Meeting the 10% planning requirement for on-site energy

An investigative report

Huish Episcopi School
Wincanton Road
Huish Episcopi
Langport
TA10 9SS

Sixth Form & Science Block Extension

July 2009

ASHMOUNT CONSULTING ENGINEERS

LOW CARBON CONSULTANTS

Introduction

This report is compiled by Ashmount Consulting on behalf of Huish Episcopi School regarding the satisfaction of the renewable energy condition relating to South Somerset District Council's **Policy RE50- Renewable Energy and New Development**.

In order to demonstrate the developer's detailed consideration of the most appropriate measures this document examines every realistic approach and shows our consideration and conclusions based around:

- Site location
- Space constraints
- Positive use of renewable technology

The Huish Episcopi new extension development consists of a new 2 storey sixth form block and a smaller single storey extension to the science block. The sixth form block is to be built on an existing hard standing area and will be connected to the existing main building directly. The energy statement for the development is based on SBEM reports and the development will comply fully with Part L2a of the Building Regulations Conservation of Fuel and Power.

As detailed in South Somerset District Council's Renewable Energy Requirement guidance document the following 4 points will be addressed:

1. Identify the Target carbon Emissions Rate (TER) for the site.
2. Assess the potential for reduction of carbon dioxide emissions through energy efficiency measures beyond Part L 2006 of the building regulations.
3. Decide which renewable energy equipment is feasible for the site.
4. Calculate the contribution of each proposed renewable energy technology to reducing the calculated carbon emissions of the development.

1 - Identify the Target carbon Emissions Rate (TER) for the site

The sixth form extension will have the majority of its heating & cooling provided by a variable refrigerant flow (VRF) system that uses air source heat pumps to achieve very high efficiency levels of around 350%. Hot water will be supplied from a new high efficiency gas water heating system.

The science block extension will be tapping off of the existing gas heating system that currently supplies the main science block for its hot water and heating.

Lighting, lifts, equipment and fans & pumps within the entire new site will all run off of mains electricity.

Methodology and tools used for calculation

For calculating the energy demand government approved SBEM software was used. An overall figure of **99,200 kWh** per annum was produced accounting for all heating, lighting and predicted equipment in all new build areas. This energy figure translates into annual emissions of 29,938 kg/CO_2.

The site therefore needs to reduce its emissions by **2994 Kg/CO_2** using renewable sources in order to meet the 10% requirement.

2 - Assess the potential for reduction of carbon dioxide emissions through energy efficiency measures beyond Part L 2006 of the building regulations.

The Proposed Development features the following key energy efficient design measures that help improve its carbon emissions beyond Part L levels:

High levels of insulation in building fabric and high specification energy efficiency measures including:

- High spec Glazing
- Well insulated External Walls, floor and roof
- Low energy lighting for 100% of fixtures
- Above regulation air tightness
- Super efficient gas boilers and air source heatpump system
- Programmable controls and sensors for optimum performance from heating systems
- PIR light sensors in all rooms that experience intermittent use

Optimising passive solar gain through orientation of the building was not possible due to restrictions on where the extension had to fit next to the existing building but fixed solar shading has been incorporated to make the most of the site restrictions.

All of the first floor windows on the south side of the sixth form building will have fixed louvres to allow winter sun into the building but to reduce the amount of summer sunlight that enters rooms, cutting down on both unwanted heat gain and glare from bright light for the rooms occupants.

Where possible rooms have been sited on appropriate sides of the building for their planned use. For example the Media/graphics suite which will house equipment that generates extra heat has been located on the north side which tends to need more heating in winter and is cooler in summer than other sides of the building. The internet café is also sited on the north side which will result in less glare from sunlight which means that the room is more likely to be used with natural daylight rather than closing blinds and putting on electrical lighting.

3 - Decide which renewable energy equipment is feasible for the site.

Technologies considered:

Wind turbines

The site has a predicted average wind speed of only 4.6 m/s at 10m which would tend to indicate that a turbine would not generate useful amounts of electricity on the site unless it was raised to very high levels (25 metres or more).

Due to limited space on the existing site a turbine would not be a sensible approach to meeting the 10% requirement as it would require a large area next to it to enable raising and lowering for installation and maintenance.

Solar Hot Water Panels

Due to the heating of hot water making up a very small percentage of the energy use for the new build a solar hot water panel system would not be able to provide 10% of the sites energy even if it produced 100% of all the hot water needed. This would mean that a second technology would also be needed if SHW was chosen which does not make economic or practical sense.

Biomass heating

A biomass system for the sixth form block was looked into in detail but due to the space constraints of fitting the sixth form building onto the side of the school and retaining access roads the plant rooms are both in locations that would make wood fuel delivery incredibly complicated. These plant rooms are also not big enough to house the biomass boiler, accumulator tank and peak demand supplementary gas boiler that would be required for an efficient and functional system and so an additional building would need to be constructed that does not fit into the existing space.

Ground Source Heat pump

A ground source heat pump quote was obtained to provide heating to all of the sixth form block but with a COP that was only a little better than the air source system and a cost of over £500,000 it was not seen as a sensible system to install.

Photovoltaic Electricity

A PV system was looked into in similar detail to the biomass system. The roof structure is not designed to accommodate the weight of the large amount of panels (approximate 150m^2) that would be required to meet the 10% and the economic costs of PV would make it a considerable proportional of the new build costs compared to the air source option.

Chosen solution/technology – Air Source Heat pump

A super efficient air source heat pump system linked in to a Variable Refrigerant Flow (VRF) system to transfer the energy into each room has been chosen as the renewable technology for the site. The overall system operates at a coefficient of performance (COP) of 3.21 and has a seasonal energy efficiency ratio (SEER) of 5.35.

The system will provide space heating to the sixth form extension building and with a COP of 3.21 is able to save significant carbon emissions over a conventional gas heating system.

The system will also provide space cooling to certain parts of the sixth form building during warmer months of the year. Conventional refrigeration equipment was planned to provide cooling to 5 of the rooms with IT equipment in as these rooms will generate a lot of extra heat. The VRF system is significantly more efficient (more than 250% better) than the planned refrigeration equipment that it will replace and so will save further carbon emissions in its use.

4 - Calculate the contribution of each proposed renewable energy technology to reducing the calculated carbon emissions of the development.

Based on the predicted heating load of the total sixth form block and the predicted cooling loads the use of the air source heat pump system will reduce the carbon emissions by **3,256 Kg/CO_2** which is an improvement of **10.88%** compared to the overall building TER + predicted equipment loading including all energy use in the science block extension.

This is calculated using a heating COP (kWhr in / kWhr out ratio) of 3.21 and a cooling SEER of 5.35. These performance figures were calculated by Toshiba's technical department based on the combination of heat pump types and predicted use for the site. The carbon savings were calculated using a gas conversion factor of 0.194 as detailed in the guidance notes and an electrical carbon conversion factor of 0.422 as detailed in Part L documentation.