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1 PROPOSED DWELLING

LAND WEST TO

PRUE ON THE HILL

PL25 5AP

ENERGY STATEMENT

FOR

ELLIOT HIGGINSON ARCHITECTURAL SERVICES

March 2024

Project no.18143

1 PROPOSED DWELLING

LAND WEST TO

PRUE ON THE HILL

PL25 5AP

ENERGY STATEMENT

ELLIOT HIGGINSON ARCHITECTURAL SERVICES

REVISION	DATE	PREPARED BY	REVIEWED BY	COMMENTS
0	08/03/2024	IF	HH	For Comment

The current report provides a brief overview of the wide range of opportunities for renewable energy and is not intended as detailed design advice. As such data and information should only be treated as INDICATIVE at this stage of the process. Further investigation can be undertaken when more accurate and detailed information is required on specific measures.

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Contents

1.0 Introduction

1.1 About C80 Solutions Ltd

C80 Solutions are independent Sustainability and Energy Consultants providing carbon reduction solutions to help the UK achieve its carbon emission reduction target of 100% by 2050.
Our range of affordable but comprehensive solutions for the construction industry are broken down into two sectors; i) Building Compliance and ii) Consultancy.

Building Compliance:

Our Building Compliance services include; Code for Sustainable Homes Assessments, SAP Calculations, On Construction Energy Performance Certificates, Water Efficiency Calculations, SBEM Calculations, Commercial EPCs, BREEAM assessments and Air Tightness Testing.

Consultancy:

Our experience and exposure to building compliance combined with previous experience and IEMA accredited training means we have built up a vast amount of knowledge which enables us to provide our clients with invaluable advice. Our Consultancy services include; Renewable Energy Feasibility Reports, Energy Statements for planning, Sustainability Statements and Building Compliance Advisory Reports.

1.2 Introduction to Developments

C80 Solutions have been instructed to prepare a sustainability statement by ELLIOT HIGGINSON ARCHITECTURAL SERVICES to undertake an energy statement on the proposed development at Land West of Prue On The Hill, PL25 5AP. The proposed development comprises the creation of 1 new residential home.

The site plan of the proposed development can be seen in Figures 1 & 2 below.

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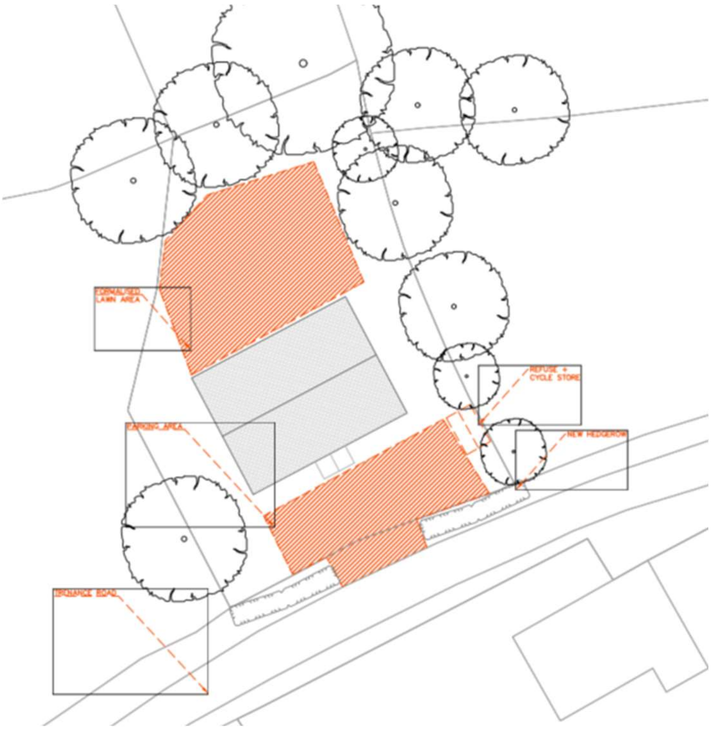
Figure 1: Site plan of the proposed development



