



PHOTOVOLTAIC SOLAR POWER

Information Service, Centre for Alternative Technology, Machynlleth, Powys, SY20 9AZ.
Tel: 0845 3308373 or 01654 705989 Fax: 01654 702782 e-mail: info@cat.org.uk
Web site: www.cat.org.uk

Solar Water Heating or Solar Electricity?

There are very different technologies, both of which involve panels on the roof. With solar water heating panels, water is circulated, heated up and fed into your domestic hot water supply. For more on this technology see our free information sheet about **Solar Water Heating**.

Solar photovoltaic (PV) panels produce electricity, which can be used to run appliances & lighting and either fed into the national grid or used to charge batteries.

PVs are particularly well suited to sites where a grid connection would be difficult or expensive or that are only used in the summer. For an independent power supply, solar works well with wind as there is a good balance of both over the year. See our free information sheet **Electricity for Off-grid Homes** for more advice on sizing and installing battery-charging systems.

Installation costs for PV tend to be higher than other renewable energy systems, but they do have some key advantages: there are no moving parts to fix so they are relatively easy to install and maintain; they can have long lifetimes; they can be sited in urban areas and are not restricted in the same way wind and hydro-power systems are; and they can replace other roofing materials.

Environmental Impact

There will be a certain amount of impact from the manufacturing of PV panels, but this should still be far less than the impact of the fossil fuels they will replace. A study of life-cycle impacts published by the World Energy Council reported that 1kWh of electricity from a PV system would be linked to carbon dioxide (CO₂) emissions of between 0.01 and 0.1 kg. This compared to emissions of 0.4 to 0.5 kg CO₂ per kWh from gas-fired power stations, and 0.8 to 1.4 kg CO₂ per kWh from coal-fired power stations. So the carbon dioxide emissions resulting from the installation of a PV system will be a fraction of those from UK grid electricity.

As the materials used are of relatively high-value, the recycling of PV cells is both economically and environmentally attractive. Several companies have started take-back schemes to recover and reuse the materials in old modules.

Choosing photovoltaic panels

There are several different types of PV panel available, and the cost, efficiency and lifetime will vary. The most widely used material for PV panels is currently crystalline silicon, as this tended to give the most reliable and efficient panels. However, PV technology is developing fast, and panels made with a range of materials are being produced that can give similar or better performance than crystalline silicon, and at a lower cost.

If you're considering installing PV panels, it's worth speaking to a few installers to see what is currently on the market. You'll need to weigh up factors including cost, efficiency and lifetime.

Panels that are cheaper may have a shorter lifetime, so check how long the power output is guaranteed for. Crystalline silicon PV modules often come with a guarantee that they will still give at least 80% of maximum output after 25 years. High efficiency itself is not the only consideration (for example, a panel may give a slight efficiency advantage but cost three times as much).

PV panels will have a 'rated power output', given in watts (W). This is the power they will produce in sunny conditions. To charge a battery for running a few lights in a caravan you may only need a panel of about 50watts. If you want to install a grid-connected system you'll need many PV panels making up an array of 1 to 3 kW (1kW = 1000W).

For a detailed guide to choosing and setting up PV systems (especially off-grid), see the factsheet **An Introduction to Photovoltaic Power**.

The current UK grant scheme (see below) has a list of accredited installers and equipment. You could also check to see if the installer is a member of a professional body that has a code of conduct and promotes high professional standards.

Siting and output

Ideally, solar panels should be roughly south-facing and free of shade at an angle of between 20 and 50 degrees. Rooftop panels are the most common, but they can be mounted at ground level. Roof mounted panels are usually a 'permitted development', so you don't have to get planning permission. Exceptions to this include National Parks and Areas of Outstanding Natural Beauty.

In a roughly south-facing location, a PV array of 1kW should produce around 750kWh of electricity per year (mostly in the summer), and will cover an area of between 8 and 20 square metres. For a more detailed evaluation of the energy you could generate, see the 'solar data resources' contacts listed below.

Grid-connected systems

If you are already connected to the national grid (or if connection would be relatively inexpensive) there is no need to have a battery-based system. A grid-connected PV system requires less maintenance, has a low and is generally simpler to run than a stand-alone (off-grid) system for charging batteries.

You can then export electricity when the PV system is generating more than you are using. It is now possible to sell the electricity generated by a domestic PV system for a similar price to that you would pay for grid-electricity.

See our free information sheet on **Grid-connected Renewable Energy Systems** for more advice.

Installation Costs

A grid-connected PV system is likely to cost from £5,000 to £8,000 per kW. The Low Carbon Buildings scheme (see below) gives a grant (currently a maximum of £2,500) towards costs.

A 2kW roof will generate around 1500kWh, which would cost £150 to £200 at current grid prices. So payback times are long. To get an accurate picture, you need to factor in future changes in energy costs, which are hard to predict. Do also factor in the price you can get for selling electricity to the grid - a good deal would lead to a quicker payback on your investment.

In any case, it's not a route to a quick profit. You certainly need to first take all possible energy efficiency measures, as these will both pay for themselves and reduce your carbon dioxide emissions more quickly. See our free information sheets on **Energy Efficiency** and **Saving Electricity** for more advice.

A PV system would also be more financially attractive if you are either undertaking substantial renovation work or building a house from new, as the panels can be used in place of roof tiles, and many associated costs (such as scaffolding) will be incurred when roofing anyway.

Solar PV is more expensive than a wind turbine of similar power output, but good wind sites are much rarer than good solar sites, and a turbine will need much more ongoing maintenance than a solar roof.

Further Information

If you want to try out PVs on a very small scale, our 'Solar Fountain' Tipsheet tells you how to make your own garden solar fountain.

For details of the CAT publications mentioned see the relevant leaflets or www.cat.org.uk/catpubs

CAT runs many residential courses, including several on solar photovoltaic systems. For details see www.cat.org.uk/courses or ring 01654 705981.

We have many solar photovoltaic systems on display here at CAT. To find out about visiting us, see the relevant leaflets or www.cat.org.uk/visitus

CAT Mail Order supply solar powered products including battery chargers, lights & fountains. www.cat.org.uk/shopping or 01654 705959.

Installers and Grants

Low Carbon Buildings Tel: 0800 915 0990;
Web: www.lowcarbonbuildings.org.uk
Grants for householders, small businesses, community schemes, and larger projects. In Northern Ireland, contact:
Action Renewables Tel: 0800 023 4077;
Web: www.actionrenewables.org

Real Assurance Scheme
Tel: 020 7747 1830; www.realassurance.org.uk
Set up by the Renewable Energy Association; aims to guarantee high quality installation. Members agree to the standards in their Consumer Code.

National Inspection Council for Electrical Installation Contracting (NICEIC)
Tel: 020 7564 2323; web: www.niceic.org.uk
Voluntary regulatory body promoting safe electrical work. Maintain a list of approved contractors whose work is assessed each year, to check they meet BS 7671 and other relevant standards.

Solar Data Resources

PV Potential Estimation Utility
<http://re.jrc.cec.eu.int/pvgis/apps/pvest.php>
Online tool for calculating energy generation from a PV system sited anywhere in Europe.

Retscreen International
www.retscreen.net
Free downloadable software for evaluating energy generation, life-cycle costs and greenhouse gas emissions for technologies including PV.

Meteorological Office
Tel: 0870 900 0100; www.met-office.gov.uk
Can supply solar radiation (insolation) data with a few days notice. Likely cost is at least £250 + VAT.