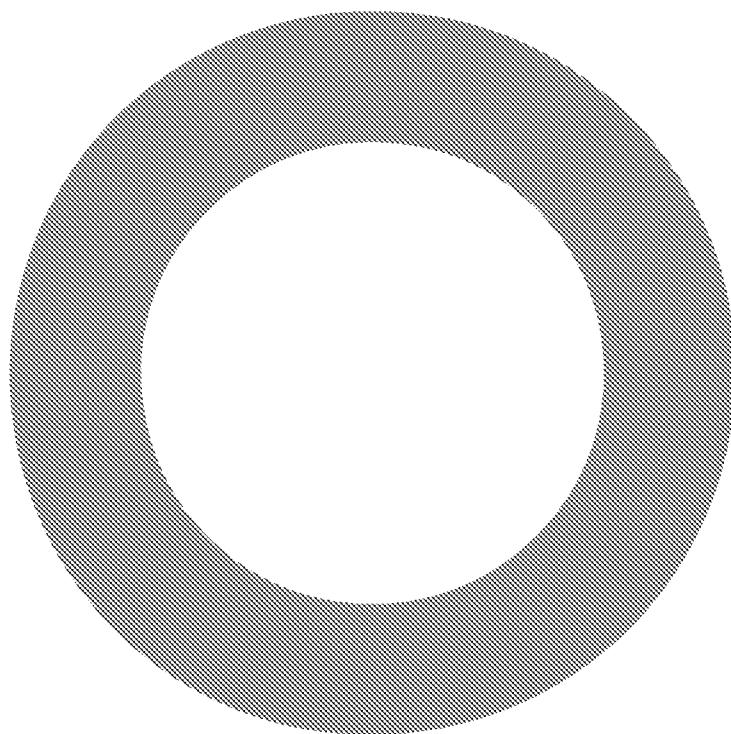


Project Cornerstone. Bognor Regis. University of Chichester.

SUSTAINABILITY
STAGE 2 - ENERGY STATEMENT

REVISION 01 - 16 MARCH 2022



Audit Sheet.

Rev.	Date	Description	Prepared	Verified	Authorised
01	16/03/2022	First issue.	GB	LH/PC	JF

This document has been prepared for The University of Chichester only and solely for the purposes expressly defined herein. We owe no duty of care to any third parties in respect of its content. Therefore, unless expressly agreed by us in signed writing, we hereby exclude all liability to third parties, including liability for negligence, save only for liabilities that cannot be so excluded by operation of applicable law. The consequences of climate change and the effects of future changes in climatic conditions cannot be accurately predicted. This report has been based solely on the specific design assumptions and criteria stated herein.

Document reference: 2324507_20220316_5A_GB_Project Cornerstone_Energy Statement Rev 01.docx

Contents.

Audit Sheet.	2
1. Introduction.	4
2. Policy Requirements, Building Regulations and Drivers.	4
2.1 Building Regulations	4
2.2 Local Planning Guidance	5
2.3 Grid decarbonisation	5
3. Energy Efficiency Measures “Be Lean”.	6
3.1 Establishing CO ₂ Emissions	6
3.2 Passive Measures	6
3.3 Active Measures	6
3.4 Mitigating Against Climate Change	6
4. Renewable Energy Generation “Be Green”.	7
4.1 Solar Water Heating Panels	7
4.2 Ground Source Heat Pumps	7
4.3 Air Source Heat Pumps	7
4.4 Biomass Boilers	7
4.5 Wind Turbines	7
4.6 Solar Photovoltaics	8
5. Results.	8
5.1 Energy Efficiency Iteration “Be Lean”	8
5.2 Renewable Energy Iteration “Be Green”	8
6. Conclusion.	9
Appendices.	10
Appendix A – BRUKL Document: Energy Efficient Scheme “Be Lean”.	10
Appendix B – BRUKL Document: Renewable Energy Scheme “Be Green”.	11
Appendix C – Roof Layout Including PV array.	12

1. Introduction.

The proposed Project Cornerstone (student residential building) at the University of Chichester is situated within the Technology Park campus in Bognor Regis.

The development includes the erection of a new student residential building comprising a mix of student bedroom/study rooms, student communal kitchen/social areas, cycle storage and associated landscaping.

The site planning boundary line (red line) and the building footprint of the Project Cornerstone development is shown in Figure 1.



Figure 1 Site Planning Boundary (red line) and Building Footprint of the Proposed Development (Credit: Architecture PLB)

This Energy Statement has been prepared in support of the Section 73 (S73) planning application submission for the proposed Project Cornerstone (student residential building) development of the University of Chichester Technology Park, hereafter referred to as the Proposed Development.

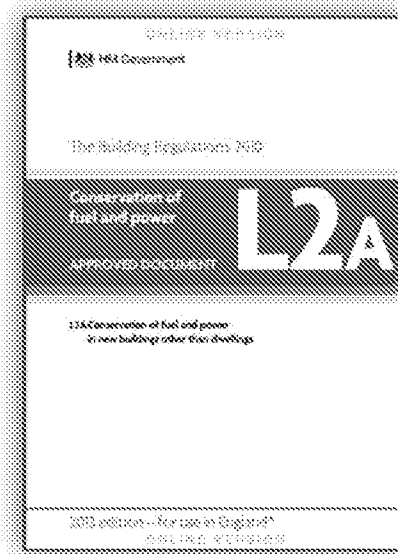
The purpose of this document is to set out the energy strategy for the Proposed Development. This document provides a summary of the key policies that are applicable to the Proposed Development and an energy strategy commensurate with the current and future building regulations as well as regional and local planning policies.

2. Policy Requirements, Building Regulations and Drivers.

The policies and regulations that are required to be satisfied are summarised as follows.

2.1 Building Regulations

Part L Conservation of Fuel and Power deals with energy efficiency requirements in the Building Regulations. New buildings will be assessed under Approved Document Part L2A (Non-Domestic) of the Building Regulations.

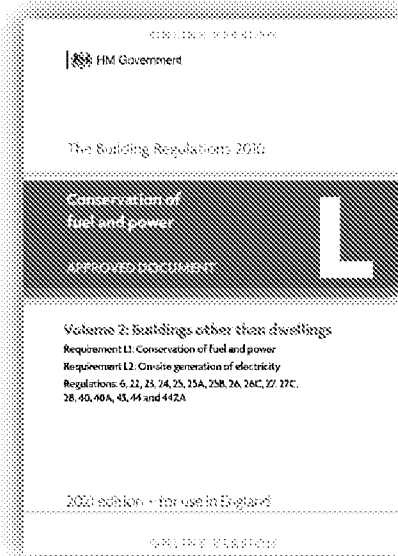


Part L2A 2013 of Building Regulations – New Non-Domestic Elements

On a national level, the current Part L2A 2013 of the Building Regulations sets the energy efficiency requirements in new non-domestic buildings.

Under Building Regulations Approved Document Part L2A: Conservation of Fuel and Power (2013 edition), compliance is achieved by demonstrating that the Building CO₂ Emission Rate (BER) does not exceed the Target CO₂ Emission Rate (TER).

In addition, Part L2A also requires that the fabric elements and the fixed building services all meet minimum energy efficiency standards (Criterion 2), and reasonable provision for limiting solar gain through the building fabric (Criterion 3).



