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11 Lake Road Chandlers Ford Eastleigh Hampshire SO53 1EZ

Low or Zero Carbon 10% Reduction Feasibility Study

For

Snug Architects

Project Reference

SAP-0713

Date

23/02/2016

unit 2 barley business park, duncan road, park gate, southampton, hampshire, so31 1zt

t: 01489 565920 f: 01489 589738 e: info@beatsolutions.co.uk

Introduction

This renewables assessment has been prepared by BEAT Solutions as required for the new dwelling known as 11 Lake Road, as instructed by Snug Architects. This report will analyse the Co^2 reduction across the development. We have used SAP2012 methodology to ascertain the CO^2 requirement and have given recommendations for suitable renewables technologies.

Site Description

A survey of the site confirms that is it's within a low rise residential area. The project consists of 1no new detached 5 bedroom dwelling.

Renewable Technologies

In arriving at our suggestions, the following types of renewables have been considered:-

Biomass Boiler:-

Biomass boilers could be used for the production of heat in buildings through combustion of bio fuels such as wood chips or pellets. Common types of biomass fuels include wood from forests, urban tree pruning, farmed coppices, farm wastes and wood waste from timber processing. For domestic heating systems, the most common fuel types are wood pellets, wood chips or logs. Wood chips can be readily available and relatively cheap with new supply routes coming into the market more and more. Pellets are the most expensive of the fuel types but also more energy dense and therefore are less bulky to store. Pellets are also much easier to handle, simplifying the boiler and fuel handling system and potentially improving reliability for smaller scale systems. Logs are less suitable for social housing and flats because they require manual handling of fuel which is difficult to co-ordinate. One of the most appropriate uses for pelleted fuel is communal heating, although for off-gas dwellings individual boilers or room heaters could be considered (but require occupants to handle the fuel).



Biomass Boiler with auto feed hopper

Biomass Boiler with external hopper





Wood Pellets



Wood Chips



Wood Logs

Fuel Types

Ground Source Heat Pump: -

Ground source heat pumps (GSHPs) concentrate the heat of the sun's rays stored naturally at low temperature in the ground. The system circulates fluid through a long loop of pipe (called a 'ground loop'), which in UK housing will normally be via a vertical borehole, though there are other options, such as trenches which requires large open spaces. Heat is extracted from the water in the ground loop via the heat exchange pump, and circulated to the home using a network of radiators or under floor heating. Because heat pumps work most efficiently when providing lower temperature heat (40-50°C), slightly larger radiators are used to ensure sufficient heat transfer within rooms.



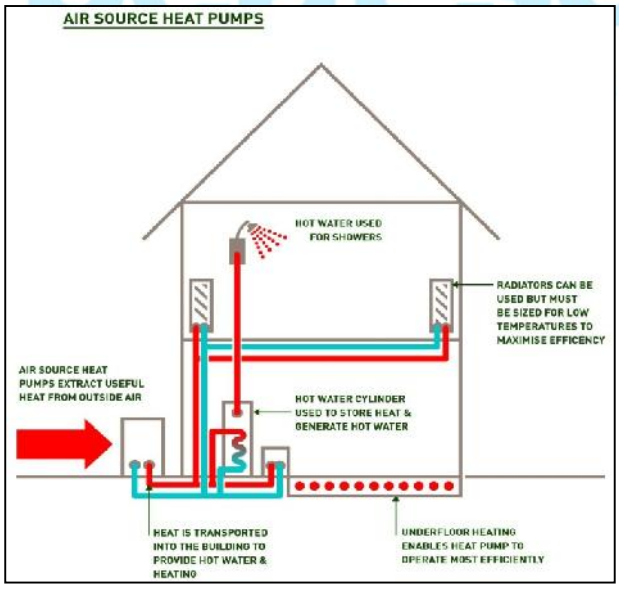
Horizontal Loop System



Vertical Loop System

Air Source Heat Pump:-

Air source heat pumps (ASHPs) use the ambient air temperature as their heat source, and thus avoid the 'ground loop' and associated drilling costs of GSHP's. However, because the temperature of air is less stable throughout the year they operate at a lower efficiency than GSHPs due to seasonal efficiencies. ASHP's could be useful in some off-gas situations where ground conditions or access issues prevent borehole drilling or trenches. Careful consideration should be given in urban areas to consider neighbouring properties as ASHP's can generate some noise and can be considered a nuisance by neighbouring properties. This can be overcome by siting the heat pumps away from nearby properties or conducting environmental noise surveys to establish acceptable levels and locations for the heat pumps.



