Energy Statement

BERRITE INDUSTRIAL ESTATE, WEST DRAYTON, HILLINGDON

AUGUST 2025

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Contents

1. EXECUTIVE SUMMARY

1..1 This report outlines the energy strategy for the proposed development at Berrite Industrial Estate, West Drayton in line with the requirements set out by the London Plan, the London Borough of Hillingdon Local Plan (2012) for the proposed new build construction of 3 no. workshop units.

1..2 The Hillingdon Local Plan requires non-residential developments to achieve carbon emission reductions in line with the London Plan's energy hierarchy and promotes zero carbon developments.

CO2 emissions reductions via the Energy Hierarchy

1..3 The methodology used to determine the expected operational CO2 emissions for the development is in accordance with the London Plan's Energy Hierarchy and the CO2 savings achieved for each step are outlined below.

- **Be Lean** - The first step addresses reduction in energy demand, through the adoption of passive and active design measures. The proposed energy efficiency measures include levels of insulation beyond Building Regulation requirements, low air tightness levels, efficient lighting as well as energy saving controls for space conditioning and lighting. A site-wide regulated CO2 emissions reduction of 17% has been noted at this stage of the energy assessment, complying with the requirements of the London Plan 2021.

- **Be Clean** - No existing or proposed community heating networks were noted in close proximity to the proposed scheme. Due to the relatively limited heating demand of the proposed scheme no assessments have been undertaken to demonstrate how it may be capable of connecting to a district heat network at a future date. In addition, a CHP unit was not considered feasible due to small scale of the development and the large plant space that would be required. Therefore, no CO2 emissions savings have been noted within the 'Be Clean' stage of the energy hierarchy.

- **Be Green** - The renewable technologies feasibility study carried out for the development identified PV and air source heat pumps as suitable technologies for the site. Air source heat pumps were deemed feasible to be used as a low carbon heating source while energy can also be generated via the proposed roof mounted PV system. A 32m^2 PV system, equivalent to approximately 16 panels or 5kWp is proposed to each unit.

- **Be Seen** – Instructions for reporting of predicted energy performance has been provided and a completed spreadsheet listing the key reportable parameters provided.

1..4 The regulated CO2 emissions reduction via the first three elements of the energy hierarchy is presented within Table 1 and Table 2.

Table 1: Site-wide - CO2 emissions compared to Part L (2021) baseline

Site-wide – Carbon dioxide emissions (Tonnes CO2/year)	
	Regulated CO2 emissions (TonnesCO2/year)
Part L Baseline	3.80
Be lean: following energy demand reduction	3.20
Be Clean: following heat network appraisal	3.20
Be green: following renewable energy appraisal	0.6

Table 2: Site-wide - Regulated CO2 emissions savings

Site-wide – Regulated carbon dioxide savings		
	Savings (TonnesCO2/year)	**Savings (%)**
Be lean: savings from energy demand reduction	0.6	17%
Be clean: savings from heat network	0	0%
Be green: Savings from renewable energy	2.6	68%
Total Savings	**3.2**	**85%**

1..5 The proposed scheme is shown to achieve a site-wide regulated CO2 emissions reduction of 85%, through the use of energy efficient building fabric, efficient systems, and renewable technology. Therefore, it is set to hit the regulated CO2 emissions reduction target of at least 35% set for all new non-residential developments using the energy hierarchy of the London Plan through on-site measures.

1..6 Remaining emissions are proposed to be offset via a financial contribution to the Carbon Offset Fund. Based upon the residual emissions a financial contribution of approximately £1,685 would be required.

2. INTRODUCTION

2..1 GreenBuild Consult has been commissioned to prepare an Energy Statement for the proposed development at Units 5-9 Berrite Industrial Estate, West Drayton, within the London Borough of Hillingdon.

2..2 This report presents the energy appraisal of the proposed development and outlines the features that have been incorporated into the design proposal to decrease energy use and carbon dioxide emissions in line with the requirements of the London Plan and Hillingdon Borough's local policies.

2..3 In line with the above, a reduction in regulated CO2 emissions against a Building Regulations Part L1 (2021) notional figure will be required, to ensure a policy compliant scheme. The methodology used to determine the anticipated regulated CO2 emissions is in accordance with the London Plan's three-step Energy Hierarchy (Policy SI 2);

- **Be Lean**; use less energy – Reduce the energy demand of a scheme via the adoption of an energy efficient building fabric and services strategy.
- **Be Clean**; supply energy efficiently – Delivery energy efficiently to a development by connecting to existing District Heat Networks or site energy centre consisting of CHP or CCHP units.
- **Be Green**; use renewable energy – Utilise appropriate renewable or low carbon technologies to offset grid-based energy use within the proposed development.

Site Proposal

2..4 The proposed scheme is to be located at Iron Bridge Road South, between the Grand Union Canal and Great Western Main Line.

2..5 The proposal comprises of three new workshop units containing the main workshop and ancillary office and WC spaces and are designed to replace the existing industrial units with a modern alternative.

Figure 1: Proposed Site Location Plan (Courtesy of afa architects and planners)

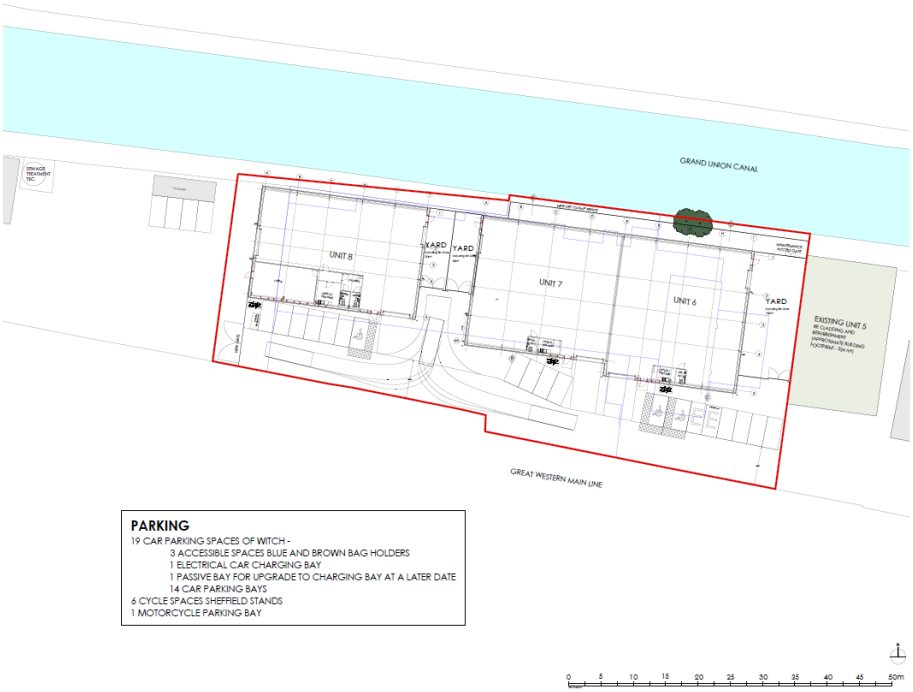
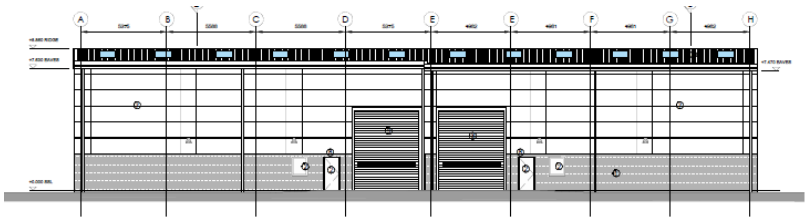
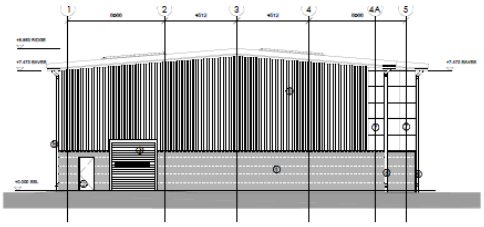


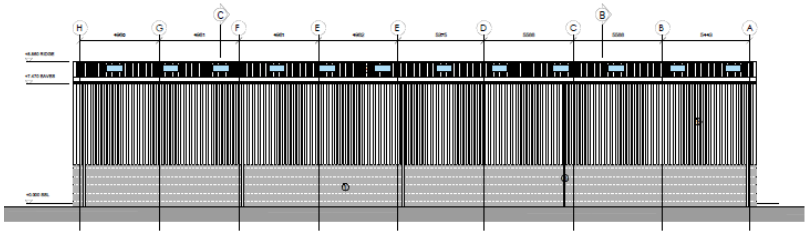
Figure 2: Proposed Elevations of Units 6 & 7 (Courtesy of afa architects and planners)



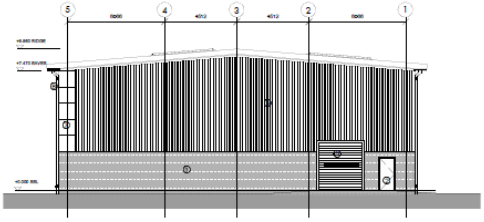
PROPOSED SOUTH ELEVATION



PROPOSED WEST ELEVATION



PROPOSED NORTH ELEVATION



PROPOSED EAST ELEVATION

3. POLICY & LEGISLATIVE CONTEXT

3..1 There are several national policy drivers for energy efficiency and reduced carbon dioxide (CO2) emissions, which have been introduced to address the issue of global warming and the implications of climate change including the Energy White Paper, National Planning Policy Framework (NPPF) and Building Regulations Approved Document Part L (2013 edition). On a regional level, the London Plan provides the policy drivers for major developments within Greater London and at the local level the relevant policies are within Hillingdon Local Plan Part 1 & 2 documents. For the purpose of completeness and comprehension policies have been quoted in full.