Approved Document L, Volume 2: Buildings other than Dwellings (2021)

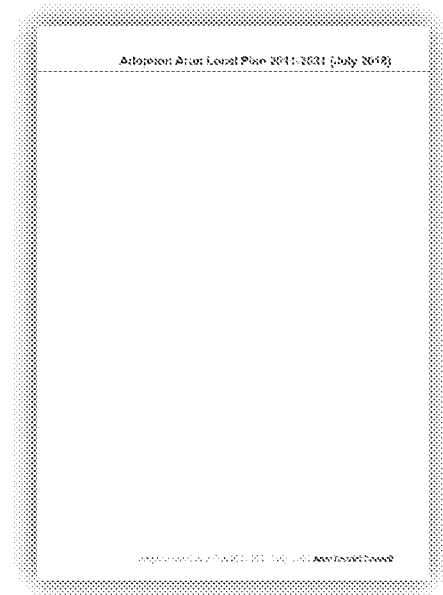
Approved Document Part L2A and the Non-Domestic Building Services Compliance guide has been replaced by Approved Document L (ADL), Volume 2: Buildings other than dwellings, which was first published on 15th December 2021.

This 2021 ADL Volume 2 (Buildings other than dwellings) will set the energy efficiency requirements in new non-domestic buildings, on a national level. In particular, new guidance on the updated CO₂ and primary energy targets for buildings other than dwellings, minimum standards for building fabric and fixed building services, as well as guidance to support the new legislation.

This 2021 ADL Volume 2 (Buildings other than dwellings) takes effect on 15 June 2022 for use in England. However, it does not apply to work subject to a building notice, full plans application or initial notice submitted before that date, provided the work for each building is started before 15 June 2023 (commencement of work).

The commencement of work would usually be marked by work such as: (1) excavation for strip or trench foundations or for pad footings; (2) digging out and preparation of ground for raft foundations; (3) vibrofloatation (stone columns) piling, boring for piles or pile driving; and (4) drainage work specific to the buildings(s) concerned.

2.2 Local Planning Guidance



Arun Local Plan 2011-2031 (July 2018)

The Local Plan sets out the vision for the future of Arun and guides development to achieve that vision.

The purpose of the Local Plan is to encourage sustainable development and manage future growth whilst ensuring that change across the District is appropriate to meet local need. It will support the strategic provision of homes, employment and shops and will look to ensure that these are carefully co-ordinated with the services and facilities that communities rely on and which are essential to wellbeing and quality of life.

The Local Plan's 'strategic policies' (where policy references are prefixed with the initials 'SP') set out the overall strategy for the Arun Local Planning Authority with regard to:

- The amount of new employment, retail and housing development that will take place in the District up to 2031;
- A strategic framework to help determine planning applications;
- The framework for neighbourhood development; and
- A statutory guide to help local communities deliver local change.

Policy ECC SP2, Energy and climate change mitigation, states that 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 (Part L 2013 as a minimum);
- 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.

2.3 Grid decarbonisation

Recent progress in the energy sector has seen emissions associated with electricity consumption reduce drastically, however this is not reflected in the current Building Regulations 2013. The carbon factor for grid-supplied electricity in the current Building Regulations (2013) is 0.519kgCO₂/kWh; as can be seen in the graph below, this is a fair reflection of the performance of the grid at that time. However, in response to legally binding targets established in line with the Paris Agreement, significant progress has been made in decarbonising the electricity grid over the past years.

At the end of 2020, the Department for Business, Energy, and Industrial Strategy (BEIS) reported the carbon factor of electricity as having fallen to 0.159kgCO₂/kWh; a 69% reduction compared to that in Part L 2013. The consequence of this is a discrepancy between emissions calculated using current building regulations methodology from electrical plant and any technologies which offset grid electricity (such as solar PV) compared to the reality of their performance. This leads to the risk that buildings could be specified with technologies with the objective of reducing CO₂ emissions which, in fact, may not offer any real benefit in practice.

The revised Building Regulations 2021 ADL Volume 2 (Buildings other than dwellings) adopted a CO₂ emissions factor of 0.136kgCO₂/kWh (SAP 10.1) and primary energy factor of 0.1501kWh_{PE}/kWh for the grid supplied electricity.

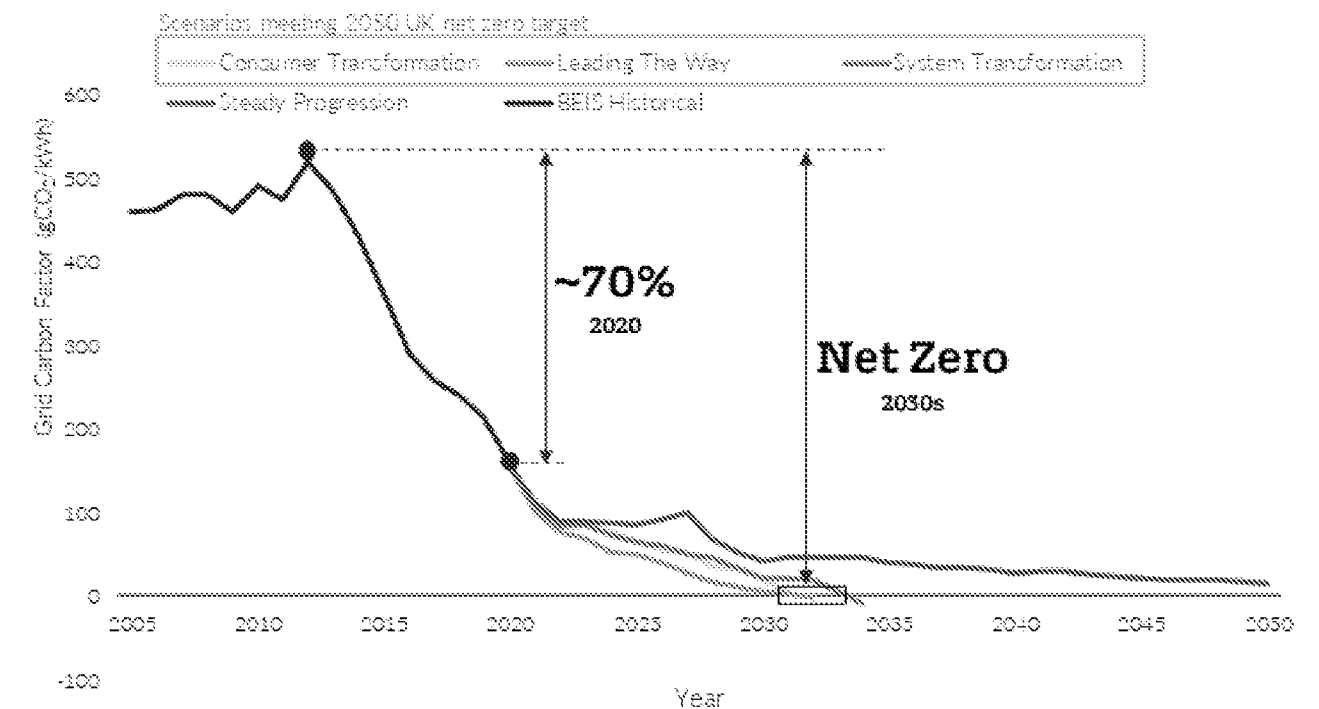


Figure 2: Historic and future projected carbon factor for the National Grid (8% transmission and distribution losses are included).

3. Energy Efficiency Measures “Be Lean”.

3.1 Establishing CO₂ Emissions

The total regulated carbon emissions at each stage of the energy hierarchy and the percentage savings in regulated emissions over Part L 2013 of the Building Regulations compliant development will be calculated for the Proposed Development.

The results in this report relate to the carbon emissions calculations based on Part L2A methodology using SAP 2012 carbon factors (current Part L 2013). However, due to the grid decarbonisation, more recent grid supplied electricity carbon factors (SAP 10 and SAP 10.1) have been adopted and reported for this energy statement.

IES VE 2019.3.2.0 using the dynamic simulation modelling (DSM) methodology was used to assess the Proposed Development.

