, heat recovery effectiveness - 70%. **Toilets and Stores** - Zonal extract systems, SFP of 0.5 W/l/s.

Table 6. **Met Centre Market and Food Hall Building Services**

6.2.2. Met Centre - Retail & Restaurant Units

The Retail and Restaurant units are 'shell only' and incoming tenants will fit out all building services. The building services assumptions for these areas are listed in the below table;

Element	Specification
Heating	ASHP SCOP =4.0
Cooling	ASHP SEER=4.5, EER=3.50
Hot Water	**Retail Units** - Instantaneous Electric **Restaurant (R9)** - Direct gas fired boiler 96% efficient with 400 litres storage. Secondary circulation with time switch
Background Lighting	80 luminaire lumens per circuit-Watt (minimum)
Display Lighting	45 lamp lumens per circuit-Watt (minimum) with photoelectric time switch
Lighting Controls	None
Ventilation	MVHR units providing supply and extract. SFP – 1.6 W/l/s, heat recovery effectiveness - 70%.

Table 7. **Met Centre Retail & Restaurant Units Building Services**

6.2.3. Met Centre – Leisure Unit

The Leisure unit is 'shell only' and incoming tenants will fit out all building services. The building services assumptions for these areas are listed in the below table;

Element	Specification
Heating	ASHP SCOP =4.0
Cooling	ASHP SEER=4.5, EER=3.50
Hot Water	Direct gas fired boiler 96% efficient with 400 litres storage. Secondary circulation with time switch.
Background Lighting	80 luminaire lumens per circuit-Watt (minimum)
Display Lighting	None
Lighting Controls	Auto-on-off throughout, daylight dimming for the front 6 m of zone
Ventilation	MVHR units providing supply and extract. Specific Fan Power (SFP) – 1.6 W/l/s, heat recovery effectiveness - 70%.

Table 8. **Met Centre Leisure Unit Building Services**

6.2.4. Met Centre – Offices

The office units are 'shell only' and incoming tenants will fit all building services. The building services assumptions for these areas are listed in the below table;

Element	Specification
Heating	ASHP SCOP =4.0
Cooling	ASHP SEER=4.5, EER=3.50
Hot Water	Direct gas fired boiler 96% efficient with 200 litres storage. Secondary circulation with time switch.
Background Lighting	80 luminaire lumens per circuit-Watt (minimum)
Display Lighting	80 lamp lumens per circuit-Watt (reception only)
Lighting Controls	**Offices/Meeting Rooms** - Man-on-off absence detection throughout and daylight dimming in all rooms with access to daylight. **Toilets and Stores** – Auto-on-off presence detection
Ventilation	MVHR units providing supply and extract. Specific Fan Power (SFP) – 1.6 W/l/s, heat recovery effectiveness - 70%.

Table 9. **Met Centre Office Building Services**

6.2.5. Library Building – Library

The Library is to be fully installed and designed by NPS Barnsley. The confirmed building services for these areas are listed in the below table;

Element	Specification
Heating	ASHP – SCOP =3.5
Cooling	ASHP – SEER=4.5, EER=3.50
Hot Water	Instantaneous Electric with or without storage
Background Lighting	As per lighting calculation received; Barnsley Library - Lighting Design - Part 2 - Revision 01.08.16 Barnsley Library - Lighting Design - Revision 01.08.16 Barnsley Library - Lighting Design -Stairs - Revision 01.08.16
Display Lighting	As per the main lighting at 139 lamp lm/W. No photoelectric time switch.
Lighting Controls	**Library** – Daylight dimming **Library Pods/Toilets/Stores/WCs/Kitchen –** Auto-on-off **Event Space/Meeting Rooms/Plant Room –** Manual
Ventilation	**Library**– AHU with plate heat exchanger SFP – 1.6 W/l/s Heat Recovery Efficiency – 65% **Lobby Areas** - Supply Fan – 1.1 W/l/s, Zonal Extract with an SFP of 0.5 W/l/s **Toilets and Stores** - Zonal Extract with an SFP of 0.5 W/l/s

Table 10. **Library Buildings Services**

6.2.6. Library Building – Library Cafe

The Library Cafe unit is 'shell only' and incoming tenants will fit out all building services. The building services assumptions for these areas are listed in the below table;

Element	Specification
Heating	ASHP – SCOP =3.5
Cooling	ASHP – SEER=4.5, EER=3.50
Hot Water	Instantaneous Electric
Background Lighting	75 luminaire lumens per circuit-Watt (minimum)
Display Lighting	40 lamp lumens per circuit-Watt (minimum)
Lighting Controls	None
Ventilation	MVHR with plate heat exchanger SFP – 1.6 W/l/s Heat Recovery Efficiency – 65%

Table 11. **Library Café Buildings Services**

6.2.7. Be Lean - Energy and CO_2 Savings

Be Lean measures would reduce CO_2 emissions by 4,764 kg.CO_2/yr making an intial 0.78% CO_2 saving.

	Predicted Annual CO_2 Emissions (kg.CO_2/year)	CO_2 Reduction (%)	Cumulative CO_2 Reduction (%)
Baseline	607,828	-	-
Be Lean	603,063	0.78%	0.78%
Be Clean	-	-	-
Be Green	-	-	-
Target	516,653	15%	**Insuffcient Reduction**

Table 12. **CO_2 reduction summary at Be Lean stage**

BE CLEAN:
SUPPLY ENERGY EFFICIENTLY

7. Be Clean

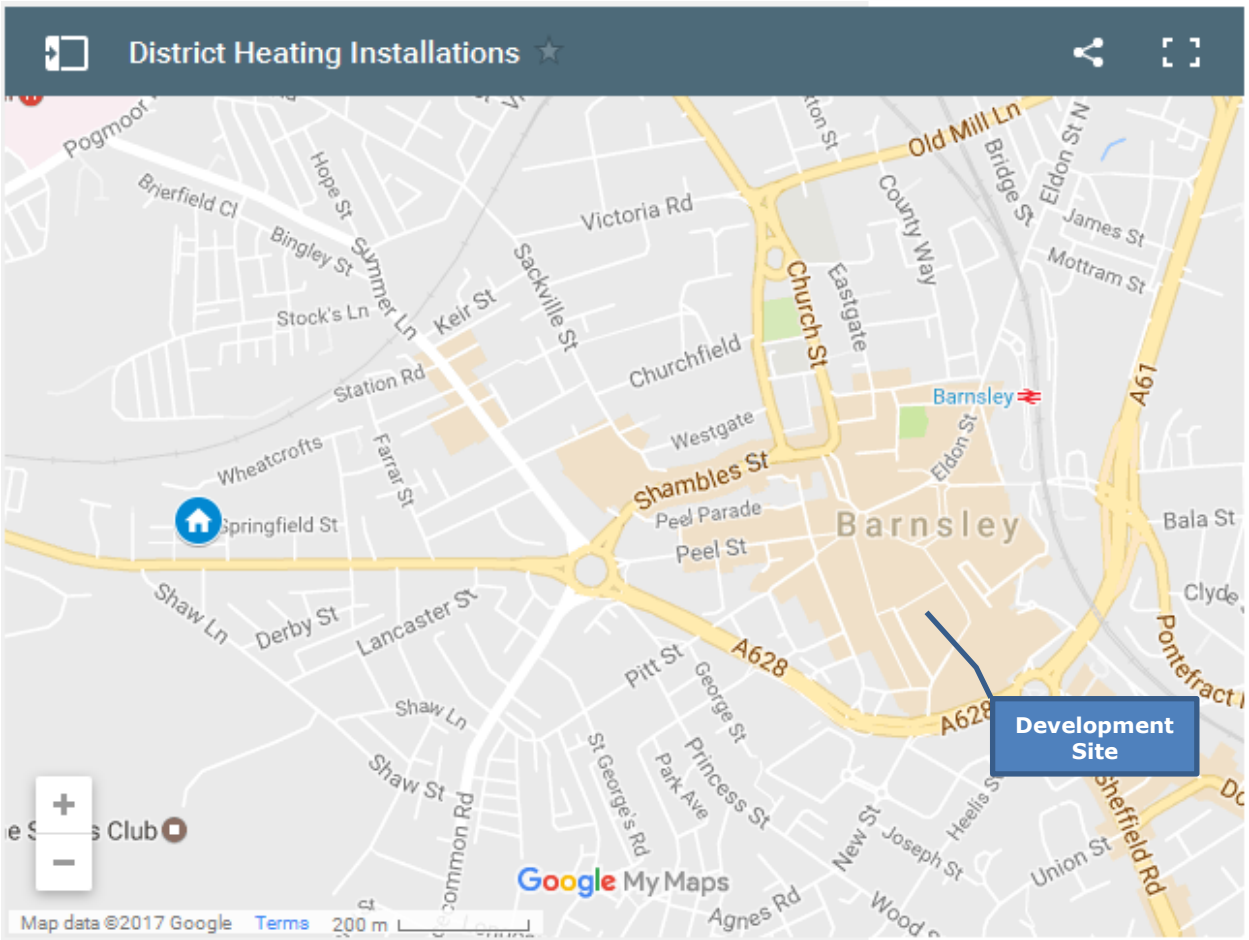

Figure 8. **District heating installation map showing an existing District system**

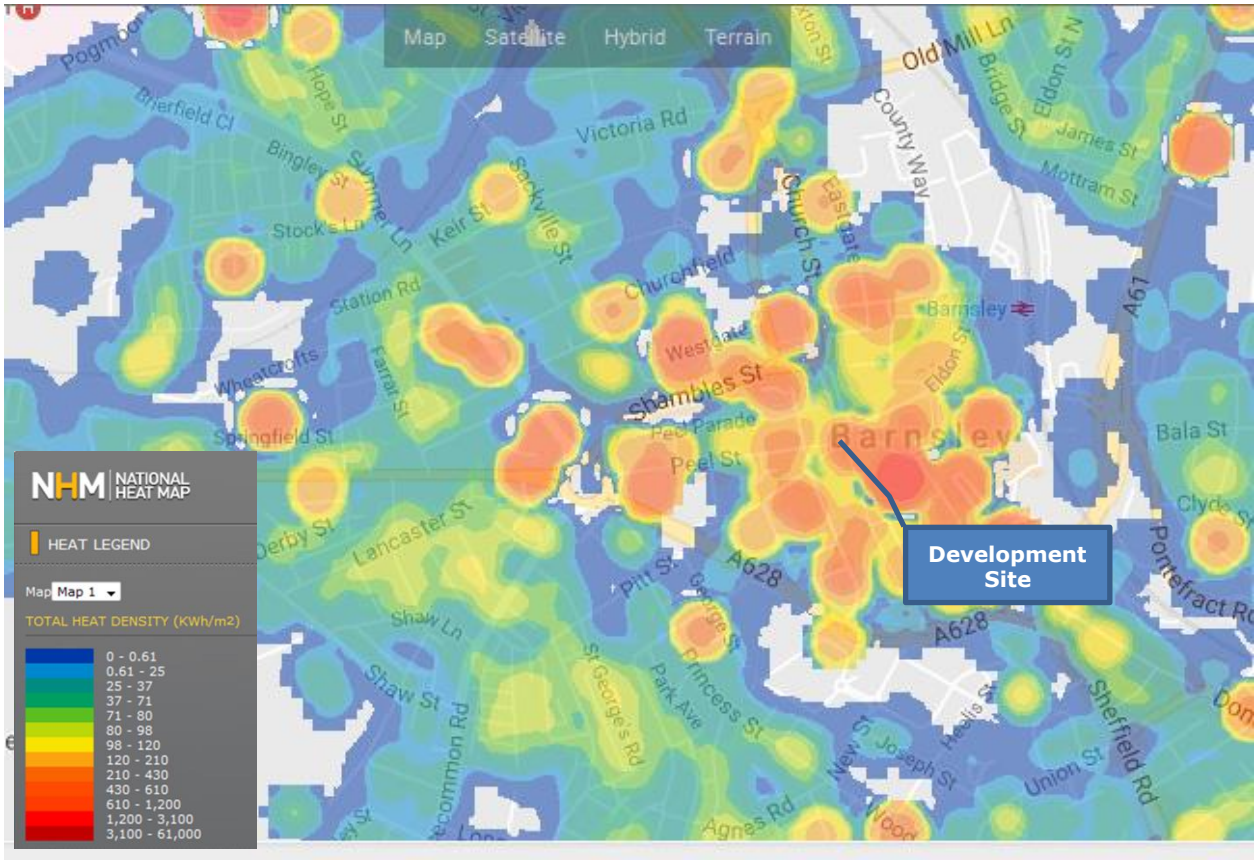

Figure 9. **UK heat map**

7.1. District Heating

The UK Heat Map has been analysed for the development region to determine whether there are any existing or proposed district heating networks within the vicinity of the site. This confirmed there is one district heat network (Figure 8) which is located approximately 1 mile from the site. This is a residential biomass district heating system and constraints on increasing the fuel storage and boiler sizes mean extending this to the proposed site is not feasible.

There have been ongoing discussions about a future district heating system for Barnsley Town centre. At this stage, this district heating system would only serve Phase 2 buildings to potentially provide heat and hot water across the 2nd Phase of this development.

The current Library's building services design has been completed with stand-alone boilers providing heating and hot water being provided by electricity, therefore there is scope for replacing the boiler with connection to the future district heating system. Due to the relatively hot water demand, the current preferred design is instantaneous electric hot water as such unless changed wouldn't be suitable for future connection to the future district heating system.

The Library Cafe as it is 'shell' only therefore the building services being assumed, there is scope for a future connection to the district heating system.

The Met Centre's proposed design currently uses Air Source Heat Pump (ASHP) for the main heating source for all areas including all 'shell only' units. Hot water will be provided by gas fired boilers with storage for the Market and Food Hall as well the 'shell only' restaurant and leisure units. The 'shell only' retail units are assumed to have instantaneous hot water. Therefore the current designs for heating won't have future capability to connect to any future district heating system. All hot water systems, aside from the assumed retail units have the capability to be connected to a future district heating system.

7.2. Combined Heat And Power (CHP)

Combined Heat and Power (CHP) units typically comprise of a reciprocating engine, electrical generator and a series of heat exchangers fitted to the oil circuit, coolant circuit and the exhaust.

Electricity generated displaces power that would otherwise be sourced from the Grid and the thermal by-product is made useful to realise CO_2 and financial savings. CHP engines are most ideally suited to developments which require significant and regular heat, e.g. swimming pools, care homes and hotels. They are not generally suited to developments where the heat load is low, sporadic or, infrequent, e.g. residential, offices and schools.

The majority of Phase 1 is unsuitable for CHP due to the amount of retail and office space with low heating and hot water demand throughout the year. The market, office and retail units are unsuitable due to the low heating and hot water demand.

The food hall hot water system has the potential to be viable for a CHP system. A viability assessment has been carried out using the DECC tool which shows a 25 kW_{elec} unit may be technically and economically viable. Therefore, it is recommended that a detailed technical appraisal be undertaken by the design team to fully assess the potential. For the purpose of this assessment an *ENER-G 25R* engine has been selected, which has a gross thermal & electrical efficiency of 53.1% and 29.5% respectively at maximum output. This CHP unit has been shown to provide an additional 1.28% CO_2 savings across Phase 1 of this site.

The leisure and restaurant units could also be viable for a similar sized micro CHP to provide hot water. As these are 'shell only' with the leisure unit currently shown as a gym with no partitions shown, it is difficult to correctly forecast the hot water consumption and therefore the viability of any CHP system.

	Predicted Annual CO_2 Emissions (kg.CO_2/year)	CO_2 Reduction (%)	Cumulative CO_2 Reduction (%)
Baseline	607,828	-	-
Be Lean	603,063	0.78%	0.78%
Be Clean	595,272	1.28%	2.07%
Be Green	-	-	-
Target	516,653	15%	**Insuffcient Reduction**

Table 14. **CO_2 reduction summary at Be Clean stage**

BE GREEN:
USE RENEWABLE ENERGY

8. Be Green – Renewable Energy Technology

The CO_2 emissions after 'Be Lean' and 'Be Clean' measures have been assessed against the baseline CO_2 emissions. Reductions have been recorded after each stage in the energy hierarchy; this will help clarify the impact that renewable energy generation has on whole site CO_2 emissions.

The feasibility and respective benefit of established renewable energy technologies has been assessed for this development.

8.1. Solar Photovoltaics

Solar Photovoltaic (PV) panels comprise of a number of inter-connected cells that utilise semi-conductor technology to convert solar energy into electricity. High voltage, direct current is converted to alternating current and phased into the mains supply via an inverter. The output of a PV panel or PV array is measured in kilowatt-peak (kWp) and defines the rate of energy output during peak solar conditions (standard test condition).

In the UK, PV panels generate their greatest output where mounted on exposed surfaces, within 45° of south and at an inclination close to 30°. Where setting out a PV array, self-shading between panels should be considered in addition to the necessary spacing for access and any planning requirements. A shadow cast onto a single cell will affect the output of the entire panel string.

Figure 10. **Solar panels installed to flat roof**[1]

8.1.1. Summary

- ✓ Established technology.
- ✓ Low maintenance 'fit-and-forget' and self-cleaning (when pitched).
- ✓ Long service life, panels typically guaranteed for 20+ years (inverters are likely to need replacement during panel service life).
- ✓ No moving parts, silent operation.
- ✓ Displaces CO_2 intensive grid electricity.
- ✓ Excess generation can be exported to the National Grid.
- ✓ Eligible for the Government's Feed-in Tariff.
- ✓ Complements other renewable technology.

- ✗ Panel efficiencies relatively low; typically 15-20%.
- ✗ Output variable; weather dependent.
- ✗ Generation extremely sensitive to panel over-shading.
- ✗ Additional loadings to building must be considered.

[1] Go Go Green Roofing and Solar, 2014

8.2. Solar Thermal

Solar thermal technology uses energy from the sun to heat water. Systems typically comprise solar collectors (glazed flat-plate or evacuated tubes), a circulated glycol fluid and a thermal store.

Although water can be heated to a temperature high enough for domestic needs, output from solar thermal technology is typically used to pre-heat a vessel. The residual energy requirement is then met via an immersion heater or, coil fed by a boiler.

Solar thermal systems can provide a significant contribution towards the annual hot water demand of a building. Similarly to PV; in the UK, panels generate their greatest output where mounted on exposed surfaces, within 45° of south and at an inclination close to 30°. As store units have a finite capacity, systems are most effective where hot water can be drawn off at several times during the day. Consideration should be given to the sun path and times of the day where a solar contribution would be most beneficial.

Figure 11. **Evacuated tube solar collectors**[2]

8.2.1. Summary

- ✔ Established technology.
- ✔ Panel efficiencies relatively high 50+%
- ✔ Low maintenance, circulation fluid requires a regular (usually annual) change
- ✔ Long service life, panels typically guaranteed for 10+ years
- ✔ Few moving parts, silent operation (excluding drain-back function).
- ✔ Eligible for the Government's Renewable Heat Incentive.

- ✘ Output variable; weather dependent and full back-up required.
- ✘ Excess generation cannot be exported.
- ✘ Panel overheating can occur where water use is irregular.
- ✘ Finite hot water demand of a building can lead to conflictions with other technology, e.g. CHP, Biomass.

[2] SEIA, 2014

8.3. Micro Wind Turbines

Wind turbines utilise kinetic energy to move propeller-like blades around a rotor. The rotor is connected to a main shaft which in turn spins a generator converting rotational energy into electricity. Depending upon local constraints, the rotor can be in the horizontal or, vertical axis.

There are two main types of wind turbine; building mounted or, pole mounted. Building mounted turbines can be installed onto a roof where there is suitable wind resource and are generally smaller in size; typically 1-2 kW. Pole mounted turbines are free standing and need to be erected in a suitably exposed position. Pole mounted systems are generally larger in size, typically 5-6 kW.

Turbines generate electricity at wind speeds between 5-25 m/s and should be located in areas where surroundings will not lead to turbulence.

Figure 12. **Horizontal axis, building-mounted turbines**[3]

8.3.1. Summary

- ✓ High efficiency, typically 70-85%.
- ✓ Long service life, guarantees of 20+ years available.
- ✓ Excess generation can be exported to the National Grid.
- ✓ Eligible for the Government's Feed-in Tariff.
- ✓ Complements other renewable technology.

- ✗ Output variable; weather dependent and full back-up required.
- ✗ Significant visual impact which can create planning problems.
- ✗ Clear unobstructed placement required.
- ✗ Building-mounted wind turbines have potential for structural, vibration and noise implications.
- ✗ Stable ground conditions with good access for machinery.
- ✗ Regular maintenance is required. Many moving parts.

[3] Photograph: Peter Macdiarmid/Getty Images

8.4. Ground Source Heat Pumps

Ground source heat pumps (GSHP) extract heat from a low temperature source via a reversed refrigeration cycle. Heat is absorbed into a collector loop buried either horizontally or vertically into the ground and then increased via compression. This useful heat is transferred to the building to provide space and/or water heating.

Although the system uses electricity, high Coefficient of Performances (COP) can be achieved resulting in overall CO_2 emissions and running costs below that of an efficient gas-fired boiler. The COP is a function of the difference between ground (source) temperature and output (flow) temperature. Therefore, systems are most efficient where used in conjunction with low surface temperature emitters, e.g. underfloor heating, ceiling panels. Systems can be cascaded to generate domestic hot water at 60+°C though efficiencies are significantly reduced.

Figure 13. **Horizontal ground loop collector**[4]

8.4.1. Summary

- ✔ High efficiency, seasonal COPs of 3-4 achievable.
- ✔ Output and performance consistent over the year as ground temperature relatively constant.
- ✔ Low maintenance.
- ✔ Space and water heating can be generated.
- ✔ Eligible for the Government's Renewable Heat Incentive.
- ✔ Complements other renewable technology, i.e. solar PV.

