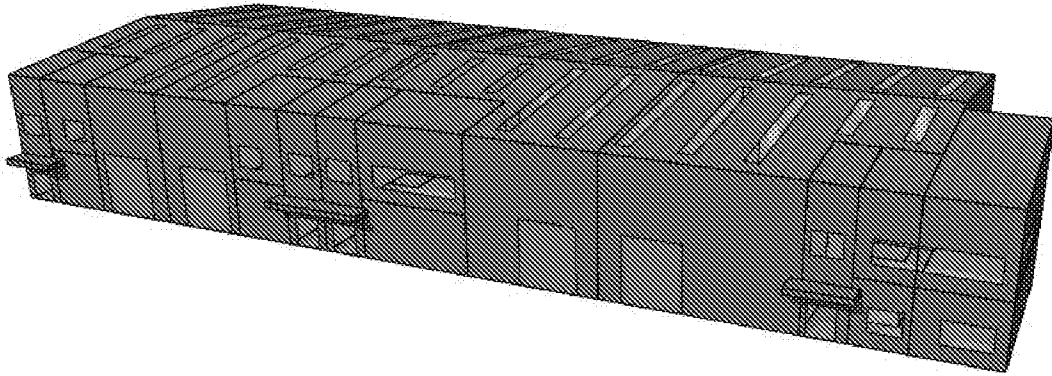




Saltbox – Unit 3
Landlink Estates



Energy Statement

May 2021

Executive Summary

This Energy Statement has been prepared to support the planning application for the proposed four no. B8 Warehouse/distribution units at Saltbox, Bognor Regis, that form part of the overall master plan.

The report aims to meet the energy and climate change requirements of the Arun Local Plan 2011 – 2031, which include Policy D DM1 Aspects of form and design quality, Policy ECC SP1 Adapting to climate change, Policy ECC SP2 Energy and climate change mitigation, and Policy ECC DM1 Renewable energy - all large developments must produce 10% of their energy from renewable and low carbon sources.

Energy Strategy

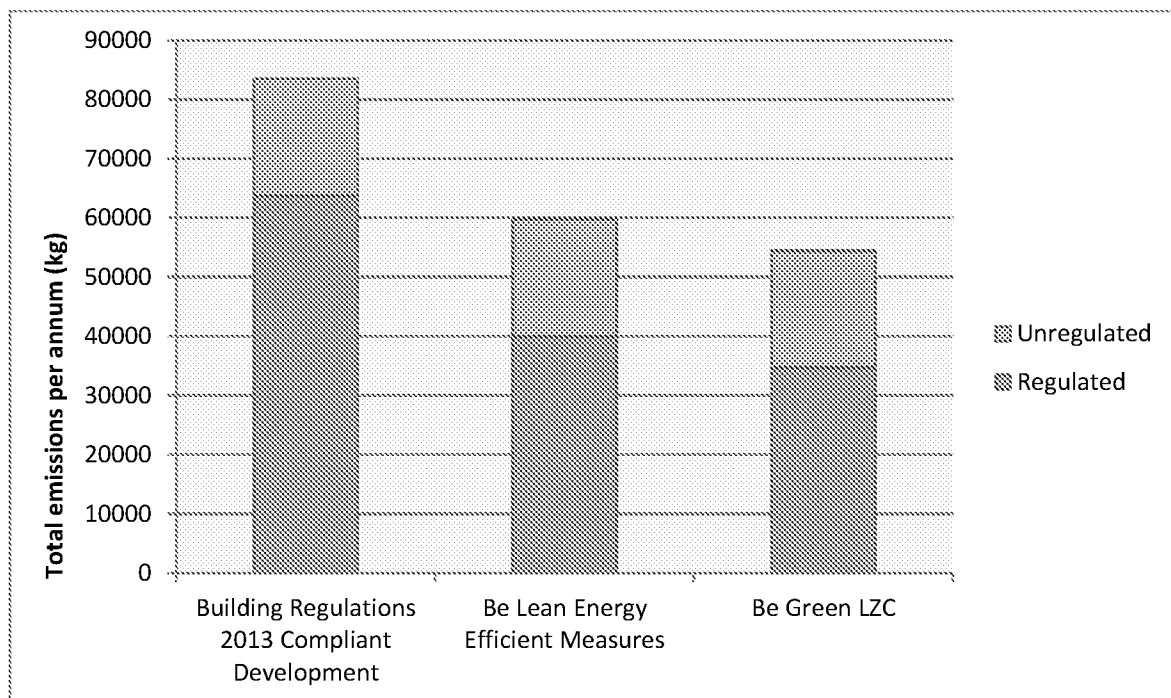
Thermal insulation levels for the development shall go beyond the building regulations' new build standards, reducing the building's heat losses.

The main office areas shall be ventilated with heat recovery, thus reducing the heating requirements of the space. High-efficiency air-source heat pumps will provide heating and cooling within the office areas of the proposed development.

The units will incorporate low-energy lighting with photoelectric dimming and presence controls to reduce energy consumption.

An extensive range of low and zero-carbon technologies have been considered in terms of providing a proportion of the development's energy demand:

- Highly efficient air source heat pumps shall condition the indoor climate (heating and cooling) within the office areas.



The Energy Hierarchy Graph



Arun Council Target	Energy (kWh/yr.)	Percentage of development energy use
Total Regulated Energy Use	66,947	-
10% Energy target from Renewables	6,694	10%
<u>Energy produced by ASHP (heating)</u>	<u>8,969</u>	<u>13.4%</u>

Development total regulated energy summary

The provision of air source heat pumps providing the space heating results in an overall reduction in CO₂ emissions for the site of approximately 43%. The total site energy produced by renewable technology equates to 13.4%, which exceeds the requirements of Policy ECC SP2.



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1.0 Introduction

1.1 Overview

This Energy Statement has been prepared to support the planning application for the proposed Unit 3 development at Saltbox, Bognor, that form part of the overall master plan. Unit 3 includes the erection of 4 no. warehouse/commercial units. The report aims to meet the energy and climate change requirements of the Arun Local Plan 2011 – 2031, which include Policy D DM1 Aspects of form and design quality, Policy ECC SP1 Adapting to climate change, Policy ECC SP2 Energy and climate change mitigation, and Policy ECC DM1 Renewable energy.

1.2 Planning Policy

Policy D DM1 Aspects of form and design quality.

Within the constraints of the site and local context, development proposals should maximise sunlight and passive solar energy. Ideally, development should be positioned (within a 15-20 degree margin) broadly south, with streets having an east-west pattern.

