Land off Llewellyn Road, Penllergaer, Swansea

Energy and Sustainability Statement

March 2021

Prepared for;

Barratt & David Wilson Homes South Wales
Oak House,
Village Way,
Tongwynlais,
Cardiff,
CF15 7NE

Darren Evans Ltd.
1 Russell Mews,
High Street
Chipping Sodbury
Bristol
BS37 6BJ

T: +44 (0)333 5777 577
F: +44 (0)1454 528 224
E: info@darren-evans.co.uk
W: www.darren-evans.co.uk

1.0 Version History

Version	Revision	Date
First Issue	-	31/03/21
Updated Location Plan and Accomdation Schedule	-	07/04/21
Upated Conclusion and Summary	-	14/04/21

2.0 Contents

Darren Evans

3.0 Executive Summary

This Statement has been prepared in support of a planning application submitted by Barratt & David Wilson Homes South Wales for a new domestic housing development at Land off Llewellyn Road, Penllergaer, Swansea for the construction of 180 open market and affordable houses and flats. This statement shows how selected energy efficiency and low carbon measures have been utilised to ensure that all house types across the site comply with the relevant building regulation and district wide energy and sustainability policies.

All the SAP calculations that have been carried out for this development have been done so in accordance with the current Part L 2013 regulations and to address the Swansea Local Development plan policy 'EU 2: Renewable and Low Carbon Energy Technology in New Development.' This policy relates to the contribution of renewable or low carbon energy technology in order to meet energy demands. As this site exceeds 100 homes this report is designed to show the incorporation of low carbon or renewable energy installations into the scheme and connect to renewable or low carbon energy technology and district heating networks.

SAP Calculations have been prepared for each house type across the development based upon the construction specification set out within the report. This provides an accurate assessment of the carbon dioxide emissions arising from the site. The report also addresses the Swansea Local Development Plan 2010 – 2025 requirement that states that all new developments which have capacity for 100 homes or more are to investigate the potential of incorporating on-site zero and low carbon equipment within the site design and to investigate feasible connections to existing local sources of renewable energy.

The report has outlined that there are no local Energy Networks present near this proposed site and so no connection to an existing network is proposed for this scheme.

This energy assessment has reviewed the proposed project design and has demonstrated that the scheme complies with the Swansea Local Development plan policy EU 2 through the incorporating of both passive and active design measures into the building design enabling the project to reduce energy usage and carbon emissions at source, rather than adopting external renewable technologies.

Designing the energy efficiency and carbon saving features of the development into the fabric of the building secures these reductions for the lifetime of the building and does not depend on any required maintenance and or further individual interventions to preserve any savings delivered through external bolt on solutions. The integral design factors that have been incorporated into the design of the project are bespoke PSI values, low thermal mass, low fabric U Values and high G Values. All of these measures are combined well to deliver energy efficient and low carbon dwellings through key passive measures.

House Type	Dwelling Type	Dwelling Emission Rate $kgCO_2/m^2/yr$	Target Emission Rate $kgCO_2/m^2/yr$	Building Regulations Compliant
Beech End	House	16.3	17.68	Yes
Alder 0F	Flat	21.59	22.16	Yes
Alder 1F	Flat	18.02	20.09	Yes
Alderney	House	16.25	17.63	Yes
Andover	House	19.03	20.48	Yes
Chester	House	17.34	18.4	Yes
Ennerdale	House	17.1	18.43	Yes
Kingsville	House	15.55	16.5	Yes
Kenley	House	19.96	20.33	Yes
Kenley End	House	17.65	18.67	Yes
Ellerton	House	17.09	18.38	Yes
Moresby End	House	16.59	17.81	Yes
Olive End	House	17.25	18.7	Yes
Olive Mid	House	15.78	17.12	Yes
Radleigh	House	15.97	17.13	Yes
Hesketh	House	15.89	16.11	Yes
Larch	House	16.48	17.69	Yes

Table 1: Summary of dwelling emissions

4.0 Introduction

This Statement has been prepared in support of a planning application submitted for a new domestic housing development on Land off Llewellyn Road, Penllergaer, Swansea for the construction of 180 open market and affordable houses and flats. The reason this has been done is to show compliance throughout site even with the worst performing dwellings and that this will pass and comply with required CO_2 emission targets for Swansea Local Development Plan and also L1A building regulations.