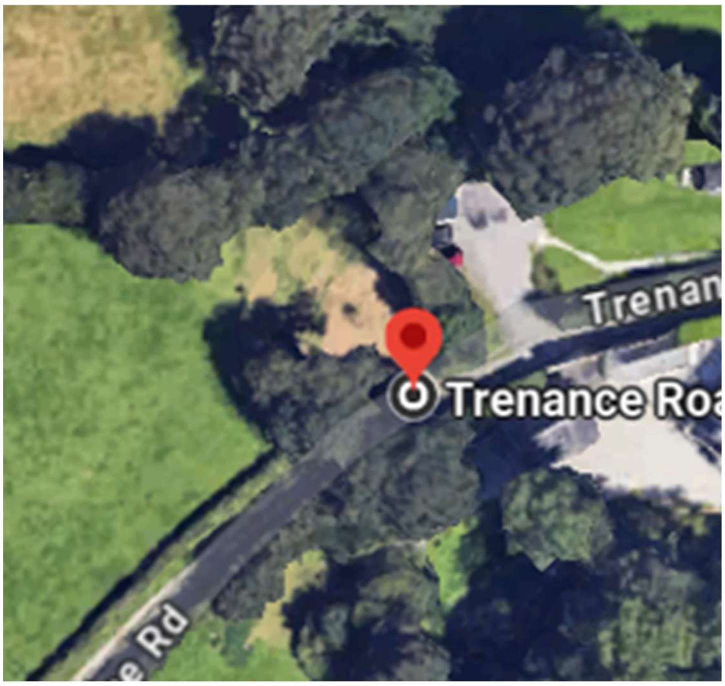


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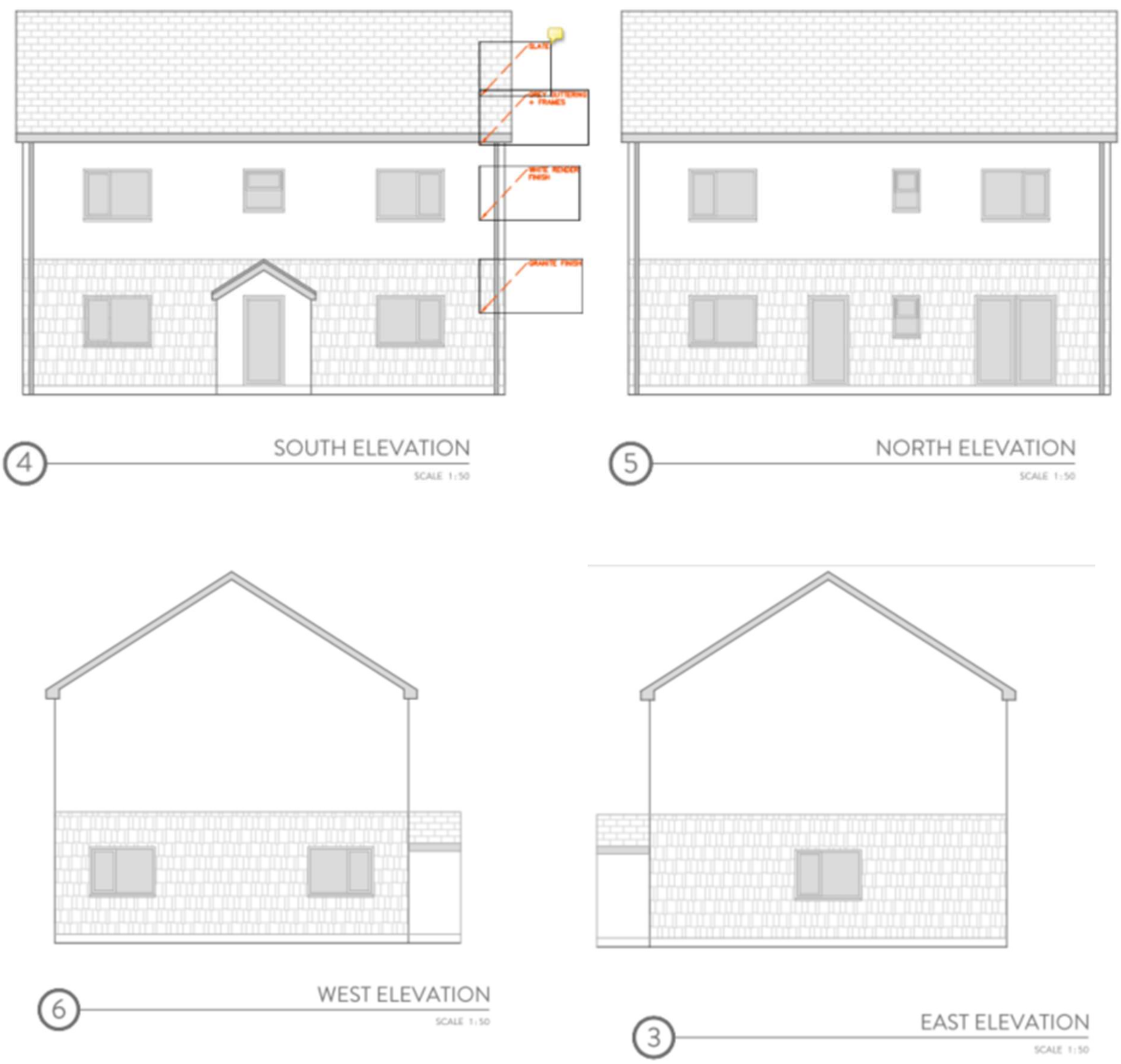
Figure 2a: Floor plans