The first step of design is to ensure that all new developments provide passive measures and energy efficient solutions. The Proposed Development is seeking to maximise the potential of the measures by the strategy outlined in the following sections.

3.2 Passive Measures

In order to reduce the energy demand of the development, the fabric of the development will be improved significantly beyond the minimum requirements of Criterion 2 of Part L2A 2013. Table 1 shows the typical envelope performance characteristics that will be incorporated into the scheme design to limit the buildings energy consumption.

Table 1 Element Parameters

Element		Value
Floor U - Value (W/m2K)		0.15
Roof U - Value (W/m2K)		0.15
External Walls U - Value (W/m2K)		0.15
Walls between heated spaces (W/m2K)		Fully filled cavity with sealed edges
Walls between corridors/stairs/lifts/risers (W/m2K)		Fully filled cavity with sealed edges
Glazing	U-value (W/m2K)	1.60
	Frame type	Metal
	G-value	0.40
	Fraction Glazed	0.90
Opaque Door/Spandrel Panel (W/m2K)		1.60
Air permeability (m3/hm2 (@ 50Pa)		3
Thermal Bridge Specification		Default

In addition, windows have been carefully designed to balance daylight, heat loss and heat gain.

3.3 Active Measures

The energy consumption will be further reduced by the incorporation of active energy efficiency measures in the design of the mechanical and electrical engineering systems. The following energy efficiency measures will be incorporated:

- Natural ventilation adopted which reduces the energy consumption of the building;
- Energy efficient mechanical extract ventilation; and
- Low energy lighting and occupancy controls.

3.4 Mitigating Against 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.

Development in the District must also be designed to mitigate against the impacts of climate change by reducing the emissions of greenhouse gas in line with the Energy Hierarchy:

- Reduce the use of energy;
- Use energy more efficiently;
- Move to energy from renewable sources; and
- Use remaining fossil fuels cleanly.

The following list shows the proposals the development will include to mitigate against the impacts of climate change:

- Heat generation will be minimised through the specification of energy efficient ventilation systems, insulation on pipework and low energy lighting.
- The amount of heat entering the building will be reduced by:
 - Energy efficient facades with appropriate proportions of glazing; and
 - A glazing shading coefficient carefully selected to minimise solar gain in the summer, but also to maximise solar gain in winter.
- Ceiling heights in the development have been maximised within the constraints of the overall building height and massing.
- Passive ventilation (openable windows) has been incorporated within the development. In addition, there will be a small amount of natural ventilation through trickle vents and infiltration.
- There will be a continuous extract from the kitchens and bathrooms in all units.
- No comfort cooling is proposed for the development.

4. Renewable Energy Generation “Be Green”.

These measures are those which serve to reduce the overall emissions of the development through the inclusion of renewable technologies such as Ground Source Heat Pump (GSHP), Air Source Heat Pumps (ASHP), Solar Photovoltaics array (PV panels), besides others.

This section addresses the requirements of Policy ECC DM1 (Renewable Energy) of The Local Plan. The supporting text states the following:

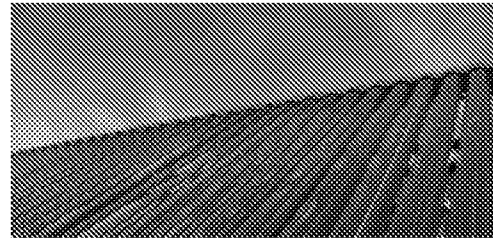
The Council will support renewable energy development subject to the criteria in this Policy. Schemes will be expected to contribute to the social, economic and environmental development and overall regeneration of the District. Within areas of protected landscapes, areas or buildings, development should generally be small scale or community based.

A number of renewable technologies have therefore been appraised in terms of technical, physical and financial feasibility as potential renewable systems for use on the project.

4.1 Solar Water Heating Panels

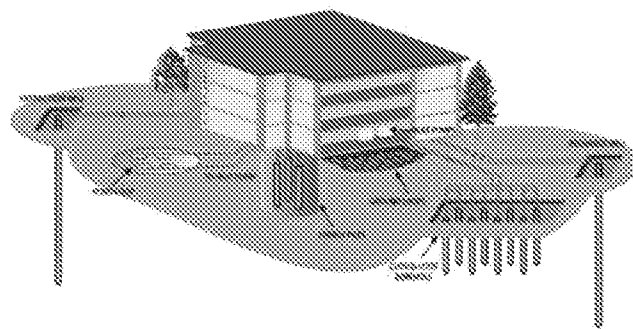
Solar water heating systems use heat from the sun to produce domestic hot water. The system requires solar panels on the roof, ideally south facing, linked to hot water storage cylinders.

There is roof area available for solar panels. However, it would be to prioritise solar PVs, since the electrical output from PV panels will be more suitable for implementation with the electrical led Energy Statement and building energy usage. Therefore, solar thermal is not proposed for the development.



4.2 Ground Source Heat Pumps

Ground source heat pumps utilise either water extracted from an aquifer (open loop) or water circulated within underground pipework (closed loop) as the heat source in a refrigeration process. This enables them to produce hot water, typically at around 45°C that can be used as means of space heating in buildings. Due to the relatively constant temperature of the ground at depth (typically 10-14°C in the UK) this produces heat more efficiently in winter than an air source heat pump, and usually with lower carbon emissions than a gas-fired boiler.

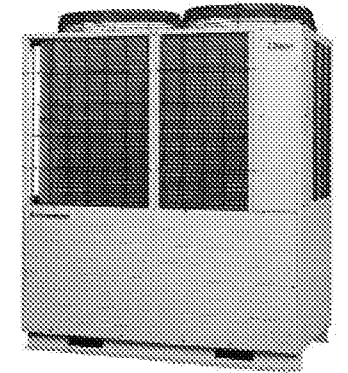


Open loop systems require the water extracted to be re-injected into the aquifer at another borehole on another part of the site. A licence from the Environment Agency (EA) is required for both abstraction and discharge although these licences cannot be obtained until a test borehole has been constructed and the appropriate EA tests undertaken.

The imbalance of heating and cooling loads (as no cooling is proposed) makes the use of GSHPs unsuitable, therefore none are proposed for this development.

4.3 Air Source Heat Pumps

Air source heat pumps (ASHP) use thermodynamic principles to convert heat from the air into useable heat within the building. Unlike some other sources of renewable energy, heat pumps do require energy (typically electricity or gas) to pump and compress refrigerant through the system. However, under the Renewable Energy Directive 2009/28/EC they are classified as renewable technologies provided that the final energy output significantly exceeds the primary energy input required to drive the heat pump. ASHP need to be located externally with access to the ambient air, typically at roof level.

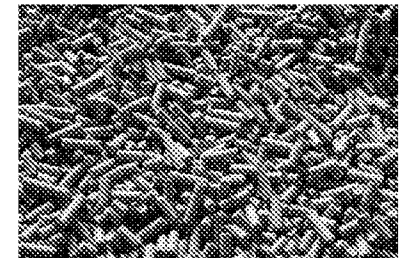


Due to grid decarbonisation and the adopted SAP10.1 carbon factors, it is expected that ASHP technology will offer significant carbon emission reductions over the gas boiler baseline scenario. ASHP plant can be located at roof level and integrated into space heating and hot water systems (albeit with some degree of ancillary top-up heating to raise water temperatures). Implementing heat-pump technology brings the additional benefit of a shift towards combustion-free development, with the associated benefit to local air quality.

Air Source Heat Pumps, in the form of a Variable Refrigerant Flow (VRF), are therefore proposed for the development as the primary heat generating technology.