It is proposed to redevelop the site with the following mix of accommodation:

	Housetype	No of Beds	Total
Open Market	Kenley	2	48
	Ellerton	3	30
	Moresby	3	2
	Kingsville	4	22
	Ennerdale	3	11
	Chester	4	19
	Hesketh	4	7
	Alderney	4	11
	Radleigh	4	16
	Andover	3	5
			171
Affordable	Larch	3	1
	Alder	1	4
	Olive	2	3
	Beech	3	1
			9
		TOTAL	180

5.0 Local Planning Policy

The following statement seeks to outline how this development will comply with the requirements and objectives of the Swansea Local Development Plan 2010 – 2025 by addressing;

EU 2: Renewable and Low Carbon Energy Technology in New Development:

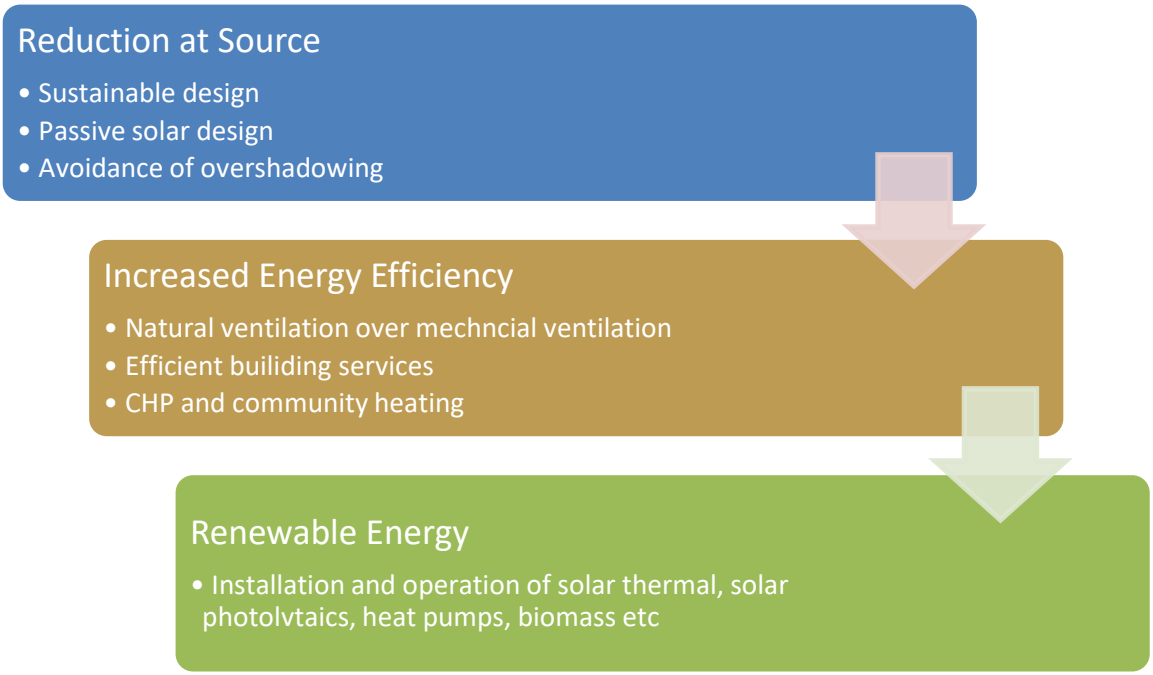
Development will be required to maximise the contribution of renewable or low carbon energy technology to meet the energy demands of the proposal, particularly for Significant Energy Consuming Developments. Residential developments on sites where there is capacity for 100 homes or more, and non-residential developments with a total floorspace of 1000 sq m or more, will be required to submit a comprehensive Energy Assessment to determine the feasibility of incorporating low carbon or renewable energy installations into the scheme and/or connect to renewable or low carbon energy technology and district heating networks.

