

A Local Eco House Renovation

This series of articles follows the renovation of a local non-listed 1850s house to be close to carbon 'zero'

PART 2: GENERATING GREEN ENERGY WITH A SOLAR PHOTOVOLTAIC (PV) ARRAY

As part of Debbie and Mike's renovation, they are looking for ways to use sustainable energy. Coal, oil and LPG are out as they take millions of years to form. Electricity comes from coal, nuclear, oil and (still minor) renewable, generation. So they decided to offset as much of the electricity used in the house as possible with 'green' generation.

There are two main options for green electricity. The most visible is the wind turbine. Two features ruled this out. Firstly it must be in a position to receive a clear stream of air. Trees, hills and buildings all disrupt the flow of air and make it turbulent. This wrecks the efficiency of a turbine and can make it an expensive mistake. The eco-house is on the lee-side of a dale so to be effective it would need to be on a tall mast. It is a beautiful area in the National Park and M & D thought that a tall structure would not be appropriate.

The second technology option is PV panels to convert light into electricity. PV panels are maintenance free and can be installed on a roof or on the ground. Until recently installation costs were too high for the 'reward' of producing electricity from a PV array (i.e. solar panels wired



together.) It made sense only in specialised buildings or in regions with year-round sunny days (alas, not North Yorkshire). However, from April 1st this year, an incentive to produce green electricity, the 'feed-in tariff' (FIT), has been introduced. It pays for each unit of renewable electricity generated.

So how much electricity could be generated?

The electricity distribution people need to be able to balance the electricity on the grid, so there is a limit to the size of PV generator that can be connected without formal negotiation. This limit is 3.7 kW, more than enough for most household appliances. M&D wanted to maximise their renewable generation so the eco-house array has two strings of ten panels generating a maximum of 3.7 kW (see photo on previous page); smaller systems of 1 or 2 kW work equally well.

Location is important: First, the array must face south to pick up maximum light, and must not be shaded as this dramatically reduces electricity generation. Then the mounting: Roof arrays require scaffolding to install with metal roof attachments, but they leave the ground area free.

M&D chose a ground array as it could be mounted on consoles made of recycled plastic.



These, and the gravel base, were 'low carbon' compared with the alternative of aluminium roof frames, or ground frames on a concrete base (aluminium and concrete release CO₂ in manufacture).

Next was the inverter which converts the electricity generated by the array to be suitable for grid connection. The inverter is usually installed indoors, maybe in a garage or barn. As the eco-house has a cellar, this was ideal. To record the electricity being provided by the PV array, an accredited 'generation meter' is installed. Once the PV system is commissioned it is registered as a Small Scale Electricity Generator and can claim the FIT payment. This runs for 25 years. Although this does improve the payback, it is a big investment and will take about 10 years to recoup the initial outlay.



Installing PV is not a D-I-Y job for two big reasons. Firstly, this is potentially dangerous high voltage work and must be installed by an accredited Microgeneration Certification Scheme (MCS) member. Secondly, if you don't use an MCS installer, you won't get the feed-in tariff!

So how is it going? Well, timing could not have been better. Sunny weather in July provided an excellent start. When the sun is out with high cloud to reflect light back, the maximum output is sustained. A clear blue sky (no clouds) gives about 2.5 kW. If there is enough sunlight for shadows, the array gives 1 kW and even when it is dull, 500 W are generated.

Habits have changed. Now the washing machine and kettle are put on after one another (not together) as the array generates enough electricity to run one at a time. Weather on washday is even more important.

A nice sunny day now means the sun washes the clothes as well as drying them on the line!

Since installation in June, over 700 units of green energy have been generated, far outstripping demand in the house. All these units will attract the feed-in tariff of 41.3p per unit. The surplus electricity has been exported to the grid at an additional 3p per unit. In winter, with shorter days and weaker sunshine, the array will not keep up with demand, but still make a contribution. Over a year, it is hoped that the array will provide 3000 units (3 MWh) of electricity; that's more than the house will use. A zero carbon result!

Next time: Ground Source Heat Pump; using the energy under our feet