Energy Statement and Assessment

Harvester Yard
Ditcheat

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Executive Summary

This document sets out the energy strategy for the proposed new home at Harvester Yard, Ditcheat. It describes how the development is expected to meet, and exceed, the relevant energy requirements of national, regional and local planning policy.

Sustainability Objectives

The Harvester Yard development will aim to:

- Meet every requirement of Mendip Council's Sustainable Energy Protocol
- Provide a new home with very low energy demands and running costs for the applicant to live in

Sustainable Energy Measures

For the new home, the Harvester Yard development will commit to:

- An truly excellent thermal envelope (U-values of around 0.1 W m^{-2} K^{-1} for the opaque elements, 1.4 for the majority of the openings, and an air test of < 1 m^3 hr^{-1} m^{-2})
- An orientation and layout to minimise heat loss and maximise passive solar gain
- Cross-ventilation and thermal mass to avoid summer over heating
- A heating system run on a high efficiency condensing gas boiler
- A mechanical ventilation system with heat recovery
- Solar thermal panels to provide around 40% of the home's hot water needs

Sustainability Achievements

- The proposed home beats the 2010 Building Regulations by 24% through energy efficiency measures alone (an 42% improvement on a 2006 Building Regulation home)
- When the renewable energy system is included, the improvement over the 2010 Regulations is 32% (49% over 2006)
- The home meets all of the on-site performance standards of a 2016 'zero' carbon home

1 Introduction

1.1 This Energy Statement has been produced by Ecofirst Consult for Mr Yeoman to form part a planning application, and is for the purpose of communicating the nature of the energy strategy at the proposed development at Harvester Yard, Ditcheat.

1.2 This document first outlines why we need to reduce carbon emissions and the other environmental impacts of our buildings. Secondly, it outlines the scope of measures that will be adopted to reduce the impact of the development on global sustainability. A further aim of the statement is to demonstrate how the proposed scheme is consistent with the main planning policy and guidance promoting sustainable development.

Motivations

1.3 It is very probable that the carbon dioxide given off by the burning of fossil fuels is upsetting the natural balance of the 'greenhouse effect', leading to global warming which increasingly impacts our environment and populations around the world.

1.4 The rate at which fossil fuels (especially oil) are being discovered is falling. The rate at which energy is demanded, and therefore that these fossil fuels are required, is growing very fast, and accelerating. At some point in the coming decade or so, the supply and demand curves are likely to cross, leading to rapidly increasing prices. Given the reliance of our society on energy, these price increases are likely to affect all aspects of the world economy, including food production and transportation, and restrict economic growth.

1.5 The UK itself is a net importer of energy. Given the dependence of our economy on oil (transport), gas (heating) and electricity (coal, gas, nuclear), this dependence upon other countries makes us vulnerable to the whim of other countries and factors outside of our control.

Supporting Documents

1.6 Various documents have been submitted with the Planning Application and should be read in conjunction with this Sustainability Statement. These documents provide additional context to the sustainability measures proposed in this strategy, and include:

Design and Access Statement

1.7 A Design and Access Statement has been produced which addresses the design concepts for the Harvester Yard site. This Sustainability Statement refers to principles within this Design and Access Statement, and cross-refers to them where appropriate.

Structure of this Energy Statement

1.8 This Statement provides a description of how the development proposals have considered the issue of energy. These measures are set against the issues raised in Mendip Council's planning documents.

1.9 The following two sections introduce the site and then discuss the policy context. The next three sections answer the questions in Annex 2 of Mendip Council's Sustainable Energy Protocol; Section 4 deals with reducing the need for energy, Section 5 addresses the efficient use of energy, and

then Section 6 deals with renewable energy. Section 7 sets out the predicted performance of the building and compares it to the minimum standards set out in the Building Regulations.