National Policy Drivers

National Planning Policy Framework

3..2 The National Planning Policy Framework (NPPF) was adopted in March 2012, setting out a key part of the Government's reforms to make the planning system less complex and more accessible, whilst protecting the environment and promoting sustainable growth. The NPPF supersedes the previous national planning guidance, namely the Planning Policy Statements and Planning Policy Guidance Notes.

3..3 At the heart of the NPPF is a 'presumption in favour of sustainable development', which requires Local Authorities as part of any plan-making or decision-making to provide clear guidance on how the presumption should be applied locally. In addition, the NPPF sets out twelve core land-use planning principles that the Government has identified that underpin both plan-making and decision-making. Of these, the following has been identified as being relevant to energy:

> *'Support the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change, and encourage the reuse of existing resources, including conversion of existing buildings, and encourage the use of renewable resources (for example, by the development of renewable energy).'*

Regional Policy Drivers

The London Plan 2021

3..4 The London Plan (2021) is the overall strategic plan for London, setting out an integrated economic, environmental, transport and social framework for the development of London over the next 20–25 years. The latest version of the London Plan replaces previous ones and was published for use on 2nd March 2021.

3..5 Section 9 'Sustainable Infrastructure' of the London Plan covers the mitigation of and adaptation to climate change and the management of natural resources. The key policies regarding climate change mitigation and adaptation which are applicable to the proposed scheme are presented as follows.

Policy SI 2 Minimising Greenhouse Gas Emissions

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

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

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

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

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

Policy SI 3 Energy infrastructure

This policy should not be applicable to minor developments, it has also been confirmed there are no CHP, communal or district networks available to connect to in the area.

Policy SI 4 Managing heat risk

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

Local Policy Drivers

Hillingdon Local Plan: 2012

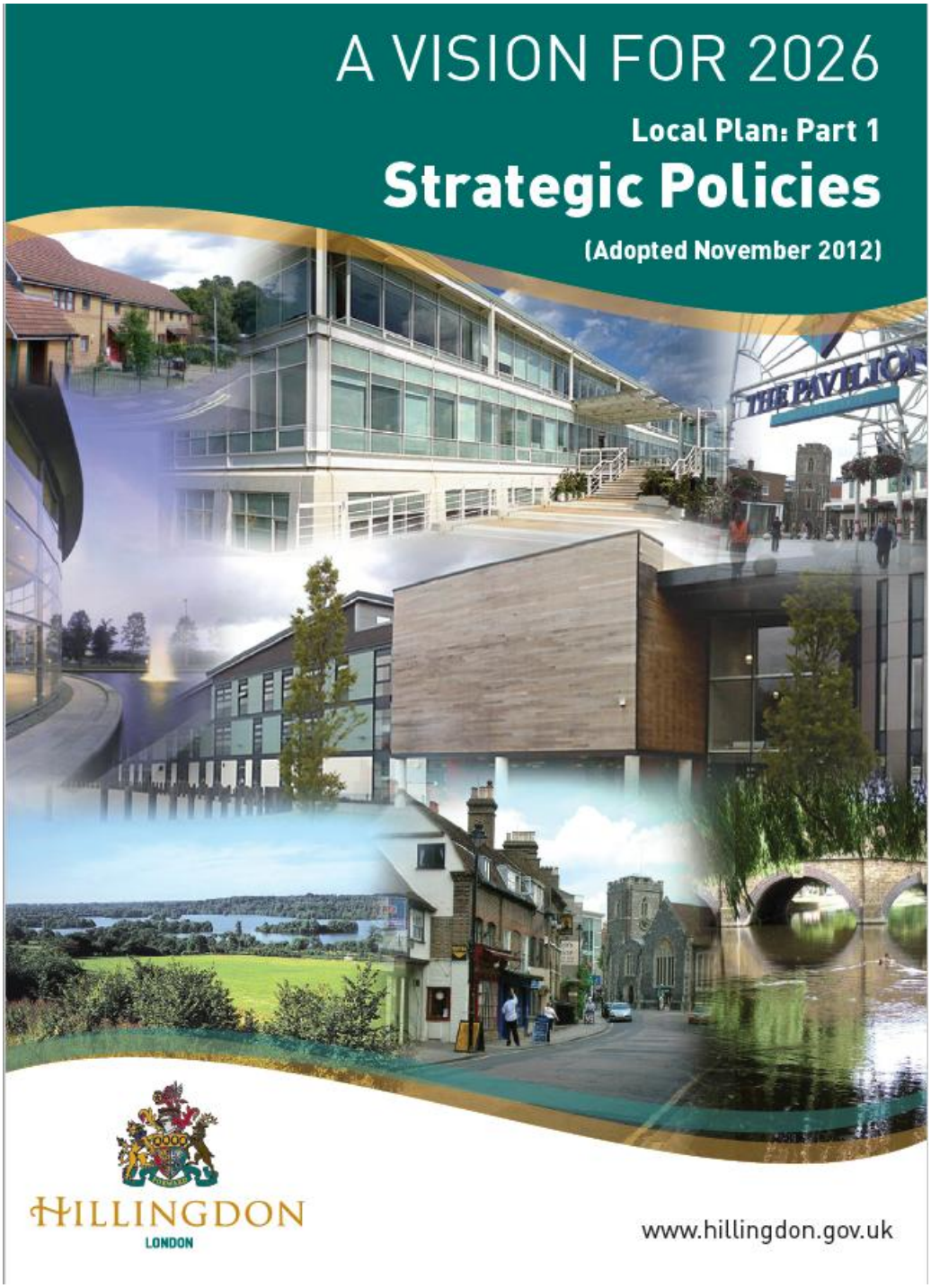
Policy EM1: Energy and Carbon Reduction

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

1. Prioritising higher density development in urban and town centres that are well served by sustainable forms of transport.
2. Promoting a modal shift away from private car use and requiring new development to include innovative initiatives to reduce car dependency.
3. Ensuring development meets the highest possible design standards whilst still retaining competitiveness within the market.
4. Working with developers of major schemes to identify the opportunities to help provide efficiency initiatives that can benefit the existing building stock.
5. Promoting the use of decentralised energy within large scale development whilst improving local air quality levels.
6. Targeting areas with high carbon emissions for additional reductions through low carbon strategies. These strategies will also have an objective to minimise other pollutants that impact on local air quality. Targeting areas of poor air quality for additional emissions reductions.
7. Encouraging sustainable techniques to land remediation to reduce the need to transport waste to landfill. In particular developers should consider bioremediation as part of their proposals.
8. Encouraging the installation of renewable energy for all new development in meeting the carbon reduction targets savings set out in the London Plan. Identify opportunities for new sources of electricity generation including anaerobic digestion, hydroelectricity and a greater use of waste as a resource.
9. Promoting new development to contribute to the upgrading of existing housing stock where appropriate.
   The Borough will ensure that climate change adaptation is addressed at every stage of the development process by:
10. Locating and designing development to minimise the probability and impacts of flooding.
11. Requiring major development proposals to consider the whole water cycle impact which includes flood risk management, foul and surface water drainage and water consumption.
12. Giving preference to development of previously developed land to avoid the loss of further green areas.
13. Promoting the use of living walls and roofs, alongside sustainable forms of drainage to manage surface water run-off and increase the amount of carbon sinks.
14. Promoting the inclusion of passive design measures to reduce the impacts of urban heat effects.

3..6 The Hillingdon Local Plan refers to the London Plan when addressing the topic of reducing CO2 emissions from all proposed developments and mitigating climate change. The following policies within the document are applicable to all schemes within the borough.

Figure 3: Hillingdon Local Plan 2012 Image



4. METHODOLOGY

4..1 The methodology used to estimate the energy demand from the building at the site has been informed by the following publications:

- The London Plan (2021)
- National Calculation Methodology (NCM) modelling guide
- Energy Assessment Guidance – GLA guidance on preparing energy assessments as part of planning applications (June 2022)

4..2 The software used to generate the Regulation baseline is approved by the DCLG as being compliant with the NCM.

4..3 As of July 2022, applicants are required to use updated SAP 10 emission factors. The carbon factors used in our calculations are as follows;

- Grid Natural Gas: 0.210 kgCO2/kWh
- Grid Electricity: 0.136 kgCO2/kWh

As the calculations have been carried out in Stroma SAP10 then there has been no need to convert any figures.

On-Site Carbon Savings – The Energy Hierarchy

4..4 The methodology employed to develop the energy strategy for the scheme and achieve on-site carbon savings is in line with the GLA's Guidance on preparing energy assessments and is as follows:

- The baseline CO2 emissions are first established, i.e. the emissions of a scheme that is compliant with Part L (2021) of the Building Regulations. The updated GLA Guidance (2020) indicates that an improvement of 15% over Part L 'notional' CO2 emissions must be shown for non-residential schemes, in line with the London Plan (2021).