Principles of designing an ASHP

ASHP Installed on a new dwelling



Solar Photovoltaic:-

Solar photovoltaic (PV) systems generate electricity from sunlight. The direct current (DC) power that is produced via the panels is converted via an inverter into alternating current (AC) power, which can be used to power the normal range of domestic appliances and/or be exported to the local electricity network to offset electricity costs. A range of systems is available, from roof-mounted panels to PV tiles which look similar to conventional tiles. The amount of power that a PV panel will deliver is proportional to the amount of sunlight that falls upon it; therefore PV panels are best placed so that they face broadly south and are unshaded for the major part of the day. The cost of installation has been driven down in the last year due the lowering of the government's feed-in-tariff (FIT) which pays property owners who generate electric for a fixed 25 year period.



Photovoltaic Panels (in roof system)

Solar Hot Water:-

Solar hot water systems (SHW) use the sun's energy to heat domestic hot water. The heat from the solar collector is used to heat water in a cylinder, where it can be stored until it is needed. A secondary heating source (such as an electric immersion heater, or a heating coil from a gas boiler) is usually used to bring the water up to the required temperature (typically 60°C) when necessary. In summer, SHW systems can provide most of a household's hot water demand, subject to the correct sizing of the solar thermal store. In winter this proportion is considerably less but averaged over the year the typical contribution to annual hot water demand is around 50%.



Solar Evacuated Tubes



Flat Panel System

Wind Turbines:-

A wind turbine is a machine for converting the kinetic energy in the wind into mechanical energy which is then converted into electrical energy. Wind turbines are usually 'horizontal axis' machines with a tower, nacelle (the enclosure for the workings), hub and three blades, although any number of blades is possible, as are 'vertical axis' turbines (which can also look visually impressive). It is generally considered that three bladed turbines are the most aesthetically pleasing horizontal axis turbine and they are usually coloured a white grey colour. Turbines are often categorised as small, medium and large, with small usually referring to turbines with rated power up to 50kW. Medium turbines range from around 250-300kW, but with the size of turbines having increased dramatically in the last ten years, a medium turbine could be referred to as anything below 800kW. The largest onshore turbines currently in the UK are 3MW (3,000kW). Large turbines in exposed areas are cost effective. The smaller the turbine, the more turbulent the airflow (such as in urban areas), the lower the economic benefit and the longer the 'payback'.



Horizontal Wind Turbine



Vertical Wind Turbine

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Proposed Renewable Strategy

After considering the above technologies the table below details a summary of our opinions and recommendations.

Technology	Cost Rate 1=£High - 5=£Low	Energy/Co² Saving Rating 1=Low – 5=High	Conclusion
Bio-Mass	1	5	Not suitable due to lack of pellet storage and also delivery would be hard to facilitate for this project. A garage has been shown on the drawings but not large enough to facilitate the storage of the boiler and pellets.
GSHP	2	4	Not suitable, due to size to the rear garden for trenching and the cost of drilling boreholes. This technology would provide a large energy saving but due to the costs and implications it is not viable for this project.
ASHP	3	3	This is a suitable technology for this development due to its size and nature. There is large enough space surrounding the dwelling to install the external unit. Unfortunately Air Source Heat Pump units don't achieve the 10% reduction/energy saving.
Solar PV*	4	4	Suitable due to the proposed dwelling having a large South-West facing elevation. Also suitable due to the cost of installation verses CO^2 saving.
Solar Thermal	4	2	Not suitable due to the supply and installation cost potentially being greater than the Solar PV that is to be installed. This option is unlikely to yield the 10% reduction that is required. The South-West elevation has also been utilised for the use of Solar PV.
Wind Turbines	1	4	Not suitable for built up urban areas and generation is low and installation cost is high. Also planning consideration would be needed.

