ENERGY STATEMENT

PLANNING

On page

DATE October 2019

SITE Parc Hadau, Waun Sterw, Potardawe

APPLICANT Yr Hadau Ltd (on behalf of Sero Homes)

INTRODUCTION

This Energy Statement has been prepared in support of a planning application, submitted on behalf of Yr Hadau Ltd (on behalf of Sero Homes Ltd), for:

"Full planning permission for the proposed development of 35 zero carbon homes along with associated works including landscaping, parking, access, engineering works and ecological mitigation."

This Energy Statement outlines the context within which the application is made and provides an examination of the energy proposals for the development.

SERO HOMES

The core team at Sero have been building "net zero carbon" and "off-grid" homes for more than a decade and have hands-on experience of financing and delivering more than 300MW of renewable energy generation.

Sero believe that peoples' homes should minimise the harm done to our planet and that they shouldn't cost the earth to run. People's homes should be healthy, light and welcoming; they should encourage community and active travel, as well as support the local flora and fauna.

Sero builds primarily homes for the private rental market, which allows them to spend a little bit more on building them. This means that they can exceed current Building Regulations and include renewable energy generation and storage systems in their schemes. Because they maintain their homes throughout their life, they also spend more to ensure that the construction quality is right, the designs are flexible and that the primary building materials are durable.

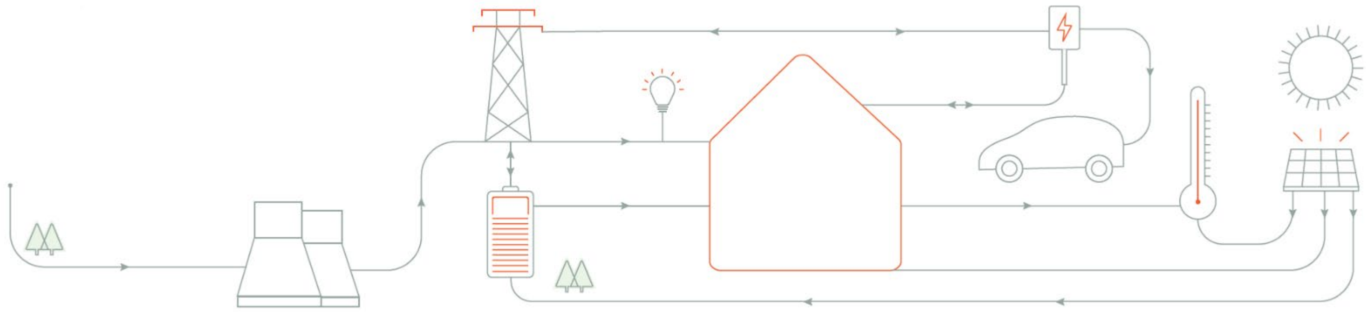
They still aim to build peoples' "forever home" though, and their normal contracts allow residents to stay as long as they wish – a lifetime if they desire – with their rent simply being index-linked so there are no nasty surprises. And because we build homes so well and use the latest renewable and storage technology, one of the three-bedroom homes will typically cost less than £40/month to run – that's less than half what a comparable house would cost.

In short, they build affordable, energy-efficient homes that are designed for people to really want to live in.

THE SERO MODEL

These first-generation homes are built to generate their own energy from renewable sources – in this case solar PV, and to store this in batteries and thermal stores so that it's available for when residents want it. This storage also allows Sero's sister company, Sero Energy, to feed energy to the National Grid and draw from it at optimum times. As a result, they can pass some of these benefits on to the residents, whilst easing the energy burden of the homes on the National Grid.

This clever technology means the homes significantly reduce carbon emissions, since when they use power from the National Grid it is typically when that power generation emits the lowest levels of carbon. To ensure 'grid zero carbon' is achieved they log every single kWh of energy and its consequential carbon emissions (or the emissions avoided) in their neighbourhoods. The homes' renewable generation is powering the National Grid, they record the carbon being avoided, so that when they need to draw a bit of power back, this can balance the Grid emissions from those avoided beforehand.



In addition, their homes are designed to demand less energy first and foremost. They go beyond current building regulations to build highly insulted homes that avoid cold spots and minimise draughts – in construction terminology that's very low U-values, very low thermal bridging values and very low air leakage to give low overall heat demand. This means the homes need much less energy to be warm and comfortable.

Because they build homes to help fight climate change, they also think about how they will perform in the future climate. Overheating can be a real issue, which is why the homes include thermal mass that helps moderate overheating on hot days by absorbing the warmth to keep the rooms cool.