Figure 2b: Elevations



1.3 Planning Policy

As Per Policy SEC1 – Sustainable Energy and Construction -Residential development proposals will be required to achieve Net Zero Carbon and submit an 'Energy Statement' that demonstrates how the proposal will achieve:

• Space heating demand less than 30kWh/m2/annum;

• Total energy consumption less than 40kWh/m2/annum; and

• On-site renewable generation to match the total energy consumption, with a preference for roof mounted solar PV.

Policy SEC1 – Sustainable Energy and Construction

Development proposals will be required to demonstrate how they have implemented the principles and requirements set out in the policy below.

1) **The Energy Hierarchy**

All proposals should embed the Energy Hierarchy within the design of buildings by prioritising fabric first, orientation and landscaping in order to minimise energy demand for heating, lighting and cooling. All proposals should consider opportunities to provide solar PV and energy storage.

2b) **New Development – Residential**

Residential development proposals will be required to achieve Net Zero Carbon and submit an 'Energy Statement' that demonstrates how the proposal will achieve:

- Space heating demand less than 30kWh/m2/annum;
- Total energy consumption less than 40kWh/m2/annum; and
- On-site renewable generation to match the total energy consumption, with a preference for roof-mounted solar PV.

Where the use of onsite renewables to match total energy consumption is demonstrated to be not technically feasible (for example with apartments) or economically viable renewable energy generation should be maximised as much as possible; and/or connection m a d e to an existing or proposed low carbon district energy network; or where this is not possible the residual energy (the amount by which total energy demand exceeds the renewable energy generation) is to be offset by a contribution to Cornwall Council's Offset Fund.

Where economic viability or technical constraints prevent policy compliance, proposals should first and foremost strive to meet the space heating and total energy consumption thresholds. Proposals must then benefit as much as possible from renewable energy generation and/or connection to an existing or proposed low carbon district energy network. As a last resort, any residual energy is to be offset by a contribution to Cornwall Council's Offset Fund, as far as economic viability allows.

While this policy does not require the application of these standards to reserved matters applications that relate to outline planning permissions that predate the adoption of this climate Emergency DPD, developers are encouraged to apply these standards on a voluntary basis, where it is feasible to do so and not within breach of existing permissions.

4 **Domestic and Non-Residential Renewables**

The Council will support domestic and non-residential renewables such as solar panels where they require planning permission. Proposals should minimise visual impact wherever possible.

Proposals affecting heritage assets, including their settings, shall seek to avoid and minimise negative impacts on their significance and conserve the character of historic townscapes, landscapes and seascapes.

5 **Water**

All dwellings (including conversions, reversions and change of use) should achieve an estimated water consumption of no more than 110 litres/person/day through the incorporation of water saving measures where feasible.

Development proposals for 50 or more dwellings and non-residential development with a floor space of 1,000 m2 or more should incorporate water reuse and recycling and rainwater harvesting measures.

6 **Materials and Waste**

All development proposals should minimise use of materials and creation of waste and promote opportunities for a circular economy through:

a) Wherever possible reusing or adapting existing buildings as part of the development, whilst maintaining and enhancing local character and distinctiveness;
b) Reuse and recycling of appropriate materials that arise through demolition and refurbishment, including the reuse of non-contaminated excavated soil and hardcore within the site;
c) Prioritise the use of locally sourced and/or sustainable materials and construction techniques that have smaller ecological and carbon footprints;
d) Using locally distinctive, resilient, low maintenance materials that are appropriate for Cornwall's damp maritime climate, for example locally won materials such as slate and granite (particularly for areas that will be harder to maintain once the building is occupied) as described in the Cornwall Design Guide;
e) Considering the lifecycle of the development and surrounding area, actively prioritise design that delivers longevity and repairability including how developments can be adapted to meet changing needs and how materials can be recycled at the end of their lifetime;
f) Providing adequate space to enable and encourage greater levels of recycling. Space requirements for residential developments should follow those outlined in the Cornwall Design Guide.