- ✘ Initial ground investigations and preparation can be expensive and intrusive.
- ✘ Borehole option may invoke planning constraints.
- ✘ Low grade heat only suitable for certain emitters.

[4] yougen 2014

8.5. Air Source Heat Pumps

Air source heat pumps (ASHP) extract heat from ambient air via a reversed refrigeration cycle. Heat is absorbed into an evaporator (outdoor unit) and increased via compression. This useful heat is transferred to the building via a refrigerant to provide space and/or water heating.

Although the system uses electricity, high Coefficient of Performances (COP) can be achieved resulting in overall CO_2 emissions and running costs below that of an efficient gas-fired boiler. The COP is a function of the difference between ambient air (source) temperature and output (flow) temperature. Therefore, systems are most efficient where used in conjunction with low surface temperature emitters, e.g. underfloor heating, ceiling panels. Systems can be cascaded to generate domestic hot water at 60+°C though efficiencies are significantly reduced.

Figure 14. **ASHP outdoor unit**[5]

8.5.1. Summary

- ✓ High efficiency, seasonal COPs of 3+ achievable.
- ✓ Low maintenance.
- ✓ Space and water heating can be generated.
- ✓ Complements other renewable technology, i.e. solar PV.

- ✗ Not eligible for the Government's Renewable Heat Incentive.
- ✗ Low grade heat only suitable for certain emitters.
- ✗ Compressor and fan within outdoor unit can generate high levels of noise and vibration.
- ✗ Not always considered to be a renewable energy technology, i.e. BREEAM 2011 Compliance Note 3.

[5] http://www.pooleplumbingservices.co.uk/air-source-heat-pump-fitted-in-bournemouth

8.6. Biofuels

Biofuel technology typically refers to the combustion of an organic product (solid, liquid or, gas) for heat generation in place of fossil fuels. Carbon dioxide released in combustion is taken to be recently fixated and then readily absorbed in the creation of the next fuel generation, e.g. tree plantation. Biofuels are therefore considered low carbon.

The most common biofuel is wood, usually utilised in chip or pellet form. This fuel is relatively energy-dense and is readily available in most parts of the UK. Boiler technology has been refined over a period of decades and is similar in appearance and installation (fuel supply excluded) to regular gas/oil-fired units.

Figure 15. **Commercial biomass boiler**[6]

8.6.1. Summary

- ✔ Established technology.
- ✔ High efficiencies achievable.
- ✔ Low CO_2 emissions.
- ✔ Relatively low cost fuel, which is less susceptible to price increases (compared with imported fossil fuels).
- ✔ Space and water heating can be generated.
- ✔ Eligible for the Government's Renewable Heat Incentive.

- ✘ Capital cost of plant high compared with fossil fuel alternative.
- ✘ Space and access required for fuel delivery and storage.
- ✘ Restrictions may apply due to particulate emissions. Alternatively, exhaust filtration is required.
- ✘ Regular specialist maintenance and cleaning is required.
- ✘ Full back-up system often required in tandem.

[6] http://www.hamworthy-heating.com/Shared/Images

9. Technology Appraisal

The feasibility of each renewable energy technology has been summarised in the below table;

Technology	Site Appraisal	Consideration
Solar PV	Solar PV is suitable for this site given the vast amount of unshaded flat roof space available. Currently the roof space above the first floor market has been earmarked for any Renewable Energy Technology.	**Suitable**
Solar thermal	Solar thermal is potentially viable for this development but any inclusion would compete for roof space required for solar PV and would also compete for heat with any CHP system. Solar thermal is also potentially viable for the Leisure and restaurant units due to the high predicted hot water loads and compatible hot water storage systems.	**Suitable**
Micro wind	Micro wind is unsuitable due to the urban nature of the town centre with high buildings surrounding the Market resulting in with average wind speeds[7] 4.9, 5.7 and m/s at 10 and 25 m AMSL respectively. A Micro wind turbine would need to be a installed at a considerable height above any adjacent building and therefore would adversely impact the aesthetics of the building as well as increasing the cost.	**Not suitable**
GSHP	A GSHP is unsuitable for this development due to the restrictions in drilling a borehole because of the existing basement.	**Not suitable**
ASHP	An ASHP is suitable for this development as there is ample outdoor space to mount any outdoor units.	**Suitable**
Biomass	Biomass is not suitable is it is not compatible with the current proposed buildings services strategy. There is also limited storage space available for fuel storage and delivery.	**Not suitable**

Table 15. **LZC Site appraisal**

[7] NOABL Wind Map - http://www.rensmart.com/Weather/BERR

9.1. ASHP Capacity and Location

Air Source heat pump (ASHP) has been deemed suitable for the heating source to all areas that are heated within the Met Centre. The 'shell only' retail, leisure and restaurant units have also been taken to have an ASHP with a SCOP of 4.0. The Market and Food Hall is taken to be served by a VRF system with an SCOP of 4.75.

9.2. Energy and CO_2 Savings

These ASHP systems would reduce CO_2 emissions by 20,929 kg.CO_2/yr an additional 3.52 % CO_2 savings contributing to an overall CO_2 reduction of 5.51%.

	Predicted Annual CO_2 Emissions (kg.CO_2/year)	CO_2 Reduction (%)	Cumulative CO_2 Reduction (%)
Baseline	607,828	-	-
Be Lean	603,063	0.78%	0.78%
Be Clean	595,272	1.29%	2.07%
Be Green ASHP	574,342	3.52%	5.51%
Target	516,653	15%	**Insuffcient Reduction**

Table 16. **CO_2 reduction summary at Be Green ASHP stage**

9.3. Solar PV – Technology Analysis

The potential for CO_2 savings from solar PV has been assessed using IES VE 2016 DSM software. This methodology considers UK solar irradiance data, collector pitch, orientation and over-shading to determine the expected annual energy yield. To fufill the requirements of Barnsley core strategy, a minimum of 111,154 kWh per annum would need to be offset through the installation of a Solar PV array.

Applying the current CO_2 emissions factor for grid-displaced electricity (0.519 kg.CO_2/kWh), this generation corresponds to a CO_2 abatement of 57,689 kg.CO_2 per annum.

9.3.1. Capacity and Location

The solar PV required will occupy approximately 1,722 m^2 of the available roof space above the Market, this includes the panels and spacing between rows. The greatest yield is achieved where panels are installed towards south at 30° to the horizontal. However, spacing between panels must be such that self-shading does not occur. The solar PV system required is a 145 kWp system using 580 250 Wp PV panels with a module efficiency of 15.15% (panels size of 1000 mm x 1650 mm). Panels are taken to be pitched at 15° to the horizontal and orientated south west in line with the orientation of the edge of the roof. A PV inverter has been assumed to have an efficiency of 95%, which reflects the minimum efficiencies obtained by commercially installed three phase inverters.

The District Network Operator (DNO) must be consulted at the earliest opportunity to confirm whether the local infrastructure offers sufficient capacity for the proposed electricity generation.

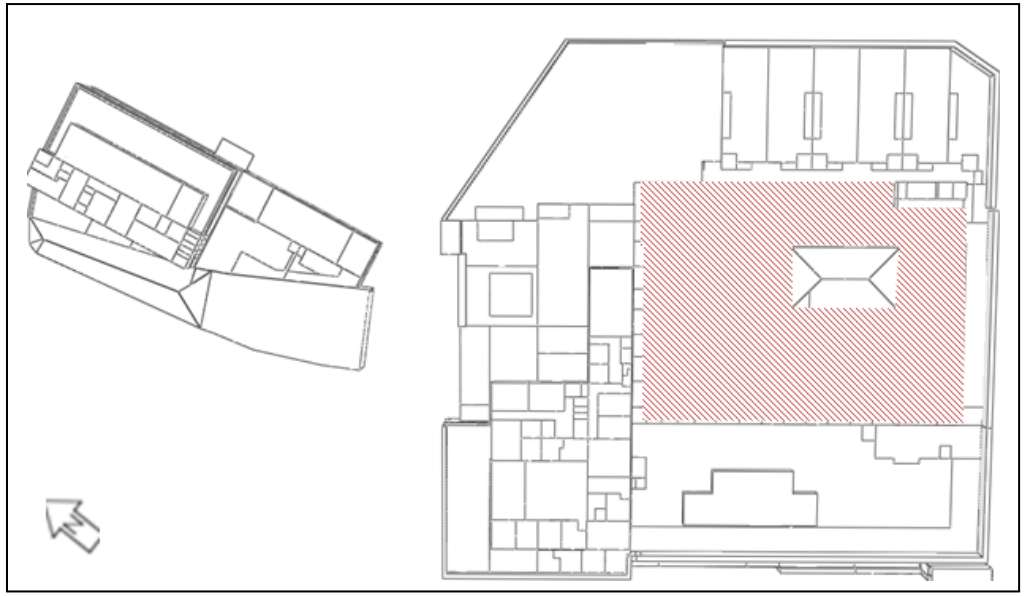

Figure 16. **PV location (shown in dashed red)**

9.3.2. Feed in Tariff Payments

Based on current Feed in Tariff (FIT) rates, 145 kWp of PV could receive approximately £2,241[8], £1,106[9] in feed in tariff and export payments annually and offset electricity of £10,800. Average industry installation costs for systems above 50 kW aren't currently published but depending on the energy used on-site and assumed electricity price and RPI rate increases, a payback of between 10-11 years is possible.

[8] Based on 1.99p/kWh, correct up to 31/03/2017
https://www.ofgem.gov.uk/system/files/docs/2017/01/tariff_table_jan_16.pdf
[9] Based on 4.91 p/kWh 31/03/2017
https://www.ofgem.gov.uk/system/files/docs/2017/01/tariff_table_jan_16.pdf

9.3.3. Energy and CO_2 Savings

In order to meet this CO_2 reduction target, a 145 kWp PV system would need to be installed on the available flat roof areas above the Market. This could consist of 580 250 Wp PV panels with a module efficiency of 15.15%. Panels have been assumed to be tilted to 15 degrees using single orientation PV mounting frames. This solar PV system would add an additional 10.17% CO_2 savings contributing to an overall CO_2 reduction of 15.12%.

	Predicted Annual CO_2 Emissions (kg.CO_2/year)	CO_2 Reduction (%)	Cumulative CO_2 Reduction (%)
Baseline	607,828	-	-
Be Lean	603,063	0.78%	0.78%
Be Clean	595,272	1.29%	2.07%
Be Green ASHP	574,342	3.52%	5.51%
Be Green PV	515,905	10.17%	15.12%
Target	516,653	15%	**Target Achieved**

Table 17. **CO_2 reduction summary at Be Green PV stage**

10. Conclusions

This Energy Strategy & LZC Study has outlined how this development will meet the requirements with respect to the established energy hierarchy. The strategy supports the *'fabric-first'* approach improving thermal elements and building services prior to the consideration of connected heat and renewables. Decentralised energy has been researched as part of the 'Be Clean' section and renewable energy technology incorporated to achieve a 15% in CO_2 emissions.

10.1. Be Lean - Energy Efficiency

A high performance thermal envelope and building services specification has been proposed to incorporate low U-values, detailing to minimise thermal bridging and air infiltration, and energy efficient boilers and control.

10.2. Be Clean – Decentralised Energy

There is a district heating network in the vicinity of the site, however this does not have the potential to be extended to this site. The future district heating system for Phase 2 does offers scope for future connection to some areas within the Library, Cafe and Met Centre.

The development size and type does offer a suitable hot water load to support the technical or economic viability of Combined Heat and Power (CHP) to some areas within the Met Centre.

10.3. Renewable and Low Carbon Technology

10.3.1. ASHP

Calculations show that a ASHP would generate sufficient heating to offset residual CO_2 emissions and contribute 3.5% towards the 15% target stipulated by policy CSP 5 of the Barnsley Core Strategy.

10.3.2. Solar PV

Calculations show that a 145 kWp solar PV system would generate sufficient electricity to offset residual CO_2 emissions and meet the 15% CO_2 target stipulated by policy CSP 5 of the Barnsley Core Strategy. This is based upon all panels being installed at 15° to the horizontal and towards south west with little to no over-shading.

11. Summary

This statement and LZC study has set out how the proposed development incorporating a fabric-first design approach, energy efficient fixed services and renewable energy technology can achieve a 15.12% reduction in CO_2 emissions as required by policy CSP 5 of Barnsley Core Strategy.

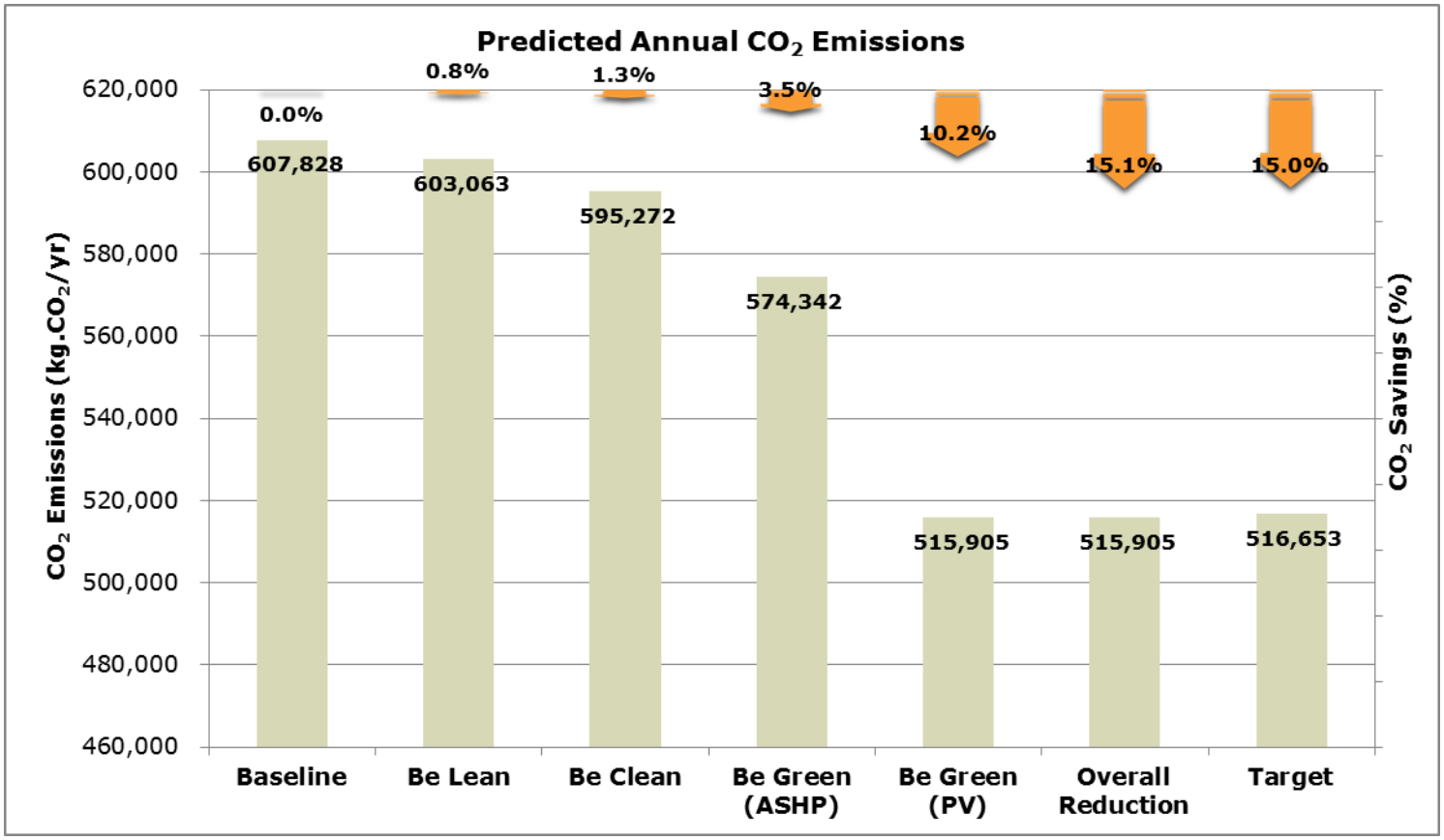

Figure 17. **Predicted annual CO_2 emissions**

APPENDICES

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name **Shell and Core**

09-15-54301_LZC1__Be Clean_Better Barnsley Market_Food Hall & Landlord

As designed

Date: Wed Jan 04 17:15:25 2017

Administrative information

Building Details

Address: Better Barnsley Market Centre, Barnsley, -

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.6

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.6

BRUKL compliance check version: v5.2.g.3

Owner Details

Name: -

Telephone number: -

Address: -, -, -

Certifier details

Name: Ian Andrews

Telephone number: 01924 237513

Address: Stroma Technology, Unit 6, Silkwood Business Park, Fryer's Way, Wakefield, WF5 9TJ

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

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	28.5
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	28.5
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	25.5
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 the building services should achieve reasonable overall standards of energy efficiency

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

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.2	0.2	MS000061:Surf[38]
Floor	0.25	0.15	0.15	FF000000:Surf[0]
Roof	0.25	0.15	0.15	MR000004:Surf[1]
Windows***, roof windows, and rooflights	2.2	1.02	2.2	ST000000:Surf[0]
Personnel doors	2.2	2.2	2.2	FH000001:Surf[4]
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	1.4	1.4	MC000003:Surf[1]

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

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

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

Building services

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

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- BL_S3- elec panels zonal extract

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.67	0	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

2- BL_VRF AHU

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	3.5	0	0	0.7
Standard value	0.91*	3.2	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

1- BL_HW3_Market

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.96	0.005
Standard value	0.9*	N/A
* Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73.		

2- BC_HW2_Food Hall

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.96	0.004
Standard value	0.9*	N/A
* Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73.		

1- CHECK2-CHP

	CHPQA quality index	CHP electrical efficiency
This building	0	0.3
Standard value	Not provided	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**
Z00_ANC__DIS	-	-	0.5	-	-	-	-	-	-	-	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
Z00_ANC__WC	-	-	0.5	-	-	-	-	-	-	-	N/A
Z00_ANC__WC	-	-	0.5	-	-	-	-	-	-	-	N/A
Z00_ANC_WC	-	-	0.5	-	-	-	-	-	-	-	N/A
Z00_ANC__WC	-	-	0.5	-	-	-	-	-	-	-	N/A
Z00_ANC__DIS WC & Shower	-	-	0.5	-	-	-	-	-	-	-	N/A
Z00_Office	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_Kiosk1	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_M_Entrance	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_Kiosk 4	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_Kiosk 03	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_Kiosk 02	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_MF	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_M_Atrium DL	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Office	-	1.6	0	-	-	-	-	-	0	-	N/A
Z01_M_MS	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_ DWC	-	1.6	0.5	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe 9 FOH	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe 8 FOH	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe 7 FOH	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe 6 FOH	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe Service	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe 5 FOH	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe 4 FOH	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe 3 FOH	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe 2 FOH	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Food Hall-Market Link 1	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Food Hall-Market Link 2	-	1.6	0	-	-	-	-	-	-	-	N/A
Z02_ANC_WC	-	-	0.5	-	-	-	-	-	-	-	N/A
Z02_ANC_WC	-	-	0.5	-	-	-	-	-	-	-	N/A
Z00_M_Entrance	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe 10 FOH	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_MF	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_MF	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_FH_Entrance & Z00_Stair01	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe 1	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Food Hall DL2	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Food Hall DL1	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_M_Circ DL1	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_M_Circ	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_M_Circ DL2	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Food Hall 2	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Food Hall 1	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_M_Circ DL	-	1.6	0	-	-	-	-	-	-	-	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
Z00_MS	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_MS	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_M_Circ	-	1.6	0	-	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	Assumed shell?
Z00_Stair04	NO
Z00_ANC__DIS	NO
Z00_ANC__WC	NO
Z00_ANC__WC Lobby	NO
Z00_ANC__WC	NO
Z00_ANC_WC	NO
Z00_ANC__WC	NO
Z00_ANC__DIS WC & Shower	NO
Z00_Office	NO
Z00_Stair06	NO
Z00_M_Accs WC	NO
Z00_Cleaning	NO
Z00_M_FemaleWC	NO
Z00_M_MaleWC	NO
Z00_M_Plant 1	NO
Z00_Cleaning	NO
Z00_Cleaning	NO
Z00_Refuse	NO
Z01_M_Cleaning Store	NO
Z00_Kiosk1	NO
Z00_M_Plant 2	NO
Z00_Stair02	NO
Z00_Stair03	NO
Z00_Service Core	NO
Z00_M_Entrance	NO
Z00_Stair04	NO
Z00_Stair05	NO
Z00_M_Service Core	NO
Z00_Kiosk 4	NO
Z00_Kiosk 03	NO
Z00_Kiosk 02	NO
Z00_Service Core	NO
Z00_M_Service Core	NO
Z00_Service Core	NO
Z00_Service Core	NO
Z00_MF	NO
Z00_M_Atrium DL	NO
Z00_M_WC Lobby	NO
Z01_FH_Office	NO