2.13.15 - Larger development proposals will need to be accompanied by an 'Energy Assessment' which investigates the potential to incorporate on-site zero and low carbon equipment and establish connections to existing sources of renewable energy. Opportunities for linking with district heating networks and where appropriate sharing renewable energy with the wider public should also be explored. The Energy Assessment will be required to set out how the proposal can make a contribution towards increased levels of energy generation from renewable or low carbon sources.

2.13.16 - Some micro-generation technologies are permitted development under the General Permitted Development Order. Prior to any assumption of permitted development, Part 40 (installation of domestic micro-generation equipment) and Part 43 (installation of non-domestic micro-generation equipment) should be referred to for further guidance. Developers may wish to undertake a Pre-Application Enquiry for further clarification regarding micro-generation.

6.0 The Energy Hierarchy

The Energy Hierarchy is a widely adopted and recognised set of principles to guide design, planning and development decisions to optimise energy provision. The Hierarchy prioritises minimising the need for energy consumption through firstly design and energy efficiency and then through generating the reduced energy demand via renewables. The Hierarchy can also help to balance the economic and environmental dimensions of sustainability, supporting choices which are both environmentally and economically sustainable.



It is considered that the above principles carbon reduction forms the most appropriate approach from both the practical and financial perspective. The industry is broadly in agreement that the energy efficiency and low carbon technologies have the greatest impact offsetting CO_2 emissions. Therefore, it is logical to encourage enhanced mitigation through energy efficiency and low carbon technologies in the first instance, as opposed to applying renewables as the first option at a significantly greater cost.

7.0 The Proposed Development

This proposal seeks the construction of 180 open market and affordable houses and flats on Land off Llewellyn Road, Penllergaer, Swansea.

