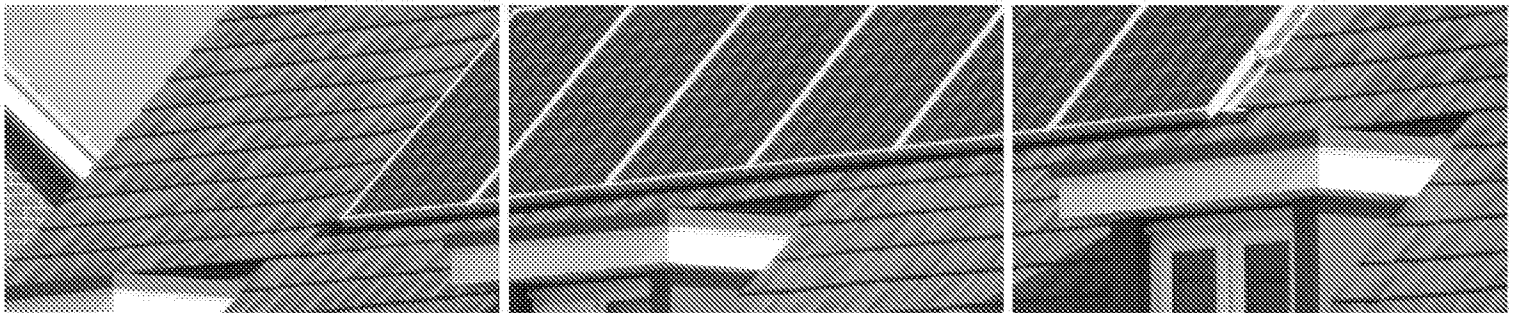
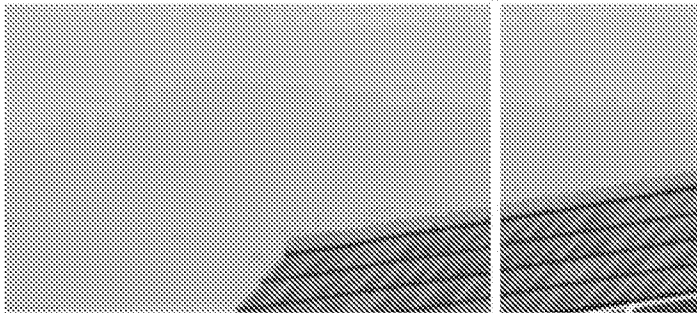
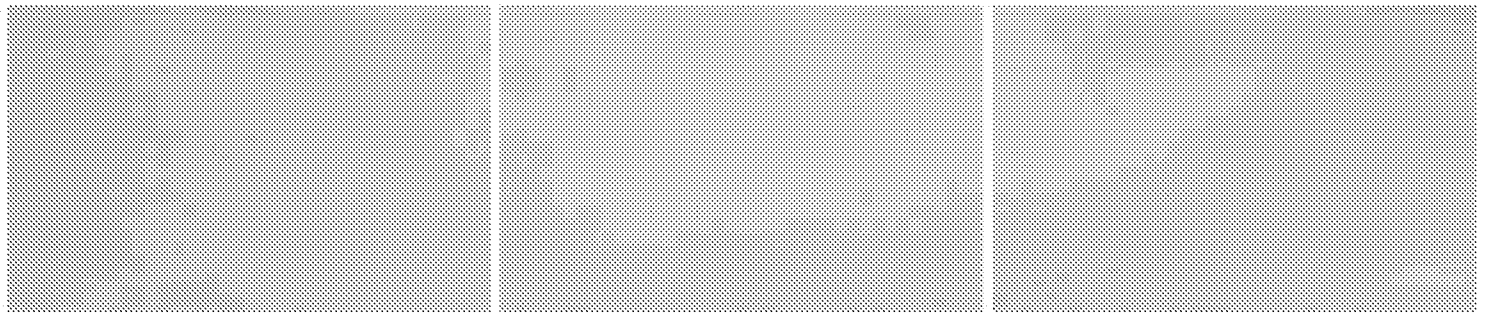


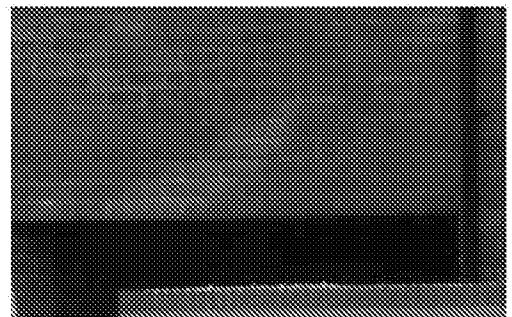


Energy Statement

Eastergate

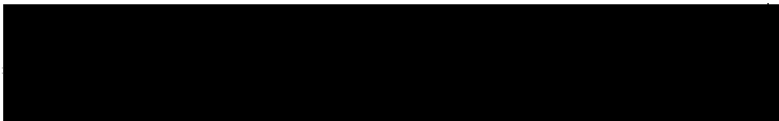
Client: Hampshire Homes

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Revision History

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1	30/06/2021	 William Vincent	Michael Woodbridge