Shell and core configuration

Zone	Assumed shell?
Z01_Stair01	NO
Z01_M_MS	NO
Z01_Stair04	NO
Z01_EC 02	NO
Z01_FH_ DWC	NO
Z01_FH_Cafe 9 FOH	NO
Z01_FH_Cafe 9 BOH	NO
Z01_FH_WC Corridor	NO
Z01_FH_Cafe 8 FOH	NO
Z01_FH_Cafe 8 BOH	NO
Z01_FH_Cafe 7 BOH	NO
Z01_FH_Cafe 7 FOH	NO
Z01_FH_Cafe 6 FOH	NO
Z01_FH_Cafe 6 BOH	NO
Z01_Lift08 Lobby	NO
Z01_FH_Service Core	NO
Z01_ME1	NO
Z01_FH_Cafe Service	NO
Z01_FH_Cafe 5 FOH	NO
Z01_FH_Cafe 5 BOH	NO
Z01_FH_Cafe 4 BOH	NO
Z01_FH_Cafe 4 FOH	NO
Z01_FH_Cafe 3 FOH	NO
Z01_FH_Cafe 3 BOH	NO
Z01_FH_Cafe 2 BOH	NO
Z01_FH_Cafe 2 FOH	NO
Z01_FH_Food Hall-Market Link 1	NO
Z01_FH_Food Hall-Market Link 2	NO
Z01_ST 13	NO
Z01_M_WC	NO
Z01_M_WC	NO
Z01_M_DWC	NO
Z01_M_ WC Lobby	NO
Z01_Z01_Service Core	NO
Z01_ST11	NO
Z01_Stair03	NO
Z01_Service Core Store	NO
Z00_Service Core	NO
Z00_Service Core	NO
Z00_Service Core	NO
Z01_Stair05	YES
Z02_ANC_Office Stair Core	NO
Z02_ANC_Plant	NO
Z02_ANC_Stair06	NO
Z02_ANC_Lobby	NO
Z02_ANC_WC	NO
Z02_ANC_WC	NO

Shell and core configuration

Zone	Assumed shell?
Z02_ANC_Plant	NO
Z02_ANC_Plant Store	NO
Z02_ANC_Plant Store	NO
Z02_ANC_Plant Corridor	NO
Z02_ANC_Corridor	NO
Z02_ANC_Store	NO
Z02_ANC_Store	NO
Z02_Stair03	NO
Z02_Lift Lobby	NO
Z00_M_Entrance	NO
Z00_ANC__Corridor	NO
Z00_ANC__Corridor	NO
Z00_ANC__Corridor	NO
Z01_Stair06	NO
Z01_FH_Male WC	NO
Z01_FH_Female WC	NO
Z01_FH_Cafe 10 BOH	NO
Z01_FH_Cafe 10 FOH	NO
Z00_ Service Corridor	NO
Z00_MF	NO
Z00_MF	NO
Z00_FH_Entrance & Z00_Stair01	NO
Z00_Service Core	NO
Z01_Stair02	NO
Z01_Stair02	NO
Z01_FH_Cafe 1	NO
Z01_ST 10	NO
Z01_M_Lift 05&06 Lobby	NO
Z01_FH_Food Hall DL2	NO
Z01_FH_Food Hall DL1	NO
Z01_M_Circ DL1	NO
Z01_M_Circ	NO
Z01_M_Circ DL2	NO
Z01_FH_Food Hall 2	NO
Z01_FH_Food Hall 1	NO
Z00_M_Circ DL	NO
Z01_Service Core Corridor	NO
Z00_MS	NO
Z00_MS	NO
Z00_M_Circ	NO

General lighting and display lighting

	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Z00_Stair04	-	90	-	61

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Z00_ANC__DIS	-	90	-	46
Z00_ANC__WC	-	90	-	50
Z00_ANC__WC Lobby	-	90	-	16
Z00_ANC__WC	-	90	-	18
Z00_ANC_WC	-	90	-	95
Z00_ANC__WC	-	90	-	112
Z00_ANC__DIS WC & Shower	90	-	-	183
Z00_Office	90	-	-	215
Z00_Stair06	-	90	-	53
Z00_M_Accs WC	-	90	-	52
Z00_Cleaning	90	-	-	11
Z00_M_FemaleWC	-	90	-	87
Z00_M_MaleWC	-	90	-	114
Z00_M_Plant 1	90	-	-	115
Z00_Cleaning	90	-	-	12
Z00_Cleaning	90	-	-	11
Z00_Refuse	90	-	-	13
Z01_M_Cleaning Store	90	-	-	29
Z00_Kiosk1	-	90	-	356
Z00_M_Plant 2	90	-	-	117
Z00_Stair02	-	90	-	50
Z00_Stair03	-	90	-	36
Z00_Service Core	-	90	-	135
Z00_M_Entrance	-	90	-	242
Z00_Stair04	-	90	-	60
Z00_Stair05	-	90	-	42
Z00_M_Service Core	-	90	-	105
Z00_Kiosk 4	-	90	-	368
Z00_Kiosk 03	-	90	-	291
Z00_Kiosk 02	-	90	-	286
Z00_Service Core	-	90	-	208
Z00_M_Service Core	-	90	-	134
Z00_Service Core	-	90	-	148
Z00_Service Core	-	90	-	124
Z00_MF	-	90	65	3624
Z00_M_Atrium DL	-	90	-	768
Z00_M_WC Lobby	-	90	-	44
Z01_FH_Office	90	-	-	190
Z01_Stair01	-	90	-	163
Z01_M_MS	-	90	65	8414
Z01_Stair04	-	90	-	50
Z01_EC 02	90	-	-	32
Z01_FH_ DWC	-	90	-	63

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Z01_FH_Cafe 9 FOH	-	90	-	177
Z01_FH_Cafe 9 BOH	-	90	-	272
Z01_FH_WC Corridor	-	90	-	100
Z01_FH_Cafe 8 FOH	-	90	-	179
Z01_FH_Cafe 8 BOH	-	90	-	323
Z01_FH_Cafe 7 BOH	-	90	-	342
Z01_FH_Cafe 7 FOH	-	90	-	190
Z01_FH_Cafe 6 FOH	-	90	-	206
Z01_FH_Cafe 6 BOH	-	90	-	253
Z01_Lift08 Lobby	-	90	-	55
Z01_FH_Service Core	-	90	-	110
Z01_ME1	90	-	-	21
Z01_FH_Cafe Service	-	90	-	288
Z01_FH_Cafe 5 FOH	-	90	-	189
Z01_FH_Cafe 5 BOH	-	90	-	307
Z01_FH_Cafe 4 BOH	-	90	-	306
Z01_FH_Cafe 4 FOH	-	90	-	193
Z01_FH_Cafe 3 FOH	-	90	-	185
Z01_FH_Cafe 3 BOH	-	90	-	309
Z01_FH_Cafe 2 BOH	-	90	-	308
Z01_FH_Cafe 2 FOH	-	90	-	183
Z01_FH_Food Hall-Market Link 1	-	90	-	71
Z01_FH_Food Hall-Market Link 2	-	90	-	111
Z01_ST 13	90	-	-	32
Z01_M_WC	-	90	-	137
Z01_M_WC	-	90	-	123
Z01_M_DWC	-	90	-	52
Z01_M_ WC Lobby	-	90	-	42
Z01_Z01_Service Core	-	90	-	74
Z01_ST11	90	-	-	28
Z01_Stair03	-	90	-	40
Z01_Service Core Store	90	-	-	19
Z00_Service Core	-	90	-	199
Z00_Service Core	-	90	-	42
Z00_Service Core	-	90	-	318
Z01_Stair05	-	90	-	39
Z02_ANC_Office Stair Core	-	90	-	42
Z02_ANC_Plant	90	-	-	65
Z02_ANC_Stair06	-	90	-	45
Z02_ANC_Lobby	-	90	-	93
Z02_ANC_WC	-	90	-	96
Z02_ANC_WC	-	90	-	96
Z02_ANC_Plant	90	-	-	306

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Z02_ANC_Plant Store	90	-	-	14
Z02_ANC_Plant Store	90	-	-	14
Z02_ANC_Plant Corridor	-	90	-	57
Z02_ANC_Corridor	-	90	-	69
Z02_ANC_Store	90	-	-	10
Z02_ANC_Store	90	-	-	6
Z02_Stair03	-	90	-	43
Z02_Lift Lobby	-	90	-	54
Z00_M_Entrance	-	90	-	723
Z00_ANC__Corridor	-	90	-	89
Z00_ANC__Corridor	-	90	-	85
Z00_ANC__Corridor	-	90	-	15
Z01_Stair06	-	90	-	68
Z01_FH_Male WC	-	90	-	169
Z01_FH_Female WC	-	90	-	157
Z01_FH_Cafe 10 BOH	-	90	-	284
Z01_FH_Cafe 10 FOH	-	90	-	216
Z00_ Service Corridor	-	90	-	163
Z00_MF	-	90	65	231
Z00_MF	-	90	65	249
Z00_FH_Entrance & Z00_Stair01	-	90	-	181
Z00_Service Core	-	90	-	30
Z01_Stair02	-	90	-	39
Z01_Stair02	-	90	-	31
Z01_FH_Cafe 1	-	90	-	225
Z01_ST 10	90	-	-	19
Z01_M_Lift 05&06 Lobby	-	90	-	92
Z01_FH_Food Hall DL2	-	90	65	1212
Z01_FH_Food Hall DL1	-	90	65	541
Z01_M_Circ DL1	-	90	-	412
Z01_M_Circ	-	90	-	1109
Z01_M_Circ DL2	-	90	-	541
Z01_FH_Food Hall 2	-	90	65	319
Z01_FH_Food Hall 1	-	90	65	318
Z00_M_Circ DL	-	90	-	153
Z01_Service Core Corridor	-	90	-	307
Z00_MS	-	90	65	12535
Z00_MS	-	90	65	245
Z00_M_Circ	-	90	-	1767

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?
Z00_ANC__DIS WC & Shower	N/A	N/A
Z00_Office	N/A	N/A
Z00_Kiosk1	NO (-74.2%)	NO
Z00_M_Entrance	NO (-55.9%)	NO
Z00_Kiosk 4	NO (-66.6%)	NO
Z00_Kiosk 03	NO (-65.2%)	NO
Z00_Kiosk 02	NO (-70.7%)	NO
Z00_MF	NO (-92.4%)	NO
Z00_M_Atrium DL	NO (-5.7%)	NO
Z01_FH_Office	N/A	N/A
Z01_M_MS	NO (-85.6%)	NO
Z01_FH_ DWC	N/A	N/A
Z01_FH_Cafe 9 FOH	NO (-88.9%)	NO
Z01_FH_Cafe 8 FOH	NO (-90.5%)	NO
Z01_FH_Cafe 7 FOH	NO (-90.4%)	NO
Z01_FH_Cafe 6 FOH	NO (-83.4%)	NO
Z01_FH_Cafe Service	N/A	N/A
Z01_FH_Cafe 5 FOH	NO (-92.9%)	NO
Z01_FH_Cafe 4 FOH	NO (-85.6%)	NO
Z01_FH_Cafe 3 FOH	NO (-84.3%)	NO
Z01_FH_Cafe 2 FOH	NO (-84.5%)	NO
Z01_FH_Food Hall-Market Link 1	NO (-96.2%)	NO
Z01_FH_Food Hall-Market Link 2	NO (-92.2%)	NO
Z00_M_Entrance	YES (+35.3%)	NO
Z01_FH_Cafe 10 FOH	NO (-34.9%)	NO
Z00_MF	NO (-10.5%)	NO
Z00_MF	NO (-2.8%)	NO
Z00_FH_Entrance & Z00_Stair01	YES (+152.2%)	NO
Z01_FH_Cafe 1	N/A	N/A
Z01_FH_Food Hall DL2	NO (-56.6%)	NO
Z01_FH_Food Hall DL1	YES (+41.1%)	NO
Z01_M_Circ DL1	NO (-72.8%)	NO
Z01_M_Circ	NO (-92.3%)	NO
Z01_M_Circ DL2	YES (+8.3%)	NO
Z01_FH_Food Hall 2	NO (-90.2%)	NO
Z01_FH_Food Hall 1	NO (-91.8%)	NO
Z00_M_Circ DL	NO (-31.3%)	NO
Z00_MS	NO (-78.7%)	NO
Z00_MS	NO (-7.3%)	NO
Z00_M_Circ	NO (-92.8%)	NO

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	9739.6	9739.6
External area [m²]	37317.9	37317.9
Weather	LEE	LEE
Infiltration [m³/hm²@ 50Pa]	5	3
Average conductance [W/K]	18232	10070
Average U-value [W/m²K]	0.49	0.27
Alpha value* [%]	6.04	10

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

Building Use

% Area	Building Type
76	**A1/A2 Retail/Financial and Professional services**
22	**A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways**
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: Crown and County Courts
1	**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	9.11	5.17
Cooling	3.18	4.94
Auxiliary	16.87	9.18
Lighting	19.58	33.88
Hot water	21.27	13.99
Equipment*	39.32	39.32
TOTAL**	**66.45**	**67.16**

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

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	3.55	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	71.94	83.38
Primary energy* [kWh/m²]	149.05	167
Total emissions [kg/m²]	25.5	28.5

* 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] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	36	56.9	11.2	4.2	9.9	0.89	3.74	0.91	5
	Notional	19.3	89.5	6.2	6.6	4.4	0.86	3.79	----	----
[ST] Other local room heater - fanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	157.9	0	52.1	0	21.6	0.84	0	1	0
	Notional	117.5	0	37.8	0	25.9	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 BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.2	ST00000B:Surf[1]
Floor	0.2	0.15	MR000000:Surf[0]
Roof	0.15	0.15	MR000004:Surf[1]
Windows, roof windows, and rooflights	1.5	0.2	ST000000:Surf[6]
Personnel doors	1.5	2.2	FH000001:Surf[4]
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	1.4	MC000003:Surf[1]

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

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

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

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name **Shell and Core**

09-15-54301_LZC1__Be Lean_Better Barnsley Market Retail Leisure Office

As designed

Date: Wed Jan 04 16:42:47 2017

Administrative information

Building Details

Address: Better Barnsley Market Centre, Barnsley, -

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.6

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.6

BRUKL compliance check version: v5.2.g.3

Owner Details

Name: -

Telephone number: -

Address: -, -, -

Certifier details

Name: Ian Andrews

Telephone number: 01924 237513

Address: Stroma Technology, Unit 6, Silkwood Business Park, Fryer's Way, Wakefield, WF5 9TJ

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

The building does not comply with England Building Regulations Part L 2013

CO_2 emission rate from the notional building, $kgCO_2/m^2$.annum	31.4
Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	31.4
Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	34.1
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 the building services should achieve reasonable overall standards of energy efficiency

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

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.2	0.2	Z0000005:Surf[1]
Floor	0.25	0.15	0.2	R_000001:Surf[50]
Roof	0.25	0.15	0.15	SU000014:Surf[0]
Windows***, roof windows, and rooflights	2.2	1.15	1.6	SU000007:Surf[15]
Personnel doors	2.2	-	-	No Personnel doors in building
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

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

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

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

Building services

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

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

1- BL_S7_ VRF MVHR - RES/Retail

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	3.5	0	0	0.7
Standard value	0.91*	3.2	N/A	N/A	0.5
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- BL_S5 _ VRF MVHR - Office

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	3.5	0	0	0.7
Standard value	0.91*	3.2	N/A	N/A	0.5
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.

3- BL_S6 _ VRF MVHR - Leisure

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	3.5	0	0	0.7
Standard value	0.91*	3.2	N/A	N/A	0.5
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.

1- BL_HW1_Retail

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
Standard value	1	N/A

2- BL_HW4_Office

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.96	0.011
Standard value	0.9*	N/A

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

3- BL_HW5_Leisure

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.96	0.008
Standard value	0.9*	N/A

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

4- BL_HW6_R9

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.96	0.008
Standard value	0.9*	N/A

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

5- BL_HW3_Market

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.96	0.005
Standard value	0.9*	N/A
* Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73.		

1- CHECK2-CHP

	CHPQA quality index	CHP electrical efficiency
This building	0	0.3
Standard value	Not provided	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
Z00_SU13	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_SU12	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_SU11	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_SU10	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_SU9	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_SU8	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_SU13	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_SU12	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_SU11	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_SU10	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_SU8	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_SU 6	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_SU6	-	1.6	0	-	-	-	-	-	-	-	N/A
Z02_O__Meeting Room 1	-	1.6	0	-	-	-	-	-	-	-	N/A
Z02_O__Meeting Room 2	-	1.6	0	-	-	-	-	-	-	-	N/A
Z02_O__Meeting Room 3	-	1.6	0	-	-	-	-	-	-	-	N/A
Z02_O__Meeting 4	-	1.6	0	-	-	-	-	-	-	-	N/A
Z02_O__Change	-	1.6	0	-	-	-	-	-	-	-	N/A
Z02_O__Change Shower	-	1.6	0	-	-	-	-	-	-	-	N/A
Z02_O__Acc WC	-	1.6	0	-	-	-	-	-	-	-	N/A
Z02_O__WC	-	1.6	0	-	-	-	-	-	-	-	N/A
Z02_O__WC	-	1.6	0	-	-	-	-	-	-	-	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
Z02_O__Comms	-	1.6	0	-	-	-	-	-	-	-	N/A
Z02_O__Office 3	-	1.6	0	-	-	-	-	-	-	-	N/A
Z02_O__Brew	-	1.6	0	-	-	-	-	-	-	-	N/A
Z02_O__Staff Mess	-	1.6	0	-	-	-	-	-	-	-	N/A
Z02_O__Reception	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_SU9	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_SU5	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_L_Gym	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_SU4	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_SU3	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_SU1	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_SU2	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_R9	-	1.6	0	-	-	-	-	-	-	-	N/A
Z02_O__Control Room	-	1.6	0	-	-	-	-	-	-	-	N/A
Z02_O__Brew/Rest	-	1.6	0	-	-	-	-	-	-	-	N/A
Z02_O__Office 2	-	1.6	0	-	-	-	-	-	-	-	N/A
Z02_O__Corridor	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_L_Leisure_Gym	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_L_Leisure_Gym DL	-	1.6	0	-	-	-	-	-	-	-	N/A
Z02_O__Office 1	-	1.6	0	-	-	-	-	-	-	-	N/A
Z02_O__Office 1 DL	-	1.6	0	-	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	Assumed shell?
Z00_SU8 Stairs	YES
Z00_SU9 Stairs	YES
Z00_SU10 Stairs	YES
Z00_SU11 Stairs	YES
Z00_SU12 Stairs	YES
Z00_SU 6_Z00_Stairs	NO
Z00_SU13 Stairs	YES
Z00_SU13	YES
Z00_SU12	YES
Z00_SU11	YES
Z00_SU10	YES
Z00_SU9	YES
Z00_SU8	YES
Z01_SU8 Stairs	YES
Z01_SU10 Stairs	YES
Z01_SU11 Stairs	YES
Z01_SU12 Stairs	YES
Z01_SU13 Stairs	YES
Z01_SU13	YES
Z01_SU12	YES
Z01_SU11	YES

Shell and core configuration

Zone	Assumed shell?
Z01_SU10	YES
Z01_SU8	YES
Z00_SU 6	YES
Z01_SU6 Stairs	NO
Z01_SU6	YES
Z01_SU9 Stairs	YES
Z02_O_Stores	NO
Z02_O__Meeting Room 1	NO
Z02_O__Meeting Room 2	NO
Z02_O__Meeting Room 3	NO
Z02_O__Meeting 4	NO
Z02_O__Change	NO
Z02_O__Change Shower	NO
Z02_O__Acc WC	NO
Z02_O__WC	NO
Z02_O__WC	NO
Z02_O__Comms	NO
Z02_O__Office 3	NO
Z02_O__Brew	NO
Z02_O__Staff Mess	NO
Z02_O__Store	NO
Z02_O__Reception	NO
Z01_SU9	YES
Z00_SU5	YES
Z01_L_Gym	YES
Z00_SU4	YES
Z00_SU3	YES
Z00_SU1	YES
Z00_SU2	YES
Z00_R9	YES
Z02_O__Control Room	NO
Z02_O__Brew/Rest	NO
Z02_O__Office 2	NO
Z02_O__Corridor	NO
Z01_L_Stair04	NO
Z01_L_Leisure_Gym	YES
Z01_L_Leisure_Gym DL	YES
Z02_O__Office 1	NO
Z02_O__Office 1 DL	NO

General lighting and display lighting

	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Z00_SU8 Stairs	-	80	-	58
Z00_SU9 Stairs	-	80	-	58

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Z00_SU10 Stairs	-	80	-	58
Z00_SU11 Stairs	-	80	-	58
Z00_SU12 Stairs	-	80	-	58
Z00_SU 6_Z00_Stairs	-	80	-	76
Z00_SU13 Stairs	-	80	-	58
Z00_SU13	-	80	45	1853
Z00_SU12	-	80	45	1813
Z00_SU11	-	80	45	1813
Z00_SU10	-	80	45	1813
Z00_SU9	-	80	45	1813
Z00_SU8	-	80	45	1813
Z01_SU8 Stairs	-	80	-	33
Z01_SU10 Stairs	-	80	-	33
Z01_SU11 Stairs	-	80	-	33
Z01_SU12 Stairs	-	80	-	33
Z01_SU13 Stairs	-	80	-	33
Z01_SU13	-	80	45	1805
Z01_SU12	-	80	45	1775
Z01_SU11	-	80	45	1776
Z01_SU10	-	80	45	1776
Z01_SU8	-	80	45	1775
Z00_SU 6	-	80	45	9224
Z01_SU6 Stairs	-	80	-	57
Z01_SU6	-	80	45	11077
Z01_SU9 Stairs	-	80	-	33
Z02_O_Stores	90	-	-	37
Z02_O__Meeting Room 1	80	-	-	199
Z02_O__Meeting Room 2	80	-	-	202
Z02_O__Meeting Room 3	80	-	-	191
Z02_O__Meeting 4	80	-	-	250
Z02_O__Change	80	-	-	94
Z02_O__Change Shower	80	-	-	68
Z02_O__Acc WC	-	80	-	37
Z02_O__WC	-	80	-	32
Z02_O__WC	-	80	-	33
Z02_O__Comms	80	-	-	54
Z02_O__Office 3	80	-	-	93
Z02_O__Brew	80	-	-	98
Z02_O__Staff Mess	80	-	-	132
Z02_O__Store	80	-	-	19
Z02_O__Reception	-	80	80	88
Z01_SU9	-	80	45	1738
Z00_SU5	-	80	45	2674