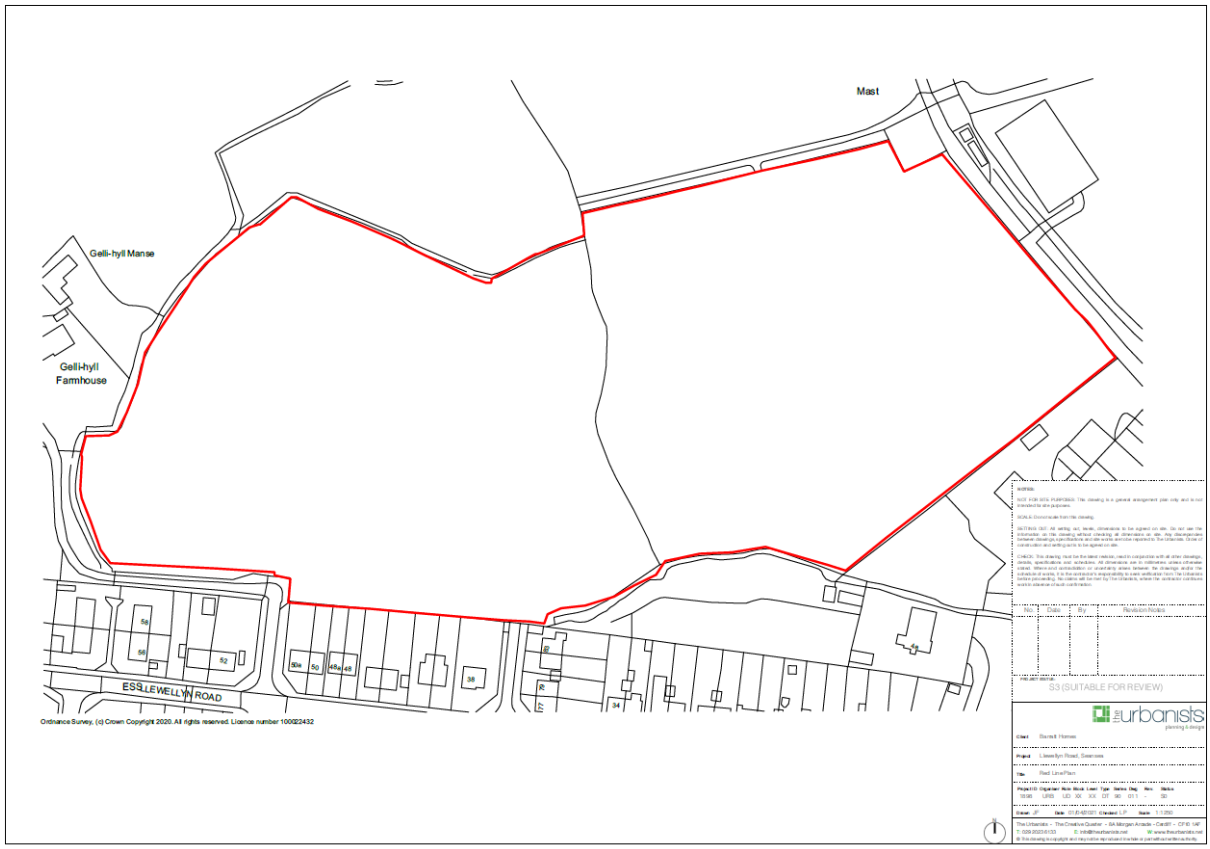


Figure 1: Proposed site location plan courtesy of the Urbanists Planning & Design

Figure 2: Proposed site plan courtesy of the Urbanists Planning & Design

8.0 Sustainable Energy Strategy

The energy performance of a building is affected by its design, construction and use and whilst occupant behaviour is beyond the remit of this statement, better design and construction methods can significantly reduce the life cycle emissions of a building and assist the occupant to reduce consumption.

Sustainable design is not just about incorporating renewable technologies; buildings should be designed at the outset to provide suitable environmental conditions for the occupants whilst also consuming as little energy as practical. It is possible to exceed Building Regulations requirements (Part L 2013) through demand reduction measures alone, which typically include a combination of passive design measures (e.g. building design and efficient building fabric) and active design measures (e.g. Building services).

Passive Design

Passive design is a key principle of sustainable design, and can be used to reduce the building's energy demand. Passive design responds to local climate and site conditions to maximise the building users' comfort and health while minimising energy use.

At the earliest stage the buildings have been designed using a fabric first approach as to initially minimise energy and resulting CO_2 emissions. Particular attention will be paid to thermal envelope and a high level of insulation will be specified to all thermal elements to minimise heat losses.

Passive solar gain reduces the amount of energy required for space heating during the winter months. The dwellings are designed to maximise passive solar gain by the specification of fenestrations to the south, east and west where possible. The specification of windows with high window g-values on this development also assists in taking advantage of potential solar gains.

The development has been designed to improve daylighting in all habitable spaces, as a way of improving the health and wellbeing of its occupants. The majority of the habitable rooms, such as living rooms, will benefit from large windows to increase the amount of daylight within the internal spaces.

A portion of the dwellings heat loss will occur due to air infiltration. Good construction detailing and the use of best practice construction techniques have minimised the amount of uncontrolled air infiltration that will affect these dwellings. Extra attention to detail will be paid, with adequate sealing to all junctions in the thermal envelope, service penetrations and window casements. This will ensure an air test target of $5m^3/m^2$ at 50Pa or better is achieved. Natural ventilation via openable windows will be used to provide fresh air to all areas.

The SAP calculations contain an overheating analysis to ensure that the risk is appropriately mitigated in the dwellings. The analysis demonstrates that all dwellings achieve a compliant level of overheating risk.

The following tables provide a summary of the energy efficient and carbon reducing design characteristics incorporated across the development.