*Proposed Strategy

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Conclusion

Of the technologies considered we believe the best solution would be to use Solar PV. We have chosen Solar PV over any other technology based on the site layout and large South-West roof elevation to site the Solar PV. Having produced SAP2012 calculations we have been able to calculate that the use of traditional gas boilers and Solar PV to the South-West roof elevation will provide over a 10% reduction in carbon emissions. We have used the Code for Sustainable Homes calculation sheet within the SAP methodology to show the reduction in carbon emissions (See Appendix A).

It may also be noted that the proposed dwellings include, well insulated external walls, floor and roof with good u-value for windows and doors together with a low air permeability rating. 100% low energy lighting fittings will be installed and use of accredited construction details for improved thermal bridging. See the building regulations compliance sheets for the proposed strategy within Appendix B

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APPENDIX A

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BEAT Solutions Ltd
Unit 2, Barley Business Park
Duncan Road, Park Gate
Southampton, Hampshire
SO31 1ZT

CODE FOR SUSTAINABLE HOMES November 2010 - June 2014 Addendum

Property Reference: SAP-0713
Survey Reference: Rev -

Issued on Date: 19.Feb.2016
Prop Type Ref:

Property: 11, Lake Road, Chandlers Ford, Eastleigh, Hampshire, SO53 1EZ

SAP Rating:	93 A	**CO2 Emissions (t/year):**	1.96	**DER:**	7.38 Pass	**TER:**	11.33	**Percentage DER<TER:**	34.85 %
Environmental:	92 A	**General Requirements Compliance:**	Pass	**DFEE:**	45.17 Pass	**TFEE:**	47.72	**Percentage DFEE<TFEE:**	5.34 %

CfSH Results **Version:** November 2010 - June 2014 Addendum **ENE1 Credits:** 4.2 **ENE2 Credits:** 7.2 **ENE7 Credits:** 2 **CfSH Level:** 4

Surveyor:	Scott Spearing, Tel: 01489 565920	Surveyor ID:	A808-0004
Address:	Duncan Road, Park Gate, Southampton, Hampshire, SO31 1ZT		
Client:	Snug Architects, SNUG ARCHITECTS		

Software Version: Elmhurst Energy Systems SAP2012 Calculator (Design System) version 3.04r05
SAP version: SAP 2012, Regs Region: England (Part L1A 2013), Calculation Type: New Build (As Designed)

ENE 1 calculation

Total floor area	403.77 m2
DER	7.38 kgCO2/yr/m2
TER	11.33 kgCO2/yr/m2
CO2 emissions offset from additional allowable electricity generation	0.00 kgCO2/yr/m2 (ZC7)
Residual CO2 emissions offset from biofuel CHP	0.00 kgCO2/yr/m2 (ZC5)
Total CO2 emissions offset from SAP Section 16 allowances	0.00 kgCO2/yr/m2
DER accounting for SAP Section 16 allowances	7.38 kgCO2/yr/m2
% reduction DER/TER	34.85 %
CfSH ENE1 credits achieved	4.2
CfSH ENE1 level achieved	4

ENE 2 calculation

Dwelling type	House, Detached
Fabric energy efficiency (F.E.E.)	45.17
CfSH ENE2 credits achieved	7.2
CfSH ENE1 and 2 overall level achieved	4

ENE 7 calculation

Standard case CO2 emissions

Total floor area	403.77 m2	
DER	14.46 kgCO2/yr/m2	
CO2 emissions from electrical appliances	7.89 kgCO2/yr/m2	(ZC2)
CO2 emissions from cooking	0.49 kgCO2/yr/m2	(ZC3)
Standard case total CO2 emissions	22.84 kgCO2/yr/m2	(ZC4)
Net Standard case CO2 emissions	22.84 kgCO2/yr/m2	(ZC8)