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Z01_L_Gym	-	80	-	183
Z00_SU4	-	80	45	3182
Z00_SU3	-	80	45	3984
Z00_SU1	-	80	45	4633
Z00_SU2	-	80	45	844
Z00_R9	-	80	45	723
Z02_O__Control Room	80	-	-	278
Z02_O__Brew/Rest	80	-	-	190
Z02_O__Office 2	80	-	-	289
Z02_O__Corridor	-	80	-	81
Z01_L_Stair04	-	90	-	203
Z01_L_Leisure_Gym	-	80	-	2644
Z01_L_Leisure_Gym DL	-	80	-	1276
Z02_O__Office 1	80	-	-	901
Z02_O__Office 1 DL	80	-	-	474

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?
Z00_SU13	NO (-58.8%)	NO
Z00_SU12	NO (-49.1%)	NO
Z00_SU11	NO (-47.3%)	NO
Z00_SU10	NO (-45.5%)	NO
Z00_SU9	NO (-45.5%)	NO
Z00_SU8	NO (-45.1%)	NO
Z01_SU13	NO (-79.4%)	NO
Z01_SU12	NO (-74%)	NO
Z01_SU11	NO (-73%)	NO
Z01_SU10	NO (-86.9%)	NO
Z01_SU8	NO (-72.2%)	NO
Z00_SU 6	YES (+16.2%)	NO
Z01_SU6	NO (-48.9%)	NO
Z02_O__Meeting Room 1	NO (-63%)	NO
Z02_O__Meeting Room 2	NO (-60%)	NO
Z02_O__Meeting Room 3	NO (-57.1%)	NO
Z02_O__Meeting 4	NO (-98.8%)	NO
Z02_O__Change	N/A	N/A
Z02_O__Change Shower	N/A	N/A
Z02_O__Acc WC	N/A	N/A
Z02_O__WC	N/A	N/A
Z02_O__WC	N/A	N/A
Z02_O__Comms	N/A	N/A
Z02_O__Office 3	NO (-91%)	NO
Z02_O__Brew	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Z02_O__Staff Mess	NO (-89.5%)	NO
Z02_O__Reception	NO (-98.8%)	NO
Z01_SU9	NO (-72.6%)	NO
Z00_SU5	YES (+21.2%)	NO
Z01_L_Gym	NO (-9.5%)	NO
Z00_SU4	YES (+22.1%)	NO
Z00_SU3	YES (+15.8%)	NO
Z00_SU1	YES (+71.6%)	NO
Z00_SU2	YES (+72.8%)	NO
Z00_R9	YES (+69.1%)	NO
Z02_O__Control Room	NO (-86.2%)	NO
Z02_O__Brew/Rest	NO (-70.7%)	NO
Z02_O__Office 2	NO (-75.7%)	NO
Z02_O__Corridor	NO (-40.1%)	NO
Z01_L_Leisure_Gym	NO (-93.9%)	NO
Z01_L_Leisure_Gym DL	NO (-54.7%)	NO
Z02_O__Office 1	NO (-95.3%)	NO
Z02_O__Office 1 DL	NO (-74%)	NO

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	7459.9	7459.9
External area [m²]	38256.2	38256.2
Weather	LEE	LEE
Infiltration [m³/hm²@ 50Pa]	5	3
Average conductance [W/K]	19588.9	12103.3
Average U-value [W/m²K]	0.51	0.32
Alpha value* [%]	9.85	10

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

Building Use

% Area	Building Type
75	**A1/A2 Retail/Financial and Professional services**
3	**A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways**
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: Crown and County Courts
21	**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	13.56	5.54
Cooling	4.16	5.36
Auxiliary	16.36	5.71
Lighting	34.78	45.86
Hot water	9.67	5.84
Equipment*	37.08	37.08
TOTAL**	**78.53**	**68.3**

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

Energy Production by Technology [kWh/m²]

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

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	89.24	90.24
Primary energy* [kWh/m²]	200.2	184.11
Total emissions [kg/m²]	34.1	31.4

* 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 SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	26.7	56.1	8.7	4.9	6.6	0.85	3.2	0.91	4.5
	Notional	41.2	87.6	13.3	6.4	3.5	0.86	3.79	----	----
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	50.3	59.4	16.5	5.2	8.1	0.85	3.2	0.91	4.5
	Notional	17.5	89	5.6	6.5	3.2	0.86	3.79	----	----
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	22.8	13.7	7.5	1.2	49.7	0.85	3.2	0.91	4.5
	Notional	11.5	26	3.7	1.9	16.5	0.86	3.79	----	----
[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 BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.2	SR00000B:Surf[1]
Floor	0.2	0.15	SU000000:Surf[0]
Roof	0.15	0.15	SU000014:Surf[0]
Windows, roof windows, and rooflights	1.5	0.2	SU000007:Surf[9]
Personnel doors	1.5	-	No Personnel doors in building
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

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

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

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

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	<0.9

1- BL_S3- elec panels zonal extract

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.67	0	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

2- BL_VRF AHU

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	3.5	0	0	0.7
Standard value	0.91*	3.2	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

1- BL_HW3_Market

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.96	0.005
Standard value	0.9*	N/A
* Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73.		

2- BL_HW2_Food Hall

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.96	0.004
Standard value	0.9*	N/A
* Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73.		

1- CHECK2-CHP

	CHPQA quality index	CHP electrical efficiency
This building	0	0.3
Standard value	Not provided	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**
Z00_ANC__DIS	-	-	0.5	-	-	-	-	-	-	-	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
Z00_ANC__WC	-	-	0.5	-	-	-	-	-	-	-	N/A
Z00_ANC__WC	-	-	0.5	-	-	-	-	-	-	-	N/A
Z00_ANC_WC	-	-	0.5	-	-	-	-	-	-	-	N/A
Z00_ANC__WC	-	-	0.5	-	-	-	-	-	-	-	N/A
Z00_ANC__DIS WC & Shower	-	-	0.5	-	-	-	-	-	-	-	N/A
Z00_Office	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_Kiosk1	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_M_Entrance	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_Kiosk 4	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_Kiosk 03	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_Kiosk 02	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_MF	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_M_Atrium DL	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Office	-	1.6	0	-	-	-	-	-	0	-	N/A
Z01_M_MS	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_ DWC	-	-	0.5	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe 9 FOH	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe 8 FOH	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe 7 FOH	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe 6 FOH	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe Service	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe 5 FOH	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe 4 FOH	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe 3 FOH	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe 2 FOH	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Food Hall-Market Link 1	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Food Hall-Market Link 2	-	1.6	0	-	-	-	-	-	-	-	N/A
Z02_ANC_WC	-	-	0.5	-	-	-	-	-	-	-	N/A
Z02_ANC_WC	-	-	0.5	-	-	-	-	-	-	-	N/A
Z00_M_Entrance	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe 10 FOH	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_MF	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_MF	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_FH_Entrance & Z00_Stair01	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe 1	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Food Hall DL2	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Food Hall DL1	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_M_Circ DL1	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_M_Circ	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_M_Circ DL2	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Food Hall 2	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Food Hall 1	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_M_Circ DL	-	1.6	0	-	-	-	-	-	-	-	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
Z00_MS	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_MS	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_M_Circ	-	1.6	0	-	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	Assumed shell?
Z00_Stair04	NO
Z00_ANC__DIS	NO
Z00_ANC__WC	NO
Z00_ANC__WC Lobby	NO
Z00_ANC__WC	NO
Z00_ANC_WC	NO
Z00_ANC__WC	NO
Z00_ANC__DIS WC & Shower	NO
Z00_Office	NO
Z00_Stair06	NO
Z00_M_Accs WC	NO
Z00_Cleaning	NO
Z00_M_FemaleWC	NO
Z00_M_MaleWC	NO
Z00_M_Plant 1	NO
Z00_Cleaning	NO
Z00_Cleaning	NO
Z00_Refuse	NO
Z01_M_Cleaning Store	NO
Z00_Kiosk1	NO
Z00_M_Plant 2	NO
Z00_Stair02	NO
Z00_Stair03	NO
Z00_Service Core	NO
Z00_M_Entrance	NO
Z00_Stair04	NO
Z00_Stair05	NO
Z00_M_Service Core	NO
Z00_Kiosk 4	NO
Z00_Kiosk 03	NO
Z00_Kiosk 02	NO
Z00_Service Core	NO
Z00_M_Service Core	NO
Z00_Service Core	NO
Z00_Service Core	NO
Z00_MF	NO
Z00_M_Atrium DL	NO
Z00_M_WC Lobby	NO
Z01_FH_Office	NO

Shell and core configuration

Zone	Assumed shell?
Z01_Stair01	NO
Z01_M_MS	NO
Z01_Stair04	NO
Z01_EC 02	NO
Z01_FH_ DWC	NO
Z01_FH_Cafe 9 FOH	NO
Z01_FH_Cafe 9 BOH	NO
Z01_FH_WC Corridor	NO
Z01_FH_Cafe 8 FOH	NO
Z01_FH_Cafe 8 BOH	NO
Z01_FH_Cafe 7 BOH	NO
Z01_FH_Cafe 7 FOH	NO
Z01_FH_Cafe 6 FOH	NO
Z01_FH_Cafe 6 BOH	NO
Z01_Lift08 Lobby	NO
Z01_FH_Service Core	NO
Z01_ME1	NO
Z01_FH_Cafe Service	NO
Z01_FH_Cafe 5 FOH	NO
Z01_FH_Cafe 5 BOH	NO
Z01_FH_Cafe 4 BOH	NO
Z01_FH_Cafe 4 FOH	NO
Z01_FH_Cafe 3 FOH	NO
Z01_FH_Cafe 3 BOH	NO
Z01_FH_Cafe 2 BOH	NO
Z01_FH_Cafe 2 FOH	NO
Z01_FH_Food Hall-Market Link 1	NO
Z01_FH_Food Hall-Market Link 2	NO
Z01_ST 13	NO
Z01_M_WC	NO
Z01_M_WC	NO
Z01_M_DWC	NO
Z01_M_ WC Lobby	NO
Z01_Z01_Service Core	NO
Z01_ST11	NO
Z01_Stair03	NO
Z01_Service Core Store	NO
Z00_Service Core	NO
Z00_Service Core	NO
Z00_Service Core	NO
Z01_Stair05	YES
Z02_ANC_Office Stair Core	NO
Z02_ANC_Plant	NO
Z02_ANC_Stair06	NO
Z02_ANC_Lobby	NO
Z02_ANC_WC	NO
Z02_ANC_WC	NO

Shell and core configuration

Zone	Assumed shell?
Z02_ANC_Plant	NO
Z02_ANC_Plant Store	NO
Z02_ANC_Plant Store	NO
Z02_ANC_Plant Corridor	NO
Z02_ANC_Corridor	NO
Z02_ANC_Store	NO
Z02_ANC_Store	NO
Z02_Stair03	NO
Z02_Lift Lobby	NO
Z00_M_Entrance	NO
Z00_ANC__Corridor	NO
Z00_ANC__Corridor	NO
Z00_ANC__Corridor	NO
Z01_Stair06	NO
Z01_FH_Male WC	NO
Z01_FH_Female WC	NO
Z01_FH_Cafe 10 BOH	NO
Z01_FH_Cafe 10 FOH	NO
Z00_ Service Corridor	NO
Z00_MF	NO
Z00_MF	NO
Z00_FH_Entrance & Z00_Stair01	NO
Z00_Service Core	NO
Z01_Stair02	NO
Z01_Stair02	NO
Z01_FH_Cafe 1	NO
Z01_ST 10	NO
Z01_M_Lift 05&06 Lobby	NO
Z01_FH_Food Hall DL2	NO
Z01_FH_Food Hall DL1	NO
Z01_M_Circ DL1	NO
Z01_M_Circ	NO
Z01_M_Circ DL2	NO
Z01_FH_Food Hall 2	NO
Z01_FH_Food Hall 1	NO
Z00_M_Circ DL	NO
Z01_Service Core Corridor	NO
Z00_MS	NO
Z00_MS	NO
Z00_M_Circ	NO

General lighting and display lighting

	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Z00_Stair04	-	90	-	61

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Z00_ANC__DIS	-	90	-	46
Z00_ANC__WC	-	90	-	50
Z00_ANC__WC Lobby	-	90	-	16
Z00_ANC__WC	-	90	-	18
Z00_ANC_WC	-	90	-	95
Z00_ANC__WC	-	90	-	112
Z00_ANC__DIS WC & Shower	90	-	-	183
Z00_Office	90	-	-	215
Z00_Stair06	-	90	-	53
Z00_M_Accs WC	-	90	-	52
Z00_Cleaning	90	-	-	11
Z00_M_FemaleWC	-	90	-	87
Z00_M_MaleWC	-	90	-	114
Z00_M_Plant 1	90	-	-	115
Z00_Cleaning	90	-	-	12
Z00_Cleaning	90	-	-	11
Z00_Refuse	90	-	-	13
Z01_M_Cleaning Store	90	-	-	29
Z00_Kiosk1	-	90	-	356
Z00_M_Plant 2	90	-	-	117
Z00_Stair02	-	90	-	50
Z00_Stair03	-	90	-	36
Z00_Service Core	-	90	-	135
Z00_M_Entrance	-	90	-	242
Z00_Stair04	-	90	-	60
Z00_Stair05	-	90	-	42
Z00_M_Service Core	-	90	-	105
Z00_Kiosk 4	-	90	-	368
Z00_Kiosk 03	-	90	-	291
Z00_Kiosk 02	-	90	-	286
Z00_Service Core	-	90	-	208
Z00_M_Service Core	-	90	-	134
Z00_Service Core	-	90	-	148
Z00_Service Core	-	90	-	124
Z00_MF	-	90	65	3624
Z00_M_Atrium DL	-	90	-	768
Z00_M_WC Lobby	-	90	-	44
Z01_FH_Office	90	-	-	190
Z01_Stair01	-	90	-	163
Z01_M_MS	-	90	65	8414
Z01_Stair04	-	90	-	50
Z01_EC 02	90	-	-	32
Z01_FH_ DWC	-	90	-	63

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Z01_FH_Cafe 9 FOH	-	90	-	177
Z01_FH_Cafe 9 BOH	-	90	-	272
Z01_FH_WC Corridor	-	90	-	100
Z01_FH_Cafe 8 FOH	-	90	-	179
Z01_FH_Cafe 8 BOH	-	90	-	323
Z01_FH_Cafe 7 BOH	-	90	-	342
Z01_FH_Cafe 7 FOH	-	90	-	190
Z01_FH_Cafe 6 FOH	-	90	-	206
Z01_FH_Cafe 6 BOH	-	90	-	253
Z01_Lift08 Lobby	-	90	-	55
Z01_FH_Service Core	-	90	-	110
Z01_ME1	90	-	-	21
Z01_FH_Cafe Service	-	90	-	288
Z01_FH_Cafe 5 FOH	-	90	-	189
Z01_FH_Cafe 5 BOH	-	90	-	307
Z01_FH_Cafe 4 BOH	-	90	-	306
Z01_FH_Cafe 4 FOH	-	90	-	193
Z01_FH_Cafe 3 FOH	-	90	-	185
Z01_FH_Cafe 3 BOH	-	90	-	309
Z01_FH_Cafe 2 BOH	-	90	-	308
Z01_FH_Cafe 2 FOH	-	90	-	183
Z01_FH_Food Hall-Market Link 1	-	90	-	71
Z01_FH_Food Hall-Market Link 2	-	90	-	111
Z01_ST 13	90	-	-	32
Z01_M_WC	-	90	-	137
Z01_M_WC	-	90	-	123
Z01_M_DWC	-	90	-	52
Z01_M_ WC Lobby	-	90	-	42
Z01_Z01_Service Core	-	90	-	74
Z01_ST11	90	-	-	28
Z01_Stair03	-	90	-	40
Z01_Service Core Store	90	-	-	19
Z00_Service Core	-	90	-	199
Z00_Service Core	-	90	-	42
Z00_Service Core	-	90	-	318
Z01_Stair05	-	90	-	39
Z02_ANC_Office Stair Core	-	90	-	42
Z02_ANC_Plant	90	-	-	65
Z02_ANC_Stair06	-	90	-	45
Z02_ANC_Lobby	-	90	-	93
Z02_ANC_WC	-	90	-	96
Z02_ANC_WC	-	90	-	96
Z02_ANC_Plant	90	-	-	306

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Z02_ANC_Plant Store	90	-	-	14
Z02_ANC_Plant Store	90	-	-	14
Z02_ANC_Plant Corridor	-	90	-	57
Z02_ANC_Corridor	-	90	-	69
Z02_ANC_Store	90	-	-	10
Z02_ANC_Store	90	-	-	6
Z02_Stair03	-	90	-	43
Z02_Lift Lobby	-	90	-	54
Z00_M_Entrance	-	90	-	723
Z00_ANC__Corridor	-	90	-	89
Z00_ANC__Corridor	-	90	-	85
Z00_ANC__Corridor	-	90	-	15
Z01_Stair06	-	90	-	68
Z01_FH_Male WC	-	90	-	169
Z01_FH_Female WC	-	90	-	157
Z01_FH_Cafe 10 BOH	-	90	-	284
Z01_FH_Cafe 10 FOH	-	90	-	216
Z00_ Service Corridor	-	90	-	163
Z00_MF	-	90	65	231
Z00_MF	-	90	65	249
Z00_FH_Entrance & Z00_Stair01	-	90	-	181
Z00_Service Core	-	90	-	30
Z01_Stair02	-	90	-	39
Z01_Stair02	-	90	-	31
Z01_FH_Cafe 1	-	90	-	225
Z01_ST 10	90	-	-	19
Z01_M_Lift 05&06 Lobby	-	90	-	92
Z01_FH_Food Hall DL2	-	90	65	1212
Z01_FH_Food Hall DL1	-	90	65	541
Z01_M_Circ DL1	-	90	-	412
Z01_M_Circ	-	90	-	1109
Z01_M_Circ DL2	-	90	-	541
Z01_FH_Food Hall 2	-	90	65	319
Z01_FH_Food Hall 1	-	90	65	318
Z00_M_Circ DL	-	90	-	153
Z01_Service Core Corridor	-	90	-	307
Z00_MS	-	90	65	12535
Z00_MS	-	90	65	245
Z00_M_Circ	-	90	-	1767

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?
Z00_ANC__DIS WC & Shower	N/A	N/A
Z00_Office	N/A	N/A
Z00_Kiosk1	NO (-74.2%)	NO
Z00_M_Entrance	NO (-55.9%)	NO
Z00_Kiosk 4	NO (-66.6%)	NO
Z00_Kiosk 03	NO (-65.2%)	NO
Z00_Kiosk 02	NO (-70.7%)	NO
Z00_MF	NO (-92.4%)	NO
Z00_M_Atrium DL	NO (-5.7%)	NO
Z01_FH_Office	N/A	N/A
Z01_M_MS	NO (-85.6%)	NO
Z01_FH_Cafe 9 FOH	NO (-88.9%)	NO
Z01_FH_Cafe 8 FOH	NO (-90.5%)	NO
Z01_FH_Cafe 7 FOH	NO (-90.4%)	NO
Z01_FH_Cafe 6 FOH	NO (-83.4%)	NO
Z01_FH_Cafe Service	N/A	N/A
Z01_FH_Cafe 5 FOH	NO (-92.9%)	NO
Z01_FH_Cafe 4 FOH	NO (-85.6%)	NO
Z01_FH_Cafe 3 FOH	NO (-84.3%)	NO
Z01_FH_Cafe 2 FOH	NO (-84.5%)	NO
Z01_FH_Food Hall-Market Link 1	NO (-96.2%)	NO
Z01_FH_Food Hall-Market Link 2	NO (-92.2%)	NO
Z00_M_Entrance	YES (+35.3%)	NO
Z01_FH_Cafe 10 FOH	NO (-34.9%)	NO
Z00_MF	NO (-10.5%)	NO
Z00_MF	NO (-2.8%)	NO
Z00_FH_Entrance & Z00_Stair01	YES (+152.2%)	NO
Z01_FH_Cafe 1	N/A	N/A
Z01_FH_Food Hall DL2	NO (-56.6%)	NO
Z01_FH_Food Hall DL1	YES (+41.1%)	NO
Z01_M_Circ DL1	NO (-72.8%)	NO
Z01_M_Circ	NO (-92.3%)	NO
Z01_M_Circ DL2	YES (+8.3%)	NO
Z01_FH_Food Hall 2	NO (-90.2%)	NO
Z01_FH_Food Hall 1	NO (-91.8%)	NO
Z00_M_Circ DL	NO (-31.3%)	NO
Z00_MS	NO (-78.7%)	NO
Z00_MS	NO (-7.3%)	NO
Z00_M_Circ	NO (-92.9%)	NO

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	9739.6	9739.6
External area [m^2]	37317.9	37317.9
Weather	LEE	LEE
Infiltration [m^3/hm^2@ 50Pa]	5	3
Average conductance [W/K]	18232	10070
Average U-value [W/m^2K]	0.49	0.27
Alpha value* [%]	6.04	10

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

Building Use

% Area	Building Type
76	**A1/A2 Retail/Financial and Professional services**
22	**A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways**
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: Crown and County Courts
1	**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	9.14	5.19
Cooling	3.18	4.93
Auxiliary	16.86	9.18
Lighting	19.58	33.88
Hot water	16.44	13.99
Equipment*	39.32	39.32
TOTAL**	**65.2**	**67.17**

* 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]	71.99	83.32
Primary energy* [kWh/m^2]	154.2	166.99
Total emissions [kg/m^2]	26.3	28.5

* 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] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	35.9	56.9	11.2	4.2	9.9	0.89	3.74	0.91	5
	Notional	19.2	89.4	6.2	6.6	4.3	0.86	3.79	----	----
[ST] Other local room heater - fanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	165.8	0	54.7	0	22.7	0.84	0	1	0
	Notional	123.4	0	39.8	0	27.2	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 BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.2	ST00000B:Surf[1]
Floor	0.2	0.15	MR000000:Surf[0]
Roof	0.15	0.15	MR000004:Surf[1]
Windows, roof windows, and rooflights	1.5	0.2	ST000000:Surf[6]
Personnel doors	1.5	2.2	FH000001:Surf[4]
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	1.4	MC000003:Surf[1]

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

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

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

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name **Shell and Core**

09-15-54301_LZC1__Be Clean_Better Barnsley Market_Food Hall & Landlord

As designed

Date: Wed Jan 04 17:15:25 2017

Administrative information

Building Details

Address: Better Barnsley Market Centre, Barnsley, -

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.6

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.6

BRUKL compliance check version: v5.2.g.3

Owner Details

Name: -

Telephone number: -

Address: -, -, -

Certifier details

Name: Ian Andrews

Telephone number: 01924 237513

Address: Stroma Technology, Unit 6, Silkwood Business Park, Fryer's Way, Wakefield, WF5 9TJ

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

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	28.5
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	28.5
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	25.5
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 the building services should achieve reasonable overall standards of energy efficiency

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

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.2	0.2	MS000061:Surf[38]
Floor	0.25	0.15	0.15	FF000000:Surf[0]
Roof	0.25	0.15	0.15	MR000004:Surf[1]
Windows***, roof windows, and rooflights	2.2	1.02	2.2	ST000000:Surf[0]
Personnel doors	2.2	2.2	2.2	FH000001:Surf[4]
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	1.4	1.4	MC000003:Surf[1]

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

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

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

Building services

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

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- BL_S3- elec panels zonal extract

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.67	0	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

2- BL_VRF AHU

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	3.5	0	0	0.7
Standard value	0.91*	3.2	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

1- BL_HW3_Market

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.96	0.005
Standard value	0.9*	N/A
* Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73.		