4.4 Biomass Boilers

A biomass boiler uses a natural fuel such as wood chips or wood pellets for combustion. Since it uses a natural resource that can be replanted it is considered as a renewable energy source subject to the distance the fuel is transported. The carbon dioxide emitted from burning biomass is balanced by that absorbed during the fuel's production. Biomass heating therefore approaches a carbon neutral process.



The primary disadvantage of a biomass boiler is that it would require a central energy centre and heat distribution network. In addition, large storage volumes are required for fuel along with regular deliveries. Biomass exhaust gases would also require significant treatment to avoid degrading local air quality. There are concerns that the number of deliveries and large vehicle numbers would cause alarm and a hazard to residents and users of the premises.

Biomass boilers are therefore not proposed for the development.

4.5 Wind Turbines

Wind turbines use the wind's lift forces to turn aerodynamic blades that turn a rotor thus generating electricity. There are three basic types to consider: horizontal axis (propeller type), vertical access (helical type) and building integrated (where the building design is adapted to suit the wind turbine).

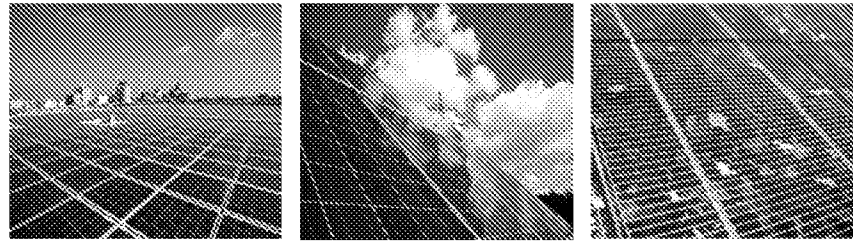
Wind turbines have a significant visual impact and the roof space will be sensitive in townscape terms, which is likely to preclude wind turbines. They can create noise and vibration problems. Additionally, there is limited roof area across the site where clean air flows and good wind speeds can be realised and which are vital to delivering a useful electrical output. Even if a suitable location could be found, the output of a wind turbine and the consequential carbon dioxide emissions will be very limited when compared to the emissions of the whole development.



Wind turbines are therefore not proposed for the development.

4.6 Solar Photovoltaics

Solar photovoltaic (PV) cells generate electricity from the sun's energy. Solid PV panels can be either roof or façade mounted (although solar modules fitted on a south facing façade have only 75% the output of roof mounted modules).



There is roof area available and a good opportunity for the deployment of solar Photovoltaic technologies for onsite electricity generation. The Proposed Development has an electrical led Energy Statement and building electricity usage. Therefore, PV panels are proposed for the development.

The Proposed Development will include 126 photovoltaic panels (approximately 200 sqm). These panels will provide approximately 40kWp of energy. This reduces the carbon output compared to the baseline scheme. The proposed roof layout can be seen in Appendix C.

5. Results.

5.1 Energy Efficiency Iteration “Be Lean”

The regulated CO₂ emissions for the energy efficient case has been compared against a Part L2A compliant development (SAP 2012 carbon factor). Figure 3 below shows that the regulated carbon dioxide emissions of the energy efficient scheme are approximately 1% below that of the baseline scheme.

The BRUKL Document for the Energy Efficient model can be found in Appendix A.

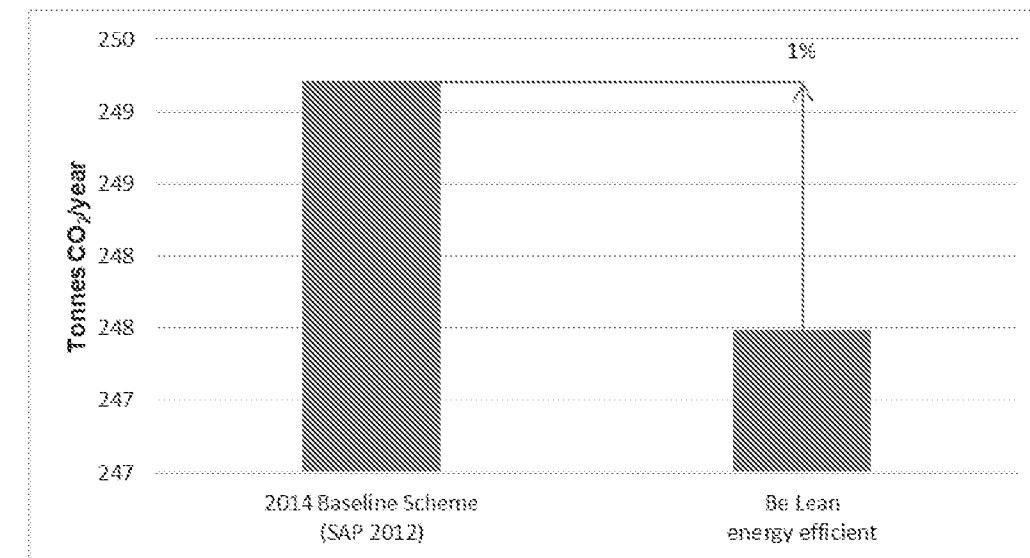


Figure 3 - Regulated Carbon Dioxide Emissions - Energy Efficient Scheme

5.2 Renewable Energy Iteration “Be Green”

Figure 4 below shows the revised estimated reduction in domestic regulated carbon dioxide emissions taking into account the contribution of the ASHPs system and PV panels is approximately 35% below the energy efficient scheme and 35% below the baseline scheme.

The BRUKL Document for the renewable energy model can be found in Appendix B.

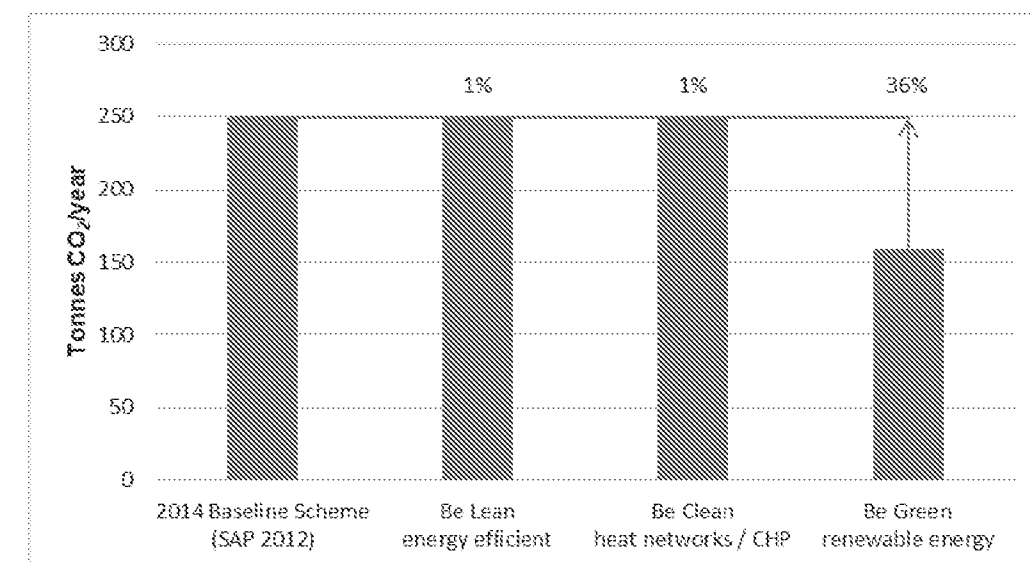


Figure 4 - Regulated Carbon Dioxide Emissions- Renewable Energy Iteration

Table 2 below summarises the carbon emission reduction using the SAP 2012 carbon factors from current Part L 2013, but also includes results using SAP 10 and SAP 10.1 carbon factors, which reflect better the decarbonisation of the electricity grid and the revised Building Regulations 2021 ADL Volume 2 (Buildings other than dwellings).