- The software used to model and calculate the energy performance and carbon emissions of the scheme is IESVE VE Compliance and each unit has been modelled individually and the total site wide emissions performance reported.

- The same approach is followed to determine the energy performance and CO2 emissions of the proposed scheme for each of the steps of the Energy Hierarchy. The CO2 emissions are estimated based on the Building Emission Rate (BER) figures.

4..5 The steps of the Energy Hierarchy applicable to the proposed scheme are:

- **Be Lean** - whereby the demand for energy is reduced through a range of passive and active energy efficiency measures - as part of this step the Cooling Hierarchy is implemented (see London Plan policy SI 2) and measures are proposed to reduce the demand for active cooling;
- **Be Clean** - whereby as much of the remaining energy demand is supplied as efficiently as possible (e.g. by connecting to a district energy network or developing a site-wide CHP network); and
- **Be Green** - whereby renewable technologies are incorporated to offset part of the carbon emissions of the development. The uptake of renewable technologies is based on feasibility and viability considerations, including their compatibility with the energy system determined in the previous step.

4..6 The implementation of the Energy Hierarchy determines the total regulated carbon savings that can be feasibly and viably achieved on site. The % improvement against the baseline emissions is compared to the relevant targets for each element and in case of a shortfall, savings through off-site measures should be achieved.

Off-Site Carbon Savings – Carbon Offsetting

4..7 The London Plan 2021 has established provisions to ensure that the shortfall in carbon savings is met off-site; this comprises a carbon offset payment with a figure of £95/tonne for a period of 30 years in accordance with the GLA Guidance for Energy Statements (2022).

4..8 The cash in lieu contribution is calculated and summed to provide the total carbon offset payment to be made to the Council.

4..9 The structure of the Energy Assessment follows the methodology presented above and comprises the following sub-sections:

- Be Lean;
- Be Clean;
- Be Green.

4..10 The Conclusions section summarises the energy strategy and associated carbon savings for the proposed development.

5. ENERGY ASSESSMENT

'Be Lean' – Reduce the Energy Demand

5..1 In order to achieve a building that improves upon the baseline compliance threshold of Part L (2021), the proposal incorporates a range of passive and active design measures that will reduce the energy demand for space conditioning, hot water and lighting. The 'Be-Lean' measures alone aren't enough to pass the full Part L check but as the DPER isn't met we would recommend that renewable tech is needed as reviewed in the 'Be Green' section of the report, of these Solar PV has been found to be the most appropriate.

Passive Design Measures

Improved U-values

5..2 The heat loss of different building fabric elements is dependent upon their U-value. A building with low U-values provides better levels of insulation and reduced heating demand during the cooler months. The proposed development will incorporate high levels of insulation for all solid elements and high-performance glazing beyond Part L 2021 targets and notional building specifications, in order to reduce the demand for space conditioning (heating and cooling) as far as possible.

5..3 Table 3 presents the improved performance of the proposed building fabric beyond the Building Regulations requirements for the proposed scheme.

Table 3: Proposed building fabric U-values

Building Fabric U-value comparison with Part L (2021) recommendations			
Element	**Sub-Element**	**Building Regulations Part L2**	**Proposed Scheme**
Walls	All External Walls	0.26	0.19
Floor	Ground Floor	0.18	0.14
Roof	Pitched Roof	0.16	0.14
Windows	All Windows	1.60	1.6 (G value of 0.55)
Rooflights	Rooflights	2.20	1.6 (G value of 0.55)
Doors	Pedestrian Door	1.60	1.20
Doors	Vehicle Access Doors	1.30	1.30

Air Tightness

5..4 Heat losses that occur due to air infiltration can be minimised via good construction detailing and the use of best practice construction techniques. The proposed development will aim to improve upon the Part L2 (2021) minimum standard for air tightness of 8m³/m².h at 50Pa, by targeting an air permeability rate of **3 m³/m².h** at 50Pa for all areas.

Thermal Bridging

5..5 It is envisaged that the construction details for the proposed dwelling will be designed to comply with a similar performance to previous Accredited Construction Details, minimising heats losses through the junctions if the building.

Reducing the Need for Artificial Lighting

5..6 The development has been designed to maximise daylight as much as possible, as a way of improving the health and wellbeing of its occupants. All habitable areas will benefit from large areas of glazing to increase the amount of daylight within the internal spaces where possible. This is expected to reduce the need for artificial lighting whilst delivering pleasant, healthy spaces for occupants.

Active Design Measures

Auxiliary Ventilation

5..7 No mechanical ventilation with heat recovery is proposed however energy efficient mechanical exhaust dans will be provided to the WC spaces to achieve extract ventilation in the most energy-efficient way.

Energy Efficient lighting

5..8 Low energy light fittings will be incorporated throughout the development. All light fittings will be specified as LED luminaires only as shown in Table 4. This will enable the proposal to reduce energy use and internal gains as much as possible.

Building Energy Monitoring

5..9 The development will incorporate smart meters monitoring the consumption of energy, either directly or indirectly (using third-party equipment or software) of all areas of the proposed scheme.

5..10 In addition, comprehensive metering of the proposed heating system will future proof the scheme for changes in the energy market, including enabling the occupier / building owner to take advantage of a 'demand side' response strategy.

Reducing Overheating Risks

5..11 The potential risk of overheating will be mitigated as far as possible by incorporating passive and active design measures, in line with London Plan (2021) Policy SI 4 and its cooling hierarchy.

The Cooling Hierarchy

Energy Efficient Pipework

5..12 Electric instantaneous hot water systems are proposed within the WCs and kitchenette spaces, therefore limiting the lateral lengths of hot water pipework and reducing unwanted heat gains via hot water circulation.

Glazing Properties

5..13 As a means of reducing unwanted solar heat gains, glazing will not have a solar transmittance 'g-value' not exceeding 0.55.

External & Internal shading

5..14 Although not included within the dynamic simulation modelling undertaken for the scheme, it is assumed that building occupants will install internal blinds to further reduce the amount of heat entering the office spaces.

Thermal Mass

5..15 It is envisaged that the internal floors of the building will provide a degree of thermal massing to absorb and store excess heat during the hottest periods of a day. The building will release its heat in the cooler times of a day to dampen the peak diurnal weather conditions.

Natural Ventilation

5..16 Openable windows within the offices, kitchenette and WC will be employed as the main strategy for providing fresh air and dissipating heat across the proposed scheme. It is envisaged that the large vehicle access doors will be open to the workshop spaces during much of the day and will provide a means of purging warm air from the workshop areas when needed.

'Be Lean; Stage - Energy Use & CO2 Emissions Performance

5..17 Table 4 presents the services inputs used within the 'Lean Stage calculations of the energy assessment for the proposed scheme.

Table 4: Building Services Inputs - Lean Stage

Building Services Inputs – Lean Stage	
Ventilation Strategy	Natural Ventilation with mechanical extract to WC spaces.
Heating	ASHP Powered convector heaters to workshop areas S.C.O.P 2.64 ASHP Powered radiators to office areas S.C.O.P 2.64
	Controls – Programmer, time and temperature controls
Hot Water System	Electric instantaneous at point of use
Lighting	100% energy efficient lighting Approx efficiency 120 lm/W

5..18 Table 5 presents the site-wide CO2 emissions for the proposed scheme when compared to the Part L baseline and 'Be Lean' calculation figures, while Table 6 presents the resulting regulated CO2 emission savings at the 'Be Lean' stage of the GLA's energy hierarchy. As no connection to a district or communal heating system or site-wide CHP system is proposed, no regulated CO2 emissions saving can be noted at this stage.

Table 5: Be Lean Stage: Site-wide - CO2 emissions compared to Part L (2021) baseline

Site-wide – Carbon dioxide emissions (Tonnes CO2/year)	
	Regulated CO2 emissions
Part L Baseline	3.8
Be lean: following energy demand reduction	3.2

Table 6: Be Lean Stage: Site-wide - Regulated CO2 emissions savings

Site-wide – Regulated carbon dioxide savings		
	Savings (TonnesCO2/year)	**Savings (%)**
Be lean: savings from energy demand reduction	0.6	17%
Total Savings	**0.6**	**17%**

5..19 In addition to the site-wide CO2 emissions performance reported above, the Energy Use Intensity (EUI) and Space Heating Demand are also reported in the following table.

Table 7: EUI and Space Heating Demand Results

Energy Use Intensity & Heating Demand Results		
	Energy Use Intensity (EUI) (KWh/m2/yr)	**Space Heating Demand (KWh/m2/yr)**
Unit 6	44.38	8.78
Unit 7	44.58	8.95
Unit 8	54.07	13.14
Benchmark: All other no-residential	**55**	**15**

5..20 The Energy Use Intensity metric depicts the predicted energy demand of the building for both regulated and unregulated energy demands such as equipment, cooking, electrical appliances, and other small power. These have not been calculated in detail, but an estimate has been included based on the 'Equipment' energy that is calculated using the SBEM calculation methodology.

5..21 Combining the energy demand from building equipment with regulated energy uses for heating, hot water, lighting and mechanical ventilation based upon the Part L2 DSM calculations conducted as part of the assessment provides an indication of the EUI.

5..22 Benchmark targets as reported within the GLA Energy Assessment Guidance (2021) are achieved for each unit for both space heating and EUI metrics based on the above calculation method.