1.10 All work in this document is based on SAP 2009, and the 2010 version of Part L of the Building Regulations.

2 The Site

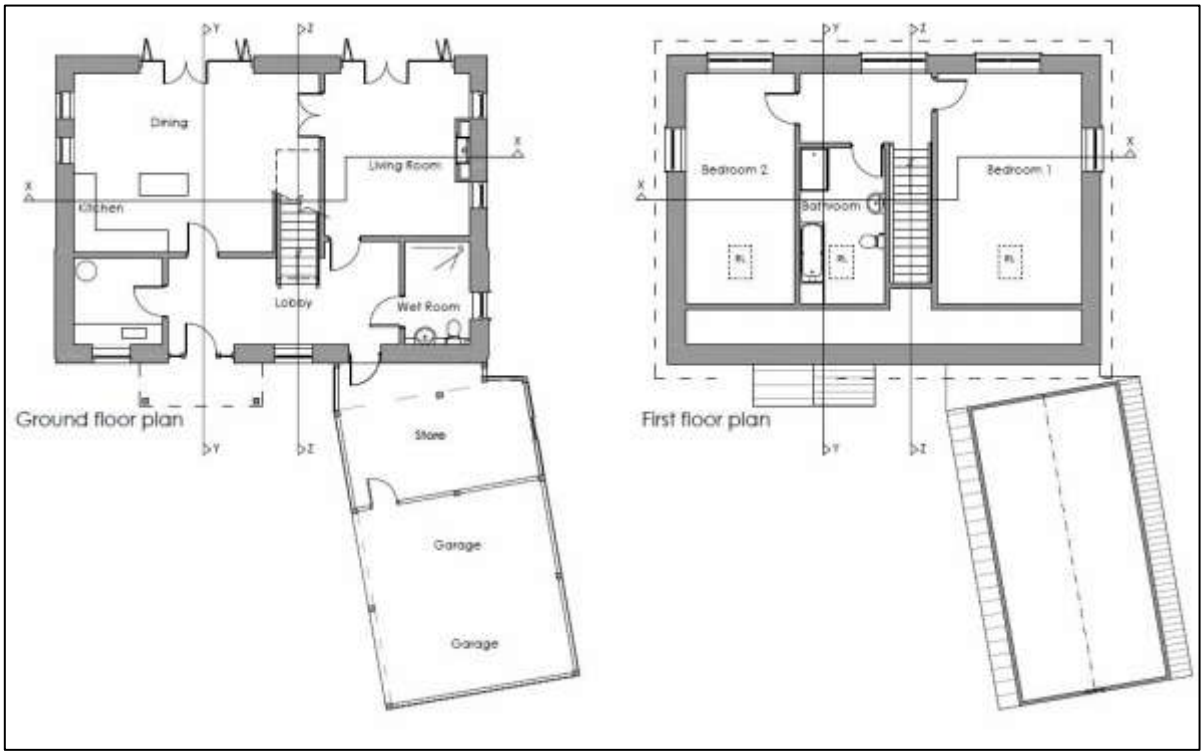
Site Address

2.1 Plot 1, Harvester Yard, Ditcheat, Somerset, BA4 6RB

Proposed Scheme

2.2 The proposal is to build a single, energy efficient, home.

Figure 1: Development as proposed



3 Policy Context

3.1 The motivations discussed in Section 1 are recognised in a pantheon of policy, from international treaties to local planning policy. The strategy on which this Energy Statement is based was developed with reference to international, national, and local policies and strategies that address sustainability. In developing the framework for this strategy, the following documents and policies were considered.

International

3.2 There are many international treaties and agreements designed to address the issues discussed above. They hold various degrees of legal adoption, but show that the international community has realised the need for development to be sustainable.

3.3 The UN has been less than successful at adopting a useful legally-binding agreement on climate change. The Kyoto Protocol was legal binding, but did not include the world's largest emitters, and was not ambitious enough to make a significant difference. In 2009, at Copenhagen, many countries signed a non-legally binding accord to keep warming below 2°C.

3.4 The EU has self-imposed and legally binding targets for deployment of renewable energy, and non-legally binding emission reduction targets of 20% by 2020 (though this may increase to 30%). Also, the EU Energy Use in Buildings Directive addresses energy from buildings.

National Policy

3.5 There are many policies regarding sustainability at a UK level. A selection follows.

Climate Change Act 2008

3.6 The UK is committed to reducing its greenhouse gas emissions by 80% by 2050, with an interim target of 34% by 2020. Allowing dwellings to be built which add large new sources of emissions is therefore somewhat counter-productive.

Planning Policy

- Planning Policy Statement 1 (PPS1): Delivering Sustainable Development. (February 2005).
- Securing the Future: Delivering UK sustainable development strategy. (May 2005).