2- BC_HW2_Food Hall

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.96	0.004
Standard value	0.9*	N/A
* Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73.		

1- CHECK2-CHP

	CHPQA quality index	CHP electrical efficiency
This building	0	0.3
Standard value	Not provided	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**
Z00_ANC__DIS	-	-	0.5	-	-	-	-	-	-	-	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
Z00_ANC__WC	-	-	0.5	-	-	-	-	-	-	-	N/A
Z00_ANC__WC	-	-	0.5	-	-	-	-	-	-	-	N/A
Z00_ANC_WC	-	-	0.5	-	-	-	-	-	-	-	N/A
Z00_ANC__WC	-	-	0.5	-	-	-	-	-	-	-	N/A
Z00_ANC__DIS WC & Shower	-	-	0.5	-	-	-	-	-	-	-	N/A
Z00_Office	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_Kiosk1	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_M_Entrance	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_Kiosk 4	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_Kiosk 03	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_Kiosk 02	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_MF	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_M_Atrium DL	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Office	-	1.6	0	-	-	-	-	-	0	-	N/A
Z01_M_MS	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_ DWC	-	1.6	0.5	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe 9 FOH	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe 8 FOH	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe 7 FOH	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe 6 FOH	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe Service	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe 5 FOH	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe 4 FOH	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe 3 FOH	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe 2 FOH	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Food Hall-Market Link 1	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Food Hall-Market Link 2	-	1.6	0	-	-	-	-	-	-	-	N/A
Z02_ANC_WC	-	-	0.5	-	-	-	-	-	-	-	N/A
Z02_ANC_WC	-	-	0.5	-	-	-	-	-	-	-	N/A
Z00_M_Entrance	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe 10 FOH	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_MF	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_MF	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_FH_Entrance & Z00_Stair01	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe 1	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Food Hall DL2	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Food Hall DL1	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_M_Circ DL1	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_M_Circ	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_M_Circ DL2	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Food Hall 2	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Food Hall 1	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_M_Circ DL	-	1.6	0	-	-	-	-	-	-	-	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
Z00_MS	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_MS	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_M_Circ	-	1.6	0	-	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	Assumed shell?
Z00_Stair04	NO
Z00_ANC__DIS	NO
Z00_ANC__WC	NO
Z00_ANC__WC Lobby	NO
Z00_ANC__WC	NO
Z00_ANC_WC	NO
Z00_ANC__WC	NO
Z00_ANC__DIS WC & Shower	NO
Z00_Office	NO
Z00_Stair06	NO
Z00_M_Accs WC	NO
Z00_Cleaning	NO
Z00_M_FemaleWC	NO
Z00_M_MaleWC	NO
Z00_M_Plant 1	NO
Z00_Cleaning	NO
Z00_Cleaning	NO
Z00_Refuse	NO
Z01_M_Cleaning Store	NO
Z00_Kiosk1	NO
Z00_M_Plant 2	NO
Z00_Stair02	NO
Z00_Stair03	NO
Z00_Service Core	NO
Z00_M_Entrance	NO
Z00_Stair04	NO
Z00_Stair05	NO
Z00_M_Service Core	NO
Z00_Kiosk 4	NO
Z00_Kiosk 03	NO
Z00_Kiosk 02	NO
Z00_Service Core	NO
Z00_M_Service Core	NO
Z00_Service Core	NO
Z00_Service Core	NO
Z00_MF	NO
Z00_M_Atrium DL	NO
Z00_M_WC Lobby	NO
Z01_FH_Office	NO

Shell and core configuration

Zone	Assumed shell?
Z01_Stair01	NO
Z01_M_MS	NO
Z01_Stair04	NO
Z01_EC 02	NO
Z01_FH_ DWC	NO
Z01_FH_Cafe 9 FOH	NO
Z01_FH_Cafe 9 BOH	NO
Z01_FH_WC Corridor	NO
Z01_FH_Cafe 8 FOH	NO
Z01_FH_Cafe 8 BOH	NO
Z01_FH_Cafe 7 BOH	NO
Z01_FH_Cafe 7 FOH	NO
Z01_FH_Cafe 6 FOH	NO
Z01_FH_Cafe 6 BOH	NO
Z01_Lift08 Lobby	NO
Z01_FH_Service Core	NO
Z01_ME1	NO
Z01_FH_Cafe Service	NO
Z01_FH_Cafe 5 FOH	NO
Z01_FH_Cafe 5 BOH	NO
Z01_FH_Cafe 4 BOH	NO
Z01_FH_Cafe 4 FOH	NO
Z01_FH_Cafe 3 FOH	NO
Z01_FH_Cafe 3 BOH	NO
Z01_FH_Cafe 2 BOH	NO
Z01_FH_Cafe 2 FOH	NO
Z01_FH_Food Hall-Market Link 1	NO
Z01_FH_Food Hall-Market Link 2	NO
Z01_ST 13	NO
Z01_M_WC	NO
Z01_M_WC	NO
Z01_M_DWC	NO
Z01_M_ WC Lobby	NO
Z01_Z01_Service Core	NO
Z01_ST11	NO
Z01_Stair03	NO
Z01_Service Core Store	NO
Z00_Service Core	NO
Z00_Service Core	NO
Z00_Service Core	NO
Z01_Stair05	YES
Z02_ANC_Office Stair Core	NO
Z02_ANC_Plant	NO
Z02_ANC_Stair06	NO
Z02_ANC_Lobby	NO
Z02_ANC_WC	NO
Z02_ANC_WC	NO

Shell and core configuration

Zone	Assumed shell?
Z02_ANC_Plant	NO
Z02_ANC_Plant Store	NO
Z02_ANC_Plant Store	NO
Z02_ANC_Plant Corridor	NO
Z02_ANC_Corridor	NO
Z02_ANC_Store	NO
Z02_ANC_Store	NO
Z02_Stair03	NO
Z02_Lift Lobby	NO
Z00_M_Entrance	NO
Z00_ANC__Corridor	NO
Z00_ANC__Corridor	NO
Z00_ANC__Corridor	NO
Z01_Stair06	NO
Z01_FH_Male WC	NO
Z01_FH_Female WC	NO
Z01_FH_Cafe 10 BOH	NO
Z01_FH_Cafe 10 FOH	NO
Z00_ Service Corridor	NO
Z00_MF	NO
Z00_MF	NO
Z00_FH_Entrance & Z00_Stair01	NO
Z00_Service Core	NO
Z01_Stair02	NO
Z01_Stair02	NO
Z01_FH_Cafe 1	NO
Z01_ST 10	NO
Z01_M_Lift 05&06 Lobby	NO
Z01_FH_Food Hall DL2	NO
Z01_FH_Food Hall DL1	NO
Z01_M_Circ DL1	NO
Z01_M_Circ	NO
Z01_M_Circ DL2	NO
Z01_FH_Food Hall 2	NO
Z01_FH_Food Hall 1	NO
Z00_M_Circ DL	NO
Z01_Service Core Corridor	NO
Z00_MS	NO
Z00_MS	NO
Z00_M_Circ	NO

General lighting and display lighting

	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Z00_Stair04	-	90	-	61

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Z00_ANC__DIS	-	90	-	46
Z00_ANC__WC	-	90	-	50
Z00_ANC__WC Lobby	-	90	-	16
Z00_ANC__WC	-	90	-	18
Z00_ANC_WC	-	90	-	95
Z00_ANC__WC	-	90	-	112
Z00_ANC__DIS WC & Shower	90	-	-	183
Z00_Office	90	-	-	215
Z00_Stair06	-	90	-	53
Z00_M_Accs WC	-	90	-	52
Z00_Cleaning	90	-	-	11
Z00_M_FemaleWC	-	90	-	87
Z00_M_MaleWC	-	90	-	114
Z00_M_Plant 1	90	-	-	115
Z00_Cleaning	90	-	-	12
Z00_Cleaning	90	-	-	11
Z00_Refuse	90	-	-	13
Z01_M_Cleaning Store	90	-	-	29
Z00_Kiosk1	-	90	-	356
Z00_M_Plant 2	90	-	-	117
Z00_Stair02	-	90	-	50
Z00_Stair03	-	90	-	36
Z00_Service Core	-	90	-	135
Z00_M_Entrance	-	90	-	242
Z00_Stair04	-	90	-	60
Z00_Stair05	-	90	-	42
Z00_M_Service Core	-	90	-	105
Z00_Kiosk 4	-	90	-	368
Z00_Kiosk 03	-	90	-	291
Z00_Kiosk 02	-	90	-	286
Z00_Service Core	-	90	-	208
Z00_M_Service Core	-	90	-	134
Z00_Service Core	-	90	-	148
Z00_Service Core	-	90	-	124
Z00_MF	-	90	65	3624
Z00_M_Atrium DL	-	90	-	768
Z00_M_WC Lobby	-	90	-	44
Z01_FH_Office	90	-	-	190
Z01_Stair01	-	90	-	163
Z01_M_MS	-	90	65	8414
Z01_Stair04	-	90	-	50
Z01_EC 02	90	-	-	32
Z01_FH_ DWC	-	90	-	63

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Z01_FH_Cafe 9 FOH	-	90	-	177
Z01_FH_Cafe 9 BOH	-	90	-	272
Z01_FH_WC Corridor	-	90	-	100
Z01_FH_Cafe 8 FOH	-	90	-	179
Z01_FH_Cafe 8 BOH	-	90	-	323
Z01_FH_Cafe 7 BOH	-	90	-	342
Z01_FH_Cafe 7 FOH	-	90	-	190
Z01_FH_Cafe 6 FOH	-	90	-	206
Z01_FH_Cafe 6 BOH	-	90	-	253
Z01_Lift08 Lobby	-	90	-	55
Z01_FH_Service Core	-	90	-	110
Z01_ME1	90	-	-	21
Z01_FH_Cafe Service	-	90	-	288
Z01_FH_Cafe 5 FOH	-	90	-	189
Z01_FH_Cafe 5 BOH	-	90	-	307
Z01_FH_Cafe 4 BOH	-	90	-	306
Z01_FH_Cafe 4 FOH	-	90	-	193
Z01_FH_Cafe 3 FOH	-	90	-	185
Z01_FH_Cafe 3 BOH	-	90	-	309
Z01_FH_Cafe 2 BOH	-	90	-	308
Z01_FH_Cafe 2 FOH	-	90	-	183
Z01_FH_Food Hall-Market Link 1	-	90	-	71
Z01_FH_Food Hall-Market Link 2	-	90	-	111
Z01_ST 13	90	-	-	32
Z01_M_WC	-	90	-	137
Z01_M_WC	-	90	-	123
Z01_M_DWC	-	90	-	52
Z01_M_ WC Lobby	-	90	-	42
Z01_Z01_Service Core	-	90	-	74
Z01_ST11	90	-	-	28
Z01_Stair03	-	90	-	40
Z01_Service Core Store	90	-	-	19
Z00_Service Core	-	90	-	199
Z00_Service Core	-	90	-	42
Z00_Service Core	-	90	-	318
Z01_Stair05	-	90	-	39
Z02_ANC_Office Stair Core	-	90	-	42
Z02_ANC_Plant	90	-	-	65
Z02_ANC_Stair06	-	90	-	45
Z02_ANC_Lobby	-	90	-	93
Z02_ANC_WC	-	90	-	96
Z02_ANC_WC	-	90	-	96
Z02_ANC_Plant	90	-	-	306

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Z02_ANC_Plant Store	90	-	-	14
Z02_ANC_Plant Store	90	-	-	14
Z02_ANC_Plant Corridor	-	90	-	57
Z02_ANC_Corridor	-	90	-	69
Z02_ANC_Store	90	-	-	10
Z02_ANC_Store	90	-	-	6
Z02_Stair03	-	90	-	43
Z02_Lift Lobby	-	90	-	54
Z00_M_Entrance	-	90	-	723
Z00_ANC__Corridor	-	90	-	89
Z00_ANC__Corridor	-	90	-	85
Z00_ANC__Corridor	-	90	-	15
Z01_Stair06	-	90	-	68
Z01_FH_Male WC	-	90	-	169
Z01_FH_Female WC	-	90	-	157
Z01_FH_Cafe 10 BOH	-	90	-	284
Z01_FH_Cafe 10 FOH	-	90	-	216
Z00_ Service Corridor	-	90	-	163
Z00_MF	-	90	65	231
Z00_MF	-	90	65	249
Z00_FH_Entrance & Z00_Stair01	-	90	-	181
Z00_Service Core	-	90	-	30
Z01_Stair02	-	90	-	39
Z01_Stair02	-	90	-	31
Z01_FH_Cafe 1	-	90	-	225
Z01_ST 10	90	-	-	19
Z01_M_Lift 05&06 Lobby	-	90	-	92
Z01_FH_Food Hall DL2	-	90	65	1212
Z01_FH_Food Hall DL1	-	90	65	541
Z01_M_Circ DL1	-	90	-	412
Z01_M_Circ	-	90	-	1109
Z01_M_Circ DL2	-	90	-	541
Z01_FH_Food Hall 2	-	90	65	319
Z01_FH_Food Hall 1	-	90	65	318
Z00_M_Circ DL	-	90	-	153
Z01_Service Core Corridor	-	90	-	307
Z00_MS	-	90	65	12535
Z00_MS	-	90	65	245
Z00_M_Circ	-	90	-	1767

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?
Z00_ANC__DIS WC & Shower	N/A	N/A
Z00_Office	N/A	N/A
Z00_Kiosk1	NO (-74.2%)	NO
Z00_M_Entrance	NO (-55.9%)	NO
Z00_Kiosk 4	NO (-66.6%)	NO
Z00_Kiosk 03	NO (-65.2%)	NO
Z00_Kiosk 02	NO (-70.7%)	NO
Z00_MF	NO (-92.4%)	NO
Z00_M_Atrium DL	NO (-5.7%)	NO
Z01_FH_Office	N/A	N/A
Z01_M_MS	NO (-85.6%)	NO
Z01_FH_ DWC	N/A	N/A
Z01_FH_Cafe 9 FOH	NO (-88.9%)	NO
Z01_FH_Cafe 8 FOH	NO (-90.5%)	NO
Z01_FH_Cafe 7 FOH	NO (-90.4%)	NO
Z01_FH_Cafe 6 FOH	NO (-83.4%)	NO
Z01_FH_Cafe Service	N/A	N/A
Z01_FH_Cafe 5 FOH	NO (-92.9%)	NO
Z01_FH_Cafe 4 FOH	NO (-85.6%)	NO
Z01_FH_Cafe 3 FOH	NO (-84.3%)	NO
Z01_FH_Cafe 2 FOH	NO (-84.5%)	NO
Z01_FH_Food Hall-Market Link 1	NO (-96.2%)	NO
Z01_FH_Food Hall-Market Link 2	NO (-92.2%)	NO
Z00_M_Entrance	YES (+35.3%)	NO
Z01_FH_Cafe 10 FOH	NO (-34.9%)	NO
Z00_MF	NO (-10.5%)	NO
Z00_MF	NO (-2.8%)	NO
Z00_FH_Entrance & Z00_Stair01	YES (+152.2%)	NO
Z01_FH_Cafe 1	N/A	N/A
Z01_FH_Food Hall DL2	NO (-56.6%)	NO
Z01_FH_Food Hall DL1	YES (+41.1%)	NO
Z01_M_Circ DL1	NO (-72.8%)	NO
Z01_M_Circ	NO (-92.3%)	NO
Z01_M_Circ DL2	YES (+8.3%)	NO
Z01_FH_Food Hall 2	NO (-90.2%)	NO
Z01_FH_Food Hall 1	NO (-91.8%)	NO
Z00_M_Circ DL	NO (-31.3%)	NO
Z00_MS	NO (-78.7%)	NO
Z00_MS	NO (-7.3%)	NO
Z00_M_Circ	NO (-92.8%)	NO

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	9739.6	9739.6
External area [m²]	37317.9	37317.9
Weather	LEE	LEE
Infiltration [m³/hm²@ 50Pa]	5	3
Average conductance [W/K]	18232	10070
Average U-value [W/m²K]	0.49	0.27
Alpha value* [%]	6.04	10

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

Building Use

% Area	Building Type
76	**A1/A2 Retail/Financial and Professional services**
22	**A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways**
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: Crown and County Courts
1	**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	9.11	5.17
Cooling	3.18	4.94
Auxiliary	16.87	9.18
Lighting	19.58	33.88
Hot water	21.27	13.99
Equipment*	39.32	39.32
TOTAL**	**66.45**	**67.16**

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

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	3.55	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	71.94	83.38
Primary energy* [kWh/m²]	149.05	167
Total emissions [kg/m²]	25.5	28.5

* 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] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	36	56.9	11.2	4.2	9.9	0.89	3.74	0.91	5
	Notional	19.3	89.5	6.2	6.6	4.4	0.86	3.79	----	----
[ST] Other local room heater - fanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	157.9	0	52.1	0	21.6	0.84	0	1	0
	Notional	117.5	0	37.8	0	25.9	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 BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.2	ST00000B:Surf[1]
Floor	0.2	0.15	MR000000:Surf[0]
Roof	0.15	0.15	MR000004:Surf[1]
Windows, roof windows, and rooflights	1.5	0.2	ST000000:Surf[6]
Personnel doors	1.5	2.2	FH000001:Surf[4]
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	1.4	MC000003:Surf[1]

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

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

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

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name **Shell and Core**

09-15-54301_LZC1__Be Green 1_Better Barnsley Market Food Hall & Landlord

As designed

Date: Thu Jan 05 09:19:25 2017

Administrative information

Building Details

Address: Better Barnsley Market Centre, Barnsley, -

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.6

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.6

BRUKL compliance check version: v5.2.g.3

Owner Details

Name: -

Telephone number: -

Address: -, -, -

Certifier details

Name: Ian Andrews

Telephone number: 01924 237513

Address: Stroma Technology, Unit 6, Silkwood Business Park, Fryer's Way, Wakefield, WF5 9TJ

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

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	28.3
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	28.3
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	24.5
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 the building services should achieve reasonable overall standards of energy efficiency

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

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.2	0.2	MS000061:Surf[38]
Floor	0.25	0.15	0.15	FF000000:Surf[0]
Roof	0.25	0.15	0.15	MR000004:Surf[1]
Windows***, roof windows, and rooflights	2.2	1.02	2.2	ST000000:Surf[0]
Personnel doors	2.2	2.2	2.2	FH000001:Surf[4]
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	1.4	1.4	MC000003:Surf[1]

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

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

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

Building services

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

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- BL_S3- elec panels zonal extract

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.67	0	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

2- BL_VRF AHU

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.75	3.5	0	0	0.7
Standard value	2.5*	3.2	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

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

1- BL_HW3_Market

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.96	0.005
Standard value	0.9*	N/A

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

2- BC_HW2_Food Hall

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.96	0.004
Standard value	0.9*	N/A

