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your energy assessor

ENERGY STRATEGY

Compliance with BCS14

PROJECT NAME
Lawnwood House

DATE
21st April 2020 2020

ASSESSOR
Benjamin Leech

Energy Strategy

Project: 3676JH – 2020.04 ER (Lawnwood House – Hadfield+Noblin)

Contents

Energy Strategy

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Executive Summary

This Energy Assessment has been compiled to demonstrate compliance with the Bristol City Council Policy BCS14 (from the Development Framework Core Strategy).

The proposal is for the erection of a block of nine flats over two stories above the existing office block of Lawnwood House, Lawnwood Road.

Following the methodology outlined in the Climate Change and Sustainability – Practice Note, SAP calculations have been completed in stages to demonstrate a 20% reduction in regulated carbon emissions.

Firstly, SAP calculations achieving Part L compliance were modelled to provide 'baseline' energy demand and emissions. Then, appropriate decentralised renewables were included in the SAP calculations to provide the final energy demand and emissions figures for comparison. More detail is provided in the following sections.

To summarize the results, the total reduction in carbon emissions from on-site renewables is as follows:

Total CO_2 Savings on Residual Emissions

20.85%

Result

Pass

Design Principles to Reduce Energy Consumption and Carbon Emissions

Fabric

Low U-values and good detailing will help to limit heat losses through the fabric of the proposed extension.

All non-repeating thermal bridges (e.g. between the external walls and the roofs) will be specified to Accredited Construction Details. This will ensure that heat losses through these junctions are minimised and that the corresponding psi values can be utilised in the SAP calculations.

Fenestration and Solar Gain

Careful consideration will be given to the fenestration, given that a considerable proportion of the façade will be glazed. Low U-values will need to be specified to limit heat losses through these areas. The glazing design allows for passive heating into the building. However, to minimise the risk of overheating within the dwelling, the glazing will be openable where practical and a combination of internal and external shading will be employed.

The positioning of the glazed openings will also maximise the available daylight into the building. This will not only improve comfort levels for the occupants but also reduce the energy consumption through artificial lighting.

The overheating risk, as assessed in the SAP calculations, is ‘slight’ which is a very low level of risk.

Mechanical Services

A well designed building envelope must be supplemented by appropriate services within the building.

It is proposed that the flats be heated by air source heat pumps ormodern, efficient gas combi boilers.

Additionally, mechanical extract fans will be fitted to wet rooms.

Lighting

It is proposed that only energy efficient lighting is installed at the property. This means that all light fittings should have lamps with a luminous efficacy of greater than 45 lamp lumens per circuit-watt and a total output greater than 400 lamp lumens.

Renewables

In addition to the use of a heat pump on site, other forms of renewable technologies have been considered.

Some systems such as wind turbines are unsuitable for a site that is seeking to blend in with the surroundings.

Solar panels to generate either heat, electricity or both are feasible, if there is sufficient space for a suitable array on the flat roof of the building.

Overall performance

The following tables detail how the proposed building has been specified at this stage, incorporating the above principles. Also displayed is how the building performs in relation to the building regulations and the planning requirements for BCS14.

Selecting Renewables

Table 1 – Feasibility Matrix of Appropriate Renewables

Showing the considerations in choosing a renewable technology for this site.

Technology	Requirements	Requirements Met?	Appropriate?
Photovoltaic panels	Roof facing east to west (through south)	Yes	Yes
	Little/no or modest overshading	Yes*	
	Flat roof or pitched roof not greater than 45°	Yes	
	Any size development	Yes	
Solar thermal	All requirements as for photovoltaic panels	Yes	No
	Hot water tank (not compatible with combi boilers)	No	
Air source heat pumps	Suitable external wall or other location on-site for equipment	Yes	Yes
	Aesthetic considerations	Yes	
	Noise impact	Yes	
	Any size development	Yes	
Ground source heat pumps	External space for horizontal trench or vertical borehole	Yes	No
	Medium to large sized development	No	
	Archaeology	Unknown	
	Best suited to underfloor heating	No	
Biomass	Space needed for plant, fuel storage and deliveries	No	No
	Medium to large sized development	No	
	Minimal impact on residents (air quality, deliveries)	No	
Combined heat and power	Space need for plant, access and servicing	No	No
	Large sized development (large heat demand)	No	
District heating	Available network	No	No
	Very large sized development (substantial heat demand)	No	

**See the following aerial image demonstrating that the overshading risk is low for the likely location of any solar panels.*

Fig. 1 – Aerial Image of the Site – Overshading Risk

Note: the blue arrow shows the location of Lawnwood House. As can be seen, there are no obstructions that are likely to create overshading to any potential solar panels.

Heat Hierarchy

Table 2 – Following the Heat Hierarchy

Showing how the heat hierarchy, as outlined in BCS14 can be applied to this site.

