

Yeo Valley and Holt Farms

Wills Barn ~ a Low Energy Building



Introduction

The barn was originally constructed over 250 years ago, using local limestone – it's actually built into the hillside, making best use of natural protection from the prevailing winds. It's believed that it was used by drovers as an overnight shelter for their animals.

Several times a year, the drovers would drive their sheep down from the Mendip pastures to the livestock markets in the valley below. The sheep wash in the yard beside the building would allow them to give the animals a good clean to help them get the best prices in the auction. But the days of the drovers are long since gone and so the barn fell into disuse. Slowly but surely, it became just a ruin, in danger of total collapse.





Yeo Valley's restoration project began in July 2006 and, such was the state of the building by then, it involved a very significant amount of rebuilding work. This did bring some advantages, though, since it allowed the restoration team to add modern building systems such as inner cavity walls - which contribute to the very high levels of insulation in the barn today.

Defining a Low Energy Building

From the outset of the project, Yeo Valley envisaged an eco-friendly, low-impact building, to stay very much in keeping with the environment around it. This means that the plans had to consider three distinct elements:

- The construction methods and materials used in the restoration
- Careful design to minimise the amount of energy needed to run the building
- And the selection of energy systems for heat, light and power that would be, as far as possible, carbon-neutral

Construction methods and materials

The abundance of natural wood in the barn gives some pretty obvious clues to the approach that's been taken. The floorboards are re-used from another building, as you can see from the original nail marks in them, and the beams are of sustainably grown, green oak from the south west.

The same natural approach applies to the internal doors and the furniture selected for the project.

Thoughtful design to reduce energy

Hidden behind the plasterboard linings of the walls, in the roof, and even under the floor are the highest levels of insulation to keep the building warm even in the coldest Mendip winter.





Meanwhile, the design of the building takes full advantage of natural light, both upstairs and down, to minimise the need for artificial lighting. Upstairs, the double-glazed roof-light floods daylight down through the staircase below it while the north-facing, fully-glazed gable-end provides glare-free ambient light and, of course, makes the most of the spectacular view across the Yeo Valley.



Low energy systems

Good design can dramatically reduce the need for artificial lighting or expensive space heating but there are clearly going to be times that such things will be needed. So, the second phase of delivering this Low Energy Building was to install only energy-efficient appliances and systems.



The lighting uses only low-energy bulbs – the wall lights use just 16 watts of power each. Downstairs some relatively new-technology LED downlighters each use only 1 watt rather than the normal 20 or even 50 watts consumed by the normal halogen bulbs.

If you switched on every bulb in the building (*and please don't*) the total power consumption is less than 200 watts (*that's equivalent to just 2 normal household filament bulbs*).

Other electrical appliances are low-energy here, too. Most modern, fast-boiling household kettles use 3000 watts – it seems that we're all too busy to wait for a kettle to boil but perhaps forget that the unused water left in it after making a cuppa has wasted electricity and contributed to CO2 emissions. The kettle here uses only 1000w so you have to be patient!

Carbon-neutral heat, light and water supplies

The third and perhaps most novel aspect of this project is the supply of electricity, heat and water.



The building has its own electricity generating system which runs with no connection to the National Grid at all. South facing solar panels, more properly known as Photovoltaic Cells, turn daylight into electricity, even on a dull winter's day. In bright sunshine the 12 panels will produce up to 2000w.



A control room downstairs contains the clever electrical equipment that turns the rather variable output of the panels into usable, 240v domestic power.

This controller manages the solar panels and gives a readout of the instantaneous power that they are generating. The electricity that comes from it is Direct Current, at about 48volts, so the next piece of clever electronics is the transformer and inverter. This turns the electricity into the 240v Alternating current, with which we are more familiar.



A second readout tells us how much power we are drawing out of the domestic system

- in this case 2300W which is more than the panels are generating.

And a third readout is a digital meter counting up the total KWh that we've used. At home this is the meter that would be read to see how much your electricity bill would be for the quarter – here it's just more of a point of interest since the Wills Barn electricity is absolutely free.



The solar panels only generate power during the day, of course, and even then, there may be times when the demand exceeds supply, so there's a bank of heavy duty 48 volt batteries which store 2-3 day's worth of use.

As far as heating the barn is concerned, a range of options was considered and a bio-fuel pellet boiler was chosen. It burns sawdust – a by-product of saw mills – which has been compressed into pellets. These are fed automatically from the hopper at the back of the boiler into the hearth and a small electric fan drives the flames up through a water jacket. It's computer controlled – the readout here shows the water temperature – and the timer will allow the boiler to light automatically for a pre-determined time, just like a conventional central heating device.



The hot water is pumped around the thermostatically-controlled central heating radiators and the boiler will generate up to 22kW of heat – more than enough for a building of this size.



When it comes to water supply, the barn doesn't require much – especially compared to a house where baths, showers and washing machines are high volume users. The biggest use of water here is to flush the toilets and it makes no sense to use purified drinking water for this. So rainwater is captured from the gutters – it runs down these chains into a special drain.

The water is then directed through a filter into an underground storage tank and is then pumped up to toilet cisterns when needed. This supply also feeds the boot wash tap by the door.

The only drinking water outlets are at the sink – and the taps in the toilet hand-wash sinks even have an automatic timer to reduce the water used.

Thinking sustainably in the Barn – what can you do?

All of this low energy design and construction only delivers a truly green performance, of course, if we, the users of the Barn, act accordingly. Leaving appliances running or wasting heat will undo much of the good work. So we need you to think about how you use the building.

Please shut the doors and windows so that we don't waste heat. If it's getting too warm, we can turn down the radiator thermostats or switch off the boiler.

The electricity at the barn may be free but it's certainly not unlimited – excessive use could easily drain the batteries, particularly in winter. So, please, switch off the lights unless you really need them. And be aware that a computer projector uses about 250 watts (more than all of the lights in the building switched on together) so switch it off when it's not needed.



If you use the kitchen sink, please conserve hot water by using the washing-up bowl and don't leave the tap running unnecessarily.



Applying the Low Energy Building theory elsewhere

Whilst much of the technology at Wills Barn is relatively novel, many of the principles can be applied at home or in the work place. Replacing inefficient appliances and lights with low energy versions is an important step and, of course, switching off unnecessary lights, computers, printers and so on costs nothing. Beyond these simple low- and no-cost steps, there are opportunities to invest in design features that will maximise natural light and the cost of green energy features such as solar panels and bio-fuel boilers is reducing as the demand increases.



Wills Barn is a **Low Energy Building**. This means that it is:

- Constructed with low-impact, sustainable and re-cycled materials wherever possible. The floorboards are all re-used from another building, for example.
- Designed to minimise energy usage
 - It has extremely high levels of insulation (in the walls, floors, roof and windows) to reduce loss of heat
 - It utilises natural light wherever possible, so we don't have to use the electric lights very often
 - It uses carefully-selected, low-energy electrical appliances
- Designed to only use resources that don't damage the environment
 - We generate all the electricity used in the building through on-site solar panels
 - Waste wood sawdust (compressed into small pellets) is used to generate heat in a special central heating boiler
 - Rain water is harvested from the roof to flush the toilets so this reduces the need for mains water

Wills Barn Web Site

For more information log onto www.willsbarn.co.uk



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