LOCAL PLANNING POLICY REQUIREMENT

The Council's planning policy in relation to the various types of renewable and low carbon energy is set out in the Neath Port Talbot Local Development Plan (LDP)(1) Strategic Policy SP18 (Renewable and Low Carbon Energy) and detailed policies RE1 (Criteria for the Assessment of Renewable and Low Carbon Energy Developments) and RE2 (Renewable and Low Carbon Energy in New Development).

Policy RE2 specifically outlines that *"Schemes that connect to existing sources of renewable energy, district heating networks and incorporate on-site zero / low carbon technology (including microgeneration technologies) will be encouraged."*

Furthermore, Supplementary Planning Guidance: Renewable and Low Carbon Energy (July 2017) provides additional guidance on how to incorporate such measures into development and provides guidance on the preparation of Energy Assessments.

ASSESSMENT

As outlined above, at the heart of what Sero Homes are trying to achieve is to tackle climate change and its causes. One of their main aims is to reduce the pressure on the Grid during peak times, and give energy back into the grid for others to use when possible. This section outlines the technologies and features of the buildings that make them 'true grid carbon zero', how this has been calculated, and how they compare with other energy saving measures.

Technology Used

To achieve true grid carbon zero level through active energy management the homes will include a number of energy saving features and through two main stages:

- Stage 1 – Reduce Demand

  This will be achieved with a fabric first approach. The demand will be reduced by insulating the building and creating an airtight envelope. This will be to a standard well above building regulations requirements. Particular focus will be placed on site to reduce the performance gap between design and constructed reality. This will be achieved through training and site inspections as well as early site air testing. This will ensure that the in use performance matches the design performance.

  The houses are designed to be terraced to minimise energy use as well as minimise material use. This makes for a lower operation and embodied carbon scheme.

  The materials have also been chosen for their embodied energy. Stone is a natural product with low embodied energy. It is also easy to reuse and recycle at the end of the buildings life. Timber has a low embodied energy and it also has the ability so sequester and store carbon that it has absorbed during its life.

  A-rated energy efficient appliances will be installed.

- Stage 2 – Servicing the Demand

  The PV panels will generate electricity for the homes. Each house type will include a certain number of panels on the roof – for example an average 3-bed home will have 24 panels (around 35sqm).

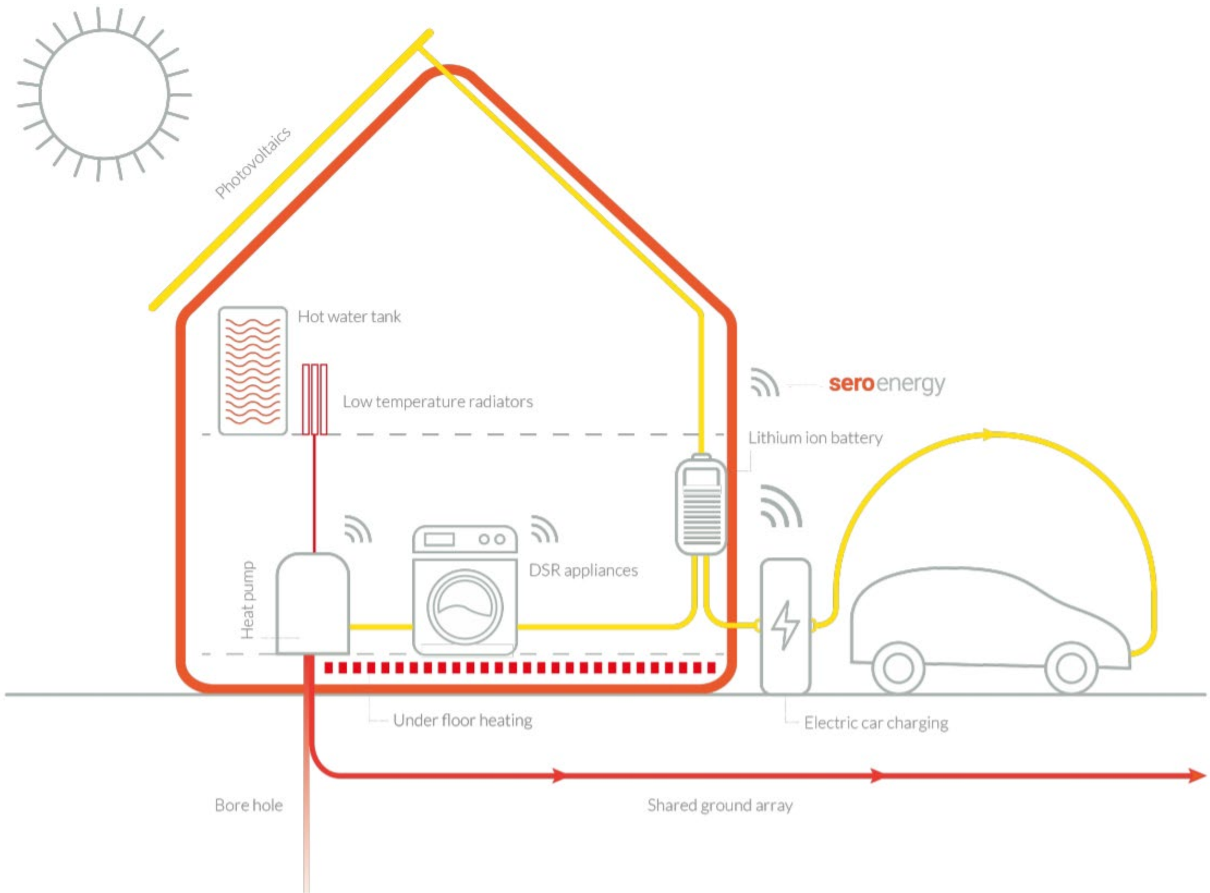
  Solar energy production is more closely aligned with demand. People are generally in their homes in the mornings and evenings and are out at midday so by angling the solar panels away from direct south it means more of the solar energy can be used at source and less is exported to the grid.