Stage	Feasible	Notes
1. Connection to existing CHP/CCHP distribution networks	No	No network available
2. Site-wide renewable CHP/CCHP	No	Only a single unit proposed for the site
3. Site-wide gas-fired CHP/CCHP	No	Only a single unit proposed for the site
4. Site-wide renewable community heating/cooling	No	Only a single unit proposed for the site
5. Site-wide gas-fired community heating/cooling	No	Only a single unit proposed for the site
6. Individual building renewable heating	Yes	Air source heat pumps are feasible

Feasibility of Appropriate Renewables - Conclusion

Due to the location, size and type of development most renewable technologies are not appropriate for this site.

Although individual air source heat pumps may be feasible, assuming suitable locations for them could be found, they would need to be complimented by additional renewable technologies in order to achieve the 20% reduction in CO_2. For this development, air source heat pumps show no savings on residual emissions (see Appendix C). As such, many more photovoltaic panels will be needed to not only achieve baseline compliance but subsequently also to reach the required 20% reduction in carbon emissions (see Appendix D).

In contrast, individual gas boilers prove much more beneficial when trying to achieve baseline compliance (see Table 6). Subsequently, the amount of PV to achieve the required 20% reduction in carbon is a lot less when compared to the use of air source heat pumps.

In the future, if a district heating system were to be introduced to the area, the proposed dwellings could be connected to this network. This could be facilitated as wet central heating systems are planned for this development.

However, photovoltaic panels do offer an immediate, appropriate solution. The number of panels can be scaled to achieve the 20% reduction in CO_2, as demonstrated in Table 6. This will need to be confirmed by survey before installation.

Appropriate Solution(s)

Photovoltaic Panels

Proposed Fabric and Services Specification

Table 3 – Baseline Compliance

Showing the minimum specification required to achieve compliance with Part L.

Category	Item	Reference/Source	Value/Details
Building Fabric (W/m^2K)	Exposed Floor	Assumed	0.13
	Cavity Walls	Assumed	0.18
	Flat Roof	Assumed	0.13
Fenestration (W/m^2K)	Solid Door	Assumed	1.80
	Window	Assumed	1.40
Thermal Bridging (y-value)	Accredited Construction Details	Calculated	0.1391-0.2050
Ventilation	Air Permeability (m^3/hm^2)	Assumed	5.00
	Mechanical Ventilation	Assumed	Natural ventilation (mechanical extract fans fitted to wet rooms)
Heating	Primary Heating System	Assumed	Ideal Logic Combi ESP1 30
	Controls	Assumed	Time and temperature zone controls with a delayed start thermostat
	Heat Distribution	Assumed	Radiators
	Water Heating	Assumed	Combi
	Secondary Heating System	Assumed	None
Additional Features	Low Energy Lighting (%)	Assumed	100
	SAP Appendix Q	Assumed	None
	Renewables	Assumed	None
	Regulation 36 Compliance (litres/person/day)	Assumed	125

Additional Energy Efficiency Measures

Given the specification proposed for the baseline model, there are no additional energy efficiency measures that could be cost-effectively implemented.

Table 4 – Proposed Renewables

Showing renewables added to the specification to reduce carbon emissions.

Category	Item	Reference/Source	Value/Details
Additional Features	Renewables	Calculated	5.50kWp PV Panels

Please note the following:

A minimum array of 5.50kWp of photovoltaic panels is required for this development to meet the required target (20% reduction in CO_2). Additional panels can be added to increase the potential output, as appropriate. The proposed set up is as follows:

Table 5 – Renewables Specification

Total Array Size	Direct/Landlord's Supply	Orientation	Inclination	Overshading
5.50kWp	Landlord's Supply	Horizontal	0° (nominal)*	None or very little

**The SAP calculation accepts 0°, 30°, 45°, 60° and 90°. The angle given is the nearest of these values to the true pitch of the PV.*

This size of array can be achieved with e.g. 22 × 250W panels and take up an area of approximately 36-44m^2 of roof space.

Table 6 – Summary Table

Showing how energy demand and carbon emissions can be reduced by implementing the measures detailed in the preceding steps.

	Energy demand (kWh pa)	Energy saving achieved (%)	Regulated CO_2 emissions (kg pa)	Saving achieved on residual CO_2 emissions (%)
Building Regulations Part L compliance ("Baseline" energy demand and emissions)	**43,609.22**		**10,414.01**	
Proposed scheme after energy efficiency measures and CHP ("Residual" energy demand and emissions)	**43,609.22**	**0.00**	**10,414.01**	
Proposed scheme after on-site renewables	**39,426.52**	**9.59**	**8,243.19**	**20.85**
Proposed scheme offset for financial contribution or other "allowable solution"			**N/A**	**N/A**
Total savings on residual emissions				**20.85**

For further details please refer to the SAP Reports and the appendices.