Design SAP Data Input Table			
Element		**Details**	**Comments**
Floor U-Values	Ground Floors	0.15 W/m²K	Block and Beam Floor Construction
	Floor Over Garage	0.22 W/m²K	22mm chipboard, 200mm mineral wool between timber joists, 22mm Chipboard
Wall U-Values	External Walls	0.19 W/m²K	3mm Plaster on 12.5mm Plasterboard on Dabs, 100mm Lightweight Block, 75mm Celotex CW4000, 50mm Low E Cavity, 102.5mm brick or 100mm Block with 20mm Render Finish
	Spandrell Walls	0.25 W/m²K	Specialist Manufacturer
	Dormer Cheeks	0.26 W/m²K	Storm King
	Dwarf Walls	0.12 W/m²K	
	Walls to Garage	0.28 W/m²K	Solid Wall with Insulated Plasterboard
Roof U-Values	Insulation at Slope	0.16 W/m²K	PIR through and under rafters
	Cold Pitched Roof	0.10 W/m²K	Insulation laid between and across joists
	Ceiling to roof Void	0.12 W/m²K	Insulation to follow slope
	Storm King Dormer Roof	0.19 W/m²K	Specialist Manufacturer
Opening U-Values	Windows	1.41 W/m²K	Double Glazed, Low-E Coated. G Value: 0.71
	French Doors	1.41 W/m²K	Double Glazed, Low-E Coated. G Value: 0.71
	Solid Doors	1.20 W/m²K	
	Roof Lights	1.81 W/m²K	Double Glazed Velux Roof lights
Thermal Bridging	y - value	Various	Accredited & Bespoke Construction Details Used
Ventilation	Air Tightness	5.00	-
	Mechanical ventilation		Natural Ventilation – Extract ONLY
Heating and Hot Water	Primary heating system	Gas Fired Condensing Boiler	Ideal Logic ESP1 35 Ideal Logic Heat H24
			Boiler Information: Pump in heated space, boiler Interlock, fan assisted flue
	Controls	Full time and temperature zone controls	Suitable arrangement of plumbing & electrical services Delayed Start Thermostat
	Heat distribution	Radiators	-
	Water heating	From Boiler	250L Hot Water Storage Maximum Standing Heat Losses: 1.63 kWh per day Cylinder to have thermostat, all primary pipework to be insulated, and water heating on separate timer to main heating
Low Energy Lighting		100% Low-Energy Fittings	Minimum Efficiency 45 Lumens per Circuit Watt

Table 1: Energy Efficient Measures of SAP Calculations

9.0 Dwelling Emissions Assessment

SAP calculations have been produced for the dwellings as a means of determining the Dwelling Emission Rate (DER) using the approved modelling software Elmhurst Design SAP 2012.

Incorporating the energy saving measures from the previous section into the design SAP Assessment will reduce the sites overall energy demand and subsequent CO_2 emissions beyond the requirements of Part L Building Regulations for every dwelling on site.

The following table provides a summary of the emissions for each house type across the site.

Dwelling Emissions Summary

House Type	Dwelling Type	Dwelling Emission Rate $kgCO_2/m^2/yr$	Target Emission Rate $kgCO_2/m^2/yr$	Building Regulations Compliant
Beech End	House	16.3	17.68	Yes
Alder 0F	Flat	21.59	22.16	Yes
Alder 1F	Flat	18.02	20.09	Yes
Alderney	House	16.25	17.63	Yes
Andover	House	19.03	20.48	Yes
Chester	House	17.34	18.4	Yes
Ennerdale	House	17.1	18.43	Yes
Kingsville	House	15.55	16.5	Yes
Kenley	House	19.96	20.33	Yes
Kenley End	House	17.65	18.67	Yes
Ellerton	House	17.09	18.38	Yes
Moresby End	House	16.59	17.81	Yes
Olive End	House	17.25	18.7	Yes
Olive Mid	House	15.78	17.12	Yes
Radleigh	House	15.97	17.13	Yes
Hesketh	House	15.89	16.11	Yes
Larch	House	16.48	17.69	Yes

Table 2: Summary of dwelling emissions

10.0 Renewables Feasibility

The following renewable technologies have been evaluated for use:

- Solar photovoltaic Cells (PV)
- Solar Hot Water
- Wind Turbines
- Ground Source Heat Pump
- Air Source Heat Pump

Photovoltaics

Solar photovoltaics (PVs) convert energy from daylight into electricity using a semiconductor material such as silicon. When light hits the semiconductor, the energy in the light is absorbed, 'exciting' the electrons in the semiconductor so that they break free from their atoms. The resultant flow of electrons through the semiconductor material produces electricity.