Policy ECC SP1 Adapting to climate change

The Council will support development, which is located and appropriately designed to adapt to impacts arising from climate change, such as the increased probability of tidal and fluvial flooding; water stress; health impacts as a result of extreme temperatures, and a decline in the quality of habitats and richness of biodiversity.

In order to achieve this, development must be designed to take account of the following issues:

*Shade, cooling, ventilation, solar gain
Connectivity to the green infrastructure network; *

Policy ECC SP2 Energy and climate change mitigation

All new residential and commercial development (including conversions, extensions, and changes of use) will be expected to be energy efficient and to demonstrate how they will:

Achieve energy efficiency measures that reflect the current standards applicable at the time of submission;

Use design and layout to promote energy efficiency; and

Incorporate decentralised, renewable, and low carbon energy supply systems, for  example, small-scale renewable energy systems such as solar panels.

All major developments must produce 10% of the total predicted energy requirements from renewable or low carbon energy generation on-site unless it can be demonstrated that this is unviable. Energy efficiency measures will be taken into consideration when the total predicted energy requirements are calculated. The Council will consider 'allowable solutions' where it is clearly demonstrated that the provision of on-site renewable or low carbon energy generation is unviable or not feasible.

Policy ECC DM1 Renewable energy.

The Council will support renewable energy development subject to the criteria in this Policy. Schemes will be expected to contribute to the social, economic, and environmental development and overall regeneration of the District.



Within areas of protected landscapes, areas, or buildings, development should generally be small-scale or community-based.

The Council will support proposals for appropriately located renewable energy development and their ancillary development where they meet the following criteria:

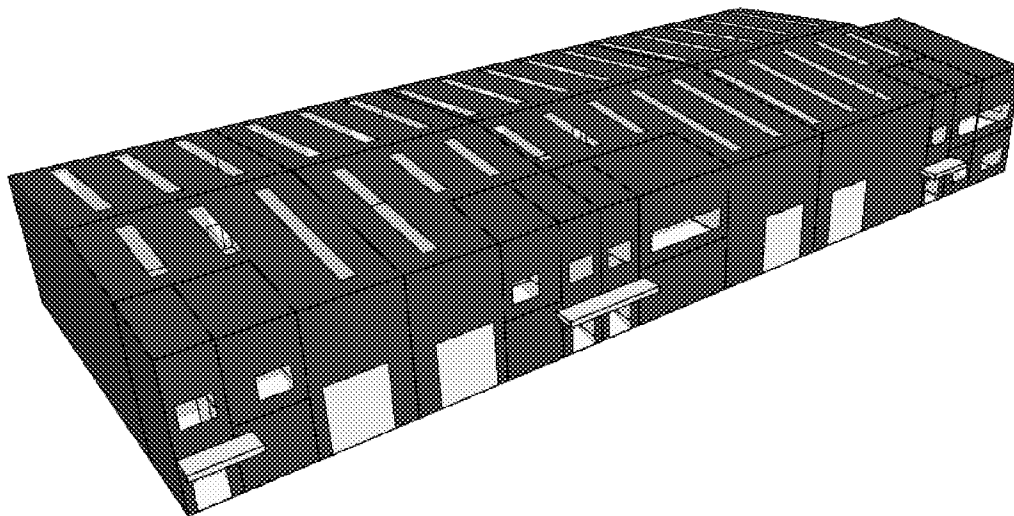
The proposal is located and designed to minimise adverse impacts to landscape, habitats, the historic environment, and residential amenity including visual, noise, and odour effects; ^[66]

The location and design of proposals will need to take account of the Council's landscape assessment and landscape sensitivity studies (or successor documents), and proposals for large scale renewable energy projects will need to be supported by a zone of theoretical visibility and viewpoint assessment; ^[66]

Priority should be given to proposals that integrate with existing or new development where appropriate to do so having regard to (a); and ^[66]

All proposals will need to demonstrate a suitable connection to the electricity distribution network or appropriate energy storage facility and provide evidence to demonstrate that the connection will not result in unacceptable impacts upon the landscape, natural and historic environment, or visual and residential amenity. ^[66]

2.0 Development Overview



2.1 IES Model of the Proposed Unit 3 development



3.0 Energy & CO₂ Emission Assessment Approach

To precisely model the dynamic nature of the building's thermal response, hourly weather data is used in the DSM process. Typically, such data will reflect records of temperature, radiation, and sunshine duration throughout the period of a year. Modelling using IES (Integrated Environmental Solutions) has been undertaken to estimate the regulated and unregulated (equipment) energy use and associated CO₂ emissions of the development.

3.1 Carbon Dioxide Emission Factors

The carbon emission factors used in this report are shown below:

Fuel	Emission Factor (kgCO ₂ /kWh)
Natural Gas	0.216
Grid Supplied Electricity	0.519
Grid Displaced Electricity	0.519

Table 3.1: Carbon dioxide emission factors



4.0 Baseline Energy Consumption

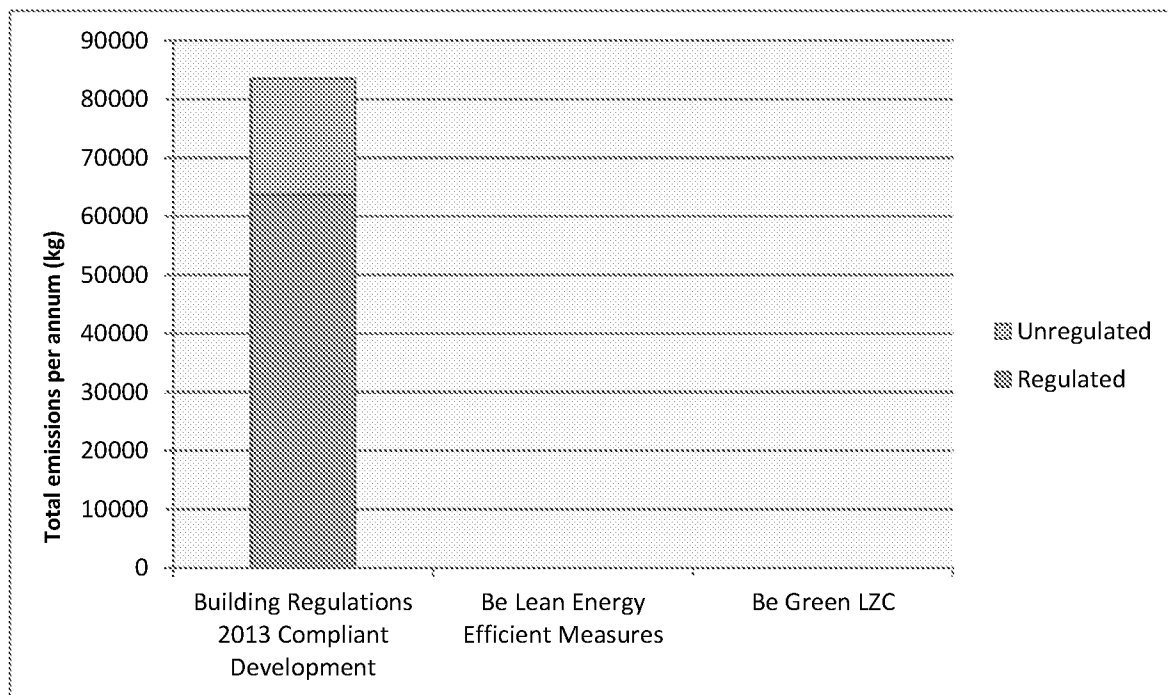
The table below illustrates the regulated CO₂ emissions for the proposed development based on compliance with L2A 2013 of the Building Regulations using Building Regulations approved compliance software by Integrated Environmental Solutions (IES). As per the relevant guidance, it has been assumed that natural gas shall fuel the heating with cooling provided by electrically powered equipment. ^[1]