2.0 Energy

2.1 Methodology

The methodology that has been applied in this report is as follows:

1. Prepare baseline energy calculations for the site based on a Part L 2021 compliant construction specification designed for the development.

2. From the baseline energy calculations, the predicted energy demand for the development in kWh/year and the predicted CO2 emissions in kgCO2/year for the site can be established.

3. **BE LEAN**: Apply energy efficient design principles (improved fabric spec) in order to reduce the energy demand and CO2 emissions of the site. Prepare energy calculations using the improved fabric specification.

4. **BE CLEAN:** Explore opportunities to improve the building services and increase the efficiency in which energy can be delivered to the dwelling.

5. **BE GREEN**: Carry out a renewable energy feasibility study to ascertain which LZC technologies would be suitable for the development and ascertain the impact of introducing different technologies.

6. Establish the sizing of suitable renewable technologies to ensure the PV array size target is met.

2.2 Predicted Annual Carbon Emissions

Baseline SAP 10 calculations were prepared based on the Part L Notional Specification shown in table 1 below. This specification is as outlined in Approved Document Part L:

Aspect		L1A
	External Walls	0.18 W/m²K
	Communal Walls	N/A
	Insulated Roofs	0.11 W/m²K
	Ground floors	0.13 W/m²K
	Windows (All)	1.2 W/m²K
	External Doors	1.0 W/m²K
	Thermal Bridging	SAP version 10.2 - Table R2: Reference values of psi for junctions
Ventilation	**Airtightness m3/(hr.m²)**	5
Heating	**Heating**	Gas Boiler
	Hot Water	As Per Heating
	Controls	TTZC
Low energy lighting		80 lm/cw
Ventilation		Natural ventilation with extracts
Renewables / LZC	**PV (KWp)**	(40% of GF Area/6.5) = 4.77KWp

Part L compliant construction specifications

The SAP calculations have shown the notional baseline development having a TER of **9.27 kgCO2/yr/m2**

As Per Policy SEC1 planning for this development sets out a requirement for a minimum an improvement over the TER, meaning that a reduction of:
9.27 kgCO2/yr/m2 is expected.
This means that there is a maximum DER rating of:
0.0 kgCO2/yr/m2 allowed for this development equalling 'net-zero'.

'Where this requirement cannot be met due to economic viability or technical constraints, 'proposals must then benefit as much as possible from renewable energy generation and/or connection to an existing or proposed low carbon district energy network. As a last resort, any residual energy is to be offset by a contribution to Cornwall Council's Offset Fund, as far as economic viability allows.'

2.3 Predicted Annual Energy Demand

Baseline

Based on using the specification outlined in table 1 above, this would create a total predicted energy demand for the development of **48.61 kWh/m2/year**. The breakdown of this predicted energy demand can be seen in table 2 below. The figures quoted have been derived from the Design Stage SAP 10 Calculations for the development.

			Total Predicted Energy Requirement (kWh/yr)			
			Space Heating	Water Heating	Lighting, Pumps, Fans	Total Predicted Energy Requirement (kWh/yr)
Plot	No.	Units	Gas	Gas	Electric	
Plot 1	1	kWh/yr	6541.8622	3447.2708	589.0302	10578.1632
	1	kWh/yr			Electricity generated	-3145.4625
						7432.7008
						Total Predicted Energy Requirement (kWh/m2/yr)
						48.61

Baseline Predicated Annual Energy Demand

2.4 Reducing Carbon Emissions through Energy Reduction

The Energy Hierarchy sets out the most effective way to reduce a dwelling's CO_2 emissions. Firstly, by reducing energy demand, then by using energy efficiently and lastly by incorporating LZC/Renewable technologies.