Building Regulations

3.7 The minimum performance for many aspects of building are set out in the Building Regulations. Part L deals with energy use, and sets out a worst allowable performance for each building element, and an overall level that the regulated emissions (heating, lighting, hot water, ventilation) are not allowed to exceed. Other energy uses (appliances, cooking, etc) are ignored.

2016 and 'Zero Carbon' Homes

3.8 Part L of the Building Regulations has a published timescale for change. Set out in 2006, the regulations were set to tighten, relative to a 2006 baseline, by 25% in 2010, 44% in 2013, and reach zero carbon in 2016.

3.9 The 2010 step has occurred, and all new homes have to consider energy carefully to pass the current minimum energy standards in Part L. The next step will occur in 2013, and the Coalition government has repeatedly stated its commitment to zero carbon homes in 2016.

3.10 There is one issue which is important to highlight. There are several definitions of what a zero carbon home is. They are all limited to the ongoing use of the building; i.e. they ignore the embodied carbon in the materials. The definition used in the Code for Sustainable Homes, and required as mandatory at Code level 6, is that net emissions from all energy use across a year should be equal to zero. This is a challenging level of performance which requires energy to be the dominant input into the design of a house, especially since *all* energy use is considered, so a home needs to generate sufficient electricity to cover cooking and appliance use (the 'unregulated' emissions) as well as heating, lighting, hot water and ventilation.

3.11 Since the first announcement of zero carbon homes in 2006, there have been several releases on how zero carbon will be defined in the context of the 2016 Building Regulations. The first, which has been confirmed by Government, was the inclusion of a strict, but not excessive, energy efficiency standard. Three other definitions have been suggested by the Zero Carbon Hub, and have various levels of official endorsement from Government. The first was that only 70% of the reductions of the regulated emissions (around 50% of the total) would need to be made on site. The remaining could be offset for the first 30 years of the building's life, and ignored for the remainder. The second announcement reduced this amount of on-site reduction to around 40% (around 20% of total). The third announcement, which formed part of the 2011 Budget announcement, stated that unregulated emissions (appliances, cooking, etc, around 30% of the total) will not be included in the calculations.

3.12 There are therefore currently two definitions of a zero carbon home. One is true zero carbon, as required by the Code for Sustainable Homes, and one is 'zero' carbon, which ignores most of the emissions from the life cycle of a home, and allows most of the reduction to be done through offsetting. This 2016 'zero' carbon standard is equivalent to the energy requirement of somewhere between Code 3 and 4.

Local Policy

Planning Policy – Local Plan

3.13 The Core Strategy of the Mendip Local Development Framework is currently only available in a draft form, and so the planning policy that has been considered at the Harvester Yard development is based in the Saved Policies of the Local Plan.

3.14 The policy considerations relevant to this statement are summed up in Policy ER1 – Energy Conservation. 'Development will only be permitted where all practicable measures for the conservation of energy have been included in the design, layout and siting of the proposal'.

3.15 This policy is further detailed in Mendip Council's Sustainable Energy; Protocol for Planning Applications, around which the rest of this statement is based. Annex 2 of this document sets out a series of questions under three headings: Reducing the Need for Energy; Using Energy More Efficiently; and Using Renewable Energy. The following three sections answer the questions under these three headings.

4 Reducing the Need for Energy

Introduction

4.1 As discussed in Section 1, the production of energy from fossil fuels has widespread and far-reaching impacts on sustainability. The careful management of energy is therefore a central theme of sustainable design. It has been one fo the main motivating factors behind the design at Harvester Yard, with energy experts (Ecofirst Consult) being involved throughout the design process.

4.2 This section answers the first set of questions in Annex 2 of Mendip Council's Sustainable Energy Protocol.

Question 1

4.3 Detail how the layout and design of buildings encourages conservation of heat, by minimising the external wall and roof area through which heat can escape?

Answer 1

4.4 Energy use has been a key factor in determining the layout and design. The form has been kept simple to reduce the ratio of surface area to heated volume. Indeed, the heated parts of the building are a simple symmetric shape.

Question 2

4.5 Describe how the development has been laid out to provide orientation for optimal solar benefit.

Answer 2

4.6 Once again, energy was the key factor influencing orientation. The building is orientated south to maximise passive solar gain. Whilst a large portion of the roof does point north, the southern face has been designed to host solar thermal panels while leaving sufficient space for 3.6kW of PV to potentially be installed in the future (which would provide around 90% of the average home's electricity use).

