

Background

The Centre for Alternative Technology (CAT) is an education and visitor centre in Machynlleth, Wales demonstrating practical solutions for sustainability. Its principal aim is to educate people about living sustainably. They cover all aspects of green living: environmental building, eco-sanitation, woodland management, renewable energy, energy efficiency and organic growing.



Visitor entrance at CAT across the pond

The aim of this case study is to educate people on CAT's use of photovoltaic (PV) solar modules.

Roof solar PV installations

Photovoltaic solar has played a big part in CAT's history. There have been two major installations which will be the focus of this study but around the site and in the past there are many other smaller examples.

The first major photovoltaic solar project at CAT was completed in 1997 with an extension to this added in 2007. The table beneath provides the key statistics for both these installations.

	1997 roof	2007 extension
Modules	75W BP monocrystalline	84.3W Romag Powerglaz monocrystalline
Peak output	13.5 kW	6.6 kW
Area	112 m ²	60 m ²
Orientation	15 degrees West of South	
Pitch	35 degrees	

It is worth noting that the ideal orientation for solar would be due South or as close to it as possible with a roof pitch of 30 to 40 degrees. However as long as the orientation is between South-East and South-West and the pitch between 10-50 degrees, there are little efficiency losses. Even outside these ranges solar can still be effective.

Despite the 1997 roof being installed almost 20 years ago, at a refurbishment in 2010 it was found that the installation had only lost 5% of its generation potential when the warranty of the solar PV modules was only 20 years. A key reason for this is because modules are able to last longer when

sunlight is at a lower intensity. Another point to consider is that the cooler a solar panel is the more efficient it is in generating electricity and for this reason there should always be good ventilation both sides of the solar modules. Although costs in solar have greatly reduced there is actually little difference between the efficiency of the modules now, than in 1997.



Part of the 1997 roof

A key feature of both solar installations is that they are the waterproof layer of the roofs. With sufficient ventilation behind the roofs this system works just as effectively as traditional roof mounted systems, means the cost of both a roof and solar are not required and ensures the whole roof can be easily covered with modules. These modules are also integrated with glass providing passive lighting, shelter and shade. In addition there is immediate ventilation both sides of the roofs so the modules stay cooler helping them work more efficiently. Instances of solar modules being used creatively as a roof have become more and more common recently with instalments on sheds, log stores, large barns and even commonly on large glass office buildings now.

A further point to note is that in Germany and Denmark poorly mounted solar modules have seen wind uplift rip them off the roof but this could not occur in these instances; or to note with any well installed system.

An interesting fact is that despite not being a warm country Finland is actually one of the best countries in the world for solar because of it long summer days and cool climate.



The 2007 extension from both inside and out

Solar slates

CAT also has a display of solar slates. Here the modules form part of the tiles elegantly removing the barrier between electricity generation and use. These modules can be blended in aesthetically and can be used on retrofits if good ventilation can be included, and more easily for new builds. Although the costs of the modules are higher than a simpler roof and installation is more challenging, this process again removes the need for both and the energy generation is similar to that of traditional roof systems.

CAT uses solar slate modules donated by Solar Century and integrated with reused slates. Research in to these has seen a great array of different colours, flexibility and weights. For example growth in film 'organic' modules that can be used for curved roofs, which can capture indoor light as well, helping to increase generation. There is also development in the construction of elements that combine thin-film PV and conventional materials, for example steel for roofs, but further development still needs to occur in this area.

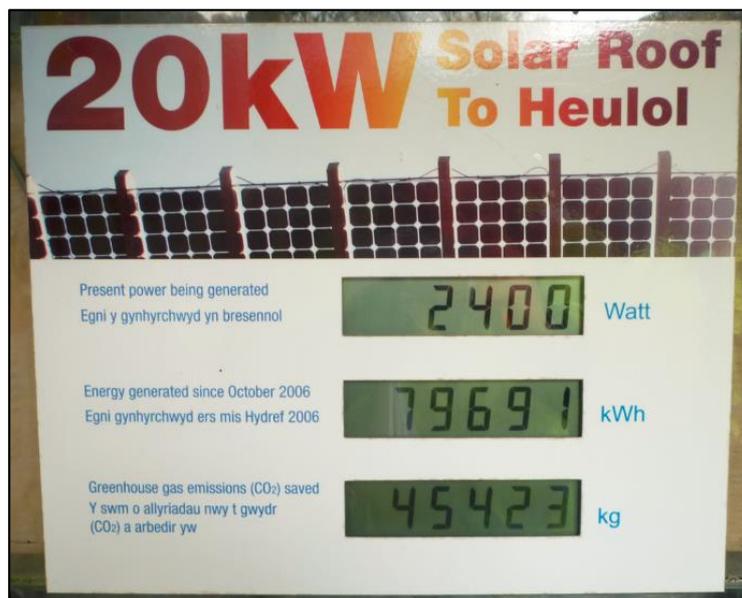


Solar slate modules

The positives of solar

The positives of solar are well understood. It reduces ones reliance on the grid increasing energy resilience, decreases greenhouse gas emissions, helps reduce your bills and can even earn you extra income as well.

The beneath image shows some key statistics of the roof solar modules, notably on a cold wet winters day which is the reason only 2,400 W electricity is being produced.



The costs of solar in recent years have fallen dramatically and this decrease is expected to continue over the coming years. Solar is beginning to have cost parity with other forms of electricity in the UK and it will be an important factor in a clean energy future without reliance on fossil fuels.

A lesson to take away

Though solar installations can be very effective, the number one step to reducing emissions and save energy costs in any walk of life is to reduce your energy demand. In short, if you use less, you pay less. This can be achieved through a whole host of common measures from switching off lights and appliances, to better insulating buildings, to having more efficient electrical appliances.

For more information on CAT or to arrange a visit to the centre please visit their website

<http://www.cat.org.uk/index.html>

This case study was compiled in January 2016