Feasibility	Further Consideration
The house type orientation across the site generally lends itself to good southerly orientations to maximise passive solar gain. This would support the orientations best suited to PV location. Although there are a number of house types that contain a number of design features that make the installation of PV panels more less effectual such as dormers, rooflights and orientation. There are no potential over shading risks which will limit efficiency of the installed array. As PV system has no moving parts, generate no noise or pollution, this is an attractive option. If designed and properly installed require minimal maintenance and have long service lifetimes, with in excess of 20 years of access to the feed in tariffs.	Yes

Solar Thermal (Hot Water)

Solar water heating systems convert solar radiation to heat carried by water for use in space heating or the provision of domestic hot water. Solar water heating systems normally operate with a back-up source of heat, such as gas condensing boilers. The solar water heating preheats the incoming water, which is topped up by the back-up heat source when there is insufficient solar energy to reach the target water temperature.

Feasibility	Further Consideration
Although many properties will have an adequate area of roof, the hot water demand for the residential properties on this site is minimal. Hot water requirement is at its highest during the winter, where generation is at its lowest. As the dwellings aren't overly large, it is proposed the majority of the properties will have combination boilers in order to minimise hot water losses through storage with a small number of dwellings having system boilers with a hot water cylinder, therefore solar thermal would not be compatible with this installation. Furthermore, the potential gains are capped for domestic applications as only so much hot water can be used within a property.	No

Wind Turbines

Wind turbines are modern, high-technology descendants of the windmills that have been around for centuries. In modern windmills the kinetic energy of the wind is used to turn a turbine to generate electricity as opposed to moving water or turning a grist mill wheel. There are two types of wind turbine, the horizontal-axis type which faces up or downstream of the wind and where the rotational movement of the blade is connected to a generator to create electricity. The other is the vertical-axis design, which is by far the most flexible type of wind turbine being best suited to more urban sites as it is more cost effective and operates with wind coming from any direction.

Feasibility	Further Consideration
Owing to site-constraints, micro-wind turbines have not been considered as part of this feasibility study. The primary constraints include the character of the building, the dense urban surroundings (and associated potential planning restrictions) and relatively low wind speeds in this area, averaging ~ 4.7ms at 10m above ground level. (http://www.rensmart.com/Weather/BERR) Wind turbines are also likely to have a significant visual and noise impact on local environment, as well as health and safety implications for occupiers or users on-site and on adjacent areas as a result of noise and light flicker associated with the wind turbines.	No

Ground Source Heat Pumps

Ground source heating takes advantage of the stable ground temperature of 12ºC to heat either air or water to provide energy efficient heating (and optional comfort cooling) to a building. The energy flow is driven by the temperature difference between the ground and the circulating fluid which can then be used to deliver heating (and optional cooling) to the building.

The direct bore hole type of installation requires a number of boreholes with a depth of up to 100m and a minimum centreline distance of 6m separating each bore hole. Alternatively, closed loops can be installed along with the piles and or pad foundations of the building to take advantage of the foundation excavations to maximise the earth-connectivity of the system.

Feasibility	Further Consideration
In this instance ground source heat pumps have not been considered for this development due to the particular site characteristics including the urban streetscape. Ground source heat pumps also work best when there is a constant demand for heating and this is minimal for most of this site, it is deemed unfeasible to consider this option. Along with this, ground source heat pumps perform best where the system is not intermittently being switched off and on again.	No

Air Source Heat Pumps

An air source heat pump (ASHP) is a system which transfers heat from outside to inside a building. Under the principles of vapour compression refrigeration, an ASHP uses a refrigerant system involving a compressor and a condenser to absorb heat at one place and release it at another.