About Environmental Economics

Our team of experienced consultants specialise in construction and building energy. We have qualifications in sustainability, energy, engineering, building physics and construction as well as environmental, quality management and auditing.

Over the last decade, we have provided assessments and consultancy for some of the largest UK house builders, including Barratt Developments, David Wilson Homes, Bellway Homes, Abbey New Homes and Davidsons. We develop flexible, practical, cost-effective specifications for our clients through identifying solutions and delivering design advice. This includes the following disciplines:

- *Overheating Analysis (dynamic thermal modelling)*
- *Daylighting / Sunlight Simulations*
- *Energy Reports*
- *Compliance assessments and advice covering*
 - *Part L (SAP)*
 - *Part F (ventilation)*
 - *Part G (water)*
- *BREEAM*
- *SBEM (existing and new build)*
- *Minimum Energy Efficiency Standards (MEES)*
- *Thermal Bridging (Psi value calculations)*

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1. Project Overview

1.1. Introduction

- 1.1.1. This energy study was prepared by Environmental Economics Ltd on behalf of Hampshire Homes. The report assesses measures to reduce the energy demand of the domestic housing on site through the use of renewables.

1.2. Description of Site

- 1.2.1. The site consists of 42 plots. These units comprise a range of detached, semi-detached and terraced dwellings.
- 1.2.2. The proposed site location/boundary for the whole site is shown in Appendix A.
- 1.2.3. This report addresses a domestic development being undertaken by Hampshire Homes, and does not include any further proposals for subsequent developments or non-residential parcels.

1.3. Client Brief

- 1.3.1. The development has been designed to achieve a 10% reduction in energy demand through the use of renewables, in accordance Fareham Borough Local Plan policy.

1.4. Building Regulations

- 1.4.1. The SAP assessments have been undertaken using the appropriate legislative guidance; Approved Document Part L1A 2013. It should be noted that future policies and building regulations will reflect changes to the carbon content of fuels. In particular grid electricity is expected to become significantly decarbonized due to the ongoing investment in wind, solar and nuclear energy.
- 1.4.2. It is therefore possible that the solutions outlined in this report will require significant revision if the project is delivered against future building regulations. Currently, it is expected that Approved Document L will be updated in late 2021, and to be enforced in 2022.

2. Improvement Measures

2.1. Assessment Methodology

2.1.1. Environmental Economics have modelled the proposed dwellings using Design SAP software. The software provides a number of outputs which can be used to assess and compare the improvements from any number of build specifications in terms of:

- *Building regulations compliance*
- *Energy usage per year (kWh/annum)*
- *Carbon emissions as a measure of building regulations compliance (kg CO₂/m²/year)*
- *Energy costs per year (£/annum)*
- *More detailed breakdowns by end use (space heating, water heating, cooking, lighting, appliances)*
- *Code for Sustainable Homes compliance*
- *Effective air change rate*

2.1.2. Each of these outputs can be used in different ways to analyse the performance of the dwelling. The total regulated carbon emissions for each property is based upon:

- *Space heating*
- *Water heating*
- *Electricity for pumps and fans*
- *Electricity for lighting*

2.1.3. Two models were created in order to calculate the energy demand. The required data for the site is calculated for each of the models, and then the difference used to establish the level of improvement. In order to achieve this representative house types have been utilised.

2.1.4. The emissions calculation for the space and water heating, as well as the electricity for pumps, fans and lighting were all assessed using the Standard Assessment Procedure (SAP 2012) through Design SAP software. An example SAP worksheet is shown in Appendix D.

2.2. Design Philosophy

2.2.1. Upgrades have been made to a number of elements from a standard build specification in order to improve energy efficiency across the development. The site adopts the good design principles endorsed and promoted by The Zero Carbon Hub, the construction industries' key advisors and partners with the Governments Communities and Local Government Department. This guidance follows the general good principles of energy efficiency as the industry moves towards zero carbon. The principles are illustrated in figure 1 below.