‘Be Clean’ – Supply Energy Efficiently

5..23 The energy system for the development has been selected in accordance with the London Plan decentralised energy hierarchy. The hierarchy listed in Policy SI 3 states that energy systems should consider:

- Communal heating
- Site wide CHP network; and,
- Connection to existing of future proposed heating networks.

Communal Heating

5..24 Local heat and power sources minimise distribution and achieve greater efficiencies when compared to separate energy systems, thus reducing CO2 emissions. In communal energy system. Energy in the form of heat, cooling and/or electricity is generated from a central source and distributed via a network of insulated surrounding residences. However, no communal energy centres have been identified in close proximity to the proposed site see Figure 4.

Site Wide CHP Network

5..25 Combined Heat and Power generation (CHP), or co-generation, is the production of electricity and useful heat from a single engine. Unlike conventional electricity generation, heat is re-used in a CHP system, primarily for hot water, thereby improving the overall energy conversion from 25-35% to around 80%.

5..26 A CHP unit is not considered feasible for the proposed development due to its size and the plant space that would be required. Therefore, it has not been included within the proposed scheme at Berrite Industrial Estate.

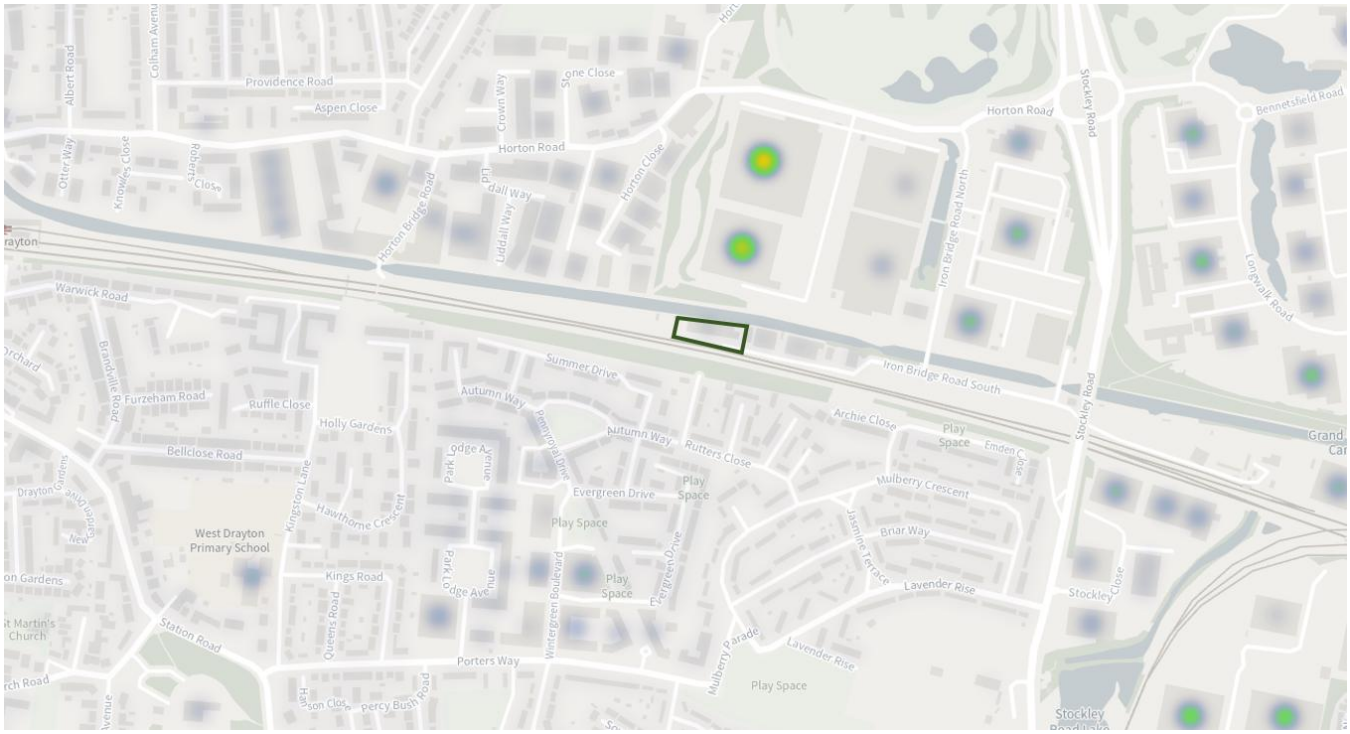
5..27 It would also be noted that due to the nature of the development, there is unlikely to be a continuous year-round energy demand for heating and hot water to justify the inclusion of a CHP system.

Connection to an Existing Network

5..28 The London Heat Map identifies existing and potential opportunities for decentralised energy projects in London. It builds on the 2005 London Community Heating Development Study. An excerpt from the London Heat Map can be seen in Figure 8.

5..29 No existing or proposed heat networks have been noted in close proximity to the proposed scheme at Berrite Industrial Estate.

Figure 4: Site location within London Heat Map



'Be Clean' Stage - Energy Use & CO2 Emissions Performance

5..30 Table 5 presents the site-wide CO2 emissions for the proposed scheme when compared to the Part L baseline and 'Be Lean' calculation figures, while Table 6 presents the resulting regulated CO2 emission savings at the 'Be Clean' stage of the GLA's energy hierarchy. As no connection to a district or communal heating system or site-wide CHP system is proposed, no regulated CO2 emissions saving can be noted at this stage.

Table 8: Clean Stage: Site-wide - CO2 emissions compared to Part L (2021) baseline

Site-wide – Carbon dioxide emissions (Tonnes CO2/year)	
	Regulated CO2 emissions
Part L Baseline	3.8
Be lean: following energy demand reduction	3.2
Be Clean: following heat network appraisal	3.2

Table 9: Clean Stage: Site-wide - Regulated CO2 emissions savings

Site-wide – Regulated carbon dioxide savings		
	Savings (TonnesCO2/year)	**Savings (%)**
Be lean: savings from energy demand reduction	0.6	17%
Be clean: savings from heat network	0	0%
Total Savings	**0.6**	**17%**

Be Green' – Use Renewable Energy

5..31 Methods of generating on-site renewable energy have been assessed, once Lean and Clean measures have been considered. The proposed development will benefit from an energy efficient building fabric which will reduce the energy consumption of the proposed development in the first instance. In addition, a range of renewable technologies were considered, including:

- Biomass;
- Photovoltaic panels
- Solar thermal panels
- Ground source heat pump;
- Air source heat pump; and
- Wind energy.

5..32 In determining the appropriate renewable technology for the site, the following factors were considered:

- CO2 savings achieved;
- Site constraints;
- Any potential visual impacts, and,
- Compatibility with the energy loads of the proposal.

Renewable Energy Appraisal

5..33 Table 7 summarises the factors considered in determining the appropriate renewable technologies for this project. This includes estimated capital cost, anticipated lifespan, level of maintenance and level of impact on external appearance. The final column indicates the feasibility of the technology in relation to the site conditions. It is important to note that the information provided is indicative and based upon early project stage estimates.

Table 10: Renewable energy feasibility table

Technology Considered	Comments	Estimated Lifespan	Maintenance	Impact on external appearance	Overall feasibility
Biomass	Burning of wood pellets releases high NOx emissions and there are limitations for their storage and delivery within an urban location.	20 yrs.	High	High	Not feasible
PV	Roof space of development allows PV panels to be laid on the south-west facing roof, with no overshadowing.	25 yrs.	Low	Medium	Feasible
Solar thermal	Additional plumbing and kit requirement too significant to warrant effective CO2 emissions reductions from solar thermal array. Also very limited hot water demand for this development.	25 yrs.	Low	Medium	Feasible – but discarded due to building services integration
GSHP	The site does not have enough space to allow for the installation of ground loops.	20 yrs.	Medium	Low	Not feasible
ASHP	There is sufficient outside space to accommodate air source heat pump condenser units.	20 yrs.	Medium	Medium	Feasible
Wind	Wind turbines located at the site will have a significant visual impact on the building and there are expected to be minimal wind speeds in an urban setting.	25 yrs.	Medium	High	Not feasible

Roof mounted PV

5..34 The main types of commercially available PV panels on offer in the UK are constructed from cells as described below:

- Monocrystalline silicon cells are the most efficient of the PV technologies with a conversion efficiency of between 15-18% (available solar energy to electricity produced). They are cut from single ingots of silicon, have an unbroken crystal lattice and are the most expensive of PVs;

- Polycrystalline silicon cells have a conversion efficiency of between 13-16%. They are less expensive than monocrystalline cells, are constructed of a number of smaller crystals and are recognisable from a visible 'grain' on the panel; and

- Thin film cells have a conversion efficiency of between 5-10%. As well as being less efficient, they are cheaper than silicon derived cells. Thin films can be mounted on folded or curved surfaces and are used extensively in Building Integrated PV products.

5..35 The PV system will comprise of a 5 kWp system which will be made up of approximately 12 no. panel array of roof mounted panels located along the south westerly sloping roof. This is equivalent to approximately 32 m^2 array of horizontal roof mounted panels to each unit.

5..36 Given current constraints of Part L modelling software and calculations it has not been feasible to model the potential for energy storage via batteries on this scheme. However, by installing a PV panel system during construction the developer will be allowing for the potential future connection to an onsite electrical storage in future.