  The surplus energy not used by the residents will be stored in batteries for use when renewable sources are not producing energy. Sero Energy will also offer grid balancing to the national grid from the energy not used in the homes.

A heat pump systems will capture thermal energy from the ground, this energy will be absorbed into a fluid and passed through a compressor to raise its temperature. This will be used mainly for space heating and water heating in the homes. The energy required to run the pumps will be sourced from the PV panels.

Electric car charging points will be installed and integrated with the battery storage. This will reduce the residents use of fossil fuels.

The below diagram illustrates how this might be achieved:



Calculations

To determine the number of PV panels would be required to achieve the 'true grid carbon zero' target, Sero Homes have undertaken the following calculation. This calculation is based on an average occupancy and average size of home.

Reduce	
Number of Homes in Neighbourhood	35 homes
Average Number of Occupants per Home	4 people
Average Size of Homes	100.00 m²
Average Space Heating Demand per m²	25.00 kWh/m²/Yr
Average Space Heating Heat Pump CoEfficient of Productivity	275.0%
Average Space Heating Energy per Home per year	0.91 mWh
Average Mains Incoming Water Temperature	12.0°C
Interim Water Temperature (Heat Pump hands to Immersion)	45.0°C
Average Hot Water Temperature	55.0°C
Average Hot Water Immersion CoEfficient of Productivity	99.0%
Average Hot Water Use per Person *(25 litre/person is normal)*	25 litres/person
Average Hot Water Use per House *(inc. 36 litre baseline)*	136 litres/home
Average Hot Water Demand per Home	1.28 mWh
Average Electricity Annual Demand per Home	3.80 mWh
Average Electric Vehicle Mileage per Year per Home	10,000 miles
Average Electric Vehicle Efficiency	0.248 kWh/mile
Total Neighbourhood Annual Energy Demand (no EV)	**209.5 mWh**
Total Annual Energy Demand per Home (no EV)	**6.0 mWh**
Total Neighbourhood Annual Energy Demand (with EV)	296.3 mWh
Total Annual Energy Demand per Home (with EV)	8.5 mWh

Balance	
Battery Storage efficiency	88.0%
Estimated proportion of generation needing to demand shift to match occupant demand (reflects PV aligning with demand, i.e. lower with WSW facing PV as more direct pass through)	95.0%
Average Efficiency	**88.600%**
Total Neighbourhood Annual Energy Demand (no EV)	**236.5 mWh**
Total Annual Energy Demand per Home (no EV)	**6.8 mWh**
Total Neighbourhood Annual Energy Demand (with EV)	334.4 mWh
Total Annual Energy Demand per Home (with EV)	9.6 mWh

Generate	
Specific Yield (assumed 35° pitched South)	949.0 kWh/kWp
PV Generation that can feed directly to demand should beat	*840.8 kWh/kWp*
Shading Factor (assumed none)	1
Total Neighbourhood Peak Generation Required	**249.17 kWp**
Peak Generation Required per Home	**7.12 kWp**
Total Neighbourhood Peak Generation Required (with EV)	352.41 kWp
Peak Generation Required per Home (with EV)	10.07 kWp