Baseline: Part L 2013	Total CO ₂ Emissions (kgCO ₂ /yr)
Breakdown by Use	
Heating	12,279 KgCO ₂ /yr
Cooling	6,352 KgCO ₂ /yr
Auxiliary	3,207 KgCO ₂ /yr
Lighting	40,758 KgCO ₂ /yr
Hot Water	1,091 KgCO ₂ /yr
Unregulated	19,776 KgCO ₂ /yr

Table 4.1: Baseline Emissions

	Floor Area (m ²)	TER (kgCO ₂ /m ²)	Total Regulated CO ₂ Emissions (kgCO ₂ /yr)	Total Unregulated CO ₂ Emissions (kgCO ₂ /yr)	Total CO ₂ Emissions (kgCO ₂ /yr)
Building Regulation 2013 Compliant	2102.6	30.3	63,687	19,776	82,969

Table 4.2: Baseline Total Regulated & Unregulated CO₂ Emissions



Graph 4.1: Baseline Total Regulated & Unregulated CO₂ Emissions



5.0 Energy Strategy (Be Lean)

The proposed Unit 3 development design has been developed to minimise the annual energy consumption while providing energy in the most environmentally friendly way to reduce the annual CO₂ footprint. As the development is constructed as shell & core, the incoming occupiers shall need to satisfy the minimum requirements to ensure all planning conditions and local building regulations are met. Various energy efficient measures have been assumed to the proposal, including the following:

Building Envelope - Improving the thermal insulation standards beyond the minimum Building Regulation requirements will help to reduce the annual CO₂ emissions by limiting the heat loss through the building's fabric. The following U Values shall be incorporated together with a reduced air permeability target:

Element	Warehouse/commercial (Unit 3) Proposed U Values (W/m ² K)
Exposed Walls	0.22
Roof	0.18
Ground floor	0.20
Glazing	1.4, g value: 0.40 Roof lights: 1.3, g value: 0.51
Air permeability	5.0 m ³ /hm ² @ 50 Pa

Table 5.1: Proposed Fabric

Energy efficient Systems

A further reduction of CO₂ emissions can be achieved by including efficient mechanical and electrical systems to manage the energy used during operation. As the units are to be delivered as shell and core units, the following assumptions have been made for a consideration by the incoming occupiers and have been used in the energy assessment in order to reduce the CO₂ emissions of the development.

Ventilation

The warehouse/commercial units shall be ventilated with heat recovery, thus reducing the heating requirements of the space. The mechanical ventilation system specified shall have a specific fan power (SFP) of 1.6W/l/s and a heat recovery efficiency of 80%. This exceeds the 2013 minimum requirements set out within the non-domestic building services guide. All local extract fans shall have a proposed SFP of 0.3 W/l/s.

Low Energy Lighting

An LED lighting solution with luminous efficacies of 80-100lm/W has been applied to the units with a light output ratio of 100%. All lighting systems shall have provision for metering with a warning for out-of-range values. Photoelectric controls are also proposed within the warehouse/commercial areas with presence detection throughout.

HVAC Plant Efficiencies

An air conditioning system has been assumed for cooling to serve the associated areas with a Nominal Energy Efficiency Ratio and Seasonal Energy Efficiency Ratio of 3.91 & 4.39, respectively.



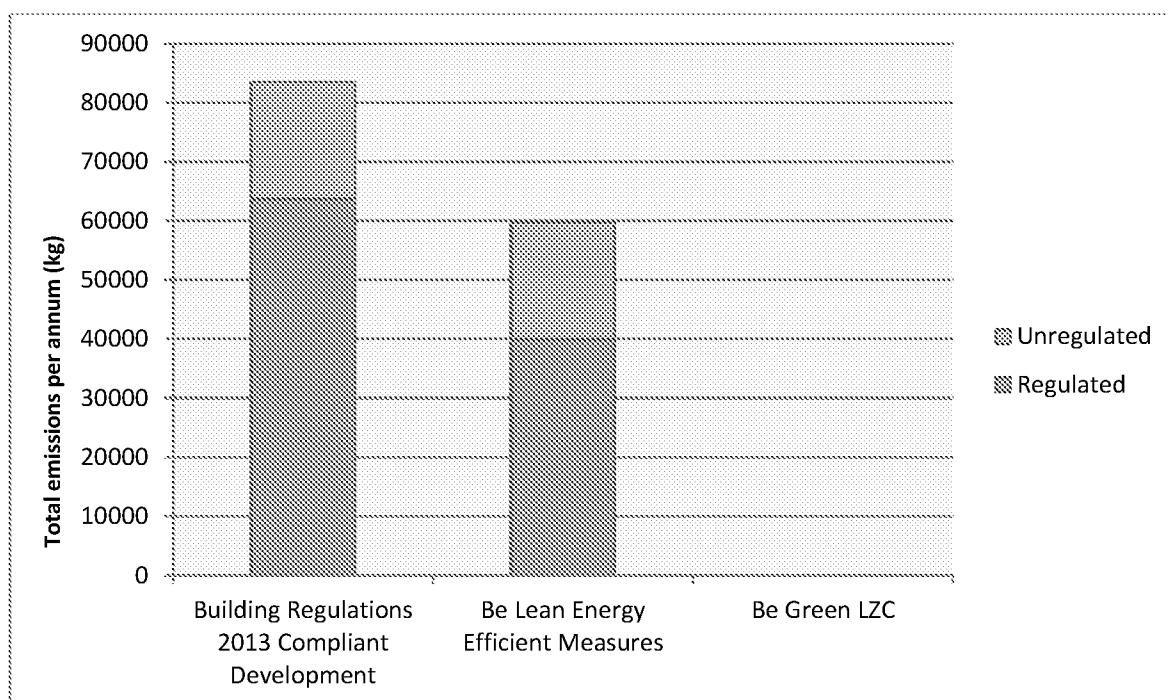
6.0 Be Lean Emissions

Baseline: Part L 2013	Total CO ₂ Emissions (kgCO ₂ /yr)	
<u>Breakdown by Use</u>		
Heating	10,768	KgCO ₂ /yr
Cooling	8,392	KgCO ₂ /yr
Auxiliary	6,927	KgCO ₂ /yr
Lighting	12,289	KgCO ₂ /yr
Hot Water	1,615	KgCO ₂ /yr
Unregulated	19,776	KgCO ₂ /yr