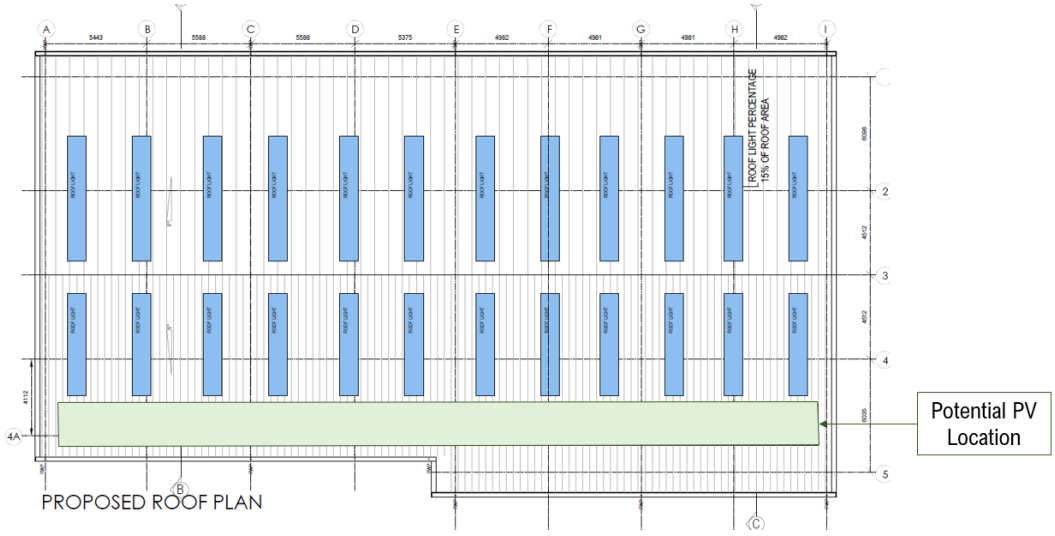
5..37 Table 11 summarises the technical data for the proposed PV array and estimated CO2 savings and energy generation from the application of this technology. An indicative area for the installation of the PV panels on the roof is shown in Figure 6.

Table 11: Proposed photovoltaic system details for each building unit

Photovoltaic Panels – Non-Domestic System Details	
System Size	5 kWp to each unit
Orientation	Southwest
Approximate no. panels	12 no.
Approximate Array area (m^2)	32m^2
Primary energy offset by PV (kWh/yr)	5,407

5..38 Figure 5 illustrates the potential location of the roof mounted PV system for Units 6 & 7

Figure 5: Roof layout showing potential location of PV system for Units 6 & 7



Air Source Heat Pump (ASHPs)

5..39 Air source heat pumps (ASHP) were found to be an effective means of providing heating to the building via a low-carbon heat source. Heating can be supplied by radiators to the office areas and by convectors within the workshop spaces. This system should also be designed with a minimum coefficient of performance of 3.2, giving improved performance beyond minimum acceptable standards.

5..40 There is sufficient space to house the external condensers within the yard to the side of each building which can be easily accessed for maintenance.

5..41 This system will be sized according to the heating requirements of the scheme and therefore will not be suitable for exporting heat energy however it should be noted that due to the scale of the scheme, exporting heat energy to neighbouring buildings is not found to be practical.

Table 12: Be Green stage Building Services Inputs

Building Services Inputs – Green Stage	
Ventilation Strategy	Natural Ventilation with mechanical extract to WC spaces.
Heating	ASHP Powered convector heaters to workshop areas S.C.O.P 3.20 ASHP Powered radiators to office areas S.C.O.P 3.20
	Controls – Programmer, time and temperature controls
Hot Water System	Electric instantaneous at point of use
Lighting	100% energy efficient lighting Approx efficiency 120 lm/W
Renewable Technology	5 KWp PV system to each unit

'Be Green' Stage - Energy Use & CO2 Emissions Performance

5..42 Table 8 presents the site-wide CO2 emissions for the proposed scheme when compared to the Part L baseline and 'Be Lean' calculation figures, while Table 9 presents the resulting regulated CO2 emissions savings at the 'Be Clean' stage of the GLA's energy hierarchy.

Table 13: Be Green Stage: Site-wide - CO2 emissions compared to Part L (2021) baseline

Site-wide – Carbon dioxide emissions (Tonnes CO2/year)	
	Regulated CO2 emissions
Part L Baseline	3.8
Be lean: following energy demand reduction	3.2
Be Clean: following heat network appraisal	3.2
Be Green: following renewable energy appraisal	0.6

Table 14: Green Stage: Site-wide – Regulated CO2 emissions savings

Site-wide – Regulated carbon dioxide savings		
	Savings (TonnesCO2/year)	**Savings (%)**
Be lean: savings from energy demand reduction	0.6	17%
Be clean: savings from heat network	0	0%
Be green: Savings from renewable energy	3.2	68%
Total Savings	**3.8**	**85%**

Carbon Offsetting

5..43 In accordance with the London Plan, GLA guidance and Hillingdon Borough's local policies, all non-domestic developments are required to be net zero carbon, i.e. achieve at least a 35% on-site reduction beyond Part L of Building Regulations and offset any remaining emissions in the form of a Carbon Offset Payment.

5..44 The Offset payment is determined by calculating the remaining CO2 of the site for the year and then multiplying that by 30 years. This is then multiplied by the Carbon Dioxide Offset Price, which can vary between different local authorities. In this case, it is £95 per tonne which is London's recommended carbon offset price.

Table 15: Carbon Offset Contribution calculation

Regulated carbon dioxide savings		
Cumulative emissions to offset	0.591 x 30 years = 17.73tCO2	17.73
Cash-in-lieu contribution	17.73 x £95	£1,684.35

‘Be Seen’ – Energy Monitoring

5..45 The ‘Be Seen’ requirement in the London Plan is part of Policy SI 2, which aims to close the gap between predicted and actual energy performance in buildings. For major developments operational energy use should be reported for at least five years post-occupancy.

5..46 The following section provides a breakdown of what’s required across the development lifecycle;

Planning Stage

5..47 At planning stage the ‘Planning stage ‘be seen’ webform should be completed by the planning applicant based on information from the energy modelling exercise completed within the energy statement. To assist with this a copy of the be seen spreadsheet has been completed alongside this report to assist with the assessment.

5..48 The following table depicts the key performance indicators for the development at Berrite Industrial Estate

Be Seen – Key Reporting Parameters		
Contextual Data	Typology/Building Use	Workshop
	GIA [m2]	1,296.1
	Target Date – As Built	
	Target Date - Occupation	
Building Energy Use	Grid Electricity Consumption [kWh]	45,465
	Gas Consumption [kWh]	0
	Other Fuels Consumption [kWh]	0
Renewable Energy	Energy Generation [kWh]	16,221
Carbon Emissions	Carbon Emission Estimates [tonnes CO2]	0.6
	Carbon Shortfall for the development [tonnes CO2]	17.73
	Estimated Carbon Offset Amount [£]	£1,685

As-Built stage

5..49 At the As-Built Stage (RIBA Stage 6) the client is responsible for providing as-built energy performance estimates and the as-built specification for the scheme and submit this via the 'Be Seen' Webform. This stage of the assessment captures changes during the construction that affect energy performance.

5..50 Reportable units are comparable to the requirements at the planning stage however represent the actual final design of the building, including the actual performance of the building services installed and refinement if the building model to reflect internal room divisions that may have changed since the initial planning stage works.

5..51 The developer is expected to supply a draft whole building Display Energy Certificate (DEC) for the building which will provide an illustrative DEC rating for each building based on the latest modelling results.

5..52 Since there are 3 no. units within the scheme at Berrite Industrial Estate each building should be assessed separately and to facilitate individual Display Energy Certificates for each building. As a minimum metering should be supplied that will provide recordings of electricity consumption and on-site energy generation from renewable sources.

In-Use Stage (RIBA Stage 7)

5..53 During the in-use stage (RIBA Stage 7), responsibility for monitoring and reporting actual performance rests with the legal owner of the building.

5..54 The building owner should monitor and report annual energy performance data and collect this date over the following 5 years from the date of occupancy.

5..55 The first point of reporting will be from the point where the first DEC assessment can be produced, generally at a point where a minimum of 11 months of energy consumption data can be provided.

5..56 The Be Seen requirements identify potential difficulties in gathering the necessary energy consumption information once the building is occupied therefore recommends either the developer/building owner mandating each tenant to produce their own DEC, or by mandating tenants to share their annual energy purchases with the developer/building owner, in which case the landlord should commission all official DEC certificates.

5..57 Details from the DEC assessment should then be supplied through the 'Be Seen' reporting webform at each stage.

6. CONCLUSIONS

6..1 In accordance with the London Plan, GLA guidance and Hillingdon Local Plan policies, the baseline energy figures derived from Part L compliant energy calculations have indicated that the proposed scheme will have a regulated CO2 emissions 'notional' baseline of 3.8 tonnes of CO2 per year (tCO2/year).

6..2 By incorporating energy efficient measures such as improved insulation levels, efficient lighting and controls as described within the 'Be Lean' section of this report an emission saving of approximately 0.6 tCO2 per year can be expected, equivalent to a 17% reduction beyond baseline levels.