Generation (Physical Hardware)	
Peak Generation per PV Panel	0.37 kWp
25th Year PV Panel Efficiency	88.4%
PV panel area (without edge zones etc.)	1.73 m²
Total Neighbourhood PV Panels Required (no EV)	**674 PV panels**
Total Neighbourhood PV Area Required (no EV)	**1,164.13 m²**
Total PV Panels Required per Home (no EV)	**20 PV panels**
Total PV Area Required per Home (no EV)	**34.54 m²**
Total Neighbourhood PV Panels Required (with EV)	953 PV panels
Total Neighbourhood PV Area Required (with EV)	1,646.02 m²
Total PV Panels Required per Home (with EV)	28 PV panels
Total PV Area Required per Home (with EV)	48.36 m²

Generation requirements after 25 years (presuming no other variables)	
Total Neighbourhood PV Panels Required (no EV)	762 PV panels
Total Neighbourhood PV Area Required (no EV)	1,316.89 m²
Total PV Panels Required per Home (no EV)	22 PV panels
Total PV Area Required per Home (no EV)	37.63 m²

Note 25 year figure assumes PV remains original, but is based on the battery being replaced with a like-for-like efficiency. This might well be conservative, though the battery degradation between replacement cycles would mitigate the efficiency 'steps' each time the battery is replaced.

Given that each 3-bed dwelling will only require 20 PV panels and the scheme overprovides by 4 panels per 3-bed dwelling. Accordingly, there will be more than sufficient generation for each property, which also ought mean that more energy can be stored and 'put back' into the grid when it needs it most.

Comparison with Other Measures

As an exercise to compare how the sustainability credentials of the scheme compares to other highly sustainable schemes, the team have pulled together a simple comparison in the below table. The below figures are based on a three-bedroom home built to roughly current building regulations fabric performance with a family of four living there.

Features	CO_2 Emissions (per year)	Assumptions
Baseline Building Regulation Home	3,298kg	Assuming the house has a gas boiler for heating & hot water, and the family's probable electric usage is counted based on grid emissions.
All Electric, No Renewables *[Likely to be the next Building Regulation Requirement in 2020]*	1,738kg	Assuming a switch to a heat pump with a coefficient of performances around 2.75, the efficiency of the heat pump combined with the Grid carbon levels drops the carbon emissions compared to the baseline.
High Fabric Performance All Electric, No PV *[PassivHaus]*	1,233kg	Assuming build to PassivHaus standard, the absence of any renewable generation means the hot water and occupant energy demands still leave more than a tonne of CO_2 emissions.
PV for "Regulated" Energy (primarily heating & hot water) *[Old "Code for Sustainable Homes" Level 5 – what many consider as a "Zero Carbon Home"]*	963kg	Reverting to the baseline fabric (not PassivHaus), and adding a South facing 30˚ degree PV array sized to generate the same amount of electricity over the course of a year as the heating & hot water requires in the same period, the carbon emissions drop again. This assumes all excess PV generation is usefully passed to the National Grid.
PV for All Energy (includes occupant energy usage) *[Old "Code for Sustainable Homes" Level 6 – what more ambitious/academic people consider to be a "Zero Carbon Home"]*	131kg	More South facing 30˚ degree PV to generate enough electricity to match the total demand of the home and occupants, and assuming excess electricity can be usefully passed to the National Grid if not used on site. Whilst widely called a "Zero Carbon Home" or "True Zero Carbon Home", it is not, because the grid carbon emissions vary and generally excess generation is at low grid carbon times, and import is at high grid carbon times.
PV, Storage & Active Management for All Energy *["True Grid Zero Carbon Homes" from Sero (or maybe just "Grid Zero Carbon Homes")]*	0kg	Active energy management and storage tracks grid carbon emissions and ensures all electricity exported earns carbon credits at the instantaneous grid carbon intensity, whilst imports erode these credits. By managing the system against the variable grid carbon emissions over the course of the year, at True Grid Zero Carbon performance can be achieved.

The above demonstrates that the proposed scheme would be a significant improvement on what was previously regarded as the most efficient home (i.e. Code for Sustainable Homes Level 6).

CONCLUSION

Sero Homes is a newly formed housing provider. They are determined to establish themselves as one of the UK's best providers of quality homes, overturning the issues around the existing supply of new housing and providing quality, sustainable homes for future generations. To achieve this, Sero Homes is innovating across the board – finances, ownership models, design, energy, sustainability, travel, culture, and more.

As outlined in this Statement, their aim first is to reduce energy demand from the homes by looking at the fabric of the structure and providing A-rated energy efficient appliances will be installed. The PV panels on the roof will then provide the energy needs of the homes, with any surplus energy stored in batteries for high demand periods, or to filter back to the grid.

This results in a 'true grid zero carbon' development which is entirely in line, and indeed exceeds, Neath Port Talbot Council's policy in respect of low energy development.