Table 5.2: Be Lean Emissions

	Floor Area (m ²)	BER (kgCO ₂ /m ²)	Total Regulated CO ₂ Emissions (kgCO ₂ /yr)	Total Unregulated CO ₂ Emissions (kgCO ₂ /yr)	Total CO ₂ Emissions (kgCO ₂ /yr)
Building Regulation 2013 Compliant	2102.6	30.3	63,687	19,776	82,969
After energy efficiency measures	2102.6	19	39,992	19,776	59,768

Table 5.3: Be Lean Total Regulated & Unregulated CO₂ Emissions



Graph 5.1: Be Lean Total Regulated & Unregulated CO₂ Emissions



7.0 Be Clean

7.1 Decentralised Energy Networks

An evaluation to ascertain the viability of the development to connect to a current or proposed district heating network in the area has been undertaken. It has been determined that there are no existing heat networks within the locality of the site.

7.2 Combined Heating & Power

Combined heat and power (CHP) can provide effective onsite electricity generation, with the by-product of 'waste heat' from the process being used by the Heating and DHW systems. Though CHP is commercially available, the heat profile and demand of the development are not deemed appropriate for the operation due to the seasonal nature of the space heating requirements and relatively low hot water demand and, therefore, not considered viable.



0

8.0 Energy Strategy (Be Green)

The final stage is to use renewable technologies to achieve or contribute to the achievement of CO₂ reduction targets after consumption has been reduced by applying energy efficiency measures in the previous 'be lean' and 'be clean' stages. A recommendation is made for the technologies' inclusion or exclusion at the proposed development in each case.

The following 'be green' (renewable energy) technologies have been considered for their viability for the proposed development:

- Fuel cells
- Ground source heating and cooling
- Air source heat pumps
- Biomass/biofuel heating
- Photovoltaic panels
- Solar thermal hot water heating
- Wind power
- Micro-hydro

A further detailed assessment has been carried out to determine which technologies are feasible on the site. This may be found in the appendix, with its findings summarised in this section of the energy statement.

Technology	Viability	CO ₂ reduction (tonnes)	CO ₂ reduction (%)
Fuel cells	No	N/A	N/A
Ground source heating and/or cooling	No	N/A	N/A
Air source heat pumps	Yes	5.24	13%
Biomass/biofuel heating	No	N/A	N/A
Photovoltaic panels	No	N/A	N/A
Solar thermal hot water heating	No	N/A	N/A
Wind power	No	N/A	N/A

Table 9: Renewable technology summary

The new warehouse/commercial areas shall be heated via high efficient Air Source Heat Pumps. The Seasonal Coefficient of Performance (COP) of the proposed system is 4.65. These measures result in approximately a 13% reduction in emissions compared with the 'Be Lean' stage.



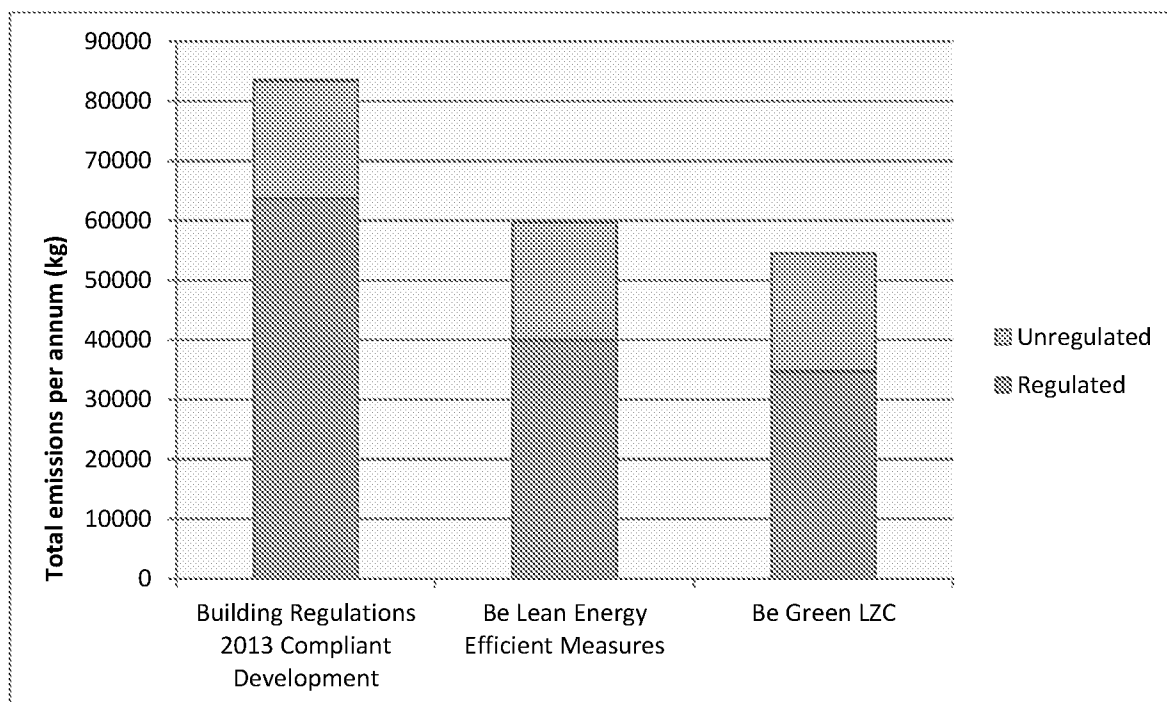
8.1 Be Green Emissions

Baseline: Part L 2013	Total CO ₂ Emissions (kgCO ₂ /yr)
Breakdown by Use	
Heating	5,524 KgCO ₂ /yr
Cooling	8,392 KgCO ₂ /yr
Auxiliary	6,927 KgCO ₂ /yr
Lighting	12,289 KgCO ₂ /yr
Hot Water	1,615 KgCO ₂ /yr
Unregulated	19,776 KgCO ₂ /yr