6..3 For the 'Be Clean' stage, no existing community heating system was noted in close proximity to the proposed development. A CHP unit was not considered feasible due to size and location of the development and the large plant space that would be required. Therefore, no CO2 emissions savings have been noted within the 'Be Clean' stage of the energy hierarchy.

6..4 Potential low carbon alternatives were assessed that would provide a significant CO2 emissions reduction for the 'Be Green' stage of the energy hierarchy. PV and air source heat pumps have been considered, and found to be practical and effective solutions for this development. Combined, these measures account for a further 3.2 tCO2 saving in emissions performance, equivalent to a 68% reduction.

6..5 Therefore, it can be ascertained that a significant CO2 emissions saving has been calculated for the proposed development at Berrite Industrial Estate in line with the local requirements and the ambition of the design team.

6..6 Table 10 and Table 11 summarise the implementation of the energy hierarchy for the proposed scheme and detail the CO2 emissions and savings against the Part L baseline for each step of the hierarchy.

Table 16: Energy Hierarchy - CO2 emissions compared to Part L (2021) baseline

Site-wide – Carbon dioxide emissions (Tonnes CO2/year)	
	Regulated CO2 emissions
Part L Baseline	3.8
Be lean: following energy demand reduction	3.2
Be Clean: following heat network appraisal	3.2
Be green: following renewable energy appraisal	0.6

Table 17: Energy Hierarchy – Regulated CO2 emissions savings

Site-wide – Regulated carbon dioxide savings		
	Savings (TonnesCO2/year)	**Savings (%)**
Be lean: savings from energy demand reduction	0.6	17%
Be clean: savings from heat network	0	0%
Be green: Savings from renewable energy	3.2	68%
Total Savings	**3.8**	**85%**

Appendix A

SBEM BRUKL Results

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name **Shell and Core**

Unit 6 - Be Lean

As designed

Date: Mon Sep 26 09:50:23 2022

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.15

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.15

BRUKL compliance check version: v6.1.b.0

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Foundation area [m^2]: 430

The CO_2 emission and primary energy rates of the building must not exceed the targets

Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	2.8	
Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	2.37	
Target primary energy rate (TPER), kWh/m^2.annum	28.83	
Building primary energy rate (BPER), kWh/m^2.annum	24.19	
Do the building's emission and primary energy rates exceed the targets?	BER =< TER	BPER =< TPER

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

Fabric element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	First surface with maximum value
Walls*	0.26	0.2	0.21	NT000003:Surf[2]
Floors	0.18	0.14	0.14	NT000003:Surf[0]
Pitched roofs	0.16	-	-	No Pitched roofs in building
Flat roofs	0.18	0.14	0.14	NT000000:Surf[20]
Windows** and roof windows	1.6	1.6	1.6	NT000003:Surf[1]
Rooflights***	2.2	1.6	1.6	NT000000:Surf[15]
Personnel doors^	1.6	-	-	No Personnel doors in building
Vehicle access & similar large doors	1.3	1.3	1.3	NT000000:Surf[2]
High usage entrance doors	3	-	-	No High usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m^2K)] $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m^2K)]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m^2K)]

* 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. *** Values for rooflights refer to the horizontal position.

^ For fire doors, limiting U-value is 1.8 W/m^2K

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	Limiting standard	This building
$m^3/(h.m^2)$ at 50 Pa	8	3

Building services

For details on the standard values listed below, system-specific guidance, and additional regulatory requirements, refer to the Approved Documents.

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

1- NCM - Rads via Heatpump

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	2.64	-	0.2	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

2- NCM - Warm Air - Workshop

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	2.64	-	0.2	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

1- Instantanious Hot Water

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

Zone-level mechanical ventilation, exhaust, and terminal units

ID	**System type in the Approved Documents**
A	Local supply or extract ventilation units
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 balanced supply and extract ventilation system
E	Local balanced supply and extract ventilation units
F	Other local ventilation units
G	Fan assisted terminal variable air volume units
H	Fan coil units
I	Kitchen extract with the fan remote from the zone and a grease filter

NB: Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

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	2.3	2	0.5	0.5	0.4	1	**Zone**	**Standard**
Unit 6 - WC	-	-	0.1	-	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	**Assumed shell?**
Unit 6 - Office/Welfare	NO
Unit 6 - Workshop	NO
Unit 6 - WC	NO

General lighting and display lighting	General luminaire	Display light source	
Zone name	**Efficacy [lm/W]**	**Efficacy [lm/W]**	**Power density [W/m²]**
Standard value	95	80	0.3
Unit 6 - Office/Welfare	120	-	-
Unit 6 - Workshop	120	-	-
Unit 6 - WC	120	-	-

The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Unit 6 - Office/Welfare	NO (-68%)	NO
Unit 6 - Workshop	NO (-20.1%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m^2]	441.7	441.7
External area [m^2]	1360.3	1360.3
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	3	5
Average conductance [W/K]	346.48	413.42
Average U-value [W/m^2K]	0.25	0.3
Alpha value* [%]	10.02	10

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

Building Use

% Area	Building Type
	Retail/Financial and Professional Services
	Restaurants and Cafes/Drinking Establishments/Takeaways
100	**Offices and Workshop Businesses**
	General Industrial and Special Industrial Groups
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
	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	10.64	12.26
Cooling	0	0
Auxiliary	1.01	1.03
Lighting	2.5	4.05
Hot water	1.66	1.58
Equipment*	18.19	18.19
TOTAL**	**15.81**	**18.92**

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

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*0*	*0*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	94.96	122.66
Primary energy [kWh/m^2]	24.19	28.83
Total emissions [kg/m^2]	2.37	2.8

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: convectors, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	93.1	0	10.4	0	1	2.48	0	2.64	0
	Notional	119.1	0	11.9	0	1	2.78	0	----	----
[ST] Central heating using water: radiators, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	163.2	0	18.3	0	1.2	2.48	0	2.64	0
	Notional	253.2	0	25.3	0	1.7	2.78	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

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name **Shell and Core**

Unit 7 - Be Lean

As designed

Date: Mon Sep 26 09:27:15 2022

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.15

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.15

BRUKL compliance check version: v6.1.b.0

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Foundation area [m^2]: 433.6

The CO_2 emission and primary energy rates of the building must not exceed the targets

Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	2.83	
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	2.37	
Target primary energy rate (TPER), $kWh/m^2.annum$	29.11	
Building primary energy rate (BPER), $kWh/m^2.annum$	24.2	
Do the building's emission and primary energy rates exceed the targets?	BER =< TER	BPER =< TPER

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

Fabric element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	First surface with maximum value
Walls*	0.26	0.2	0.21	NT000005:Surf[2]
Floors	0.18	0.14	0.14	NT000005:Surf[0]
Pitched roofs	0.16	-	-	No Pitched roofs in building
Flat roofs	0.18	0.14	0.14	NT000001:Surf[18]
Windows** and roof windows	1.6	1.6	1.6	NT000005:Surf[1]
Rooflights***	2.2	1.6	1.6	NT000001:Surf[12]
Personnel doors^	1.6	-	-	No Personnel doors in building
Vehicle access & similar large doors	1.3	1.3	1.3	NT000001:Surf[1]
High usage entrance doors	3	-	-	No High usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$] $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$]

* 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. *** Values for rooflights refer to the horizontal position.

^ For fire doors, limiting U-value is 1.8 W/m^2K

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	Limiting standard	This building
$m^3/(h.m^2)$ at 50 Pa	8	3

Building services

For details on the standard values listed below, system-specific guidance, and additional regulatory requirements, refer to the Approved Documents.

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

1- NCM - Rads via Heatpump

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	2.64	-	0.2	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

2- NCM - Warm Air - Workshop

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	2.64	-	0.2	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

1- Instantanious Hot Water

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

Zone-level mechanical ventilation, exhaust, and terminal units

ID	**System type in the Approved Documents**
A	Local supply or extract ventilation units
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 balanced supply and extract ventilation system
E	Local balanced supply and extract ventilation units
F	Other local ventilation units
G	Fan assisted terminal variable air volume units
H	Fan coil units
I	Kitchen extract with the fan remote from the zone and a grease filter
NB: Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.	