Table 2 - CO₂ Emissions Summary Results Including Different Carbon Factors at Renewable Energy Iteration "Be Green".

Building's CO ₂ emissions pass rates		
Part L 2013 (SAP 2012 Carbon Factors)	Part L 2013 (SAP 10 Carbon Factors)	Part L 2013 (SAP 10.1 Carbon Factors)
Pass by 36%	Pass by 67%	Pass by 82%

6. Conclusion.

An energy assessment has been carried out to show compliance with local policy.

The assessment showed that a reduction in carbon emissions of 36% over a Part L 2013 compliant development (SAP 2012) can be achieved. In addition, reduction in carbon emissions using more recent carbon factors (SAP 10 and SAP 10.1) have been provided, which reflects better the decarbonisation of the electricity grid and the revised Building Regulations 2021 ADL Volume 2 (Buildings other than dwellings).

Table 3 below includes for the reduction in carbon emissions summary results using the different carbon factors.

Table 3 - CO₂ Emissions Summary Results Including Different Carbon Factors at Renewable Energy Iteration "Be Green".

Building's CO ₂ emissions pass rates		
Part L 2013 (SAP 2012 Carbon Factors)	Part L 2013 (SAP 10 Carbon Factors)	Part L 2013 (SAP 10.1 Carbon Factors)
Pass by 36%	Pass by 67%	Pass by 82%

This reduction in carbon dioxide emissions will be achieved through the incorporation of passive and active energy efficiency measures and is in line with Arun's local plan requirements.

Further to this, in response to Policy ECC SP2, 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. Table 4 below shows the total predicted energy consumption for both the energy efficient scheme (without ASHPs and PV array) and the renewable energy scheme (with ASHPs and PV array). From this table it can be seen that the percentage requirement from renewables is 32.14% for regulated energy consumption, while the unregulated energy consumption remains the same.

Table 4 - Regulated and unregulated total predicted energy consumption

	Regulated (kWh/m ²)	Unregulated (kWh/m ²)
Total Predicted Energy Consumption (TPEC) (Energy Efficient Iteration)	183.18	24.12
Total Predicted Energy Consumption (Renewable Iteration)	58.88	24.12
Change in TPEC	124.30	-
Percentage of the total predicted energy requirements from renewable or low carbon energy generation on site	32.14%	-

The development is achieving 32.14% of regulated energy from renewable sources. However, in practice this is likely to be much higher as the Part L compliance thermal modelling uses a set occupancy and hot water profile for student residential buildings (NCM profiles). This gives an artificially high hot water demand, and with the inclusion of low water demand sanitary fittings and a more accurate occupancy profile, the total hot water demand will be less than 50% of that calculated by the Part L compliance modelling software.

Appendices.

Appendix A – BRUKL Document: Energy Efficient Scheme “Be Lean”.

BRUKL Output Document

HM Government
Compliance with England Building Regulations Part L 2013

Project name

Project Cornerstone - Be Lean As designed

Date: Wed Mar 16 12:16:48 2022

Administrative information

Building Details

Address: Bognor Regis, PO21 1HR

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: HL

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	43.4
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	43.4
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	43.1
Are emissions from the building less than or equal to the target?	BER ≤ TER
Are as built details the same as used in the BER calculations?	Separate submission

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

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

Building fabric

Element	U _a -Limit	U _a -Calc	U _i -Calc	Surface where the maximum value occurs*
Wall**	0.35	0.19	1.6	L0000044:Surf[1]
Floor	0.25	-	-	UNKNOWN
Roof	0.25	0.15	0.15	L0000044:Surf[3]
Windows***, roof windows, and rooflights	2.2	1.6	1.6	L0000044:Surf[0]
Personnel doors	2.2	-	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

U_a-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	3

Building services

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

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	0.9 to 0.95

1- HVAC 1-ASHP_NV

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

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

2- HVAC 3-ASHP_EV_WC

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

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

3- HVAC 2-ASHP_EV_KITCHEN

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

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

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

Local mechanical ventilation, exhaust, and terminal units

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

Zone name	SFP [W/(l/s)]										HR efficiency	
	ID of system type	A	B	C	D	E	F	G	H	I	Zone	Standard
	Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1		
L04-F1-Living/Kitchen		-	-	-	-	-	-	-	-	0.6	-	N/A
L04-F2-Living/Kitchen		-	-	-	-	-	-	-	-	0.6	-	N/A
L04-F3-Living/Kitchen		-	-	-	-	-	-	-	-	0.6	-	N/A

Zone name	SFP [W/(l/s)]										HR efficiency	
	ID of system type	A	B	C	D	E	F	G	H	I	Zone	Standard
L04-F4-Living/Kitchen	Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	-	N/A

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
L04-Lift Lobby	-	-	110	-	81
L04-F1-Bath 1	-	-	110	-	15
L04-F1-Bath 2	-	-	110	-	15
L04-F1-Bath 3	-	-	110	-	15
L04-F1-Bath 4	-	-	110	-	15
L04-F1-Bath 5	-	-	110	-	15
L04-F1-Bath 6	-	-	110	-	15
L04-F1-Bath 7	-	-	110	-	15
L04-F1-Bath 8	-	-	110	-	15
L04-F1-Bath 9	-	-	110	-	15
L04-F1-Bed 1	-	-	110	-	26
L04-F1-Bed 2	-	-	110	-	26
L04-F1-Bed 3	-	-	110	-	26
L04-F1-Bed 4	-	-	110	-	26
L04-F1-Bed 5	-	-	110	-	26
L04-F1-Bed 6	-	-	110	-	26
L04-F1-Bed 7	-	-	110	-	26
L04-F1-Bed 8	-	-	110	-	26
L04-F1-Bed 9	-	-	110	-	26
L04-F1-Circulation 1	-	-	110	-	40
L04-F1-Circulation 2	-	-	110	-	54
L04-F1-Living/Kitchen	-	-	110	-	248
L04-F2-Bath 2	-	-	110	-	15
L04-F2-Bath 3	-	-	110	-	15
L04-F2-Bath 4	-	-	110	-	15
L04-F2-Bath 5	-	-	110	-	15
L04-F2-Bed 2	-	-	110	-	26
L04-F2-Bed 3	-	-	110	-	26
L04-F2-Bed 4	-	-	110	-	26
L04-F2-Bed 5	-	-	110	-	26
L04-F2-Living/Kitchen	-	-	110	-	299
L04-F3-Bath 2	-	-	110	-	15
L04-F3-Bath 3	-	-	110	-	15
L04-F3-Bath 4	-	-	110	-	15
L04-F3-Bath 5	-	-	110	-	15
L04-F3-Bath 6	-	-	110	-	15
L04-F3-Bath 7	-	-	110	-	15
L04-F3-Bed 2	-	-	110	-	26