Table 4: Be Green Emissions

	Floor Area (m ²)	BER (kgCO ₂ /m ²)	Total Regulated CO ₂ Emissions (kgCO ₂ /yr)	Total Unregulated CO ₂ Emissions (kgCO ₂ /yr)	Total CO ₂ Emissions (kgCO ₂ /yr)
Building Regulation 2013 Compliant	2102.6	30.3	63,687	19,776	82,969
After energy efficiency measures	2102.6	19	39,992	19,776	59,768
After LZC measures	2102.6	16.5	34,693	19,776	54,469

Table 5: Be Green Total Regulated & Unregulated CO₂ Emissions



Graph 5: Be Green Total Regulated & Unregulated CO₂ Emissions



9.0 Results & Findings

The following is a summary of the carbon dioxide emissions after each stage of the Energy Hierarchy. Combining the design measures and renewable technologies results in an overall reduction in CO₂ emissions for the site of approximately 43%. The total site energy produced by renewable technology equates to 13.4%, which exceeds the requirements of Policy ECC SP2.

	Floor Area (m ²)	BER (kgCO ₂ /m ²)	Total Regulated CO ₂ Emissions (kgCO ₂ /yr)	Total Unregulated CO ₂ Emissions (kgCO ₂ /yr)	Total CO ₂ Emissions (kgCO ₂ /yr)
Building Regulation 2013 Compliant	2102.6	30.3	63,687	19,776	82,969
After energy efficiency measures	2102.6	19	39,992	19,776	59,768
After LZC measures	2102.6	16.5	34,693	19,776	54,469

Arun Council Target	Energy (kWh/yr.)	Percentage of development energy use
Total Regulated Energy Use	66,947	-
10% Energy target from Renewables	6,694	10%
<u>Energy produced by ASHP (heating)</u>	<u>8,969</u>	<u>13.4%</u>

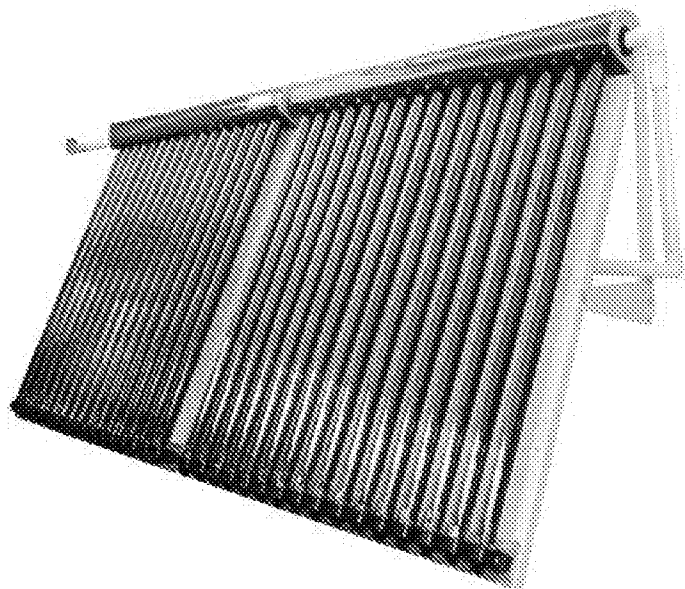
Table 13: Energy hierarchy summary



10.0 APPENDICES

10.1 APPENDIX I – Renewable Energy

Solar thermal for Domestic Hot Water



It is hypothetically possible to incorporate a Solar Heating Water system for the domestic hot water within the development; For a Domestic Hot Water (DHW) installation, solar plate collectors are widely used. Plate solar collectors have a highly transparent, virtually unbreakable polycarbonate cover, which has been treated to ensure long life. Behind this is the solar absorber, which is made of a metal sheet covered with a black chromium oxide selective layer. The solar-heated water flows through a heat exchanger, warming the water stored in the hot water cylinder. The hot water in the cylinder can then be used for domestic use as usual, with the boiler providing backup heating.

Due to the low hot water demands of Unit 3, it is considered that a solution using domestic solar hot water is not viable.

Lane use	Roof-mounted, no extra land required
Planning requirements	According to PPS 22
Noise	N/A
Energy export	N/A
Financial driver	Enhanced capital allowance



Wind turbines



Wind turbines use the current wind to produce energy/electricity. They can be used in rural or urban surroundings; however, the output rate relies on the average wind flow rate, so high-speed uninterrupted currents are the most suitable. [SEP]

The manufacturer determines a turbine's cut-in and cut-out speeds to protect the turbine from damage. The cut-in speed is the point at which the turbine starts generating electricity from turning. The cut-out point is more important, though, and signifies how fast the turbine can go before wind speeds get so fast that it risks further operation. The majority of turbines have a rated peak speed at which they'll return the optimal amount of power. Wind speeds both lower and higher than this speed are likely to produce less energy.

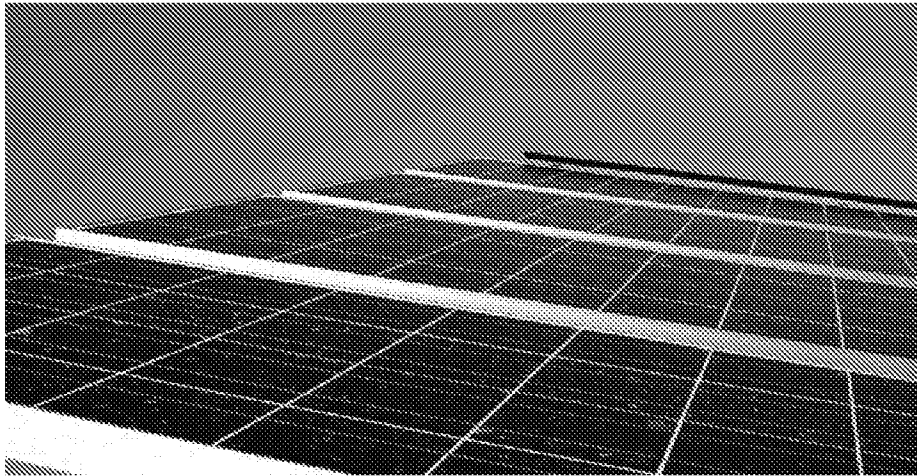
Wind speed is a measure of how rapidly the air is moving in a particular area. For the sake of ease, this is usually expressed in metres per second (m/sec). The NOABL wind speed database estimated average wind speeds at this location in the UK are 5.3 m/s at 10 metres above ground, 6.2 m/s at 25 metres above ground, and 6.6 m/s at 45 metres above the ground. [SEP]

Due to the visual impact and quantity/size of turbines required to satisfy 10% target, this technology has been deemed unfeasible.