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

1- CHECK2-CHP

	CHPQA quality index	CHP electrical efficiency
This building	0	0.3
Standard value	Not provided	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
Z00_ANC__DIS	-	-	0.5	-	-	-	-	-	-	-	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
Z00_ANC__WC	-	-	0.5	-	-	-	-	-	-	-	N/A
Z00_ANC__WC	-	-	0.5	-	-	-	-	-	-	-	N/A
Z00_ANC_WC	-	-	0.5	-	-	-	-	-	-	-	N/A
Z00_ANC__WC	-	-	0.5	-	-	-	-	-	-	-	N/A
Z00_ANC__DIS WC & Shower	-	-	0.5	-	-	-	-	-	-	-	N/A
Z00_Office	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_Kiosk1	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_M_Entrance	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_Kiosk 4	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_Kiosk 03	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_Kiosk 02	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_MF	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_M_Atrium DL	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Office	-	1.6	0	-	-	-	-	-	0	-	N/A
Z01_M_MS	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_ DWC	-	1.6	0.5	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe 9 FOH	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe 8 FOH	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe 7 FOH	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe 6 FOH	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe Service	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe 5 FOH	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe 4 FOH	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe 3 FOH	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe 2 FOH	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Food Hall-Market Link 1	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Food Hall-Market Link 2	-	1.6	0	-	-	-	-	-	-	-	N/A
Z02_ANC_WC	-	-	0.5	-	-	-	-	-	-	-	N/A
Z02_ANC_WC	-	-	0.5	-	-	-	-	-	-	-	N/A
Z00_M_Entrance	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe 10 FOH	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_MF	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_MF	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_FH_Entrance & Z00_Stair01	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe 1	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Food Hall DL2	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Food Hall DL1	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_M_Circ DL1	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_M_Circ	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_M_Circ DL2	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Food Hall 2	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Food Hall 1	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_M_Circ DL	-	1.6	0	-	-	-	-	-	-	-	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
Z00_MS	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_MS	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_M_Circ	-	1.6	0	-	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	Assumed shell?
Z00_Stair04	NO
Z00_ANC__DIS	NO
Z00_ANC__WC	NO
Z00_ANC__WC Lobby	NO
Z00_ANC__WC	NO
Z00_ANC_WC	NO
Z00_ANC__WC	NO
Z00_ANC__DIS WC & Shower	NO
Z00_Office	NO
Z00_Stair06	NO
Z00_M_Accs WC	NO
Z00_Cleaning	NO
Z00_M_FemaleWC	NO
Z00_M_MaleWC	NO
Z00_M_Plant 1	NO
Z00_Cleaning	NO
Z00_Cleaning	NO
Z00_Refuse	NO
Z01_M_Cleaning Store	NO
Z00_Kiosk1	NO
Z00_M_Plant 2	NO
Z00_Stair02	NO
Z00_Stair03	NO
Z00_Service Core	NO
Z00_M_Entrance	NO
Z00_Stair04	NO
Z00_Stair05	NO
Z00_M_Service Core	NO
Z00_Kiosk 4	NO
Z00_Kiosk 03	NO
Z00_Kiosk 02	NO
Z00_Service Core	NO
Z00_M_Service Core	NO
Z00_Service Core	NO
Z00_Service Core	NO
Z00_MF	NO
Z00_M_Atrium DL	NO
Z00_M_WC Lobby	NO
Z01_FH_Office	NO

Shell and core configuration

Zone	Assumed shell?
Z01_Stair01	NO
Z01_M_MS	NO
Z01_Stair04	NO
Z01_EC 02	NO
Z01_FH_ DWC	NO
Z01_FH_Cafe 9 FOH	NO
Z01_FH_Cafe 9 BOH	NO
Z01_FH_WC Corridor	NO
Z01_FH_Cafe 8 FOH	NO
Z01_FH_Cafe 8 BOH	NO
Z01_FH_Cafe 7 BOH	NO
Z01_FH_Cafe 7 FOH	NO
Z01_FH_Cafe 6 FOH	NO
Z01_FH_Cafe 6 BOH	NO
Z01_Lift08 Lobby	NO
Z01_FH_Service Core	NO
Z01_ME1	NO
Z01_FH_Cafe Service	NO
Z01_FH_Cafe 5 FOH	NO
Z01_FH_Cafe 5 BOH	NO
Z01_FH_Cafe 4 BOH	NO
Z01_FH_Cafe 4 FOH	NO
Z01_FH_Cafe 3 FOH	NO
Z01_FH_Cafe 3 BOH	NO
Z01_FH_Cafe 2 BOH	NO
Z01_FH_Cafe 2 FOH	NO
Z01_FH_Food Hall-Market Link 1	NO
Z01_FH_Food Hall-Market Link 2	NO
Z01_ST 13	NO
Z01_M_WC	NO
Z01_M_WC	NO
Z01_M_DWC	NO
Z01_M_ WC Lobby	NO
Z01_Z01_Service Core	NO
Z01_ST11	NO
Z01_Stair03	NO
Z01_Service Core Store	NO
Z00_Service Core	NO
Z00_Service Core	NO
Z00_Service Core	NO
Z01_Stair05	YES
Z02_ANC_Office Stair Core	NO
Z02_ANC_Plant	NO
Z02_ANC_Stair06	NO
Z02_ANC_Lobby	NO
Z02_ANC_WC	NO
Z02_ANC_WC	NO

Shell and core configuration

Zone	Assumed shell?
Z02_ANC_Plant	NO
Z02_ANC_Plant Store	NO
Z02_ANC_Plant Store	NO
Z02_ANC_Plant Corridor	NO
Z02_ANC_Corridor	NO
Z02_ANC_Store	NO
Z02_ANC_Store	NO
Z02_Stair03	NO
Z02_Lift Lobby	NO
Z00_M_Entrance	NO
Z00_ANC__Corridor	NO
Z00_ANC__Corridor	NO
Z00_ANC__Corridor	NO
Z01_Stair06	NO
Z01_FH_Male WC	NO
Z01_FH_Female WC	NO
Z01_FH_Cafe 10 BOH	NO
Z01_FH_Cafe 10 FOH	NO
Z00_ Service Corridor	NO
Z00_MF	NO
Z00_MF	NO
Z00_FH_Entrance & Z00_Stair01	NO
Z00_Service Core	NO
Z01_Stair02	NO
Z01_Stair02	NO
Z01_FH_Cafe 1	NO
Z01_ST 10	NO
Z01_M_Lift 05&06 Lobby	NO
Z01_FH_Food Hall DL2	NO
Z01_FH_Food Hall DL1	NO
Z01_M_Circ DL1	NO
Z01_M_Circ	NO
Z01_M_Circ DL2	NO
Z01_FH_Food Hall 2	NO
Z01_FH_Food Hall 1	NO
Z00_M_Circ DL	NO
Z01_Service Core Corridor	NO
Z00_MS	NO
Z00_MS	NO
Z00_M_Circ	NO

General lighting and display lighting

	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Z00_Stair04	-	90	-	61

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Z00_ANC__DIS	-	90	-	46
Z00_ANC__WC	-	90	-	50
Z00_ANC__WC Lobby	-	90	-	16
Z00_ANC__WC	-	90	-	18
Z00_ANC_WC	-	90	-	95
Z00_ANC__WC	-	90	-	112
Z00_ANC__DIS WC & Shower	90	-	-	183
Z00_Office	90	-	-	215
Z00_Stair06	-	90	-	53
Z00_M_Accs WC	-	90	-	52
Z00_Cleaning	90	-	-	11
Z00_M_FemaleWC	-	90	-	87
Z00_M_MaleWC	-	90	-	114
Z00_M_Plant 1	90	-	-	115
Z00_Cleaning	90	-	-	12
Z00_Cleaning	90	-	-	11
Z00_Refuse	90	-	-	13
Z01_M_Cleaning Store	90	-	-	29
Z00_Kiosk1	-	90	-	356
Z00_M_Plant 2	90	-	-	117
Z00_Stair02	-	90	-	50
Z00_Stair03	-	90	-	36
Z00_Service Core	-	90	-	135
Z00_M_Entrance	-	90	-	242
Z00_Stair04	-	90	-	60
Z00_Stair05	-	90	-	42
Z00_M_Service Core	-	90	-	105
Z00_Kiosk 4	-	90	-	368
Z00_Kiosk 03	-	90	-	291
Z00_Kiosk 02	-	90	-	286
Z00_Service Core	-	90	-	208
Z00_M_Service Core	-	90	-	134
Z00_Service Core	-	90	-	148
Z00_Service Core	-	90	-	124
Z00_MF	-	90	65	3624
Z00_M_Atrium DL	-	90	-	768
Z00_M_WC Lobby	-	90	-	44
Z01_FH_Office	90	-	-	190
Z01_Stair01	-	90	-	163
Z01_M_MS	-	90	65	8414
Z01_Stair04	-	90	-	50
Z01_EC 02	90	-	-	32
Z01_FH_ DWC	-	90	-	63

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Z01_FH_Cafe 9 FOH	-	90	-	177
Z01_FH_Cafe 9 BOH	-	90	-	272
Z01_FH_WC Corridor	-	90	-	100
Z01_FH_Cafe 8 FOH	-	90	-	179
Z01_FH_Cafe 8 BOH	-	90	-	323
Z01_FH_Cafe 7 BOH	-	90	-	342
Z01_FH_Cafe 7 FOH	-	90	-	190
Z01_FH_Cafe 6 FOH	-	90	-	206
Z01_FH_Cafe 6 BOH	-	90	-	253
Z01_Lift08 Lobby	-	90	-	55
Z01_FH_Service Core	-	90	-	110
Z01_ME1	90	-	-	21
Z01_FH_Cafe Service	-	90	-	288
Z01_FH_Cafe 5 FOH	-	90	-	189
Z01_FH_Cafe 5 BOH	-	90	-	307
Z01_FH_Cafe 4 BOH	-	90	-	306
Z01_FH_Cafe 4 FOH	-	90	-	193
Z01_FH_Cafe 3 FOH	-	90	-	185
Z01_FH_Cafe 3 BOH	-	90	-	309
Z01_FH_Cafe 2 BOH	-	90	-	308
Z01_FH_Cafe 2 FOH	-	90	-	183
Z01_FH_Food Hall-Market Link 1	-	90	-	71
Z01_FH_Food Hall-Market Link 2	-	90	-	111
Z01_ST 13	90	-	-	32
Z01_M_WC	-	90	-	137
Z01_M_WC	-	90	-	123
Z01_M_DWC	-	90	-	52
Z01_M_ WC Lobby	-	90	-	42
Z01_Z01_Service Core	-	90	-	74
Z01_ST11	90	-	-	28
Z01_Stair03	-	90	-	40
Z01_Service Core Store	90	-	-	19
Z00_Service Core	-	90	-	199
Z00_Service Core	-	90	-	42
Z00_Service Core	-	90	-	318
Z01_Stair05	-	90	-	39
Z02_ANC_Office Stair Core	-	90	-	42
Z02_ANC_Plant	90	-	-	65
Z02_ANC_Stair06	-	90	-	45
Z02_ANC_Lobby	-	90	-	93
Z02_ANC_WC	-	90	-	96
Z02_ANC_WC	-	90	-	96
Z02_ANC_Plant	90	-	-	306

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Z02_ANC_Plant Store	90	-	-	14
Z02_ANC_Plant Store	90	-	-	14
Z02_ANC_Plant Corridor	-	90	-	57
Z02_ANC_Corridor	-	90	-	69
Z02_ANC_Store	90	-	-	10
Z02_ANC_Store	90	-	-	6
Z02_Stair03	-	90	-	43
Z02_Lift Lobby	-	90	-	54
Z00_M_Entrance	-	90	-	723
Z00_ANC__Corridor	-	90	-	89
Z00_ANC__Corridor	-	90	-	85
Z00_ANC__Corridor	-	90	-	15
Z01_Stair06	-	90	-	68
Z01_FH_Male WC	-	90	-	169
Z01_FH_Female WC	-	90	-	157
Z01_FH_Cafe 10 BOH	-	90	-	284
Z01_FH_Cafe 10 FOH	-	90	-	216
Z00_ Service Corridor	-	90	-	163
Z00_MF	-	90	65	231
Z00_MF	-	90	65	249
Z00_FH_Entrance & Z00_Stair01	-	90	-	181
Z00_Service Core	-	90	-	30
Z01_Stair02	-	90	-	39
Z01_Stair02	-	90	-	31
Z01_FH_Cafe 1	-	90	-	225
Z01_ST 10	90	-	-	19
Z01_M_Lift 05&06 Lobby	-	90	-	92
Z01_FH_Food Hall DL2	-	90	65	1212
Z01_FH_Food Hall DL1	-	90	65	541
Z01_M_Circ DL1	-	90	-	412
Z01_M_Circ	-	90	-	1109
Z01_M_Circ DL2	-	90	-	541
Z01_FH_Food Hall 2	-	90	65	319
Z01_FH_Food Hall 1	-	90	65	318
Z00_M_Circ DL	-	90	-	153
Z01_Service Core Corridor	-	90	-	307
Z00_MS	-	90	65	12535
Z00_MS	-	90	65	245
Z00_M_Circ	-	90	-	1767

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?
Z00_ANC__DIS WC & Shower	N/A	N/A
Z00_Office	N/A	N/A
Z00_Kiosk1	NO (-74.2%)	NO
Z00_M_Entrance	NO (-55.9%)	NO
Z00_Kiosk 4	NO (-66.6%)	NO
Z00_Kiosk 03	NO (-65.2%)	NO
Z00_Kiosk 02	NO (-70.7%)	NO
Z00_MF	NO (-92.4%)	NO
Z00_M_Atrium DL	NO (-5.7%)	NO
Z01_FH_Office	N/A	N/A
Z01_M_MS	NO (-85.6%)	NO
Z01_FH_ DWC	N/A	N/A
Z01_FH_Cafe 9 FOH	NO (-88.9%)	NO
Z01_FH_Cafe 8 FOH	NO (-90.5%)	NO
Z01_FH_Cafe 7 FOH	NO (-90.4%)	NO
Z01_FH_Cafe 6 FOH	NO (-83.4%)	NO
Z01_FH_Cafe Service	N/A	N/A
Z01_FH_Cafe 5 FOH	NO (-92.9%)	NO
Z01_FH_Cafe 4 FOH	NO (-85.6%)	NO
Z01_FH_Cafe 3 FOH	NO (-84.3%)	NO
Z01_FH_Cafe 2 FOH	NO (-84.5%)	NO
Z01_FH_Food Hall-Market Link 1	NO (-96.2%)	NO
Z01_FH_Food Hall-Market Link 2	NO (-92.2%)	NO
Z00_M_Entrance	YES (+35.3%)	NO
Z01_FH_Cafe 10 FOH	NO (-34.9%)	NO
Z00_MF	NO (-10.5%)	NO
Z00_MF	NO (-2.8%)	NO
Z00_FH_Entrance & Z00_Stair01	YES (+152.2%)	NO
Z01_FH_Cafe 1	N/A	N/A
Z01_FH_Food Hall DL2	NO (-56.6%)	NO
Z01_FH_Food Hall DL1	YES (+41.1%)	NO
Z01_M_Circ DL1	NO (-72.8%)	NO
Z01_M_Circ	NO (-92.3%)	NO
Z01_M_Circ DL2	YES (+8.3%)	NO
Z01_FH_Food Hall 2	NO (-90.2%)	NO
Z01_FH_Food Hall 1	NO (-91.8%)	NO
Z00_M_Circ DL	NO (-31.3%)	NO
Z00_MS	NO (-78.7%)	NO
Z00_MS	NO (-7.3%)	NO
Z00_M_Circ	NO (-92.8%)	NO

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	9739.6	9739.6
External area [m²]	37317.9	37317.9
Weather	LEE	LEE
Infiltration [m³/hm²@ 50Pa]	5	3
Average conductance [W/K]	18232	10070
Average U-value [W/m²K]	0.49	0.27
Alpha value* [%]	6.04	10

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

Building Use

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

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	2.29	2.07
Cooling	3.18	4.94
Auxiliary	16.87	9.18
Lighting	19.58	33.88
Hot water	21.27	13.99
Equipment*	39.32	39.32
TOTAL**	**59.63**	**64.06**

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

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	3.55	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	71.93	83.38
Primary energy* [kWh/m²]	148.69	170.73
Total emissions [kg/m²]	24.5	28.3

* 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	36	56.9	2.1	4.2	9.9	4.66	3.74	4.75	5
	Notional	19.3	89.5	2.1	6.6	4.4	2.56	3.79	----	----
[ST] Other local room heater - fanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	157.9	0	52.1	0	21.6	0.84	0	1	0
	Notional	117.5	0	37.8	0	25.9	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 BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.2	ST00000B:Surf[1]
Floor	0.2	0.15	MR000000:Surf[0]
Roof	0.15	0.15	MR000004:Surf[1]
Windows, roof windows, and rooflights	1.5	0.2	ST000000:Surf[6]
Personnel doors	1.5	2.2	FH000001:Surf[4]
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	1.4	MC000003:Surf[1]

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

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

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

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name **Shell and Core**

09-15-54301_LZC1__Be Green 2_Better Barnsley Market Food Hall & Landlord

As designed

Date: Thu Jan 05 11:02:15 2017

Administrative information

Building Details

Address: Better Barnsley Market Centre, Barnsley, -

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.6

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.6

BRUKL compliance check version: v5.2.g.3

Owner Details

Name: -

Telephone number: -

Address: -, -, -

Certifier details

Name: Ian Andrews

Telephone number: 01924 237513

Address: Stroma Technology, Unit 6, Silkwood Business Park, Fryer's Way, Wakefield, WF5 9TJ

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

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	28.3
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	28.3
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	18.5
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 the building services should achieve reasonable overall standards of energy efficiency

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

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.2	0.2	MS000061:Surf[38]
Floor	0.25	0.15	0.15	FF000000:Surf[0]
Roof	0.25	0.15	0.15	MR000004:Surf[1]
Windows***, roof windows, and rooflights	2.2	1.02	2.2	ST000000:Surf[0]
Personnel doors	2.2	2.2	2.2	FH000001:Surf[4]
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	1.4	1.4	MC000003:Surf[1]

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

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

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

Building services

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

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- BL_S3- elec panels zonal extract

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.67	0	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

2- BL_VRF AHU

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.75	3.5	0	0	0.7
Standard value	2.5*	3.2	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

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

1- BL_HW3_Market

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.96	0.005
Standard value	0.9*	N/A

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

2- BC_HW2_Food Hall

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.96	0.004
Standard value	0.9*	N/A

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

1- CHECK2-CHP

	CHPQA quality index	CHP electrical efficiency
This building	0	0.3
Standard value	Not provided	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
Z00_ANC__DIS	-	-	0.5	-	-	-	-	-	-	-	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
Z00_ANC__WC	-	-	0.5	-	-	-	-	-	-	-	N/A
Z00_ANC__WC	-	-	0.5	-	-	-	-	-	-	-	N/A
Z00_ANC_WC	-	-	0.5	-	-	-	-	-	-	-	N/A
Z00_ANC__WC	-	-	0.5	-	-	-	-	-	-	-	N/A
Z00_ANC__DIS WC & Shower	-	-	0.5	-	-	-	-	-	-	-	N/A
Z00_Office	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_Kiosk1	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_M_Entrance	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_Kiosk 4	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_Kiosk 03	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_Kiosk 02	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_MF	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_M_Atrium DL	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Office	-	1.6	0	-	-	-	-	-	0	-	N/A
Z01_M_MS	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_ DWC	-	1.6	0.5	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe 9 FOH	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe 8 FOH	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe 7 FOH	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe 6 FOH	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe Service	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe 5 FOH	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe 4 FOH	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe 3 FOH	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe 2 FOH	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Food Hall-Market Link 1	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Food Hall-Market Link 2	-	1.6	0	-	-	-	-	-	-	-	N/A
Z02_ANC_WC	-	-	0.5	-	-	-	-	-	-	-	N/A
Z02_ANC_WC	-	-	0.5	-	-	-	-	-	-	-	N/A
Z00_M_Entrance	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe 10 FOH	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_MF	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_MF	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_FH_Entrance & Z00_Stair01	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Cafe 1	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Food Hall DL2	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Food Hall DL1	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_M_Circ DL1	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_M_Circ	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_M_Circ DL2	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Food Hall 2	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_FH_Food Hall 1	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_M_Circ DL	-	1.6	0	-	-	-	-	-	-	-	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
Z00_MS	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_MS	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_M_Circ	-	1.6	0	-	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	Assumed shell?
Z00_Stair04	NO
Z00_ANC__DIS	NO
Z00_ANC__WC	NO
Z00_ANC__WC Lobby	NO
Z00_ANC__WC	NO
Z00_ANC_WC	NO
Z00_ANC__WC	NO
Z00_ANC__DIS WC & Shower	NO
Z00_Office	NO
Z00_Stair06	NO
Z00_M_Accs WC	NO
Z00_Cleaning	NO
Z00_M_FemaleWC	NO
Z00_M_MaleWC	NO
Z00_M_Plant 1	NO
Z00_Cleaning	NO
Z00_Cleaning	NO
Z00_Refuse	NO
Z01_M_Cleaning Store	NO
Z00_Kiosk1	NO
Z00_M_Plant 2	NO
Z00_Stair02	NO
Z00_Stair03	NO
Z00_Service Core	NO
Z00_M_Entrance	NO
Z00_Stair04	NO
Z00_Stair05	NO
Z00_M_Service Core	NO
Z00_Kiosk 4	NO
Z00_Kiosk 03	NO
Z00_Kiosk 02	NO
Z00_Service Core	NO
Z00_M_Service Core	NO
Z00_Service Core	NO
Z00_Service Core	NO
Z00_MF	NO
Z00_M_Atrium DL	NO
Z00_M_WC Lobby	NO
Z01_FH_Office	NO