Appendix A – Plot Detail

Plot	Baseline Energy Demand (kWh pa)	Baseline CO_2 (kg pa)	Additional Measures Energy Demand (kWh pa)	Additional Measures CO_2 (kg pa)	Renewables Demand (kWh pa)	Renewables CO_2 (kg pa)
Flat 1	4,665.90	1,125.89	4,665.90	1,125.89	4,177.66	872.50
Flat 2	5,047.21	1,197.84	5,047.21	1,197.84	4,565.06	947.60
Flat 3	4,901.85	1,164.59	4,901.85	1,164.59	4,432.63	921.07
Flat 4	4,535.12	1,099.69	4,535.12	1,099.69	4,018.75	831.69
Flat 5	5,737.15	1,334.44	5,737.15	1,334.44	5,352.34	1,134.72
Flat 6	4,732.9	1,141.78	4,732.9	1,141.78	4,266.72	899.83
Flat 7	4,545.88	1,085.2	4,545.88	1,085.2	4,100.23	853.91
Flat 8	4,475.51	1,069.53	4,475.51	1,069.53	4,038.99	842.98
Flat 9	4,967.7	1,195.05	4,967.7	1,195.05	4,474.14	938.89

Appendix B – PV Share, Apportioned By Flat Area

Plot	Area (m^2)	Total Area (m^2)	Weighting	PV Share (kWp)	Total Array Size (kWp)
Flat 1	63.2	549.0	0.117	0.642	**5.50**
Flat 2	62.5		0.115	0.634	
Flat 3	61.1		0.112	0.617	
Flat 4	66.7		0.123	0.679	
Flat 5	50.0		0.092	0.506	
Flat 6	61.0		0.111	0.613	
Flat 7	61.0		0.107	0.586	
Flat 8	61.0		0.104	0.574	
Flat 9	62.5		0.118	0.649	

Appendix C – Summary Table for using Air Source Heat Pumps only

The table below shows the savings achieved on residual CO_2 emissions by installing air source heat pumps for each property. The value of -8.12% in total savings on residual emissions demonstrates the need for considerable amounts of PV to achieve baseline compliance as well as the required 20% reduction in CO_2.

	Energy demand (kWh pa)	Energy saving achieved (%)	Regulated CO_2 emissions (kg pa)	Saving achieved on residual CO_2 emissions (%)
Building Regulations Part L compliance (“Baseline” energy demand and emissions)	**43,609.22**		**10,414.01**	
Proposed scheme after energy efficiency measures and CHP (“Residual” energy demand and emissions)	**43,609.22**	**0.00**	**10,414.01**	
Proposed scheme after on-site renewables	**22,371.25**	**48.70**	**11,259.92**	**-8.12**
Proposed scheme offset for financial contribution or other “allowable solution”			**N/A**	**N/A**
Total savings on residual emissions				**-8.12**

Appendix D – Summary Table for using Air Source Heat Pumps and PV

To achieve the required 20% reduction in CO_2, the flats would need at least 30 x 250W panels (7.50=7.5/.25kWp), requiring approximately 60m^2 of roof space. This represents a significant increase in the amount of PV required when using individual gas boilers (5.50kWp), resulting in significantly higher costs and loading onto the roof.

	Energy demand (kWh pa)	Energy saving achieved (%)	Regulated CO_2 emissions (kg pa)	Saving achieved on residual CO_2 emissions (%)
Building Regulations Part L compliance (“Baseline” energy demand and emissions)	43,609.22		10,414.01	
Proposed scheme after energy efficiency measures and CHP (“Residual” energy demand and emissions)	43,609.22	0.00	10,414.01	
Proposed scheme after on-site renewables	19,316.02	55.71	8,291.07	20.39
Proposed scheme offset for financial contribution or other “allowable solution”			N/A	N/A
Total savings on residual emissions				**20.39**

Appendix E – Proposed Solar Panel

SUNPOWER®

SunPower® P19-320-BLK

SunPower® Performance Panel for Residential Installations

SunPower Performance Panels wrap front contact cells with 30+ years of SunPower materials and manufacturing expertise. The weakest points of Conventional Panel design are eliminated to deliver superior power, reliability, value and savings.[1]

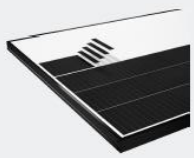
High Power
Enhanced active area and monocrystalline cells increase power and savings while designing out fragile ribbons and solder bonds on the cells.

High Performance
Up to 28% more energy in the same space over 25 years.[2] Outperforms Conventional Panels in partial shade thanks to unique parallel circuitry. Proprietary bussing design limits power loss, maximizing production during morning and evening shading or soiling.

Premium Aesthetics
SunPower® Performance Panels with their black frame and black backsheets blend harmoniously into your roof and add elegance to your home.