Lane use	Roof-mounted or External to building, additional land required
Planning requirements	According to PPS 22, conservation areas, listed buildings, scheduled ancient monuments
Noise	45dbA (A) @ 5m/s per unit
Energy export	Average
Financial driver	Carbon reduction commitment / Renewable Obligation Certificates



Photovoltaic Panels



Photovoltaic (PV) cells convert the sun's light energy into electricity, which can supplement the development's energy requirements. The most common types of PV cells available are polycrystalline silicon, monocrystalline silicon, and amorphous silicon. These silicon-based cells are electrically linked to form modules assembled by laminating each cell to guard the surfaces. An inverter, which converts direct current electricity into alternating current, is wired to the PV cells to ensure the energy generated can be used on-site.

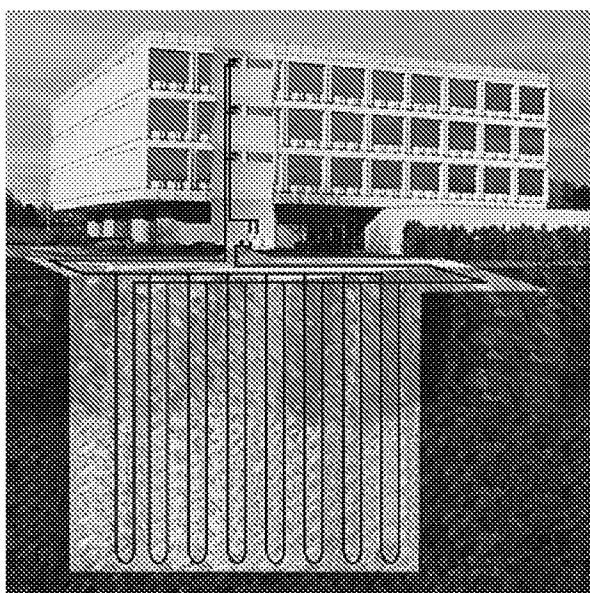
PV modules are rated by the power they generate in kilowatt-hours peak (kW_p). Monocrystalline, made using cells saw-cut from a single cylindrical crystal of silicon, is generally the most efficient panel with an efficiency of approximately 18% in good light conditions.

A suitable location is not available for using a PVS due to the nature of the building geometry and the use of roof lights that span across the entirety of the area.

Lane use	Roof-mounted, no extra land required
Planning requirements	According to PPS 22
Noise	N/A
Energy export	Minimum
Financial driver	Renewable Obligation Certificates / Feed-in tariffs



Ground Source Heat Pumps



Ground source heat pumps (GSHPs) use pipes buried in the ground to extract heat from the ground. This heat can then be used to heat for space heating, i.e., radiators, underfloor or warm air heating systems, and domestic hot water. Heat pumps impact the environment as they need electricity to run, but the heat they extract from the ground, the air, or water is constantly being renewed naturally.

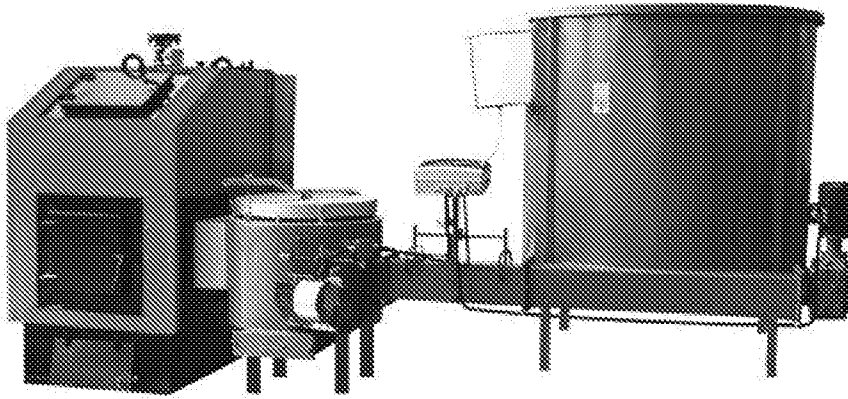
The heat from the ground is absorbed at low temperatures into a fluid inside a loop of pipe (a ground loop) buried underground. The fluid then passes through a compressor that raises it to a higher temperature, which can then heat water for the development's heating and hot water circuits. The cooled ground-loop fluid passes back into the ground, where it absorbs further energy from the ground in a continuous process as long as heating is required. Below a certain depth, the ground stays at a relatively constant temperature under the surface so that the heat pump can be used throughout the year.

The nature of the development consisting of multiple units and the more complex technology compared with ASHP has discounted GSHP as an option.

Lane use	Within a suitable plant room with boreholes external to the building, additional land required
Planning requirements	According to PPS 22
Noise	Plant room design specifications
Energy export	N/A
Financial driver	Enhanced capital allowances (ECA) / Renewable heat incentive



Biomass



Biomass fuels produce much fewer Carbon emissions of fossil fuels, making them a carbon lean technology and would significantly positively impact CO₂ reduction. Biomass fuels such as wood chips are known as new carbon, which means that when they are combusted, they release the same carbon levels that the growing plant recently consumed, meaning that the carbon levels are sustainable. Currently, the most available fuels are wood chips or pellets. The quality of biomass fuel is essential to the efficiency of a boiler. In general, the fuel stock must be of a standard size and moisture content; wood chips should have a moisture content of a maximum of 30%, which represents at least a year of air-drying, if not more.

Biomass boilers will need suitable storage and a local supplier of fuel. The storage facility should eliminate any risk of composting and should be ventilated as per building regulations.