In domestic heating use, an ASHP absorbs heat from outside air and releases it inside the building, as hot air, hot water-filled radiators, under floor heating and/or domestic hot water supply.

As there are 180 dwellings proposed for this development, 180 separate heat pumps would be required to be situated outside the properties. Air source heat pumps have extremely high capital, running and maintenance costs compared to conventional systems. Heat pumps can be quite prone to have airflow problems caused by air leaks and poor refrigeration. Due to the facts stated above, it has been deemed unfeasible to consider air source heat pumps on this project due to there being too many cons outweighing the pros.	No

Renewables Summary

Although PV panels have been shown to be a good option on some of the house types across the site, no renewable technologies are proposed on this scheme due to the projects intense focus on a fabric first approach. The project has been designed to incorporating passive and active design measures to reduce energy and carbon at source. Designing the energy efficiency and carbon saving features of the development into the fabric of the building secures the passive reductions for the lifetime of the building and is not reliant on maintenance and further individual interventions to preserve savings that are delivered through external solutions. Integral design factors that have been combined to achieve and deliver this carbon reduction and energy efficiency are the calculation of bespoke 'as built' PSI values to ensure that heat losses are accurately accounted for in the construction to minimise uncontrolled air leakage leading to a loss of temperature control within the dwellings. The buildings have been designed to incorporate a low thermal mass to ensure that the dwellings respond swiftly to the need to additional heat through the use of lightweight construction materials. The adoption of low U Values incorporating high levels of thermal insulation to provide good levels of heat conservation. High performance windows with low U Values but high G Values to enable passive solar radiation to enter the dwellings to offset the use of the heating system where possible and conserve the heat that is generated.

11.0 Renewable Energy Network

This site has been assessed in line with its ability to connect to a local Energy Network and it has been identified that the site location is outside of the reach any local network. Given the removed site location connection to any existing Energy Network, connection is not possible with this site.

12.0 Conclusions and Summary

This statement has reviewed the sustainability performance of the proposed development at Land off Llewellyn Road, Penllergaer, Swansea against building regulation standards and local policies. The material specification and fixed building services strategy for the development have also been reviewed.

The developer has considered all sustainable solutions and has reduced the energy demand and resultant carbon dioxide emissions of the development above and beyond the requirements of the Building Regulations Part L1A. This has all be done in with a fabric first approach in mind rather than the use of renewables. Although there are some benefits to using renewables on this development, a fabric first approach outweighs these benefits and would be the most beneficial long-term solution for the site.

This report has shown how the proposed development has been designed using the principles of the Energy Hierarchy in order to deliver significant carbon dioxide savings. In particular, the design team have sought to minimise emissions at source by the incorporation of a “Fabric First” approach utilising the principles of passive design including thermal junction development and design. A number of different factors have been accounted for when using this fabric first approach and these are integral design factors such as bespoke PSI values, low thermal mass, low U-values and also high performing windows with low U-Values. All of these measures have contributed massively to the performance and energy efficiency of the dwellings making sure that there will be significant carbon savings and passive reductions for the lifetime of the building.

Furthermore, the implementation of sustainable design features such as the high efficiency gas combi boilers coupled with advanced controls and high efficiency lighting throughout the project has further helped reduce emissions and create comfortable living spaces.

Due to the financial viability constraints involved with the development of this site, whilst PV is to be considered a good option, it is not being proposed for the scheme at this current stage, with the main focus being on a fabric-first approach and incorporating passive and active design measures to reduce energy and carbon at source. The financial viability of the development will of course be discussed with the Council during the determination of the application in an open and transparent manner.

No renewable technologies are required across the site given the focus that has been placed on the development of a fabric first approach incorporating passive and active design measures to reduce energy and carbon at source.

Darren Evans Ltd.
1 Russell Mews, High Street, Chipping Sodbury
Bristol, BS37 6BJ, United Kingdom
T: +44 (0)333 5777 577
F: +44 (0)1454 528 224
E: info@darren-evans.co.uk
W: www.darren-evans.co.uk