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	2.3	2	0.5	0.5	0.4	1	**Zone**	**Standard**
Unit 7 - WC	-	-	0.1	-	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	**Assumed shell?**
Unit 7 - Office/Welfare	NO
Unit 7 - Workshop	NO
Unit 7 - WC	NO

General lighting and display lighting	General luminaire	Display light source	
Zone name	**Efficacy [lm/W]**	**Efficacy [lm/W]**	**Power density [W/m²]**
Standard value	95	80	0.3
Unit 7 - Office/Welfare	120	-	-
Unit 7 - Workshop	120	-	-
Unit 7 - WC	120	-	-

The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Unit 7 - Office/Welfare	NO (-68.3%)	NO
Unit 7 - Workshop	NO (-2.7%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m^2]	433.6	433.6
External area [m^2]	1342.5	1342.5
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	3	5
Average conductance [W/K]	361.31	408.34
Average U-value [W/m^2K]	0.27	0.3
Alpha value* [%]	10.02	10

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

Building Use

% Area	Building Type
	Retail/Financial and Professional Services
	Restaurants and Cafes/Drinking Establishments/Takeaways
100	**Offices and Workshop Businesses**
	General Industrial and Special Industrial Groups
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
	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	10.85	12.42
Cooling	0	0
Auxiliary	1.01	1.03
Lighting	2.27	4.08
Hot water	1.66	1.58
Equipment*	18.2	18.2
TOTAL**	**15.81**	**19.11**

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

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*0*	*0*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	96.89	124.29
Primary energy [kWh/m^2]	24.2	29.11
Total emissions [kg/m^2]	2.37	2.83

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: convectors, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	95.2	0	10.7	0	1	2.48	0	2.64	0
	Notional	120.8	0	12.1	0	1	2.78	0	----	----
[ST] Central heating using water: radiators, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	161	0	18	0	1.2	2.48	0	2.64	0
	Notional	255	0	25.5	0	1.7	2.78	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

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name **Shell and Core**

Unit 8 - Be Lean

As designed

Date: Mon Sep 26 10:03:26 2022

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.15

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.15

BRUKL compliance check version: v6.1.b.0

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Foundation area [m^2]: 420.81

The CO_2 emission and primary energy rates of the building must not exceed the targets

Target CO_2 emission rate (TER), $kgCO_2/m^2.annum$	4.04	
Building CO_2 emission rate (BER), $kgCO_2/m^2.annum$	3.39	
Target primary energy rate (TPER), $kWh/m^2.annum$	41.44	
Building primary energy rate (BPER), $kWh/m^2.annum$	34.65	
Do the building's emission and primary energy rates exceed the targets?	BER =< TER	BPER =< TPER

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

Fabric element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	First surface with maximum value
Walls*	0.26	0.19	0.19	NT000009:Surf[1]
Floors	0.18	0.14	0.14	NT000009:Surf[2]
Pitched roofs	0.16	-	-	No Pitched roofs in building
Flat roofs	0.18	0.14	0.14	NT000007:Surf[8]
Windows** and roof windows	1.6	1.6	1.6	NT000009:Surf[3]
Rooflights***	2.2	1.6	1.6	NT000007:Surf[0]
Personnel doors^	1.6	1.2	1.2	NT000009:Surf[0]
Vehicle access & similar large doors	1.3	1.3	1.3	NT000007:Surf[10]
High usage entrance doors	3	-	-	No High usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$] $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$]

* 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. *** Values for rooflights refer to the horizontal position.

^ For fire doors, limiting U-value is 1.8 W/m^2K

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	Limiting standard	This building
$m^3/(h.m^2)$ at 50 Pa	8	3

Building services

For details on the standard values listed below, system-specific guidance, and additional regulatory requirements, refer to the Approved Documents.

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

1- NCM - Rads via Heatpump

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	2.64	-	0.2	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

2- NCM - Warm Air - Workshop

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	2.64	-	0.2	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

1- Instantanious Hot Water

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

Zone-level mechanical ventilation, exhaust, and terminal units

ID	**System type in the Approved Documents**
A	Local supply or extract ventilation units
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 balanced supply and extract ventilation system
E	Local balanced supply and extract ventilation units
F	Other local ventilation units
G	Fan assisted terminal variable air volume units
H	Fan coil units
I	Kitchen extract with the fan remote from the zone and a grease filter

NB: Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

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	2.3	2	0.5	0.5	0.4	1	**Zone**	**Standard**
Unit 8 - WC	-	-	0.1	-	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	**Assumed shell?**
Unit 8 - Offiice	NO
Unit 8 - Office - Welfare	NO
Unit 8 - Circ	NO
Unit 8 - WC	NO
Unit 8 - Workshop	NO

General lighting and display lighting	General luminaire	Display light source	
Zone name	**Efficacy [lm/W]**	**Efficacy [lm/W]**	**Power density [W/m²]**
Standard value	95	80	0.3
Unit 8 - Offiice	120	-	-
Unit 8 - Office - Welfare	120	-	-
Unit 8 - Circ	120	-	-
Unit 8 - WC	120	-	-
Unit 8 - Workshop	120	-	-

The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Unit 8 - Offiice	NO (-80%)	NO
Unit 8 - Office - Welfare	NO (-67.9%)	NO
Unit 8 - Workshop	NO (-49.8%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m^2]	420.8	420.8
External area [m^2]	1867.7	1867.7
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	3	5
Average conductance [W/K]	471.54	626.49
Average U-value [W/m^2K]	0.25	0.34
Alpha value* [%]	10.15	10

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

Building Use

% Area	Building Type
	Retail/Financial and Professional Services
	Restaurants and Cafes/Drinking Establishments/Takeaways
100	**Offices and Workshop Businesses**
	General Industrial and Special Industrial Groups
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
	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	15.92	20.54
Cooling	0	0
Auxiliary	1.01	1.03
Lighting	3.99	3.93
Hot water	1.76	1.67
Equipment*	21.32	21.32
TOTAL**	**22.69**	**27.17**

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

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*0*	*0*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	142.14	205.51
Primary energy [kWh/m^2]	34.65	41.44
Total emissions [kg/m^2]	3.39	4.04

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: convectors, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	139.9	0	15.7	0	1	2.48	0	2.64	0
	Notional	207	0	20.7	0	1	2.78	0	----	----
[ST] Central heating using water: radiators, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	150.7	0	16.9	0	1	2.48	0	2.64	0
	Notional	200.1	0	20	0	1.1	2.78	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

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name **Shell and Core**

Unit 6 - Be Green

As designed

Date: Mon Sep 26 11:51:04 2022

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.15

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.15

BRUKL compliance check version: v6.1.b.0

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Foundation area [m^2]: 422.17

The CO_2 emission and primary energy rates of the building must not exceed the targets

Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	2.8	
Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	0.54	
Target primary energy rate (TPER), kWh/m^2.annum	28.83	
Building primary energy rate (BPER), kWh/m^2.annum	3.41	
Do the building's emission and primary energy rates exceed the targets?	BER =< TER	BPER =< TPER

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

Fabric element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	First surface with maximum value
Walls*	0.26	0.2	0.21	NT000003:Surf[2]
Floors	0.18	0.14	0.14	NT000003:Surf[0]
Pitched roofs	0.16	-	-	No Pitched roofs in building
Flat roofs	0.18	0.14	0.14	NT000000:Surf[20]
Windows** and roof windows	1.6	1.6	1.6	NT000003:Surf[1]
Rooflights***	2.2	1.6	1.6	NT000000:Surf[15]
Personnel doors^	1.6	-	-	No Personnel doors in building
Vehicle access & similar large doors	1.3	1.3	1.3	NT000000:Surf[2]
High usage entrance doors	3	-	-	No High usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [$W/(m^2K)$] $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [$W/(m^2K)$]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [$W/(m^2K)$]

* 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. *** Values for rooflights refer to the horizontal position.

^ For fire doors, limiting U-value is 1.8 W/m^2K

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	Limiting standard	This building
$m^3/(h.m^2)$ at 50 Pa	8	3

Building services

For details on the standard values listed below, system-specific guidance, and additional regulatory requirements, refer to the Approved Documents.

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

1- Rads via Heatpump

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	3.2	-	0.2	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

2- Warm Air - Workshop via heatpump

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	3.2	-	0.2	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

1- Instantanious Hot Water

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

Zone-level mechanical ventilation, exhaust, and terminal units

ID	**System type in the Approved Documents**
A	Local supply or extract ventilation units
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 balanced supply and extract ventilation system
E	Local balanced supply and extract ventilation units
F	Other local ventilation units
G	Fan assisted terminal variable air volume units
H	Fan coil units
I	Kitchen extract with the fan remote from the zone and a grease filter
NB: Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.	

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	2.3	2	0.5	0.5	0.4	1	**Zone**	**Standard**
Unit 6 - WC	-	-	0.1	-	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	**Assumed shell?**
Unit 6 - Office/Welfare	NO
Unit 6 - Workshop	NO
Unit 6 - WC	NO

General lighting and display lighting	General luminaire	Display light source	
Zone name	**Efficacy [lm/W]**	**Efficacy [lm/W]**	**Power density [W/m²]**
Standard value	95	80	0.3
Unit 6 - Office/Welfare	120	-	-
Unit 6 - Workshop	120	-	-
Unit 6 - WC	120	-	-

The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Unit 6 - Office/Welfare	NO (-68%)	NO
Unit 6 - Workshop	NO (-20.1%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m^2]	441.7	441.7
External area [m^2]	1360.3	1360.3
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	3	5
Average conductance [W/K]	346.48	413.42
Average U-value [W/m^2K]	0.25	0.3
Alpha value* [%]	10.02	10

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

Building Use

% Area	Building Type
	Retail/Financial and Professional Services
	Restaurants and Cafes/Drinking Establishments/Takeaways
100	**Offices and Workshop Businesses**
	General Industrial and Special Industrial Groups
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
	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	8.78	12.26
Cooling	0	0
Auxiliary	1.01	1.03
Lighting	2.5	4.05
Hot water	1.66	1.58
Equipment*	18.19	18.19
TOTAL**	**13.95**	**18.92**

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

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	12.24	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*12.24*	*0*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	94.96	122.66
Primary energy [kWh/m^2]	3.41	28.83
Total emissions [kg/m^2]	0.54	2.8

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] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	163.2	0	15.1	0	1.2	3.01	0	3.2	0
	Notional	253.2	0	25.3	0	1.7	2.78	0	----	----
[ST] Central heating using water: convectors, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	93.1	0	8.6	0	1	3.01	0	3.2	0
	Notional	119.1	0	11.9	0	1	2.78	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

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name **Shell and Core**

Unit 7 - Be Green

As designed

Date: Mon Sep 26 11:45:18 2022

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.15

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.15

BRUKL compliance check version: v6.1.b.0

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Foundation area [m^2]: 422.17

The CO_2 emission and primary energy rates of the building must not exceed the targets

Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	2.83	
Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	0.51	
Target primary energy rate (TPER), kWh/m^2.annum	29.11	
Building primary energy rate (BPER), kWh/m^2.annum	3.02	
Do the building's emission and primary energy rates exceed the targets?	BER =< TER	BPER =< TPER

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

Fabric element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	First surface with maximum value
Walls*	0.26	0.2	0.21	NT000005:Surf[2]
Floors	0.18	0.14	0.14	NT000005:Surf[0]
Pitched roofs	0.16	-	-	No Pitched roofs in building
Flat roofs	0.18	0.14	0.14	NT000001:Surf[18]
Windows** and roof windows	1.6	1.6	1.6	NT000005:Surf[1]
Rooflights***	2.2	1.6	1.6	NT000001:Surf[12]
Personnel doors^	1.6	-	-	No Personnel doors in building
Vehicle access & similar large doors	1.3	1.3	1.3	NT000001:Surf[1]
High usage entrance doors	3	-	-	No High usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m^2K)] $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m^2K)]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m^2K)]

* 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. *** Values for rooflights refer to the horizontal position.