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
L04-F3-Bed 3	-	-	110	-	26
L04-F3-Bed 4	-	-	110	-	26
L04-F3-Bed 5	-	-	110	-	26
L04-F3-Bed 6	-	-	110	-	26
L04-F3-Bed 7	-	-	110	-	26
L04-F3-Living/Kitchen	-	-	110	-	307
L04-F4-Circulation 1	-	-	110	-	38
L04-F4-Circulation 2	-	-	110	-	44
L04-F4-Living/Kitchen	-	-	110	-	244
L04-Stairs 1	-	-	90	-	33
L04-Stairs 2	-	-	90	-	36
L04-Stairs 3	-	-	90	-	33
L04-Lobby 1	-	-	110	-	16
L04-F2-Circulation 1	-	-	110	-	31
L04-F2-Acc Bath 1	-	-	110	-	21
L04-F2-Acc Bed 1	-	-	110	-	41
L04-Lobby 2	-	-	110	-	16
L04-F3-Acc Bed 1	-	-	110	-	41
L04-F3-Acc Bath 1	-	-	110	-	21
L04-F3-Circulation 1	-	-	110	-	49
L04-F4-Bed 1	-	-	110	-	27
L04-F4-Bath 1	-	-	110	-	16
L04-F4-Bath 2	-	-	110	-	15
L04-F4-Bed 2	-	-	110	-	26
L04-F4-Bed 3	-	-	110	-	26
L04-F4-Bath 3	-	-	110	-	15
L04-F4-Bath 4	-	-	110	-	15
L04-F4-Bed 4	-	-	110	-	26
L04-F4-Bed 5	-	-	110	-	26
L04-F4-Bath 5	-	-	110	-	15
L04-F4-Bath 6	-	-	110	-	15
L04-F4-Bed 6	-	-	110	-	26
L04-F4-Bed 7	-	-	110	-	26
L04-F4-Bath 7	-	-	110	-	15
L04-F4-Bath 8	-	-	110	-	15
L04-F4-Bed 8	-	-	110	-	26
L04-F3-Circulation 2	-	-	110	-	45
L04-F3-Bed 9	-	-	110	-	26
L04-F3-Bath 9	-	-	110	-	15
L04-F3-Bed 8	-	-	110	-	26
L04-F3-Bath 8	-	-	110	-	15
L04-F2-Circulation 2	-	-	110	-	59
L04-F2-Bed 7	-	-	110	-	10

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name	Standard value	Luminaire	Lamp	Display lamp	
L04-F2-Bed 7		60	60	22	
L04-F2-Bed 6		-	110	-	26
L04-F2-Bed 6		-	110	-	26
L04-F2-Bed 6		-	110	-	10

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?
L04-F1-Bed 1	NO (-65.4%)	NO
L04-F1-Bed 2	NO (-65.4%)	NO
L04-F1-Bed 3	NO (-64.8%)	NO
L04-F1-Bed 4	NO (-65.4%)	NO
L04-F1-Bed 5	NO (-64.8%)	NO
L04-F1-Bed 6	NO (-65.4%)	NO
L04-F1-Bed 7	NO (-64.8%)	NO
L04-F1-Bed 8	NO (-65.4%)	NO
L04-F1-Bed 9	NO (-65.4%)	NO
L04-F2-Bed 2	NO (-48.9%)	NO
L04-F2-Bed 3	NO (-48.1%)	NO
L04-F2-Bed 4	NO (-48.1%)	NO
L04-F2-Bed 5	NO (-48.3%)	NO
L04-F3-Bed 2	NO (-50.2%)	NO
L04-F3-Bed 3	NO (-48.9%)	NO
L04-F3-Bed 4	NO (-49.7%)	NO
L04-F3-Bed 5	NO (-49.8%)	NO
L04-F3-Bed 6	NO (-50%)	NO
L04-F3-Bed 7	NO (-49.4%)	NO
L04-F2-Acc Bed 1	NO (-65.7%)	NO
L04-F3-Acc Bed 1	NO (-67%)	NO
L04-F4-Bed 1	NO (-49.1%)	NO
L04-F4-Bed 2	NO (-48.2%)	NO
L04-F4-Bed 3	NO (-48.2%)	NO
L04-F4-Bed 4	NO (-48.1%)	NO
L04-F4-Bed 5	NO (-48.2%)	NO
L04-F4-Bed 6	NO (-48.2%)	NO
L04-F4-Bed 7	NO (-47.9%)	NO
L04-F4-Bed 8	NO (-48.1%)	NO
L04-F3-Bed 9	NO (-48.3%)	NO
L04-F3-Bed 8	NO (-48.6%)	NO
L04-F2-Bed 7	N/A	N/A
L04-F2-Bed 7	NO (-49.4%)	NO
L04-F2-Bed 6	NO (-49.2%)	NO
L04-F2-Bed 6	N/A	N/A

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters			Building Use
	Actual	Notional	% Area Building type
Area [m ²]	1021.5	1021.5	A1/A2 Retail/Financial and Professional services
External area [m ²]	998.1	1077.2	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
Weather	SOU	SOU	B1 Offices and Workshop businesses
Infiltration [m ³ /hm ² @ 50Pa]	3	3	B2 to B7 General Industrial and Special Industrial Groups
Average conductance [W/K]	386.14	512.22	B8 Storage or Distribution
Average U-value [W/m ² K]	0.39	0.48	C1 Hotels
Alpha value* [%]	10.02	10	C2 Residential Institutions: Hospitals and Care Homes
			C2 Residential Institutions: Residential schools
			100 C2 Residential Institutions: Universities and colleges
			C2A Secure Residential Institutions
			Residential spaces
			D1 Non-residential Institutions: Community/Day Centres
			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	52.59	59.57
Cooling	0	0
Auxiliary	3.69	2.42
Lighting	8.06	13.3
Hot water	118.84	104.47
Equipment*	24.12	24.12
TOTAL**	183.17	179.75

* 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]	161.83	184.87
Primary energy* [kWh/m ²]	244.84	247.17
Total emissions [kg/m ²]	43.1	43.4

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

HVAC Systems Performance

System Type	Heat dem MJ/m ²	Cool dem MJ/m ²	Heat con kWh/m ²	Cool con kWh/m ²	Aux con kWh/m ²	Heat SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	132.8	0	43.2	0	1.4	0.85	0	0.91	0
Notional	152.9	0	49.3	0	1.4	0.86	0	---	---
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	12.5	0	4.1	0	4.4	0.85	0	0.91	0
Notional	15.6	0	5	0	4.4	0.86	0	---	---
[ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity									
Actual	896.3	0	291.3	0	8.5	0.85	0	0.91	0
Notional	1015.7	0	327.3	0	10.5	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/m ²]	= Heating energy demand
Cool dem [MJ/m ²]	= Cooling energy demand
Heat con [kWh/m ²]	= Heating energy consumption
Cool con [kWh/m ²]	= Cooling energy consumption
Aux con [kWh/m ²]	= 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 _{typ}	U _{min}	Surface where the minimum value occurs*
Wall	0.23	0.06	L0000044:Surf[8]
Floor	0.2	-	UNKNOWN
Roof	0.15	0.15	L0000044:Surf[3]
Windows, roof windows, and rooflights	1.5	1.6	L0000044:Surf[0]
Personnel doors	1.5	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	-	No High usage entrance doors in building
U _{typ} = Typical individual element U-values [W/(m²K)]			U _{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	3

Appendix B – BRUKL Document: Renewable Energy Scheme “Be Green”.

BRUKL Output Document

HM Government
Compliance with England Building Regulations Part L 2013

Project name

Project Cornerstone - Be Green As designed

Date: Wed Mar 16 12:06:59 2022

Administrative information

Building Details

Address: Bognor Regis, PO21 1HR

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: HL

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	35.9
Target CO ₂ emission rate (TER), kgCO ₂ /m ² .annum	35.9
Building CO ₂ emission rate (BER), kgCO ₂ /m ² .annum	27.6
Are emissions from the building less than or equal to the target?	BER ≤ TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and 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	0.19	1.6	L0000044:Surf[1]
Floor	0.25	-	-	UNKNOWN
Roof	0.25	0.15	0.15	L0000044:Surf[3]
Windows***, roof windows, and rooflights	2.2	1.6	1.6	L0000044:Surf[0]
Personnel doors	2.2	-	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	-	No Vehicle access doors in building
High usage entrance doors	3.5	-	-	No High usage entrance doors in building

U_{a-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	3

Building services

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

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	0.9 to 0.95

1- HVAC 1- ASHP_NV

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.31	-	0	0	-
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. For types <=12 kW output, refer to EN 14825 for limiting standards.					

