

Renewable energy

Factsheet

Photovoltaic (PV) - solar electricity

Introduction

Energy from the sun has been harnessed for thousands of years. We use this energy in three main ways and when talking about solar energy it is important to distinguish between these three types:

- **Passive heat:** This is the heat that we receive from the sun naturally. This can be taken into account in the design of buildings so that less additional heating is required.
- **Solar thermal:** Where we use the sun's heat to provide hot water for homes or swimming pools. We cover this topic in another fact sheet: solar water heating.
- **Photovoltaics (PV):** Uses energy from the sun to create electricity to run appliances and lighting. PV requires only daylight - not direct sunlight - to generate electricity.

How PV technology works

Photovoltaic systems use cells to convert solar radiation into electricity. The PV cell consists of one or two layers of a semi-conducting material, usually silicon. When light shines on the cell it creates an electric field across the layers, causing electricity to flow. The greater the intensity of the light, the greater the flow of electricity.

The three main types of solar cells are:

- **Monocrystalline:** made from thin slices cut from a single crystal of silicon. This has a typical efficiency of 15 per cent.
- **Polycrystalline:** made from thin slices cut from a block of silicon crystals. This has a typical efficiency of around 12 per cent.
- **Thin Film:** made from a very thin layer of semiconductor atoms deposited on a glass or metal base. This has a typical efficiency of 7 per cent.

Individual PV cells are connected together to form a module. Modules are then linked and sized to meet a particular load (need). The result is a PV array which supplies power to the building it is fitted on. If the building has mains electricity, any excess electricity can be exported to the national grid.

Alternatively, when demand is high, extra electricity can be purchased from the national grid through the utility companies. Where there is no mains supply, PV arrays can be used to charge batteries.



PV arrays now come in a variety of shapes and colours, ranging from grey 'solar tiles' that look like roof tiles, to panels and transparent cells that you can use on conservatories and glass to provide shading as well as generating electricity.

Applications

There are many applications for PV, ranging from calculators, solar torches and battery chargers to integrated systems for homes, offices, factories and public buildings. You can use PV systems for a building with a roof or wall that faces within 90 degrees of south, as long as no other buildings or large trees overshadow it. If your roof surface is in shadow for parts of the day, the output of the system decreases. Another consideration is that your roof must also be strong enough to hold the significant weight of the panels, especially if they are going to be placed on top of existing tiles.



Fig 2: A large array of solar panels for a household

Domestic installations

The size of a PV array required to provide electricity for a typical home varies, depending on a number of issues; how much power you need, the type of cell used, roof space available and budget. Typical systems are generally around 1.5-2kWp (kilowatts peak), enough to provide almost half of the average family's annual supply (assuming gas is used for heating requirements and there are no energy efficiency savings). This array would typically cover 10-15m² of roof area.



Fig 3: Typical domestic installation

Solar PV installations should always be carried out by a trained and experienced installer. The Energy Saving Trust manages an accreditation scheme for PV installers - call 0800 512 012 for further information.

Cost and maintenance

Prices for PV systems vary, depending on the size of the system to be installed, type of PV cell used and the building on which the PV is mounted.

For the average domestic system, costs can be around £4,000-£9,000 per kwp installed with most domestic systems usually between 1.5 and 2 kwp. Solar tiles cost more than conventional panels and panels that are integrated into a roof are more expensive than those that sit on top. If you intend to have major roof repairs carried out it may be worth exploring PV tiles as they can offset the cost of roof tiles.

Systems connected to the national grid require very little maintenance, generally limited to ensuring that the panels are kept relatively clean and that shade from trees has not become a problem. The wiring and components of the system should however be checked occasionally by a qualified technician. For stand-alone systems, i.e. those not connected to the national grid, further maintenance is required on other system components, such as batteries.

Planning considerations

Some local authorities require planning permission to allow you to fit a PV system, especially in conservation areas or on listed buildings. Always check with your local authority about planning issues before you have a system installed. Obtaining retrospective planning permission can be difficult and costly!

Where can I get more information?

Your nearest Energy Saving Trust Advice Centre can provide free, impartial, expert advice on renewable energy measures. Based in your region, we can help you choose the most suitable renewable energy technology for your home, as well as put you in contact with local suppliers and installers in your area. To find out more, call 0800 512 012 or visit www.est.org.uk/myhome.

Useful links

- For advice and information about renewable energy technologies and other energy saving measures for your home: www.est.org.uk/myhome
- PV-UK (the trade association of the UK PV industry): www.pv-uk.org.uk
- DTI renewables site: www.dti.gov.uk/renewables

Title picture courtesy of Proven Engineering
Figures 2 and 3 courtesy of solarcentury