Question 3

4.7 Detail how passive measures for shading and cooling of the buildings will be incorporated.

Answer 3

4.8 While the southerly orientation has been used to maximise passive solar gain, a concern about summer overheating has meant that the amount of glazing on the southern side is not excessive (for example, there are no windows in the roof). The construction system proposed offers thermal inertia inside the heated envelope which provides passive cooling by smoothing out internal temperature variations.

Question 4

4.9 Detail how the use of planting and landscaping will take account of opportunities to shelter buildings from the prevailing wind and from colder winds from the north and east.

Answer 4

4.10 There are no plans for any new planting to provide shelter. However, existing trees to the west and south west will shelter the home from the prevailing winds.

Question 5

4.11 Detail how will the use of planting and landscaping take account of opportunities to provide shade to buildings in the summer, without loss of natural light in winter?

Answer 5

4.12 Again, no extra planting or landscaping will be deployed to address this issue.

Question 6

4.13 How does the design allow for the use of natural light throughout the building?

Answer 6

4.14 The design includes windows in each room which are large enough to let in good levels of daylight without letting out excessive heat in winter.

Question 7

4.15 How will efficient natural ventilation be provided?

Answer 7

4.16 The truly excellent level of air tightness being proposed means that mechanical ventilation will be required. This will include a heat recovery system, recycling heat back into the dwelling; heat that would be lost to the outside in a standard home.

5 Using Energy More Efficiently

Introduction

5.1 This section answers the second set of questions in Annex 2 of Mendip Council's Sustainable Energy Protocol; those regarding the efficient use of energy.

Question 8

5.2 If a new heating system is to be installed, will it be one that conserves energy?

Answer 8

5.3 A new heating system will be installed. After minimising the need for heat (see below), it was deemed suitable that a small, highly efficient condensing gas boiler would be used. The heat loads are not sufficient to justify a biomass utility boiler or a ground source heat pump. Air source heat pumps increase greenhouse gas emissions relative to good gas boilers, and so were discounted.

Question 9

5.4 Will insulation be provided over and above building regulation requirements?

Answer 9

5.5 Insulation far beyond the Building Regulation minimum requirements will be used. An Insulated Concrete Form (ICF) construction system is being specified for the external walls. The roof will be a Euromac system with embedded insulation (with additional insulation beneath it), and the floor will be an Isoquick insulated slab.

5.6 The likely U-values for the building elements are as followed:

- **Walls**: 0.11 W m-2 K-1 compared to 0.3 in the 2010 Building Regulations.
- **Floors**: 0.11 W m-2 K-1 compared to 0.25 in the 2010 Building Regulations.
- **Roof**: 0.11 W m-2 K-1 compared to 0.2 in the 2010 Building Regulations.

5.7 At these levels of insulation (combined with the windows below), the majority of heat loss is through drafts. An air test of 10 m^3 hr^{-1} m^{-2} is allowed by the 2010 Regulations. The proposed dwelling will achieve a performance of around 1 m^3 hr^{-1} m^{-2}, again vastly better than the regulations.

Question 10

5.8 Will high performance glazing above minimum building regulations be specified?

Answer 10

5.9 Again, glazing with a performance beyond the Regulations will be used. Likely U-values are:

- **Windows**: 1.4 W m^{-2} K^{-1} compared to 2.0 in the 2010 Building Regulations
- **Rooflights:** 1.0 W m^{-2} K^{-1} compared to 2.0 in the 2010 Building Regulations
- **Solid Doors:** 1.2 W m^{-2} K^{-1} compared to 2.0 in the 2010 Building Regulations
- **Glazed Doors:** 2.0 W m^{-2} K^{-1} compared to 2.0 in the 2010 Building Regulations

Question 11

5.10 Will an air conditioning system be installed?

Answer 11

5.11 No air conditioning system will be included. To avoid summer overheating, the proposal includes carefully-designed levels of south-facing fenestration, internal thermal mass and good cross ventilation.