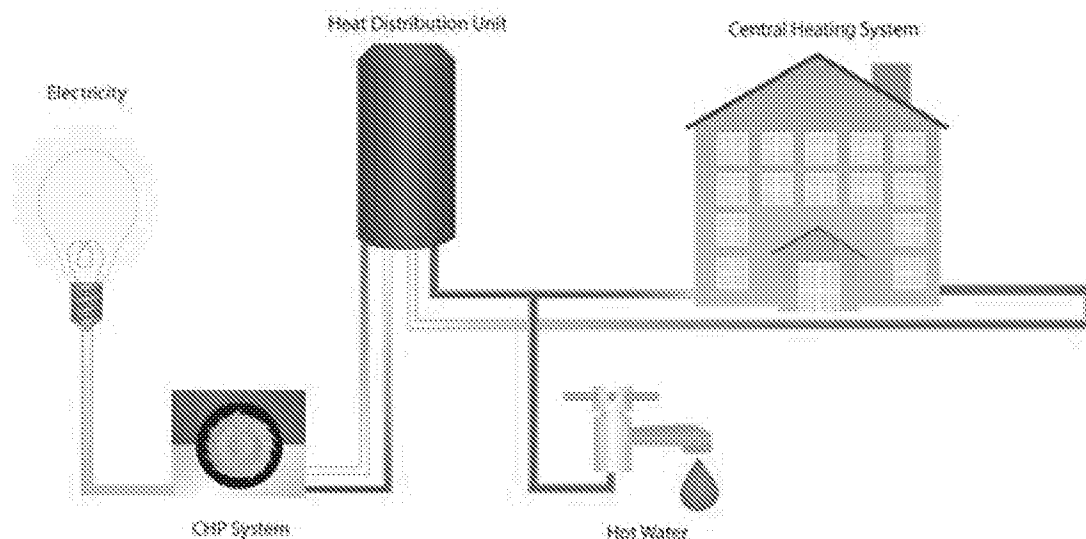
This type of technology is not deemed feasible due to the additional space required for storage and the nature of the development consisting of multiple units

Lane use	Within the plant room, extra space required for storage
Planning requirements	According to PPS 22
Noise	Plant room design specification
Energy export	N/A
Financial driver	Enhanced capital allowances (ECA) / Renewable heat incentive

Biomass



Combined Heat and Power (CHP)



Combined heat and power (CHP) can provide effective onsite electricity generation, with the by-product of 'waste heat' from the process being used by the Heating and DHW systems, which makes CHP a lot more efficient than separate utility provided electricity and on-site heat generation.

The heat profile and hot water demand of the development are not deemed appropriate for the operation of the CHP plant.

Lane use	Plant room, roof, or external – additional land required
Planning requirements	According to PPS 22
Noise	Plant room design specification
Energy export	N/A
Financial driver	Enhanced capital allowance / Renewable Obligation Certificates / Renewable heat incentive



10.2 APPENDIX II – BRUKL Output documents (Be Lean/Be Green)



Project name

Saltbox Unit 3 (Be Lean)

As designed

Date: Tue May 25 13:51:40 2021

Administrative information

Building Details

Address: Saltbox, Bognor Regis,

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.13

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.13

BRUKL compliance check version: v5.6.b.0

Certifier details

Name:

Telephone number:

Address: , ,

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

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	30.3
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	30.3
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	19
Are emissions from the building less than or equal to the target?	BER ≤ TER
Are as built details the same as used in the BER calculations?	Separate submission

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

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

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.22	0.22	G0000001:Surf[1]
Floor	0.25	0.2	0.2	G0000001:Surf[0]
Roof	0.25	0.18	0.18	G0000001:Surf[5]
Windows***, roof windows, and rooflights	2.2	1.07	1.4	G0000001:Surf[2]
Personnel doors	2.2	1.8	1.8	3G000001:Surf[12]
Vehicle access & similar large doors	1.5	1.5	1.5	3G000001:Surf[2]
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

U_a-Limit = Limiting area-weighted average U-values [W/(m²K)]U_a-Calc = Calculated area-weighted average U-values [W/(m²K)]U_i-Calc = Calculated maximum individual element U-values [W/(m²K)]

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

** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

*** Display windows and similar glazing are excluded from the U-value check.

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

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

Building services

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

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

1- ASHP (Be Lean)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	0.91	3.91	0	0	0.8
Standard value	0.91*	2.6	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.					

2- Electric Panel Heater + Extract

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.2	0	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

1- DHW

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

Local mechanical ventilation, exhaust, and terminal units

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

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		Zone	Standard
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1			
3A G0 Sales	-	-	-	1.6	-	-	-	-	-	-	-	N/A
3A G0 WC	0.3	-	-	-	-	-	-	-	-	-	-	N/A
3B G0 Sales	-	-	-	1.6	-	-	-	-	-	-	-	N/A
3B G0 WC	0.3	-	-	-	-	-	-	-	-	-	-	N/A
3C G0 Sales	-	-	-	1.6	-	-	-	-	-	-	-	N/A
3C G0 WC	0.3	-	-	-	-	-	-	-	-	-	-	N/A
3D G0 Sales	-	-	-	1.6	-	-	-	-	-	-	-	N/A
3D G0 WC	0.3	-	-	-	-	-	-	-	-	-	-	N/A

General lighting and display lighting		Luminous efficacy [lm/W]		
Zone name		Luminaire	Lamp	Display lamp
	Standard value	60	60	22
3A G0 Staircase		-	80	-
3B G0 Staircase		-	80	-
3C G0 Staircase		-	80	-
3D G0 Staircase		-	80	-
3A GM Store		80	-	-
3B GM Store		80	-	-
3C GM Store		80	-	-
3D GM Store		80	-	-
3A G0 Sales		-	100	100
3A G0 WC		-	80	-
3B G0 Sales		-	100	100
3B G0 WC		-	80	-
3C G0 Sales		-	100	100
3C G0 WC		-	80	-
3D G0 Sales		-	100	100
3D G0 WC		-	80	-
				General lighting [W]
				95
				98
				98
				92
				37
				37
				56
				102
				3679
				52
				3690
				52
				5218
				38
				5618
				38

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
3A G0 Sales	NO (-9.7%)	NO
3B G0 Sales	NO (-10.1%)	NO
3C G0 Sales	NO (-0.6%)	NO
3D G0 Sales	NO (-0.9%)	NO

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	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
Area [m ²]	2102.6	2102.6
External area [m ²]	5773.4	5773.4
Weather	SOU	SOU
Infiltration [m ³ /hm ² @ 50Pa]	5	6
Average conductance [W/K]	1692.38	1795.91
Average U-value [W/m ² K]	0.29	0.31
Alpha value* [%]	10	10

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

Building Use

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

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	22.59	26.73
Cooling	7.69	5.97
Auxiliary	6.35	3.01
Lighting	11.26	38.31
Hot water	1.48	1.63
Equipment*	18.12	18.12
TOTAL **	49.37	75.64

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

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

Energy Production by Technology [kWh/m²]

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

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	163.16	164.39
Primary energy* [kWh/m ²]	111.25	175.88
Total emissions [kg/m ²]	19	30.3

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

HVAC Systems Performance

System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	80.3	104.1	25	8.8	7.1	0.89	3.28	0.91	4.39
Notional	92.8	93.4	29.9	6.8	3.1	0.86	3.79	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity									
Actual	230.3	0	80	0	1.1	0.8	0	1	0
Notional	201.5	0	64.9	0	1.3	0.86	0	----	----
[ST] No Heating or Cooling									
Actual	0	0	0	0	0	0	0	0	0
Notional	0	0	0	0	0	0	0	----	----

Key to terms

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

Key Features

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

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.22	G0000001:Surf[1]
Floor	0.2	0.2	G0000001:Surf[0]
Roof	0.15	0.18	G0000001:Surf[5]
Windows, roof windows, and rooflights	1.5	1	3G000001:Surf[4]
Personnel doors	1.5	1.8	3G000001:Surf[12]
Vehicle access & similar large doors	1.5	1.5	3G000001:Surf[2]
High usage entrance doors	1.5	-	No High usage entrance doors in building
U _{i-Typ} = Typical individual element U-values [W/(m²K)]			U _{i-Min} = Minimum individual element U-values [W/(m²K)]
* There might be more than one surface where the minimum U-value occurs.			