^ For fire doors, limiting U-value is 1.8 W/m^2K

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	Limiting standard	This building
$m^3/(h.m^2)$ at 50 Pa	8	3

Building services

For details on the standard values listed below, system-specific guidance, and additional regulatory requirements, refer to the Approved Documents.

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

1- Rads via Heatpump

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	3.2	-	0.2	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

2- Warm Air - Workshop via heatpump

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	3.2	-	0.2	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

1- Instantanious Hot Water

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

Zone-level mechanical ventilation, exhaust, and terminal units

ID	**System type in the Approved Documents**
A	Local supply or extract ventilation units
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 balanced supply and extract ventilation system
E	Local balanced supply and extract ventilation units
F	Other local ventilation units
G	Fan assisted terminal variable air volume units
H	Fan coil units
I	Kitchen extract with the fan remote from the zone and a grease filter

NB: Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

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	2.3	2	0.5	0.5	0.4	1	**Zone**	**Standard**
Unit 7 - WC	-	-	0.1	-	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	**Assumed shell?**
Unit 7 - Office/Welfare	NO
Unit 7 - Workshop	NO
Unit 7 - WC	NO

General lighting and display lighting	General luminaire	Display light source	
Zone name	**Efficacy [lm/W]**	**Efficacy [lm/W]**	**Power density [W/m²]**
Standard value	95	80	0.3
Unit 7 - Office/Welfare	120	-	-
Unit 7 - Workshop	120	-	-
Unit 7 - WC	120	-	-

The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Unit 7 - Office/Welfare	NO (-68.3%)	NO
Unit 7 - Workshop	NO (-2.7%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m^2]	433.6	433.6
External area [m^2]	1342.5	1342.5
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	3	5
Average conductance [W/K]	361.31	408.34
Average U-value [W/m^2K]	0.27	0.3
Alpha value* [%]	10.02	10

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

Building Use

% Area	Building Type
	Retail/Financial and Professional Services
	Restaurants and Cafes/Drinking Establishments/Takeaways
100	**Offices and Workshop Businesses**
	General Industrial and Special Industrial Groups
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
	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	8.95	12.42
Cooling	0	0
Auxiliary	1.01	1.03
Lighting	2.27	4.08
Hot water	1.66	1.58
Equipment*	18.2	18.2
TOTAL**	**13.91**	**19.11**

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

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	12.47	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*12.47*	*0*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	96.89	124.29
Primary energy [kWh/m^2]	3.02	29.11
Total emissions [kg/m^2]	0.51	2.83

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] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	161	0	14.9	0	1.2	3.01	0	3.2	0
	Notional	255	0	25.5	0	1.7	2.78	0	----	----
[ST] Central heating using water: convectors, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	95.2	0	8.8	0	1	3.01	0	3.2	0
	Notional	120.8	0	12.1	0	1	2.78	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

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2021

Project name **Shell and Core**

Unit 8 - Be Green

As designed

Date: Mon Sep 26 11:41:32 2022

Administrative information

Building Details

Address: Address 1, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.15

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.15

BRUKL compliance check version: v6.1.b.0

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Foundation area [m^2]: 422.17

The CO_2 emission and primary energy rates of the building must not exceed the targets

Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	4.04	
Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	1.34	
Target primary energy rate (TPER), kWh/m^2.annum	41.44	
Building primary energy rate (BPER), kWh/m^2.annum	11.56	
Do the building's emission and primary energy rates exceed the targets?	BER =< TER	BPER =< TPER

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

Fabric element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	First surface with maximum value
Walls*	0.26	0.19	0.19	NT000009:Surf[1]
Floors	0.18	0.14	0.14	NT000009:Surf[2]
Pitched roofs	0.16	-	-	No Pitched roofs in building
Flat roofs	0.18	0.14	0.14	NT000007:Surf[8]
Windows** and roof windows	1.6	1.6	1.6	NT000009:Surf[3]
Rooflights***	2.2	1.6	1.6	NT000007:Surf[0]
Personnel doors^	1.6	1.2	1.2	NT000009:Surf[0]
Vehicle access & similar large doors	1.3	1.3	1.3	NT000007:Surf[10]
High usage entrance doors	3	-	-	No High usage entrance doors in building

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m^2K)] $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m^2K)]

$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m^2K)]

* 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. *** Values for rooflights refer to the horizontal position.

^ For fire doors, limiting U-value is 1.8 W/m^2K

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	Limiting standard	This building
$m^3/(h.m^2)$ at 50 Pa	8	3

Building services

For details on the standard values listed below, system-specific guidance, and additional regulatory requirements, refer to the Approved Documents.

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

1- Rads via Heatpump

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	3.2	-	0.2	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

2- Warm Air - Workshop via heatpump

	Heating efficiency	**Cooling efficiency**	**Radiant efficiency**	**SFP [W/(l/s)]**	**HR efficiency**
This system	3.2	-	0.2	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.

1- Instantanious Hot Water

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

Zone-level mechanical ventilation, exhaust, and terminal units

ID	**System type in the Approved Documents**
A	Local supply or extract ventilation units
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 balanced supply and extract ventilation system
E	Local balanced supply and extract ventilation units
F	Other local ventilation units
G	Fan assisted terminal variable air volume units
H	Fan coil units
I	Kitchen extract with the fan remote from the zone and a grease filter

NB: Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.

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	2.3	2	0.5	0.5	0.4	1	**Zone**	**Standard**
Unit 8 - WC	-	-	0.1	-	-	-	-	-	-	-	N/A

Shell and core configuration

Zone	**Assumed shell?**
Unit 8 - Offiice	NO
Unit 8 - Office - Welfare	NO
Unit 8 - Circ	NO
Unit 8 - WC	NO
Unit 8 - Workshop	NO

General lighting and display lighting	General luminaire	Display light source	
Zone name	**Efficacy [lm/W]**	**Efficacy [lm/W]**	**Power density [W/m²]**
Standard value	95	80	0.3
Unit 8 - Offiice	120	-	-
Unit 8 - Office - Welfare	120	-	-
Unit 8 - Circ	120	-	-
Unit 8 - WC	120	-	-
Unit 8 - Workshop	120	-	-

The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
Unit 8 - Offiice	NO (-80%)	NO
Unit 8 - Office - Welfare	NO (-67.9%)	NO
Unit 8 - Workshop	NO (-49.8%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m^2]	420.8	420.8
External area [m^2]	1867.7	1867.7
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	3	5
Average conductance [W/K]	471.54	626.49
Average U-value [W/m^2K]	0.25	0.34
Alpha value* [%]	10.15	10

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

Building Use

% Area	Building Type
	Retail/Financial and Professional Services
	Restaurants and Cafes/Drinking Establishments/Takeaways
100	**Offices and Workshop Businesses**
	General Industrial and Special Industrial Groups
	Storage or Distribution
	Hotels
	Residential Institutions: Hospitals and Care Homes
	Residential Institutions: Residential Schools
	Residential Institutions: Universities and Colleges
	Secure Residential Institutions
	Residential Spaces
	Non-residential Institutions: Community/Day Centre
	Non-residential Institutions: Libraries, Museums, and Galleries
	Non-residential Institutions: Education
	Non-residential Institutions: Primary Health Care Building
	Non-residential Institutions: Crown and County Courts
	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	13.14	20.54
Cooling	0	0
Auxiliary	1.01	1.03
Lighting	3.99	3.93
Hot water	1.76	1.67
Equipment*	21.32	21.32
TOTAL**	**19.9**	**27.17**

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

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	12.85	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
Displaced electricity	*12.85*	*0*

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	142.14	205.51
Primary energy [kWh/m^2]	11.56	41.44
Total emissions [kg/m^2]	1.34	4.04

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] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	150.7	0	13.9	0	1	3.01	0	3.2	0
	Notional	200.1	0	20	0	1.1	2.78	0	----	----
[ST] Central heating using water: convectors, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
	Actual	139.9	0	12.9	0	1	3.01	0	3.2	0
	Notional	207	0	20.7	0	1	2.78	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