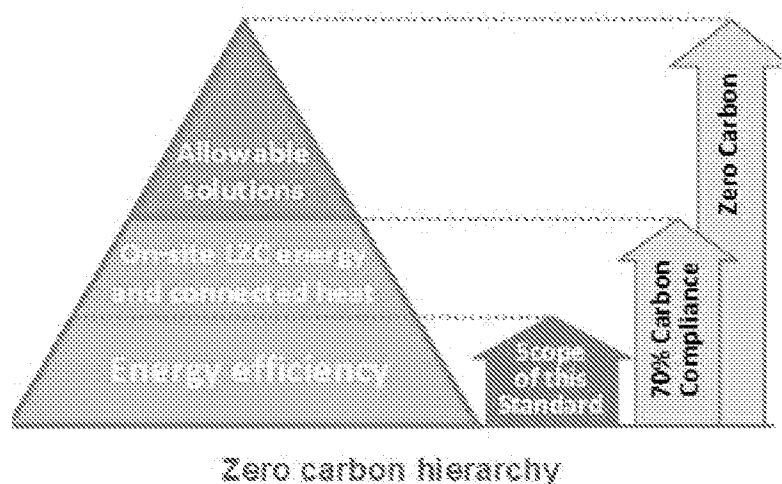


Figure 1

2.2.2. In order to reduce the residual carbon emissions a number of improvements were made to the standard material and product specification. These improvements include:

- *Upgraded heating and hot water controls*
- *Delayed start thermostat*
- *Design air permeability of 5.01m³/hr/m²*
- *Constructive thermal bridging details*

2.3. Product Improvements

- 2.3.1. The systems used in a property to supply hot water and heating, as well as control it, are important to the overall energy demand of a property. The 2013 Building Regulations state that all systems and their controls must adhere to the minimum standards shown in Domestic Heating Compliance Guide.
- 2.3.2. For a mains gas fired system the minimum boiler efficiency required is 86%. High efficiency condensing boilers have been specified throughout the site for both combination and cylinder based systems. These boilers achieve a SAP 2009 rated efficiency of at least 89% and are recommended by the Energy Saving Trust.
- 2.3.3. Where installed, hot water cylinders can lose a significant amount of energy. In order to minimise this energy loss and corresponding carbon emissions, cylinders which have higher levels of insulation in comparison to typical hot water cylinders will be used.
- 2.3.4. Finally 100% Low-E lighting fixtures shall be fitted to all properties.

2.4. Fabric Improvements

2.4.1. The building fabric for all dwellings was improved from basic compliance with Part L1A 2013 to an enhanced specification. These fabric improvements reduce the space heating requirement upon a property. The improvements have been made through a combination of upgraded materials and increased insulation thicknesses. Enhanced glazing with a larger transmittance factor allowing for increased solar gains will also be used. Changes to the U-Value of external elements are shown in table 1 below.

<i>Element</i>	<i>Minimum Standard</i>	<i>Improved Specification</i>	
-	<i>W/m²k</i>	<i>Description</i>	<i>W/m²k</i>
Walls	0.30	75mm Alreflex Platinum Cavity	0.22
Roof	0.20	400mm Mineral Wool Horizontal Ceiling, Loft Space	0.11
		Flat Roof	0.17
Floors	0.25	150mm TE Platinum Insulation on a Beam & Block	0.12 - 0.16
Doors	2.00	Double glazed Low-E, u-PVC frame	1.3
Glazing	2.00	Double glazed Low-E, u-PVC frame	1.5

Table 1

2.4.2. As improvements are made to the thermal conductivity of main elements, thermal bridging and air permeability becomes increasingly significant in the overall fabric performance. Constructive details thermal bridging designs have been utilised, which achieve much lower heat loss levels in comparison with default values.

2.4.3. As a result of following these junction details and focusing on build quality air permeability will also decrease. A target air pressure rating of 5.01m³/hr.m² has been set for all houses on site which is a 50% improvement on the maximum allowable rating in the 2013 Building Regulations.

3. Low and Zero Carbon Technologies

3.1. Photovoltaic (PV) Cells

- 3.1.1. The efficiency of PV cells has improved rapidly over the last 15 years. This has made a previously uneconomical technology an increasingly viable solution to rising energy costs and demand. The cells can be produced in a variety of formats but are typically manufactured as a panel or a roof tile for domestic housing applications.
- 3.1.2. The PV system typically produces direct current (DC) which is then sent through an inverter to supply the house with electricity. If a greater amount of electricity is produced than used by the household, this extra can be exported to the national grid, as can be seen in figure 2.