2- HVAC 3- ASHP_EV_WC

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.31	-	0	0	-
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. For types <=12 kW output, refer to EN 14825 for limiting standards.					

3- HVAC 2- ASHP_EV_KITCHEN

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.31	-	0	0	-
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. For types <=12 kW output, refer to EN 14825 for limiting standards.					

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

Local mechanical ventilation, exhaust, and terminal units

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

Zone name	SFP [W/(l/s)]										HR efficiency	
	ID of system type	A	B	C	D	E	F	G	H	I		
Standard value		0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
L04-F1-Living/Kitchen		-	-	-	-	-	-	-	-	0.6	-	N/A
L04-F2-Living/Kitchen		-	-	-	-	-	-	-	-	0.6	-	N/A
L04-F3-Living/Kitchen		-	-	-	-	-	-	-	-	0.6	-	N/A

Zone name	SFP [W/(l/s)]										HR efficiency	
	ID of system type	A	B	C	D	E	F	G	H	I	Zone	Standard
L04-F4-Living/Kitchen	Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	-	N/A

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
L04-Lift Lobby	-	-	110	-	81
L04-F1-Bath 1	-	-	110	-	15
L04-F1-Bath 2	-	-	110	-	15
L04-F1-Bath 3	-	-	110	-	15
L04-F1-Bath 4	-	-	110	-	15
L04-F1-Bath 5	-	-	110	-	15
L04-F1-Bath 6	-	-	110	-	15
L04-F1-Bath 7	-	-	110	-	15
L04-F1-Bath 8	-	-	110	-	15
L04-F1-Bath 9	-	-	110	-	15
L04-F1-Bed 1	-	-	110	-	26
L04-F1-Bed 2	-	-	110	-	26
L04-F1-Bed 3	-	-	110	-	26
L04-F1-Bed 4	-	-	110	-	26
L04-F1-Bed 5	-	-	110	-	26
L04-F1-Bed 6	-	-	110	-	26
L04-F1-Bed 7	-	-	110	-	26
L04-F1-Bed 8	-	-	110	-	26
L04-F1-Bed 9	-	-	110	-	26
L04-F1-Circulation 1	-	-	110	-	40
L04-F1-Circulation 2	-	-	110	-	54
L04-F1-Living/Kitchen	-	-	110	-	248
L04-F2-Bath 2	-	-	110	-	15
L04-F2-Bath 3	-	-	110	-	15
L04-F2-Bath 4	-	-	110	-	15
L04-F2-Bath 5	-	-	110	-	15
L04-F2-Bed 2	-	-	110	-	26
L04-F2-Bed 3	-	-	110	-	26
L04-F2-Bed 4	-	-	110	-	26
L04-F2-Bed 5	-	-	110	-	26
L04-F2-Living/Kitchen	-	-	110	-	299
L04-F3-Bath 2	-	-	110	-	15
L04-F3-Bath 3	-	-	110	-	15
L04-F3-Bath 4	-	-	110	-	15
L04-F3-Bath 5	-	-	110	-	15
L04-F3-Bath 6	-	-	110	-	15
L04-F3-Bath 7	-	-	110	-	15
L04-F3-Bed 2	-	-	110	-	26

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name		Luminaire	Lamp	Display lamp	
	Standard value	60	60	22	
L04-F3-Bed 3	-	-	110	-	26
L04-F3-Bed 4	-	-	110	-	26
L04-F3-Bed 5	-	-	110	-	26
L04-F3-Bed 6	-	-	110	-	26
L04-F3-Bed 7	-	-	110	-	26
L04-F3-Living/Kitchen	-	-	110	-	307
L04-F4-Circulation 1	-	-	110	-	38
L04-F4-Circulation 2	-	-	110	-	44
L04-F4-Living/Kitchen	-	-	110	-	244
L04-Stairs 1	-	-	90	-	33
L04-Stairs 2	-	-	90	-	36
L04-Stairs 3	-	-	90	-	33
L04-Lobby 1	-	-	110	-	16
L04-F2-Circulation 1	-	-	110	-	31
L04-F2-Acc Bath 1	-	-	110	-	21
L04-F2-Acc Bed 1	-	-	110	-	41
L04-Lobby 2	-	-	110	-	16
L04-F3-Acc Bed 1	-	-	110	-	41
L04-F3-Acc Bath 1	-	-	110	-	21
L04-F3-Circulation 1	-	-	110	-	49
L04-F4-Bed 1	-	-	110	-	27
L04-F4-Bath 1	-	-	110	-	16
L04-F4-Bath 2	-	-	110	-	15
L04-F4-Bed 2	-	-	110	-	26
L04-F4-Bed 3	-	-	110	-	26
L04-F4-Bath 3	-	-	110	-	15
L04-F4-Bath 4	-	-	110	-	15
L04-F4-Bed 4	-	-	110	-	26
L04-F4-Bed 5	-	-	110	-	26
L04-F4-Bath 5	-	-	110	-	15
L04-F4-Bath 6	-	-	110	-	15
L04-F4-Bed 6	-	-	110	-	26
L04-F4-Bed 7	-	-	110	-	26
L04-F4-Bath 7	-	-	110	-	15
L04-F4-Bath 8	-	-	110	-	15
L04-F4-Bed 8	-	-	110	-	26
L04-F3-Circulation 2	-	-	110	-	45
L04-F3-Bed 9	-	-	110	-	26
L04-F3-Bath 9	-	-	110	-	15
L04-F3-Bed 8	-	-	110	-	26
L04-F3-Bath 8	-	-	110	-	15
L04-F2-Circulation 2	-	-	110	-	59
L04-F2-Bed 7	-	-	110	-	10

General lighting and display lighting		Luminous efficacy [lm/W]			General lighting [W]
Zone name	Standard value	Luminaire	Lamp	Display lamp	
L04-F2-Bed 7		60	60	22	
L04-F2-Bed 6		-	110	-	26
L04-F2-Bed 6		-	110	-	26
L04-F2-Bed 6		-	110	-	10

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?
L04-F1-Bed 1	NO (-65.4%)	NO
L04-F1-Bed 2	NO (-65.4%)	NO
L04-F1-Bed 3	NO (-64.8%)	NO
L04-F1-Bed 4	NO (-65.4%)	NO
L04-F1-Bed 5	NO (-64.8%)	NO
L04-F1-Bed 6	NO (-65.4%)	NO
L04-F1-Bed 7	NO (-64.8%)	NO
L04-F1-Bed 8	NO (-65.4%)	NO
L04-F1-Bed 9	NO (-65.4%)	NO
L04-F2-Bed 2	NO (-48.9%)	NO
L04-F2-Bed 3	NO (-48.1%)	NO
L04-F2-Bed 4	NO (-48.1%)	NO
L04-F2-Bed 5	NO (-48.3%)	NO
L04-F3-Bed 2	NO (-50.2%)	NO
L04-F3-Bed 3	NO (-48.9%)	NO
L04-F3-Bed 4	NO (-49.7%)	NO
L04-F3-Bed 5	NO (-49.8%)	NO
L04-F3-Bed 6	NO (-50%)	NO
L04-F3-Bed 7	NO (-49.4%)	NO
L04-F2-Acc Bed 1	NO (-65.7%)	NO
L04-F3-Acc Bed 1	NO (-67%)	NO
L04-F4-Bed 1	NO (-49.1%)	NO
L04-F4-Bed 2	NO (-48.2%)	NO
L04-F4-Bed 3	NO (-48.2%)	NO
L04-F4-Bed 4	NO (-48.1%)	NO
L04-F4-Bed 5	NO (-48.2%)	NO
L04-F4-Bed 6	NO (-48.2%)	NO
L04-F4-Bed 7	NO (-47.9%)	NO
L04-F4-Bed 8	NO (-48.1%)	NO
L04-F3-Bed 9	NO (-48.3%)	NO
L04-F3-Bed 8	NO (-48.5%)	NO
L04-F2-Bed 7	N/A	N/A
L04-F2-Bed 7	NO (-49.4%)	NO
L04-F2-Bed 6	NO (-49.2%)	NO
L04-F2-Bed 6	N/A	N/A