Question 12

5.12 Will energy efficient lighting (external and internal) be fitted throughout the development?

Answer 12

5.13 All lighting will be energy efficient.

Question 13

5.14 Explain how the energy embodied in materials will be minimised during construction?

Answer 13

5.15 The Isoquick floor, Euromac roof and ICF walls are all systems which reduce construction waste, and therefore embodied emissions (as less material is used). The ICF walls are A-rated in the BRE Green Guide to Specification. The floor and roof currently have no official rating, but it is likely that they will also be A-rated. The majority of the embodied energy will be associated with the concrete in the floor and walls. This will use recycled aggregate, and as pointed out above, performs well in the BRE Green Guide.

6 Using Renewable Energy

Introduction

6.1 This section answers the final theme of questions in Annex 2 of Mendip Council's Sustainable Energy Protocol; those regarding the use of renewable energy generation.

Question 14

6.2 Will on-site renewable energy be included?

Answer 14

6.3 Although the truly excellent performance level of the efficient measures discussed above means that the proposed home will vastly outperform the performance required of it by the relevant emission rate policies and regulations, Mr Yeoman recognises the need to go further and install renewable energy generation capacity.

6.4 Renewable energy in the built environment comes in two forms; heat and electricity.

6.5 As previously mentioned, the excellent levels of insulation, air tightness and solar gain mean that the demand for *space* heating will be very small. The small demand means that the expense of a low-carbon heating system such as a biomass utility boiler or a ground-source heat pump is not justified. Air source heat pumps increase emissions compared to gas, and so have also been discounted. Heating will therefore be provided be a highly-efficient condensing gas boiler, which is not a renewable system.

6.6 Renewable electricity generation can be provided by solar photovoltaics (PV), wind turbines or biomass CHP. Biomass CHP is a maturing technology which has not yet been proven to work. Small-scale wind turbines on homes do not generate significant useful energy as the slow response times of the inverters combined with the low inertia of the blades and turbulence injected into the air flow by buildings means that their output rarely syncs up to a home's AC supply. Stand alone turbines which surmount this problem have visual and noise impacts and so have been disregarded.

6.7 Solar PV is currently the most expensive renewable energy generation technology in terms of price per kWh generated, and so has also been rejected at this time. However, as mentioned above, the south-facing roof has been designed to accomodate 3.6kW of PV in the future should the cost reduce.

6.8 Technologies to provide renewable energy for space heating and electricity have therefore been rejected. However, in a home of such low space heating demands, the largest energy use is water heating. For this reason, and 5m^2 array of solar thermal panels will be included to provide hot water. This measure is likely to provide around 42% of the hot water required, and reduce the proposed dwelling's emissions by around 251kg per year.

7 Comparative Energy Assessment

Introduction

7.1 As has been shown in the previous three sections, the proposed dwelling is a model example of the sort of development that Policy ER1 and the Sustainable Energy Protocol are trying to achieve. However, many of the questions are subjective, and require subjective answers. Because of this subjectivity, the excellent performance of the proposed home has not been fully illustrated.

7.2 This section uses the outputs from SAP analysis to illustrate objectively how good the proposed dwelling is.

SAP

7.3 The Standard Assessment Procedure (SAP) is an algorithm used by Part L of the Building Regulations to determine the performance of a proposed dwelling in terms of energy use and greenhouse gas emissions.

7.4 From the start of the design process, Mr Yeoman has considered energy as an important aspect, and he commissioned Ecofirst Consult to aid the design by experimenting with SAP models to inform decisions regarding insulation, air tightness, ventilation, and renewable energy.