Shell and core configuration

Zone	Assumed shell?
Z01_Stair01	NO
Z01_M_MS	NO
Z01_Stair04	NO
Z01_EC 02	NO
Z01_FH_ DWC	NO
Z01_FH_Cafe 9 FOH	NO
Z01_FH_Cafe 9 BOH	NO
Z01_FH_WC Corridor	NO
Z01_FH_Cafe 8 FOH	NO
Z01_FH_Cafe 8 BOH	NO
Z01_FH_Cafe 7 BOH	NO
Z01_FH_Cafe 7 FOH	NO
Z01_FH_Cafe 6 FOH	NO
Z01_FH_Cafe 6 BOH	NO
Z01_Lift08 Lobby	NO
Z01_FH_Service Core	NO
Z01_ME1	NO
Z01_FH_Cafe Service	NO
Z01_FH_Cafe 5 FOH	NO
Z01_FH_Cafe 5 BOH	NO
Z01_FH_Cafe 4 BOH	NO
Z01_FH_Cafe 4 FOH	NO
Z01_FH_Cafe 3 FOH	NO
Z01_FH_Cafe 3 BOH	NO
Z01_FH_Cafe 2 BOH	NO
Z01_FH_Cafe 2 FOH	NO
Z01_FH_Food Hall-Market Link 1	NO
Z01_FH_Food Hall-Market Link 2	NO
Z01_ST 13	NO
Z01_M_WC	NO
Z01_M_WC	NO
Z01_M_DWC	NO
Z01_M_ WC Lobby	NO
Z01_Z01_Service Core	NO
Z01_ST11	NO
Z01_Stair03	NO
Z01_Service Core Store	NO
Z00_Service Core	NO
Z00_Service Core	NO
Z00_Service Core	NO
Z01_Stair05	YES
Z02_ANC_Office Stair Core	NO
Z02_ANC_Plant	NO
Z02_ANC_Stair06	NO
Z02_ANC_Lobby	NO
Z02_ANC_WC	NO
Z02_ANC_WC	NO

Shell and core configuration

Zone	Assumed shell?
Z02_ANC_Plant	NO
Z02_ANC_Plant Store	NO
Z02_ANC_Plant Store	NO
Z02_ANC_Plant Corridor	NO
Z02_ANC_Corridor	NO
Z02_ANC_Store	NO
Z02_ANC_Store	NO
Z02_Stair03	NO
Z02_Lift Lobby	NO
Z00_M_Entrance	NO
Z00_ANC__Corridor	NO
Z00_ANC__Corridor	NO
Z00_ANC__Corridor	NO
Z01_Stair06	NO
Z01_FH_Male WC	NO
Z01_FH_Female WC	NO
Z01_FH_Cafe 10 BOH	NO
Z01_FH_Cafe 10 FOH	NO
Z00_ Service Corridor	NO
Z00_MF	NO
Z00_MF	NO
Z00_FH_Entrance & Z00_Stair01	NO
Z00_Service Core	NO
Z01_Stair02	NO
Z01_Stair02	NO
Z01_FH_Cafe 1	NO
Z01_ST 10	NO
Z01_M_Lift 05&06 Lobby	NO
Z01_FH_Food Hall DL2	NO
Z01_FH_Food Hall DL1	NO
Z01_M_Circ DL1	NO
Z01_M_Circ	NO
Z01_M_Circ DL2	NO
Z01_FH_Food Hall 2	NO
Z01_FH_Food Hall 1	NO
Z00_M_Circ DL	NO
Z01_Service Core Corridor	NO
Z00_MS	NO
Z00_MS	NO
Z00_M_Circ	NO

General lighting and display lighting

	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Z00_Stair04	-	90	-	61

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Z00_ANC__DIS	-	90	-	46
Z00_ANC__WC	-	90	-	50
Z00_ANC__WC Lobby	-	90	-	16
Z00_ANC__WC	-	90	-	18
Z00_ANC_WC	-	90	-	95
Z00_ANC__WC	-	90	-	112
Z00_ANC__DIS WC & Shower	90	-	-	183
Z00_Office	90	-	-	215
Z00_Stair06	-	90	-	53
Z00_M_Accs WC	-	90	-	52
Z00_Cleaning	90	-	-	11
Z00_M_FemaleWC	-	90	-	87
Z00_M_MaleWC	-	90	-	114
Z00_M_Plant 1	90	-	-	115
Z00_Cleaning	90	-	-	12
Z00_Cleaning	90	-	-	11
Z00_Refuse	90	-	-	13
Z01_M_Cleaning Store	90	-	-	29
Z00_Kiosk1	-	90	-	356
Z00_M_Plant 2	90	-	-	117
Z00_Stair02	-	90	-	50
Z00_Stair03	-	90	-	36
Z00_Service Core	-	90	-	135
Z00_M_Entrance	-	90	-	242
Z00_Stair04	-	90	-	60
Z00_Stair05	-	90	-	42
Z00_M_Service Core	-	90	-	105
Z00_Kiosk 4	-	90	-	368
Z00_Kiosk 03	-	90	-	291
Z00_Kiosk 02	-	90	-	286
Z00_Service Core	-	90	-	208
Z00_M_Service Core	-	90	-	134
Z00_Service Core	-	90	-	148
Z00_Service Core	-	90	-	124
Z00_MF	-	90	65	3624
Z00_M_Atrium DL	-	90	-	768
Z00_M_WC Lobby	-	90	-	44
Z01_FH_Office	90	-	-	190
Z01_Stair01	-	90	-	163
Z01_M_MS	-	90	65	8414
Z01_Stair04	-	90	-	50
Z01_EC 02	90	-	-	32
Z01_FH_ DWC	-	90	-	63

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Z01_FH_Cafe 9 FOH	-	90	-	177
Z01_FH_Cafe 9 BOH	-	90	-	272
Z01_FH_WC Corridor	-	90	-	100
Z01_FH_Cafe 8 FOH	-	90	-	179
Z01_FH_Cafe 8 BOH	-	90	-	323
Z01_FH_Cafe 7 BOH	-	90	-	342
Z01_FH_Cafe 7 FOH	-	90	-	190
Z01_FH_Cafe 6 FOH	-	90	-	206
Z01_FH_Cafe 6 BOH	-	90	-	253
Z01_Lift08 Lobby	-	90	-	55
Z01_FH_Service Core	-	90	-	110
Z01_ME1	90	-	-	21
Z01_FH_Cafe Service	-	90	-	288
Z01_FH_Cafe 5 FOH	-	90	-	189
Z01_FH_Cafe 5 BOH	-	90	-	307
Z01_FH_Cafe 4 BOH	-	90	-	306
Z01_FH_Cafe 4 FOH	-	90	-	193
Z01_FH_Cafe 3 FOH	-	90	-	185
Z01_FH_Cafe 3 BOH	-	90	-	309
Z01_FH_Cafe 2 BOH	-	90	-	308
Z01_FH_Cafe 2 FOH	-	90	-	183
Z01_FH_Food Hall-Market Link 1	-	90	-	71
Z01_FH_Food Hall-Market Link 2	-	90	-	111
Z01_ST 13	90	-	-	32
Z01_M_WC	-	90	-	137
Z01_M_WC	-	90	-	123
Z01_M_DWC	-	90	-	52
Z01_M_ WC Lobby	-	90	-	42
Z01_Z01_Service Core	-	90	-	74
Z01_ST11	90	-	-	28
Z01_Stair03	-	90	-	40
Z01_Service Core Store	90	-	-	19
Z00_Service Core	-	90	-	199
Z00_Service Core	-	90	-	42
Z00_Service Core	-	90	-	318
Z01_Stair05	-	90	-	39
Z02_ANC_Office Stair Core	-	90	-	42
Z02_ANC_Plant	90	-	-	65
Z02_ANC_Stair06	-	90	-	45
Z02_ANC_Lobby	-	90	-	93
Z02_ANC_WC	-	90	-	96
Z02_ANC_WC	-	90	-	96
Z02_ANC_Plant	90	-	-	306

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Z02_ANC_Plant Store	90	-	-	14
Z02_ANC_Plant Store	90	-	-	14
Z02_ANC_Plant Corridor	-	90	-	57
Z02_ANC_Corridor	-	90	-	69
Z02_ANC_Store	90	-	-	10
Z02_ANC_Store	90	-	-	6
Z02_Stair03	-	90	-	43
Z02_Lift Lobby	-	90	-	54
Z00_M_Entrance	-	90	-	723
Z00_ANC__Corridor	-	90	-	89
Z00_ANC__Corridor	-	90	-	85
Z00_ANC__Corridor	-	90	-	15
Z01_Stair06	-	90	-	68
Z01_FH_Male WC	-	90	-	169
Z01_FH_Female WC	-	90	-	157
Z01_FH_Cafe 10 BOH	-	90	-	284
Z01_FH_Cafe 10 FOH	-	90	-	216
Z00_ Service Corridor	-	90	-	163
Z00_MF	-	90	65	231
Z00_MF	-	90	65	249
Z00_FH_Entrance & Z00_Stair01	-	90	-	181
Z00_Service Core	-	90	-	30
Z01_Stair02	-	90	-	39
Z01_Stair02	-	90	-	31
Z01_FH_Cafe 1	-	90	-	225
Z01_ST 10	90	-	-	19
Z01_M_Lift 05&06 Lobby	-	90	-	92
Z01_FH_Food Hall DL2	-	90	65	1212
Z01_FH_Food Hall DL1	-	90	65	541
Z01_M_Circ DL1	-	90	-	412
Z01_M_Circ	-	90	-	1109
Z01_M_Circ DL2	-	90	-	541
Z01_FH_Food Hall 2	-	90	65	319
Z01_FH_Food Hall 1	-	90	65	318
Z00_M_Circ DL	-	90	-	153
Z01_Service Core Corridor	-	90	-	307
Z00_MS	-	90	65	12535
Z00_MS	-	90	65	245
Z00_M_Circ	-	90	-	1767

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?
Z00_ANC__DIS WC & Shower	N/A	N/A
Z00_Office	N/A	N/A
Z00_Kiosk1	NO (-74.2%)	NO
Z00_M_Entrance	NO (-55.9%)	NO
Z00_Kiosk 4	NO (-66.6%)	NO
Z00_Kiosk 03	NO (-65.2%)	NO
Z00_Kiosk 02	NO (-70.7%)	NO
Z00_MF	NO (-92.4%)	NO
Z00_M_Atrium DL	NO (-5.7%)	NO
Z01_FH_Office	N/A	N/A
Z01_M_MS	NO (-85.6%)	NO
Z01_FH_ DWC	N/A	N/A
Z01_FH_Cafe 9 FOH	NO (-88.9%)	NO
Z01_FH_Cafe 8 FOH	NO (-90.5%)	NO
Z01_FH_Cafe 7 FOH	NO (-90.4%)	NO
Z01_FH_Cafe 6 FOH	NO (-83.4%)	NO
Z01_FH_Cafe Service	N/A	N/A
Z01_FH_Cafe 5 FOH	NO (-92.9%)	NO
Z01_FH_Cafe 4 FOH	NO (-85.6%)	NO
Z01_FH_Cafe 3 FOH	NO (-84.3%)	NO
Z01_FH_Cafe 2 FOH	NO (-84.5%)	NO
Z01_FH_Food Hall-Market Link 1	NO (-96.2%)	NO
Z01_FH_Food Hall-Market Link 2	NO (-92.2%)	NO
Z00_M_Entrance	YES (+35.3%)	NO
Z01_FH_Cafe 10 FOH	NO (-34.9%)	NO
Z00_MF	NO (-10.5%)	NO
Z00_MF	NO (-2.8%)	NO
Z00_FH_Entrance & Z00_Stair01	YES (+152.2%)	NO
Z01_FH_Cafe 1	N/A	N/A
Z01_FH_Food Hall DL2	NO (-56.6%)	NO
Z01_FH_Food Hall DL1	YES (+41.1%)	NO
Z01_M_Circ DL1	NO (-72.8%)	NO
Z01_M_Circ	NO (-92.3%)	NO
Z01_M_Circ DL2	YES (+8.3%)	NO
Z01_FH_Food Hall 2	NO (-90.2%)	NO
Z01_FH_Food Hall 1	NO (-91.8%)	NO
Z00_M_Circ DL	NO (-31.3%)	NO
Z00_MS	NO (-78.7%)	NO
Z00_MS	NO (-7.3%)	NO
Z00_M_Circ	NO (-92.8%)	NO

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	9739.6	9739.6
External area [m^2]	37317.9	37317.9
Weather	LEE	LEE
Infiltration [m^3/hm^2@ 50Pa]	5	3
Average conductance [W/K]	18232	10070
Average U-value [W/m^2K]	0.49	0.27
Alpha value* [%]	6.04	10

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

Building Use

% Area	Building Type
76	**A1/A2 Retail/Financial and Professional services**
22	**A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways**
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: Crown and County Courts
1	**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	2.29	2.07
Cooling	3.18	4.94
Auxiliary	16.87	9.18
Lighting	19.58	33.88
Hot water	21.27	13.99
Equipment*	39.32	39.32
TOTAL**	**59.63**	**64.06**

* 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	11.65	0
Wind turbines	0	0
CHP generators	3.55	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	71.93	83.38
Primary energy* [kWh/m^2]	148.69	170.73
Total emissions [kg/m^2]	18.5	28.3

* 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	36	56.9	2.1	4.2	9.9	4.66	3.74	4.75	5
	Notional	19.3	89.5	2.1	6.6	4.4	2.56	3.79	----	----
[ST] Other local room heater - fanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
	Actual	157.9	0	52.1	0	21.6	0.84	0	1	0
	Notional	117.5	0	37.8	0	25.9	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 BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.2	ST00000B:Surf[1]
Floor	0.2	0.15	MR000000:Surf[0]
Roof	0.15	0.15	MR000004:Surf[1]
Windows, roof windows, and rooflights	1.5	0.2	ST000000:Surf[6]
Personnel doors	1.5	2.2	FH000001:Surf[4]
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	1.4	MC000003:Surf[1]

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

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

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

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name **Shell and Core**

09-15-54301_LZC1__Be Green_Better Barnsley Market Retail Leisure Office

As designed

Date: Wed Jan 04 16:45:19 2017

Administrative information

Building Details

Address: Better Barnsley Market Centre, Barnsley, -

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.6

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.6

BRUKL compliance check version: v5.2.g.3

Owner Details

Name: -

Telephone number: -

Address: -, -, -

Certifier details

Name: Ian Andrews

Telephone number: 01924 237513

Address: Stroma Technology, Unit 6, Silkwood Business Park, Fryer's Way, Wakefield, WF5 9TJ

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

The building does not comply with England Building Regulations Part L 2013

CO_2 emission rate from the notional building, $kgCO_2/m^2$.annum	31.1
Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	31.1
Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	32.6
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 the building services should achieve reasonable overall standards of energy efficiency

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

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.2	0.2	Z0000005:Surf[1]
Floor	0.25	0.15	0.2	R_000001:Surf[50]
Roof	0.25	0.15	0.15	SU000014:Surf[0]
Windows***, roof windows, and rooflights	2.2	1.15	1.6	SU000007:Surf[15]
Personnel doors	2.2	-	-	No Personnel doors in building
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

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

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

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

Building services

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

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

1- BG_S7_ VRF MVHR - RES/Retail

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	3.5	0	0	0.7
Standard value	2.5*	3.2	N/A	N/A	0.5
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- BG_S5 _ VRF MVHR - Office

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	3.5	0	0	0.7
Standard value	2.5*	3.2	N/A	N/A	0.5
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.

3- BG_S6 _ VRF MVHR - Leisure

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4	3.5	0	0	0.7
Standard value	2.5*	3.2	N/A	N/A	0.5
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- BL_HW1_Retail

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
Standard value	1	N/A

2- BL_HW4_Office

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.96	0.011
Standard value	0.9*	N/A

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

3- BL_HW5_Leisure

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.96	0.008
Standard value	0.9*	N/A

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

4- BL_HW6_R9

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.96	0.008
Standard value	0.9*	N/A

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

5- BL_HW3_Market

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.96	0.005
Standard value	0.9*	N/A
* Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73.		

1- CHECK2-CHP

	CHPQA quality index	CHP electrical efficiency
This building	0	0.3
Standard value	Not provided	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
Z00_SU13	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_SU12	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_SU11	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_SU10	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_SU9	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_SU8	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_SU13	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_SU12	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_SU11	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_SU10	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_SU8	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_SU 6	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_SU6	-	1.6	0	-	-	-	-	-	-	-	N/A
Z02_O__Meeting Room 1	-	1.6	0	-	-	-	-	-	-	-	N/A
Z02_O__Meeting Room 2	-	1.6	0	-	-	-	-	-	-	-	N/A
Z02_O__Meeting Room 3	-	1.6	0	-	-	-	-	-	-	-	N/A
Z02_O__Meeting 4	-	1.6	0	-	-	-	-	-	-	-	N/A
Z02_O__Change	-	1.6	0	-	-	-	-	-	-	-	N/A
Z02_O__Change Shower	-	1.6	0	-	-	-	-	-	-	-	N/A
Z02_O__Acc WC	-	1.6	0	-	-	-	-	-	-	-	N/A
Z02_O__WC	-	1.6	0	-	-	-	-	-	-	-	N/A
Z02_O__WC	-	1.6	0	-	-	-	-	-	-	-	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
Z02_O__Comms	-	1.6	0	-	-	-	-	-	-	-	N/A
Z02_O__Office 3	-	1.6	0	-	-	-	-	-	-	-	N/A
Z02_O__Brew	-	1.6	0	-	-	-	-	-	-	-	N/A
Z02_O__Staff Mess	-	1.6	0	-	-	-	-	-	-	-	N/A
Z02_O__Reception	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_SU9	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_SU5	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_L_Gym	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_SU4	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_SU3	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_SU1	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_SU2	-	1.6	0	-	-	-	-	-	-	-	N/A
Z00_R9	-	1.6	0	-	-	-	-	-	-	-	N/A
Z02_O__Control Room	-	1.6	0	-	-	-	-	-	-	-	N/A
Z02_O__Brew/Rest	-	1.6	0	-	-	-	-	-	-	-	N/A
Z02_O__Office 2	-	1.6	0	-	-	-	-	-	-	-	N/A
Z02_O__Corridor	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_L_Leisure_Gym	-	1.6	0	-	-	-	-	-	-	-	N/A
Z01_L_Leisure_Gym DL	-	1.6	0	-	-	-	-	-	-	-	N/A
Z02_O__Office 1	-	1.6	0	-	-	-	-	-	-	-	N/A
Z02_O__Office 1 DL	-	1.6	0	-	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	Assumed shell?
Z00_SU8 Stairs	YES
Z00_SU9 Stairs	YES
Z00_SU10 Stairs	YES
Z00_SU11 Stairs	YES
Z00_SU12 Stairs	YES
Z00_SU 6_Z00_Stairs	NO
Z00_SU13 Stairs	YES
Z00_SU13	YES
Z00_SU12	YES
Z00_SU11	YES
Z00_SU10	YES
Z00_SU9	YES
Z00_SU8	YES
Z01_SU8 Stairs	YES
Z01_SU10 Stairs	YES
Z01_SU11 Stairs	YES
Z01_SU12 Stairs	YES
Z01_SU13 Stairs	YES
Z01_SU13	YES
Z01_SU12	YES
Z01_SU11	YES

Shell and core configuration

Zone	Assumed shell?
Z01_SU10	YES
Z01_SU8	YES
Z00_SU 6	YES
Z01_SU6 Stairs	NO
Z01_SU6	YES
Z01_SU9 Stairs	YES
Z02_O_Stores	NO
Z02_O__Meeting Room 1	NO
Z02_O__Meeting Room 2	NO
Z02_O__Meeting Room 3	NO
Z02_O__Meeting 4	NO
Z02_O__Change	NO
Z02_O__Change Shower	NO
Z02_O__Acc WC	NO
Z02_O__WC	NO
Z02_O__WC	NO
Z02_O__Comms	NO
Z02_O__Office 3	NO
Z02_O__Brew	NO
Z02_O__Staff Mess	NO
Z02_O__Store	NO
Z02_O__Reception	NO
Z01_SU9	YES
Z00_SU5	YES
Z01_L_Gym	YES
Z00_SU4	YES
Z00_SU3	YES
Z00_SU1	YES
Z00_SU2	YES
Z00_R9	YES
Z02_O__Control Room	NO
Z02_O__Brew/Rest	NO
Z02_O__Office 2	NO
Z02_O__Corridor	NO
Z01_L_Stair04	NO
Z01_L_Leisure_Gym	YES
Z01_L_Leisure_Gym DL	YES
Z02_O__Office 1	NO
Z02_O__Office 1 DL	NO

General lighting and display lighting

	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Z00_SU8 Stairs	-	80	-	58
Z00_SU9 Stairs	-	80	-	58

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Z00_SU10 Stairs	-	80	-	58
Z00_SU11 Stairs	-	80	-	58
Z00_SU12 Stairs	-	80	-	58
Z00_SU 6_Z00_Stairs	-	80	-	76
Z00_SU13 Stairs	-	80	-	58
Z00_SU13	-	80	45	1853
Z00_SU12	-	80	45	1813
Z00_SU11	-	80	45	1813
Z00_SU10	-	80	45	1813
Z00_SU9	-	80	45	1813
Z00_SU8	-	80	45	1813
Z01_SU8 Stairs	-	80	-	33
Z01_SU10 Stairs	-	80	-	33
Z01_SU11 Stairs	-	80	-	33
Z01_SU12 Stairs	-	80	-	33
Z01_SU13 Stairs	-	80	-	33
Z01_SU13	-	80	45	1805
Z01_SU12	-	80	45	1775
Z01_SU11	-	80	45	1776
Z01_SU10	-	80	45	1776
Z01_SU8	-	80	45	1775
Z00_SU 6	-	80	45	9224
Z01_SU6 Stairs	-	80	-	57
Z01_SU6	-	80	45	11077
Z01_SU9 Stairs	-	80	-	33
Z02_O_Stores	90	-	-	37
Z02_O__Meeting Room 1	80	-	-	199
Z02_O__Meeting Room 2	80	-	-	202
Z02_O__Meeting Room 3	80	-	-	191
Z02_O__Meeting 4	80	-	-	250
Z02_O__Change	80	-	-	94
Z02_O__Change Shower	80	-	-	68
Z02_O__Acc WC	-	80	-	37
Z02_O__WC	-	80	-	32
Z02_O__WC	-	80	-	33
Z02_O__Comms	80	-	-	54
Z02_O__Office 3	80	-	-	93
Z02_O__Brew	80	-	-	98
Z02_O__Staff Mess	80	-	-	132
Z02_O__Store	80	-	-	19
Z02_O__Reception	-	80	80	88
Z01_SU9	-	80	45	1738
Z00_SU5	-	80	45	2674