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

Separate submission

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

Separate submission

EPBD (Recast): Consideration of alternative energy systems

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

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters			Building Use
	Actual	Notional	% Area Building Type
Area [m ²]	1021.5	1021.5	A1/A2 Retail/Financial and Professional services
External area [m ²]	998.1	1077.2	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
Weather	SOU	SOU	B1 Offices and Workshop businesses
Infiltration [m ³ /hm ² @ 50Pa]	3	3	B2 to B7 General Industrial and Special Industrial Groups
Average conductance [W/K]	386.14	512.22	B8 Storage or Distribution
Average U-value [W/m ² K]	0.39	0.48	C1 Hotels
Alpha value* [%]	10.02	10	C2 Residential Institutions: Hospitals and Care Homes
			C2 Residential Institutions: Residential schools
			100 C2 Residential Institutions: Universities and colleges
			C2A Secure Residential Institutions
			Residential spaces
			D1 Non-residential Institutions: Community/Day Centres
			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	14.46	20.08
Cooling	0	0
Auxiliary	3.69	2.42
Lighting	8.06	13.3
Hot water	32.67	35.21
Equipment*	24.12	24.12
TOTAL**	58.87	71

* 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	5.08	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]	161.83	184.87
Primary energy* [kWh/m ²]	178.93	212.53
Total emissions [kg/m ²]	27.6	35.9

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

HVAC Systems Performance

System Type	Heat dem MJ/m ²	Cool dem MJ/m ²	Heat con kWh/m ²	Cool con kWh/m ²	Aux con kWh/m ²	Heat SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Central heating using water: radiators, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity									
Actual	132.8	0	11.9	0	1.4	3.11	0	3.31	0
Notional	152.9	0	10.6	0	1.4	2.56	0	---	---
[ST] Central heating using water: radiators, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity									
Actual	12.5	0	1.1	0	4.4	3.11	0	3.31	0
Notional	15.6	0	1.7	0	4.4	2.56	0	---	---
[ST] Central heating using water: radiators, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity									
Actual	896.3	0	80.1	0	8.5	3.11	0	3.31	0
Notional	1015.7	0	110.3	0	10.5	2.56	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/m ²]	= Heating energy demand
Cool dem [MJ/m ²]	= Cooling energy demand
Heat con [kWh/m ²]	= Heating energy consumption
Cool con [kWh/m ²]	= Cooling energy consumption
Aux con [kWh/m ²]	= 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.

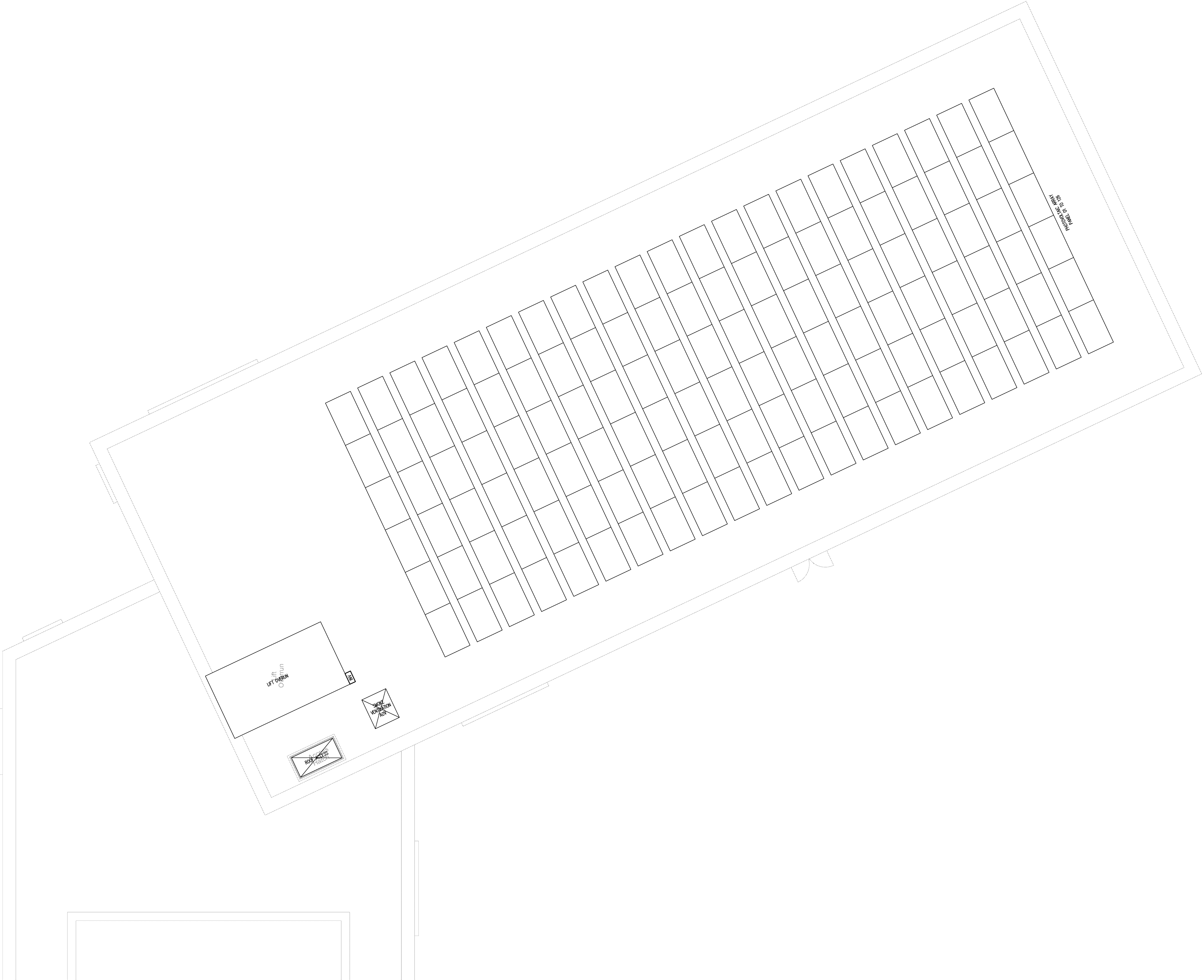
Building fabric

Element	U _{typ}	U _{min}	Surface where the minimum value occurs*
Wall	0.23	0.06	L0000044:Surf[8]
Floor	0.2	-	UNKNOWN
Roof	0.15	0.15	L0000044:Surf[3]
Windows, roof windows, and rooflights	1.5	1.6	L0000044:Surf[0]
Personnel doors	1.5	-	No Personnel doors in building
Vehicle access & similar large doors	1.5	-	No Vehicle access doors in building
High usage entrance doors	1.5	-	No High usage entrance doors in building
U _{typ} = Typical individual element U-values [W/(m²K)]			U _{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	3

Appendix C – Roof Layout Including PV array.

This drawing shall not be scaled.
Work on this drawing shall be done in accordance with the
drawing or given in relevant specifications



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