Actual case CO2 emissions

DER	10.33 kgCO2/yr/m2	
CO2 emissions from electrical appliances	7.89 kgCO2/yr/m2	(ZC2)
CO2 emissions from cooking	0.49 kgCO2/yr/m2	(ZC3)
Actual case total CO2 emissions	18.71 kgCO2/yr/m2	(ZC4)
CO2 emissions from Biomass	0.00 kgCO2/yr/m2	(ZC5)
CO2 reduction from additional allowable electricity generation	0.00 kgCO2/yr/m2	(ZC7)
Net Actual case CO2 emissions	18.71 kgCO2/yr/m2	(ZC8)
% improvement in net actual/net standard case CO2 emissions	18 %	
ENE7 credits achieved	2	

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APPENDIX B

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Southampton, Hampshire
SO31 1ZT

Building Regulation Compliance

Property Reference: SAP-0713 **Issued on Date:** 19.Feb.2016
Survey Reference: Rev - **Prop Type Ref:**
Property: 11, Lake Road, Chandlers Ford, Eastleigh, Hampshire, SO53 1EZ

SAP Rating:	93 A	**CO2 Emissions (t/year):**	1.96	**DER:** 7.38 Pass	**TER:** 11.33	**Percentage DER<TER:**	34.85 %
Environmental:	92 A	**General Requirements Compliance:**	Pass	**DFEE:** 45.17 Pass	**TFEE:** 47.72	**Percentage DFEE<TFEE:**	5.34 %

CfSH Results **Version:** **ENE1 Credits:** N/A **ENE2 Credits:** N/A **ENE7 Credits:** N/A **CfSH Level:** N/A

Surveyor: Scott Spearing, Tel: 01489 565920 Surveyor ID: A808-0004
Address: Duncan Road, Park Gate, Southampton, Hampshire, SO31 1ZT
Client: Snug Architects, SNUG ARCHITECTS

Software Version: Elmhurst Energy Systems SAP2012 Calculator (Design System) version 3.04r05
SAP version: SAP 2012, Regs Region: England (Part L1A 2013), Calculation Type: New Build (As Designed)

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

1a TER and DER

Fuel for main heating:	Mains gas	
Fuel factor:	1.00 (mains gas)	
Target Carbon Dioxide Emission Rate (TER)	11.33 kg/m^2	
Dwelling Carbon Dioxide Emission Rate (DER)	7.38 kg/m^2	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	47.72 kWh/m^2	
Dwelling Fabric Energy Efficiency (DFEE)	45.17 kWh/m^2	OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Floor	0.14 (max. 0.25)	0.22 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.20 (max. 0.35)	OK
Openings	1.59 (max. 2.00)	1.80 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	6.50 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Boiler system with radiators or underfloor - Mains gas Data from database Vaillant ecoTEC plus 637 VU GB 376/5-5 Efficiency: 89.2% SEDBUK2009 Minimum: 88.0%	OK
Secondary heating system:	Room heaters - Wood Logs Closed room heater Efficiency: 65% Minimum: 65%	OK

5 Cylinder insulation

Hot water storage	Measured cylinder loss: 2.25 kWh/day Permitted by DBSCG 2.56	OK
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls:	Time and temperature zone control	OK
Hot water controls:	Cylinderstat	OK
	Independent timer for DHW	OK
Boiler interlock	Yes	OK

7 Low energy lights

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Percentage of fixed lights with low-energy fittings:	100%	
Minimum	75%	OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England):	Not significant	OK
Based On:		
Overshading:	Average	
Windows facing North East:	5.09 m^2, No overhang	
Windows facing South East:	30.32 m^2, No overhang	
Windows facing South West:	16.18 m^2, No overhang	
Windows facing North West:	18.98 m^2, No overhang	
Air change rate:	8.00 ach	
Blinds/curtains:	None	

10 Key features

Secondary heating (wood logs)
Secondary heating fuel: wood logs
Photovoltaic array

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