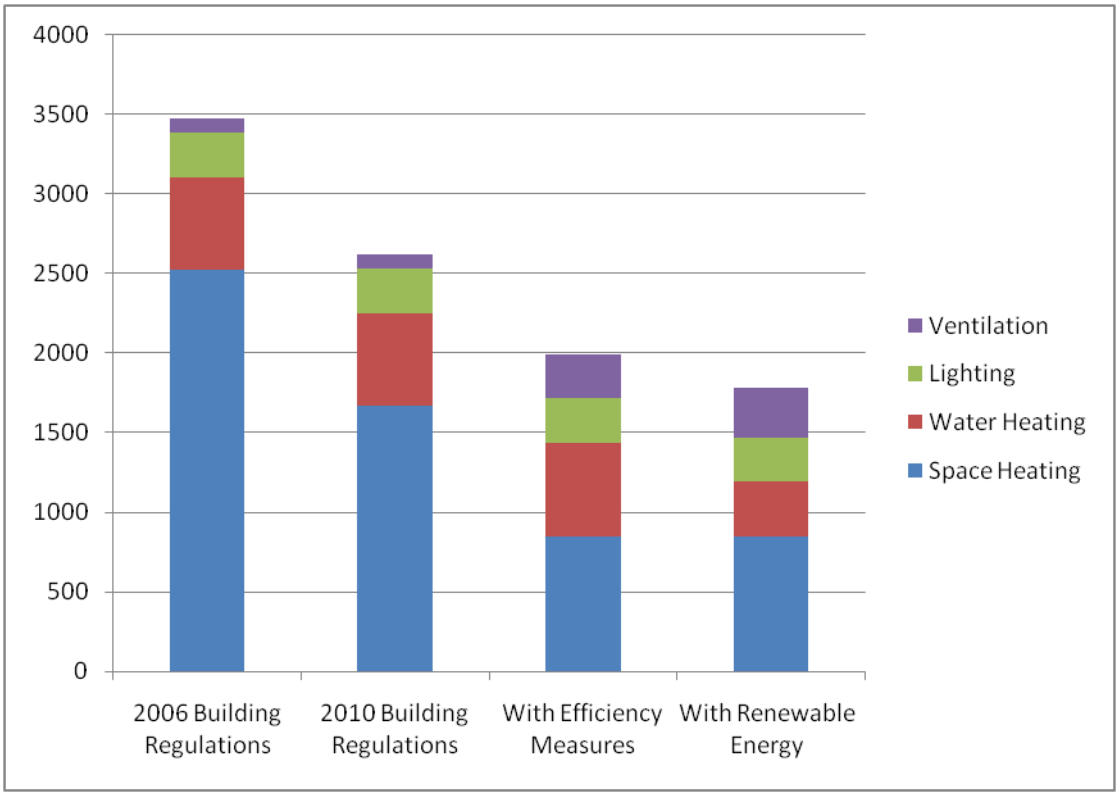
7.5 A series of SAP experiments were performed, and the outputs from a variety of stages can be seen in the table and charts below. The figures are in kg of CO_2 equivalent per year, and are based on the regulated emissions considered by the Building Regulations. The final column is the Dwelling Emission Rate given in kg of CO_2 equivalent per m^2 per year. Each line gives the figures should Harvester Yard be constructed to the specification indicated in the first column. The 2006 version is included even though such a building has not been legal since October 2010 as it is the baseline from which the Code for Sustainable Homes and the famous 25%, 44%, 'zero' carbon timeline is taken.

Emissions					
Option	Space Heating (kg CO2e)	Water Heating (kg CO2e)	Ventilation (kg CO2e)	Lighting (kg CO2e)	**DER (kg CO2e m^{-2} yr^{-1})**
2006 Building Regulations	2,527	580	90	278	**20.60**
2010 Building Regulations	1,668	584	90	278	**15.53**
With efficiency measures	845	593	90	278	**11.8**
With Renewable Energy	851	342	314	278	**10.58**

7.6 As can be seen in these figures, the proposed dwelling achieves an 24% improvement over the 2010 standards (43% over 2006) through efficiency measures alone. Once the renewable energy is included, this improvement increases to 32% over the 2010 Building Regulations (49% over 2006).

7.7 These improvements are shown visually in Fig 2 below.

Figure 2: Plot of emissions vs. stage of design



Zero Carbon Performance

7.8 Though the proposed development is clearly not a true zero carbon home (there is no electricity generation capacity), it does meets the currently-proposed on-site performance levels of a 2016 'zero' carbon home. The current definition of a 'zero' carbon home is one with a heating demand of less than 45 kWh m^{-2} yr^{-1} and an onsite emission rate of 14 $kgCO_2e$ m^{-2} yr^{-1}. The planned home has a heating demand of 41.4 kWh m^{-2} yr^{-1} and an onsite emission rate of 10.58 $kgCO_2e$ m^{-2} yr^{-1}, and therefore surpasses these requirements.

Achievement

7.9 The dwelling quite clearly has achieved the desired outcome of Policy ER1, it has taken all practical measures for the conservation of energy, in terms of design, layout and siting.