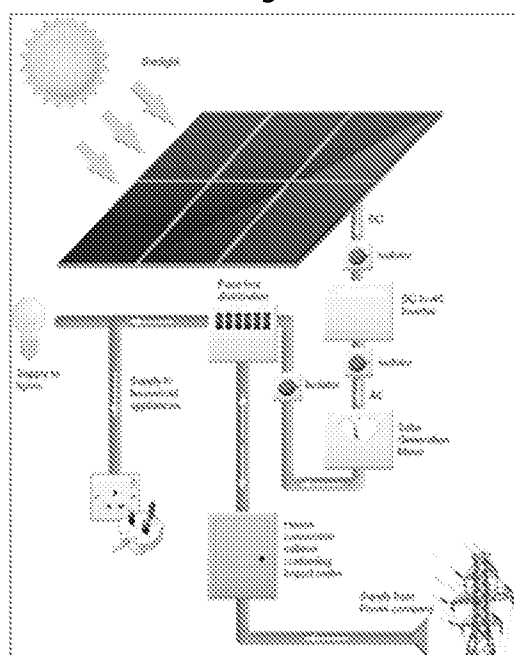


Figure 2

- 3.1.3. A PV cell is assessed on its peak power rating. This is tested by exposing the cell to the equivalent of full solar radiation and measuring the power output. The peak power is input into the Design SAP software as well as the physical attributes of the installation such as pitch, orientation and over-shading. A total energy saving per year can then be calculated through SAP for the PV installation. This is then offset against the electricity energy demand for the house.

3.2. Solar Hot Water (SHW)

- 3.2.1. SHW systems provide hot water to a household usually in conjunction with a conventional boiler and cylinder system. Because of this they are best suited to houses with a need for a cylinder hot water system rather than a combi boiler.
- 3.2.2. There are two main SHW systems; evacuated tubes and flat plate collectors. Evacuated tubes are more efficient at transferring solar irradiation to the fluid although flat plate collectors are considered to be better aesthetically and to install. An example of the latter can be seen in figure 3.



Figure 3

- 3.2.3. The final energy contribution to the household, calculated through SAP, is based on a number of factors:
- *Pitch, orientation and over-shading*
 - *Heat absorption efficiency for the collector*
 - *Average hot water usage of the dwelling*
- 3.2.4. The majority of the energy savings will be made in the hot water demand for the dwelling however, adding a SHW system will impact upon other energy demands.

3.3. Air Source Heat Pumps (ASHP)

- 3.3.1. ASHP provide heating and hot water to a home through thermal energy gathered from air outside the dwelling. Systems can be designed to work in conjunction with a boiler system but in the case of energy efficient new builds it is possible for an ASHP unit to provide 100% of the heating and hot water demand.

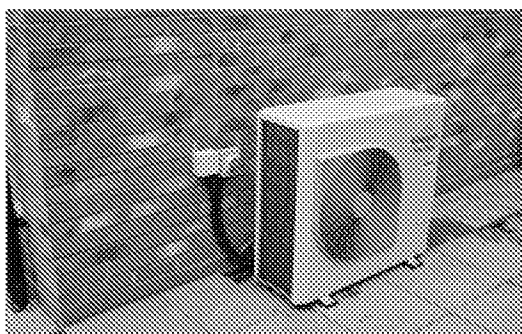


Figure 4

- 3.3.2. The thermal performance of the unit depends on the outside temperature as well as the unit's Coefficient of Performance. This is the ratio of thermal energy produced to energy used. A typical value for this would be around 3.5, meaning that for every 1kW of electricity consumed the unit would provide 3.5kW of thermal energy to the household. This efficiency leads to large carbon and energy savings for both space and water heating.
- 3.3.3. ASHP are assessed by their power output and the size of unit chosen depends on the demand from the household. An example external unit can be seen above in figure 4. The units with a larger power output can provide a larger amount of hotter water even in colder climates.

3.4. Ground Source Heat Pumps (GSHP)

- 3.4.1. GSHP provide heating and hot water to a dwelling through geothermal effects. A GSHP system would offset the energy demand from the main space heating. There is, however, an additional electricity demand for the pump and control system. This would reduce energy savings from the installation.

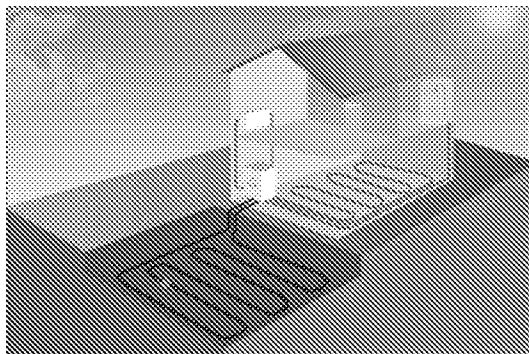


Figure 5

- 3.4.2. GSHP are expensive to install and rely on having appropriate ground conditions and suitable space around the dwelling for the pipe looping. Energy savings are dependent upon the type of system being replaced and the way the system is operated by the homeowner. A typical system can be seen above in figure 5.