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
Z01_L_Gym	-	80	-	183
Z00_SU4	-	80	45	3182
Z00_SU3	-	80	45	3984
Z00_SU1	-	80	45	4633
Z00_SU2	-	80	45	844
Z00_R9	-	80	45	723
Z02_O__Control Room	80	-	-	278
Z02_O__Brew/Rest	80	-	-	190
Z02_O__Office 2	80	-	-	289
Z02_O__Corridor	-	80	-	81
Z01_L_Stair04	-	90	-	203
Z01_L_Leisure_Gym	-	80	-	2644
Z01_L_Leisure_Gym DL	-	80	-	1276
Z02_O__Office 1	80	-	-	901
Z02_O__Office 1 DL	80	-	-	474

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?
Z00_SU13	NO (-58.8%)	NO
Z00_SU12	NO (-49.1%)	NO
Z00_SU11	NO (-47.3%)	NO
Z00_SU10	NO (-45.4%)	NO
Z00_SU9	NO (-45.3%)	NO
Z00_SU8	NO (-45%)	NO
Z01_SU13	NO (-79.2%)	NO
Z01_SU12	NO (-73.7%)	NO
Z01_SU11	NO (-72.8%)	NO
Z01_SU10	NO (-86.8%)	NO
Z01_SU8	NO (-71.9%)	NO
Z00_SU 6	YES (+16.4%)	NO
Z01_SU6	NO (-48.4%)	NO
Z02_O__Meeting Room 1	NO (-63%)	NO
Z02_O__Meeting Room 2	NO (-60%)	NO
Z02_O__Meeting Room 3	NO (-57.1%)	NO
Z02_O__Meeting 4	NO (-98.8%)	NO
Z02_O__Change	N/A	N/A
Z02_O__Change Shower	N/A	N/A
Z02_O__Acc WC	N/A	N/A
Z02_O__WC	N/A	N/A
Z02_O__WC	N/A	N/A
Z02_O__Comms	N/A	N/A
Z02_O__Office 3	NO (-91%)	NO
Z02_O__Brew	N/A	N/A

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Z02_O__Staff Mess	NO (-89.5%)	NO
Z02_O__Reception	NO (-98.8%)	NO
Z01_SU9	NO (-72.3%)	NO
Z00_SU5	YES (+16.7%)	NO
Z01_L_Gym	NO (-9.5%)	NO
Z00_SU4	YES (+16.6%)	NO
Z00_SU3	YES (+11.7%)	NO
Z00_SU1	YES (+72.4%)	NO
Z00_SU2	YES (+73.9%)	NO
Z00_R9	YES (+70.8%)	NO
Z02_O__Control Room	NO (-86.2%)	NO
Z02_O__Brew/Rest	NO (-70.7%)	NO
Z02_O__Office 2	NO (-75.7%)	NO
Z02_O__Corridor	NO (-40.1%)	NO
Z01_L_Leisure_Gym	NO (-93.9%)	NO
Z01_L_Leisure_Gym DL	NO (-54.7%)	NO
Z02_O__Office 1	NO (-95.3%)	NO
Z02_O__Office 1 DL	NO (-74%)	NO

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	7459.9	7459.9
External area [m²]	38256.2	38256.2
Weather	LEE	LEE
Infiltration [m³/hm²@ 50Pa]	5	3
Average conductance [W/K]	19578	12103.3
Average U-value [W/m²K]	0.51	0.32
Alpha value* [%]	9.83	10

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

Building Use

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

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	2.83	1.87
Cooling	4.15	5.36
Auxiliary	16.36	5.71
Lighting	34.78	45.86
Hot water	9.67	5.84
Equipment*	37.08	37.08
TOTAL**	**67.79**	**64.63**

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

Energy Production by Technology [kWh/m²]

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

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	85.69	90.24
Primary energy* [kWh/m²]	201	188.53
Total emissions [kg/m²]	32.6	31.1

* 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	24.3	56	1.8	4.9	6.6	3.73	3.2	4	4.5
	Notional	41.2	87.6	4.5	6.4	3.5	2.56	3.79	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	46.3	59.2	3.5	5.1	8.1	3.73	3.2	4	4.5
	Notional	17.5	89	1.9	6.5	3.2	2.56	3.79	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	20.6	13.7	1.5	1.2	49.7	3.73	3.2	4	4.5
	Notional	11.5	26	1.3	1.9	16.5	2.56	3.79	----	----
[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 BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.2	SR00000B:Surf[1]
Floor	0.2	0.15	SU000000:Surf[0]
Roof	0.15	0.15	SU000014:Surf[0]
Windows, roof windows, and rooflights	1.5	0.2	SU000007:Surf[9]
Personnel doors	1.5	-	No Personnel doors in building
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

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

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

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

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

09-15-54301_s1_Better Barnsley Library

As designed

Date: Wed Sep 28 09:52:08 2016

Administrative information

Building Details

Address: Library, Barnsley, -

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.6

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.6

BRUKL compliance check version: v5.2.g.3

Owner Details

Name: -

Telephone number: -

Address: -, -, -

Certifier details

Name: Ian Andrews

Telephone number: 01924 237513

Address: Unit 6 Silkwood Business Park, Fryer's Way, Wakefield, WF5 9TJ

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

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	25.7
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	25.7
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	24.4
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 the building services should achieve reasonable overall standards of energy efficiency

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

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.15	0.15	Z0000001:Surf[1]
Floor	0.25	0.09	0.09	Z0000001:Surf[0]
Roof	0.25	0.18	0.18	Z000008F:Surf[0]
Windows***, roof windows, and rooflights	2.2	1.6	1.6	Z0000019:Surf[1]
Personnel doors	2.2	-	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	1.6	1.6	Z0000094:Surf[32]

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

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

Air Permeability	Worst acceptable standard	This building
$m^3/(h.m^2)$ at 50 Pa	10	4

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	<0.9

1- L1_Rads_S&E

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.95	-	0.29	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					YES

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

2- L2_Rads_Extract

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.95	-	0.3	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					YES

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

3- L4_trench heating_AHU1

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.95	-	0.1	0	0.65
Standard value	0.91*	N/A	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

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

4- L3_Rads_Nat Vent

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.95	-	0.3	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					YES

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

5- L5_Rads_AHU1

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.95	-	-	0	0.65
Standard value	0.91*	N/A	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

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

6- L6_Comms Cooling

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.5	3.5	-	0	-
Standard value	2.5*	3.2	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

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

1- L7_Electric instant Hot Water

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
Standard value	1	N/A

2- L8_Electric instant Hot Water w/storarge

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	0.041
Standard value	1	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
L_R.00.05_WC Lobby	-	1.1	-	-	-	-	-	-	-	-	N/A
L_R.00.06_Sanctuary	-	-	0.5	-	-	-	-	-	-	-	N/A
L_R.00.07_DIS WC & Baby Change	-	-	0.5	-	-	-	-	-	-	-	N/A
L_R.00.08_Cleaner Store	-	-	0.5	-	-	-	-	-	-	-	N/A
L_R.00.01_Library Pod 1	-	-	-	1.6	-	-	-	-	-	-	N/A
L_R.00.01_Library Pod 2	-	-	-	1.6	-	-	-	-	-	-	N/A
L_R.00.01_Library Pod 3	-	-	-	1.6	-	-	-	-	-	-	N/A
L_R.00.01_Library Pod 4	-	-	-	1.6	-	-	-	-	-	-	N/A
L_R.00.02_Meeting Room	-	-	-	1.6	-	-	-	-	-	-	N/A
L_R.02.08_WC & Baby Change	-	-	0.5	-	-	-	-	-	-	-	N/A
L_R.01.08_Staff WC	-	-	0.5	-	-	-	-	-	-	-	N/A
L_R.01.03_Meeting Room	-	-	-	1.6	-	-	-	-	-	-	N/A
L_R.03.06_Lobby	-	1.1	-	-	-	-	-	-	-	-	N/A
L_R.01.01_Library	-	-	-	1.6	-	-	-	-	-	-	N/A
L_R.02.08_DIS WC & Baby Change	-	-	0.5	-	-	-	-	-	-	-	N/A
L_R.02.09_Cln' Store	-	-	0.5	-	-	-	-	-	-	-	N/A
L_R.02.03_Meeting Room	-	-	-	1.6	-	-	-	-	-	-	N/A
L_R.02.06_WC Lobby	-	1.1	-	-	-	-	-	-	-	-	N/A
L_R.02.01_Library	-	-	-	1.6	-	-	-	-	-	-	N/A
L_R.02.02_IT Room	-	-	-	1.6	-	-	-	-	-	-	N/A
L_R.02.07_IT Store	-	-	0.5	-	-	-	-	-	-	-	N/A
L_R.03.12_DSIC WC & Baby Change	-	-	0.5	-	-	-	-	-	-	-	N/A
L_R.03.12_WC 1	-	-	0.5	-	-	-	-	-	-	-	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
L_R.03.05_Kitchen	-	-	-	1.6	-	-	-	-	-	-	N/A
L_R.03.06_WC Lobby	-	1.1	-	-	-	-	-	-	-	-	N/A
L_R.03.10_Cln Store	-	-	0.5	-	-	-	-	-	-	-	N/A
L_R.01.02_Childrens Library	-	-	-	1.6	-	-	-	-	-	-	N/A
L_R.03.01_Event Space	-	-	-	1.6	-	-	-	-	-	-	N/A
L_R.03.02_Lobby	-	-	-	1.6	-	-	-	-	-	-	N/A
L_R.00.01_Library	-	-	-	1.6	-	-	-	-	-	-	N/A
L_R.00.13_WC	-	-	0.5	-	-	-	-	-	-	-	N/A
L_R.00.12_WC	-	-	0.5	-	-	-	-	-	-	-	N/A
L_R.00.14_WC	-	-	0.5	-	-	-	-	-	-	-	N/A
L_R.02.11_WC 1	-	-	0.5	-	-	-	-	-	-	-	N/A
L_R.02.12_WC 2	-	-	0.5	-	-	-	-	-	-	-	N/A
L_R.01.13_WC 1	-	-	0.5	-	-	-	-	-	-	-	N/A
L_R.01.12_WC 1	-	-	0.5	-	-	-	-	-	-	-	N/A
L_R.03.16_WC 2	-	-	0.5	-	-	-	-	-	-	-	N/A
L_R.03.06_Lobby	-	1.1	-	-	-	-	-	-	-	-	N/A
L_R.01.09_Staff Kitchen	-	1.1	-	-	-	-	-	-	-	-	N/A
L_R.01.09_Staff Office	-	1.1	-	-	-	-	-	-	-	-	N/A
L_R.00.09_Changing Places WC	-	0.3	-	-	-	-	-	-	-	-	N/A
L_R.00.09_Changing Places WC Shower	-	0.3	-	-	-	-	-	-	-	-	N/A

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
L_R.00.15_Switch Room	51	-	-	118
L_R.00.05_WC Lobby	-	65	-	110
L_R.00.06_Sanctuary	86	-	-	73
L_R.00.07_DIS WC & Baby Change	-	82	-	34
L_R.00.08_Cleaner Store	88	-	-	16
L_R.00.01_Library Pod 1	117	-	-	40
L_R.00.01_Library Pod 2	121	-	-	38
L_R.00.01_Library Pod 3	121	-	-	38
L_R.00.01_Library Pod 4	119	-	-	38
L_R.00.04_Library Store	77	-	-	257
L_R.00.02_Meeting Room	62	-	-	134
L_R.02.08_WC & Baby Change	-	82	-	34
L_R.01.08_Staff WC	-	72	-	34
L_R.01.03_Meeting Room	70	-	-	134
L_R.03.06_Lobby	-	65	-	108
L_R.01.01_Library	-	53	139	1892
L_R.02.08_DIS WC & Baby Change	-	82	-	34
L_R.02.09_Cln' Store	-	75	22	34
L_R.02.03_Meeting Room	62	-	-	134

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
L_R.02.06_WC Lobby	-	64	-	58
L_R.02.01_Library	-	107	139	2662
L_R.02.02_IT Room	87	-	-	437
L_R.02.07_IT Store	62	-	-	30
L_R.03.12_DSIC WC & Baby Change	-	73	-	34
L_R.03.12_WC 1	-	64	-	34
L_R.03.05_Kitchen	-	233	-	59
L_R.03.06_WC Lobby	-	61	-	58
L_R.03.08_Plant	91	-	-	171
L_R.03.10_Cln Store	53	-	-	38
L_R.01.14_Comm's	58	-	-	101
L_R.02.13_Map Store	84	-	-	22
L_R.03.15_Chair Store	61	-	-	87
L_R.00.10_General Store	88	-	-	112
L_R.01.02_Childrens Library	-	92	139	564
L_R.03.01_Event Space	-	112	-	875
L_R.03.02_Lobby	-	91	-	50
L_R.01.06_Buggy Store	73	-	-	77
L_R.00.01_Library	-	52	139	2249
L_R.00.13_WC	-	81	-	28
L_R.00.11_Escape Stair	-	138	-	45
L_R.00.12_WC	-	81	-	28
L_R.00.14_WC	-	81	-	29
L_R.02.10_Escape Stair	-	138	-	58
L_R.02.11_WC 1	-	81	-	28
L_R.02.12_WC 2	-	81	-	29
L_R.01.05_Store 1	81	-	-	30
L_R.01.13_WC 1	-	81	-	29
L_R.01.11_Escape Stair	-	138	-	51
L_R.01.12_WC 1	-	81	-	28
L_R.02.05_Store	93	-	-	24
L_R.03.04_Store	53	-	-	32
L_R.03.09_Store	58	-	-	77
L_R.03.07_Plant Access	-	50	-	40
L_R.03.16_WC 2	-	71	-	29
L_R.03.06_Lobby	-	73	-	14
L_R.03.13_Esc Stair	-	138	-	50
L_R.00.03_Main Stair Lobby	-	56	-	55
L_R.01.04_Main Stair Lobby	-	58	-	52
L_R.01.04_Main Stair	-	139	-	62
L_R.03.03_Main Stair Lobby	-	49	-	60
L_R.03.03_Main Stair	-	139	-	55
L_R.02_Main Stair Lobby	-	57	-	54

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
L_R.02_Main Stair	-	139	-	70
L_R.00.03_Main Stair Store	72	-	-	38
L_R.00.03_Main Stair	-	139	-	56
L_R.01.09_Staff Kitchen	118	-	-	140
L_R.01.09_Staff Office	95	-	-	249
L_R.00.09_Changing Places WC	-	183	-	54
L_R.00.09_Changing Places WC Shower	-	416	-	3

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?
L_R.00.06_Sanctuary	NO (-99.7%)	NO
L_R.00.01_Library Pod 1	NO (-45%)	NO
L_R.00.01_Library Pod 2	NO (-44.3%)	NO
L_R.00.01_Library Pod 3	NO (-44.3%)	NO
L_R.00.01_Library Pod 4	NO (-45%)	NO
L_R.00.02_Meeting Room	NO (-87.7%)	NO
L_R.01.03_Meeting Room	NO (-79.4%)	NO
L_R.01.01_Library	NO (-18.9%)	NO
L_R.02.09_Cln' Store	NO (-66.4%)	NO
L_R.02.03_Meeting Room	NO (-83.3%)	NO
L_R.02.01_Library	NO (-11.2%)	NO
L_R.02.02_IT Room	NO (-54.7%)	NO
L_R.01.14_Comm's	N/A	N/A
L_R.01.02_Childrens Library	NO (-85.1%)	NO
L_R.03.01_Event Space	NO (-73.6%)	NO
L_R.00.01_Library	NO (-31%)	NO
L_R.01.09_Staff Kitchen	NO (-57.6%)	NO
L_R.01.09_Staff Office	NO (-51%)	NO

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	2171.5	2171.5
External area [m²]	2584.4	2584.4
Weather	LEE	LEE
Infiltration [m³/hm²@ 50Pa]	4	3
Average conductance [W/K]	1370.73	1087.79
Average U-value [W/m²K]	0.53	0.42
Alpha value* [%]	11.49	10

* 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
1	**B1 Offices and Workshop businesses**
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
97	**D1 Non-residential Inst.: Libraries, Museums, and Galleries**
2	**D1 Non-residential Inst.: Education**
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others - Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	35.41	16.13
Cooling	0	0
Auxiliary	12.59	7.09
Lighting	16.26	34.49
Hot water	3.49	3.61
Equipment*	21.75	21.75
TOTAL**	**67.75**	**61.32**

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

Energy Production by Technology [kWh/m²]

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

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	114.14	50.06
Primary energy* [kWh/m²]	142.48	148.1
Total emissions [kg/m²]	24.4	25.7

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

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	173.5	0	53.8	0	12.4	0.9	0	0.95	0
	Notional	46.7	0	15.1	0	9.7	0.86	0	----	----
[ST] Central heating using water: convectors, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	106.7	0	33.1	0	13.3	0.9	0	0.95	0
	Notional	27.5	0	8.9	0	5.4	0.86	0	----	----
[ST] Single room cooling system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	0	0	0	0	0	3.43	2.99	3.5	4
	Notional	0	0	0	0	0	2.56	3.79	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	177.4	0	55	0	7.5	0.9	0	0.95	0
	Notional	169	0	54.4	0	7.7	0.86	0	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	94.9	0	29.4	0	22.5	0.9	0	0.95	0
	Notional	104.2	0	33.6	0	25.6	0.86	0	----	----
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity										
	Actual	0	0	0	0	48.1	0.9	0	0.95	0
	Notional	0.2	0	0.1	0	33.7	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 BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.14	Z0000054:Surf[21]
Floor	0.2	0.09	Z0000094:Surf[7]
Roof	0.15	0.18	Z000003F:Surf[25]
Windows, roof windows, and rooflights	1.5	1.5	Z000008D:Surf[0]
Personnel doors	1.5	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	1.6	Z0000094:Surf[32]

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

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

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	4

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name **Shell and Core**

09-15-54301_s2_Better Barnsley Cafe

As designed

Date: Thu Dec 22 13:25:45 2016

Administrative information

Building Details

Address: Cafe, Barnsley, -

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.6

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.6

BRUKL compliance check version: v5.2.g.3

Owner Details

Name: -

Telephone number: -

Address: -, -, -

Certifier details

Name: Ian Andrews

Telephone number: 01924 237513

Address: Unit 6 Silkwood Business Park, Fryer's Way, Wakefield, WF5 9TJ

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

CO_2 emission rate from the notional building, $kgCO_2/m^2.annum$	61.3
Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	61.3
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	60.3
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 the building services should achieve reasonable overall standards of energy efficiency

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

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.15	0.15	Z000005A:Surf[2]
Floor	0.25	0.09	0.09	Z000001E:Surf[0]
Roof	0.25	0.18	0.18	Z000005A:Surf[0]
Windows***, roof windows, and rooflights	2.2	1.6	1.6	Z0000015:Surf[1]
Personnel doors	2.2	-	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	1.6	1.6	Z0000015:Surf[3]

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

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

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

Building services

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

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

1- C1_ASHP MVHR

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.5	3.5	0	0	0.7
Standard value	2.5*	3.2	N/A	N/A	0.65
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- C2_Hot Water

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	0.95	0.005
Standard value	0.9*	N/A

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

Local mechanical ventilation, exhaust, and terminal units

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

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
C_R.00.18_Cafe (Shell&Core)	-	1.6	0	-	-	-	-	-	-	-	N/A
C_R.00.21_Kitchen	-	1.6	0	-	-	-	-	-	-	-	N/A
C_R.00.30_Lobby	-	1.6	0	-	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	Assumed shell?
C_R.00.36_Escape Stair	NO
C_R.00.19_Escape Stair	NO
C_R.00.18_Cafe (Shell&Core)	NO
C_R.00.21_Kitchen	NO
C_R.00.30_Lobby	NO
C_R.01.16_Cafe	NO

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			
	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
C_R.00.36_Escape Stair	-	75	-	68

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
C_R.00.19_Escape Stair	-	75	-	170
C_R.00.18_Cafe (Shell&Core)	-	75	40	674
C_R.00.21_Kitchen	-	75	-	322
C_R.00.30_Lobby	-	75	-	26
C_R.01.16_Cafe	-	75	40	952

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?
C_R.00.18_Cafe (Shell&Core)	NO (-14.9%)	NO
C_R.00.21_Kitchen	N/A	N/A
C_R.00.30_Lobby	NO (-83%)	NO
C_R.01.16_Cafe	NO (-12.6%)	NO

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	655.8	655.8
External area [m^2]	929.1	929.1
Weather	LEE	LEE
Infiltration [m^3/hm^2@ 50Pa]	5	3
Average conductance [W/K]	467.16	329.35
Average U-value [W/m^2K]	0.5	0.35
Alpha value* [%]	10.08	10

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

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	16.84	11.78
Cooling	6.18	9.35
Auxiliary	8.7	2.88
Lighting	38.06	50.37
Hot water	117.25	109.39
Equipment*	107.41	107.41
TOTAL**	**187.04**	**183.76**

* 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]	268.81	235.97
Primary energy* [kWh/m^2]	401.63	391.31
Total emissions [kg/m^2]	60.3	61.3

* 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	224.7	80.7	19.1	7	9.9	3.26	3.2	3.5	4.5
	Notional	123.2	144.9	13.4	10.6	3.3	2.56	3.79	----	----
[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 BCO can give particular attention to items with specifications that are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.15	Z000005A:Surf[2]
Floor	0.2	0.09	Z000001E:Surf[0]
Roof	0.15	0.18	Z000005A:Surf[0]
Windows, roof windows, and rooflights	1.5	1.6	Z0000015:Surf[1]
Personnel doors	1.5	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	1.6	Z0000015:Surf[3]

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

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

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