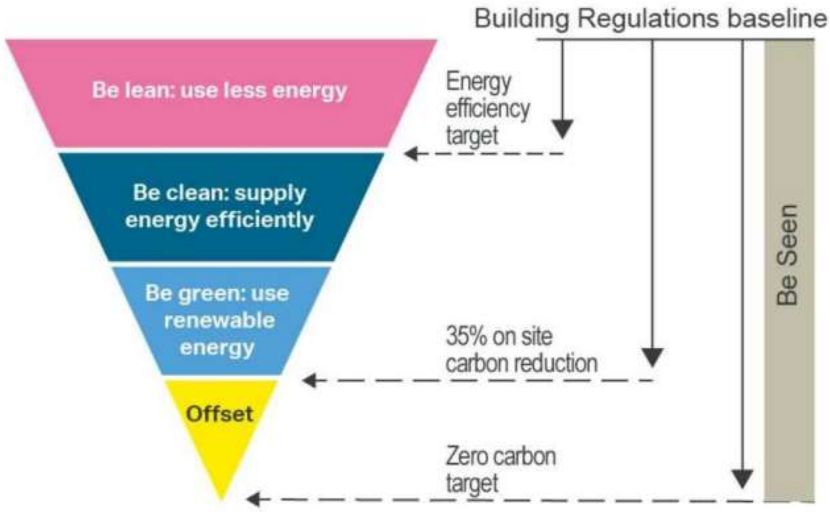


Figure 3: The Energy Hierarchy

Reducing the need for energy usage in the dwelling's design:

The first and most cost beneficial action is to reduce the amount of energy needed by the occupants of the dwelling whilst still maintaining or even improving the comfort conditions. A lot can be achieved through passive design, improving the dwelling's external fabric and following principles to reduce air infiltration.

The developer is attempting to reduce the energy demand and CO2 emissions of the development by making the following fabric and energy efficiency improvements to their standard Part L 2021 building specification:

Energy reduction strategies include:

- Adopting enhanced fabric specifications
- Installing high efficiency heating systems
- Incorporating energy-efficient lighting: 100% of all new lighting to be energy efficient
- Adopting principles of airtight construction
- All new windows will be double-glazed
- Passive Solar Design – Solar gain, solar shading, thermal mass
- Natural / Passive Ventilation strategy

2.5 Feasibility Study of Renewable Technologies

BE GREEN: Carry out a renewable energy feasibility study to ascertain which LZC technologies would be suitable for the development and ascertain the impact of introducing different technologies.

This section will assess the technical viability of the following renewable energy technologies for the site in order to rule out unfeasible options:

- Mast mounted wind turbines
- Roof mounted wind turbines
- Solar PV (Photovoltaic) Panels
- Solar Thermal Panels
- ASHP (Air Source Heat Pump)
- GSHP (Ground Source Heat Pump)
- Biomass
- CHP

The following observations have been made with regard to the technical feasibility of integrating renewable energy technologies into this development.

Renewable Technology	Feasible	Reasons
Mast Mounted Wind Turbine	No	There is no sufficient open land for a mast mounted wind turbine to be installed on site.
		The site is location is surrounded by mature trees and surrounding properties aren't far enough away to be unaffected by turbine noise, reflected light and shadow flicker.
		The site area is surrounded by mature trees and other obstructions that could cause uneven and turbulent wind patterns. Turbulent air conditions may reduce lifespan of components.
		Currently the BWEA suggests a large wind turbine to be viable where wind speed is 7m/s or above. According to the NOABL database the average wind speeds for the site is: 5.9 m/s at 10m, 6.6 m/s at 25m and 7.1 m/s at 45m height for the property postcode. Whilst a 45m height mast mounted turbine could be considered viable, the site restraints could not accommodate such a large mast.
Roof Mounted Wind Turbine	No	The site area is surrounded by buildings and other structures that could cause uneven and turbulent wind patterns. Turbulent air conditions may reduce lifespan of components.
		Roof mounted wind turbines are not yet a proven technology and a number of technical problems have been identified by manufacturers which are being investigated to rectify these issues. Vibration that can be transmitted to the building structure. Noise from a turbine may