3.5. Biomass Heating Systems

- 3.5.1. Biomass heating systems burn fuels, considered carbon neutral, to heat the water required for a dwelling. There are a large variety of systems available and choice depends on the type of fuel to be burned and the level of automation.
- 3.5.2. The system would offset the energy demand from the hot water and main space heating. However, biomass systems typically require a large amount of maintenance and monitoring. An example system can be seen in figure 6.

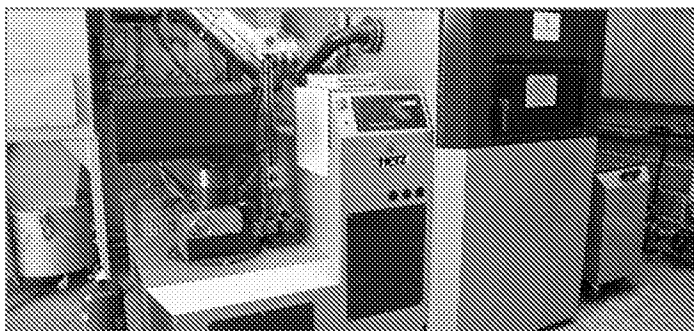


Figure 6

- 3.5.3. The savings from such a system, in terms of CO₂ and money, depends upon what it is replacing. The savings are greatest when replacing an electrical hot water system but are considerably less for replacing mains gas.

3.6. Wind Turbines

- 3.6.1. Wind turbines provide electricity directly to a dwelling. They can be added to a property in two ways: pole mounted or building mounted. The pole mounted systems are free standing and therefore require enough space around them to allow for the construction and maintenance of the structure, as well as to allow for efficient operation. The building mounted systems have a lower power output but do not require additional structures, as can be seen in figure 7.

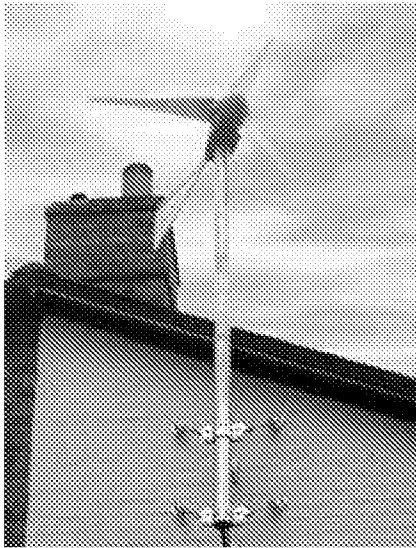


Figure 7

- 3.6.2. The energy produced from a wind turbine is heavily dependent upon the surrounding landscape. The energy saved will be offset against the electricity usage of the dwelling.

3.7. Comparison

- 3.7.1. SHW can be easily incorporated into new build house designs and has the potential to reduce the energy demand from hot water considerably.
- 3.7.2. The product and installation cost make ASHP an expensive option. There is also a degree of uncertainty about the energy saving that can be obtained from the system as it requires diligent operation. The same can be said of GSHP, as well as the fact that additional extensive ground work is required in order to make use of the system.
- 3.7.3. Biomass hot water systems are more suited to the replacement of inefficient, carbon heavy systems such as electrical immersion heaters. The requirement of maintenance and monitoring makes it unsuitable for large scale new build developments
- 3.7.4. The density of the site is a major restriction on the potential energy that could be generated from wind turbines. Surrounding houses and the urban location would restrict wind speeds.
- 3.7.5. The solution of PV panel systems will be used. 22.50kWp would be sufficient to reduce the energy demand by 10%.
- 3.7.6. For the purpose of the report this amount of PV has been distributed amongst the several plots, selected due to their having southerly facing roof spaces. See appendix B for the location of PV used for the energy report.
- 3.7.7. However, the PV may be distributed differently, as long as the total reduction in energy demand remains the same.

4. Conclusion

- 4.1.1. The tables presented in Appendix C shows reduction in energy demand achieved via a mix of fabric design efficiencies and renewable energy..
- 4.1.2. The energy demand for the model with no renewables is 294.191MWh/Annum. After introducing the renewables and accounting for design efficiency, this demand is reduced to 264.315MWh/Annum. This results in a 29.876MWh/Annum reduction in carbon emissions, which constitutes a 10.16% reduction in the energy requirements of the site, in line with the relevant planning condition.