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

Project name

Saltbox Unit 3 (Be Green)

As designed

Date: Tue May 25 13:32:28 2021

Administrative information

Building Details

Address: Saltbox, Bognor Regis,

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.13

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.13

BRUKL compliance check version: v5.6.b.0

Certifier details

Name:

Telephone number:

Address: , ,

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

CO ₂ emission rate from the notional building, kgCO ₂ /m ² .annum	29.1
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	29.1
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	16.5
Are emissions from the building less than or equal to the target?	BER ≤ TER
Are as built details the same as used in the BER calculations?	Separate submission

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

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

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.22	0.22	G0000001:Surf[1]
Floor	0.25	0.2	0.2	G0000001:Surf[0]
Roof	0.25	0.18	0.18	G0000001:Surf[5]
Windows***, roof windows, and rooflights	2.2	1.07	1.4	G0000001:Surf[2]
Personnel doors	2.2	1.8	1.8	3G000001:Surf[12]
Vehicle access & similar large doors	1.5	1.5	1.5	3G000001:Surf[2]
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

U_a-Limit = Limiting area-weighted average U-values [W/(m²K)]U_a-Calc = Calculated area-weighted average U-values [W/(m²K)]U_i-Calc = Calculated maximum individual element U-values [W/(m²K)]

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

** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

*** Display windows and similar glazing are excluded from the U-value check.

N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

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

Building services

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

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

1- ASHP (Be Green)

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.65	3.91	0	0	0.8
Standard value	2.5*	2.6	N/A	N/A	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.					

2- Electric Panel Heater + Extract

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0.2	0	-
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

1- DHW

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

Local mechanical ventilation, exhaust, and terminal units

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

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		Zone	Standard
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1			
3A G0 Sales	-	-	-	1.6	-	-	-	-	-	-	-	N/A
3A G0 WC	0.3	-	-	-	-	-	-	-	-	-	-	N/A
3B G0 Sales	-	-	-	1.6	-	-	-	-	-	-	-	N/A
3B G0 WC	0.3	-	-	-	-	-	-	-	-	-	-	N/A
3C G0 Sales	-	-	-	1.6	-	-	-	-	-	-	-	N/A
3C G0 WC	0.3	-	-	-	-	-	-	-	-	-	-	N/A
3D G0 Sales	-	-	-	1.6	-	-	-	-	-	-	-	N/A
3D G0 WC	0.3	-	-	-	-	-	-	-	-	-	-	N/A

General lighting and display lighting		Luminous efficacy [lm/W]		
Zone name		Luminaire	Lamp	Display lamp
	Standard value	60	60	22
3A G0 Staircase		-	80	-
3B G0 Staircase		-	80	-
3C G0 Staircase		-	80	-
3D G0 Staircase		-	80	-
3A GM Store		80	-	-
3B GM Store		80	-	-
3C GM Store		80	-	-
3D GM Store		80	-	-
3A G0 Sales		-	100	100
3A G0 WC		-	80	-
3B G0 Sales		-	100	100
3B G0 WC		-	80	-
3C G0 Sales		-	100	100
3C G0 WC		-	80	-
3D G0 Sales		-	100	100
3D G0 WC		-	80	-
				General lighting [W]
				95
				98
				98
				92
				37
				37
				56
				102
				3679
				52
				3690
				52
				5218
				38
				5618
				38

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
3A G0 Sales	NO (-9.7%)	NO
3B G0 Sales	NO (-10.1%)	NO
3C G0 Sales	NO (-0.6%)	NO
3D G0 Sales	NO (-0.9%)	NO

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	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
Area [m ²]	2102.6	2102.6
External area [m ²]	5773.4	5773.4
Weather	SOU	SOU
Infiltration [m ³ /hm ² @ 50Pa]	5	6
Average conductance [W/K]	1692.38	1795.91
Average U-value [W/m ² K]	0.29	0.31
Alpha value* [%]	10	10

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

Building Use

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

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	5.06	9.44
Cooling	7.69	5.97
Auxiliary	6.35	3.01
Lighting	11.26	38.31
Hot water	1.48	1.63
Equipment*	18.12	18.12
TOTAL **	31.84	58.35

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

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

Energy Production by Technology [kWh/m²]

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

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	163.16	164.39
Primary energy* [kWh/m ²]	97.75	170.37
Total emissions [kg/m ²]	16.5	29.1

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

HVAC Systems Performance

System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity									
Actual	80.3	104.1	4.9	8.8	7.1	4.56	3.28	4.65	4.39
Notional	92.8	93.4	10.1	6.8	3.1	2.56	3.79	----	----
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity									
Actual	230.3	0	80	0	1.1	0.8	0	1	0
Notional	201.5	0	64.9	0	1.3	0.86	0	----	----
[ST] No Heating or Cooling									
Actual	0	0	0	0	0	0	0	0	0
Notional	0	0	0	0	0	0	0	----	----

Key to terms

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

Key Features

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

Building fabric

Element	U _{i-Typ}	U _{i-Min}	Surface where the minimum value occurs*
Wall	0.23	0.22	G0000001:Surf[1]
Floor	0.2	0.2	G0000001:Surf[0]
Roof	0.15	0.18	G0000001:Surf[5]
Windows, roof windows, and rooflights	1.5	1	3G000001:Surf[4]
Personnel doors	1.5	1.8	3G000001:Surf[12]
Vehicle access & similar large doors	1.5	1.5	3G000001:Surf[2]
High usage entrance doors	1.5	-	No High usage entrance doors in building
U _{i-Typ} = Typical individual element U-values [W/(m²K)]			U _{i-Min} = Minimum individual element U-values [W/(m²K)]
* There might be more than one surface where the minimum U-value occurs.			

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