High Reliability
SunPower Performance Panels are the most deployed shingled solar panel in the world.[3] Innovative cell shingling mitigates the leading reliability challenges associated with conventional front contact panels by designing out fragile ribbons and solder bonds on the cells. SunPower stands behind its panels with its industry-leading Complete Confidence Warranty.

Engineered for Performance



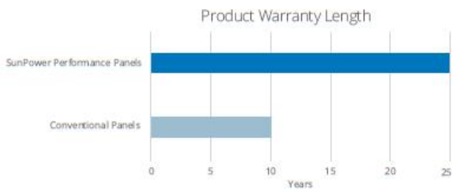
Innovative Design

- Robust and flexible cell connection technology. Outstanding reliability.
- Conductive adhesive, proven in the aerospace industry.
- Redundant cell to cell connections.

Proven Performance

- Named as a Top Performer in all DNV/GL reliability tests.
- Reduced panel temperature due to unique electrical bussing.

25 Year Combined Warranty



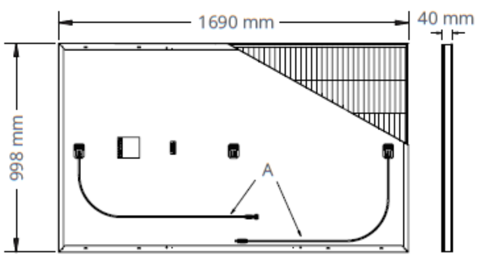
sunpowercorp.co.uk

P19-320-BLK: SunPower® Performance Panel for Residential Installations

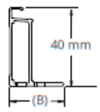
Electrical Data						
Model	SPR-P19-335-BLK	SPR-P19-330-BLK	SPR-P19-325-BLK	SPR-P19-320-BLK	SPR-P19-315-BLK	SPR-P19-310-BLK
Nominal Power (Pnom)[4]	335 W	330 W	325 W	320 W	315 W	310 W
Power Tolerance	+5/−0%	+5/−0%	+5/−0%	+5/−0%	+5/−0%	+5/−0%
Efficiency	19.9%	19.6%	19.3%	19.0%	18.7%	18.4%
Rated Voltage (Vmpp)	37.5 V	37.2 V	36.9 V	36.4 V	35.9 V	35.4 V
Rated Current (Impp)	8.94 A	8.87 A	8.80 A	8.79 A	8.77 A	8.76 A
Open-Circuit Voltage (Voc)	44.8 V	44.6 V	44.4 V	43.9 V	43.7 V	43.2 V
Short-Circuit Current (Isc)	9.51 A	9.44 A	9.37 A	9.35 A	9.33 A	9.28 A
Maximum System Voltage	1000 V IEC					
Maximum Series Fuse	18 A					
Power Temp. Coef.	−0.37% / ° C					
Voltage Temp. Coef.	−0.29% / ° C					
Current Temp. Coef.	0.05% / ° C					

Tests And Certifications (Preliminary)	
Standard Tests[5]	IEC 61215, IEC 61730
Quality Certs	ISO 9001:2008, ISO 14001:2004
EHS Compliance	OHSAS 18001:2007, Recycling Scheme
Ammonia Test	IEC 62716
Desert Test	10.1109/PVSC.2013.6744437
Salt Spray Test	IEC 61701 (maximum severity)
PID Test	Potential-Induced Degradation free: 1000 V
Available Listings	TUV

Operating Condition And Mechanical Data	
Temperature	−40° C to +85° C
Impact Resistance	25 mm diameter hail at 23 m/s
Solar Cells	Monocrystalline PERC
Tempered Glass	High-transmission tempered anti-reflective
Junction Box	IP-67, Multi-Contact (MC4), 3 bypass diodes
Weight	18.7 kg
Max. Load	Wind: 2400 Pa, 245 kg/m² front & back Snow: 5400 Pa, 550 kg/m² front
Frame	Class 1 black anodized (highest AAMA rating)



FRAME PROFILE



(A) Cable Length: 1200 mm +/-15 mm
(B) Long Side: 32 mm
Short Side: 24 mm

Read safety and installation instructions before using this product.

REFERENCES:
1 Independent Shade Study by CFV Laboratory. 2016.
2 SunPower 320 W compared to a Conventional Panel on same sized arrays (260 W, 16% efficient, approx. 1.6 m²), 0.6%/yr degradation (Leidos technical review 2017).
3 Osborne. "SunPower supplying P-Series modules to a 125MW NextEra project." PV-Tech.org. March 2017."
4 Measured at Standard Test Conditions (STC): irradiance of 1000 W/m², AM 1.5, and cell temperature 25° C.
5 Class C fire rating per IEC 61730.

See www.sunpowercorp.co.uk/company/about-sunpower for more reference information.
Specifications included in this datasheet are subject to change without notice.

SUNPOWER®

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