		cause irritation to occupants of the dwelling and adjacent buildings. Noise may also adversely affect ventilation strategy.
		Currently the BWEA suggests a large wind turbine to be viable where wind speed is 7m/s or above. According to the NOABL database the average wind speeds for the site is: 5.9 m/s at 10m, 6.6 m/s at 25m and 7.1 m/s at 45m height for the property postcode. Whilst a 45m height mast mounted turbine could be considered viable, the site restraints could not accommodate such a large mast.
Solar PV (Photovoltaic) Panels/Tiles	Yes	The proposed development has a southeast oriented roof facing the road. A PV system is recommended at a 4.77 KWp capacity, which has maximised the use of the proposed roof space.
Solar Thermal Collectors	No	The proposed development has sufficient roof area that can accommodate solar thermal panels. Although such installation would lower the available roof area allocated to Solar PV.
		Most of the roofs should be free from overshadowing for most of the day from other buildings, structures or trees.
		The site is located in a region with a high level of global horizontal irradiation. According to the NOABL database (1238 kWh/m2/year).
		Solar thermal collectors would be compatible with the planned heating system.
		There will be a year round hot water demand.
		In practical domestic solar hot water systems, the solar hot water system is usually run in conjunction with, rather than instead of, a backup conventional boiler and as a result the carbon intensity of the combined system is high relative to other renewables. Moreover the high efficiency of modern condensing boilers, which can convert over 90% of means that the carbon intensity of these heat sources is relatively low at 200-300 gCO2/kWhth. As a result domestic solar water heating systems are a relatively expensive way of mitigating carbon emissions when they replace heat from efficient modern boilers. For this reason they are not recommended.
ASHP (Air Source Heat Pump)	Yes	The proposed development has been designed to accommodate the space for a hot water cylinder.
		The building is suitable for a low-grade heat distribution system (e.g. underfloor water system, oversized radiators).

		Condenser units can be noisy and also blow out colder air to the immediate environment causing nuisance to the residents. Furthermore the noise generated could cause disruption, as plant equipment will need to be fitted to external walls near bedroom and windows.
		There is sufficient outdoor space to locate a condenser away from bedroom spaces
GSHP (Ground Source Heat Pump)	No	It will not be possible to drill a limited number of vertical or horizontal boreholes for GSHP on the site.
		It is possible for developments to accommodate a low-grade heat distribution system (e.g. underfloor water system, oversized radiators).
		The site and neighbourhood contain mature trees. Drilling boreholes on the site create the risk of damaging their roots.
		There is not sufficient space inside the proposed plant room that can service the main dwelling and all outbuildings/annexes.
Biomass Boiler	No	There is an established fuel supply chain for the area.
		There isn't sufficient space for a delivery vehicle (vehicular access to fuel storage, turning circle etc)
		There isn't sufficient space in the proposed buildings for a wood-fuel boiler and associated auxiliary equipment.
		There isn't sufficient space for fuel storage to allow a reasonable number of deliveries.
		Biomass systems are management intensive (fuel sourcing, transport, storage) and require adequate expertise from users.
CHP	No	Given the proposed building use there won't be a high demand for heat for most of the year, therefore CHP won't be suitable.
		A CHP unit only generates economic and environmental savings when it is running at least 4,500 hours per year. This equates to an average heat demand of about 17 hours a day for five days a week throughout the year. The proposed development energy and heat demand profile does not match this requirement.
		CHP is typically utilized on buildings with high electricity and heating demand for most of the year such as local authority buildings, leisure centres, universities, hotels, and district heating schemes where CHP is used to provide electricity, space and water heating.

		CHP should be considered wherever there is demand for electricity and an appropriate demand for heat in the near vicinity.
Hot Water Heat Pump	No	Dwelling has been designed to include space for a water immersion cylinder.
		The is sufficient external wall area to provide intake and exhaust vents to the external air.
		There is a too high of a predicted hot water demand to allow a system of this nature to run efficiently.
		Cost of these systems are a fraction of traditional heat pumps and they provide the same level of efficient delivery to all dwellings.

Feasibility Study of Renewable Technologies

Based on the feasibility study in table 4 above, the following technologies have been identified as being feasible for the proposed development:

- Air Source Heat Pump
- PV

2.6 Improvements to achieve a maximum reduction of primary energy for the site

The developer is proposing the following measures to improve the energy performance of the building:

Be Lean;
Improved Fabric U-values to-

- Walls: 0.16 W/m²K
- Floors: 0.11 W/m²K
- Roofs: 0.09 W/m²K
- Double Glazed Windows: 1.2 W/m²K
- Use of government approved Recognised Construction Details (www.recognisedconstructiondetails.co.uk) to limit effects of linear thermal bridging. Assumed 100mm Cavity with 90mm PIR/10mm Residual Cavity with 0.18 conductivity PIR and 0.15 conductivity blockwork.
- Air Permeability reduced to 3.5 m^3/hm^2@50 Pa
- MVHR

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Aspect		L1A
	External Walls	0.16 W/m²K
	Communal Walls	N/A
	Insulated Roofs	0.09 W/m²K
	Ground floors	0.11 W/m²K
	Windows (All)	1.2 W/m²K
	External Doors	1.0 W/m²K
	Thermal Bridging	Recognised Construction Details (www.recognisedconstructiondetails.co.uk)
Ventilation	**Airtightness m3/(hr.m²)**	3.5
Heating	**Heating**	Gas Boiler
	Hot Water	As per Heating
	Controls	TTZC
Low energy lighting		80 lm/cw
Ventilation		MVHR
Renewables / LZC	**PV (KWp)**	(40% of GF Area/6.5) = 4.77KWp

BE LEAN: calculations were prepared based upon applying energy efficient design principles (improved fabric spec) to reduce the energy demand and CO2 emissions of the site:

The SAP calculations have shown the BE LEAN development having a DER of 8.54 kgCO2/yr/m2

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Be Clean;
Improved Space & DHW Heating System-

- Installation of electric direct acting boiler to provide all space heating & water heating thereby eliminating gas usage and utilising clean electricity. All lighting to achieve an improved efficacy of 100 lm/cw. Reduction of energy usage with WWHRS.

Aspect		L1A
	External Walls	0.16 W/m²K
	Communal Walls	N/A
	Insulated Roofs	0.09 W/m²K
	Ground floors	0.11 W/m²K
	Windows (All)	1.2 W/m²K
	External Doors	1.0 W/m²K
	Thermal Bridging	Recognised Construction Details (www.recognisedconstructiondetails.co.uk)
Ventilation	**Airtightness m3/(hr.m²)**	4 m3/(hr.m2)
Heating	**Heating**	Direct acting Electric heating boiler
	Hot Water	From above with cylinder and WWHRS
	Controls	TTZC
Low energy lighting		100 lm/cw
Ventilation		MVHR
Renewables / LZC	**PV (KWp)**	(40% of GF Area/6.5) = 4.77KWp

BE CLEAN: Explore opportunities to improve the building services and increase the efficiency in which energy can be delivered to the dwelling. Including electrical heating, WWHRS and MVHR.

The conducted SAP calculations have shown the **BE CLEAN** development having a DER of **2.77 kgCO2/yr/m2**

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Be Green
Renewable Energy Sources-

- Install Mitsubishi ECODAN 8.5kw Air Source Heat pump for space heating and water heating (210 litre cylinder)

Aspect		**L1A**
	External Walls	0.16 W/m²K
	Communal Walls	N/A
	Insulated Roofs	0.09 W/m²K
	Ground floors	0.11 W/m²K
	Windows (All)	1.2 W/m²K
	External Doors	1.0 W/m²K
	Thermal Bridging	Recognised Construction Details (www.recognisedconstructiondetails.co.uk)
Ventilation	**Airtightness m3/(hr.m²)**	3.5 m3/(hr.m2)
Heating	**Heating**	ASHP
	Hot Water	From above with cylinder and WWHRS
	Controls	TTZC
Low energy lighting		100 lm/cw
Ventilation		MVHR
Renewables / LZC	**PV (KWp)**	Estimated 30 m² available southeast roof area providing approximately 1 KWp per (5 m² – 6.25 m²). = 4.8 – 6 KWp

The PV installation has been maximised within the SAP (BE GREEN model).
The concluding results on the following page are demonstrated having utilised the SAP conversion tool required to detail realistic metrics as per policy SEC1 - Sustainable Energy and Construction - Residential development.

2.7 Conclusion

The METHODOLOGY FOR ADJUSTING SAP 10.2 OUTPUTS USING THE SAP CONVERSION TOOL has been followed for demonstrating the required results identified as:
• Space heating demand less than 30kWh/m2/annum;
• Total energy consumption less than 40kWh/m2/annum; and
• On-site renewable generation to match the total energy consumption, with a preference for roof mounted solar PV.

Extract source: *energy-summary-tool-sap-v2_1*

CORNWALL COUNCIL Etude

SAP Conversion Tool V2.1

Climate Zone: 4 South West England

Results			
Space heat demand	**Total energy use**	**Renewable generation**	**Renewable deficit**
$kWh/m^2_{TFA}/yr$	$kWh/m^2_{GIA}/yr$	% total energy	kWh/year
Required values:			
<30	<40	100%	0
29.9	21.8	142%	0

The full input excel spreadsheet is provided to accompany this report.