low-impact living initiative

LILI

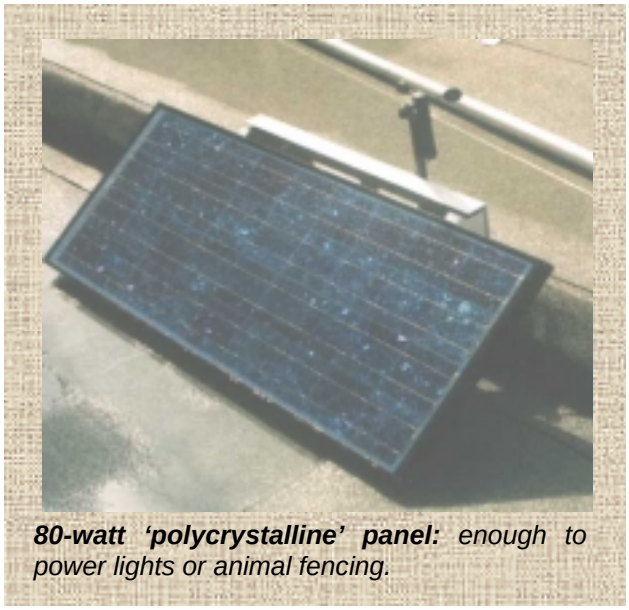
LILI information sheet
solar electricity

what is solar electricity?

It is the generation of electricity from the power of the sun, via photovoltaic cells (pv). It is different from solar water heating, where water passes through panels to be heated directly, and no electricity is generated.

Photovoltaic cells are made from silicon; when particles of sunlight (photons) fall on the cells, they dislodge the outer electrons of their atoms, and push them along to the next atom; a chain of moving electrons is produced, and if a wire is attached to the panels, these electrons can be pushed down it to supply a useable electric current. This current is measured in amps, and to give some idea of the scale involved, one amp of current involves the movement of 6 million million million electrons per second.

The electricity produced this way (and also from batteries) flows in one direction only, and so is called direct current, whereas electricity from the UK national grid is alternating current, as the flow of electrons changes direction 50 times per second. Direct current can be stored in batteries to power 12 volt appliances. However, these are more expensive and less readily available than ordinary domestic 240 volt appliances, so batteries and an inverter can be used to convert the 12 volt direct current to 240 volt alternating current, or the panels can be connected to the grid, with a meter to see how much electricity is put into the grid and how much taken from it. A grid-support system is one which charges batteries, and re-directs any surplus into the grid if the batteries are full.



80-watt 'polycrystalline' panel: *enough to power lights or animal fencing.*

roof in Germany *with 16 80-watt photovoltaic panels, which will generate around 1000kWhours of electricity per year – about one third of a family's needs. There are also 5 solar hot water panels at the bottom of the roof, which do not produce electricity – water passes through them and is heated directly.*

why is it good for the environment?

As a renewable source of energy, the main environmental benefits of pv is that they don't cause the problems that other means of electricity generation do.

Burning fossil fuels in conventional power stations releases nitric oxides, nitrogen dioxide and sulphur dioxide, causing acid rain which damages forests, wildlife and human health; it also releases carbon monoxide, nitrous oxides, lead, particulates and hydrocarbons, which cause damage to plants, ecosystems, and human health, especially respiratory problems. Also, burning fossil fuels releases 5 billion tonnes of CO_2 into the atmosphere each year. CO_2 is the most important of the 'greenhouse gases' responsible for global warming.

With pv there are no emissions, no environmentally-damaging extraction and transport of coal and oil to feed power stations, and no radioactive waste, or the potential leaks and disasters associated with nuclear power stations.

Pvs take 2 years to generate the same amount of electricity as is used in their manufacture.

Large-scale use of lead-acid batteries would cause environmental problems in their manufacture and disposal, so connection to the grid would be better unless in a remote location.

solar roof tiles: *1.56kW of solar tiles installed by Solar Century on a roof in Nottingham.*

what can I do?

You may think that pv is fine for the tropics, but can they work in temperate countries? Well the answer is yes they can, and there is enough south-facing roof space in the UK to provide all the country's electricity needs using pv.

A single panel can be used with a battery to power lights or animal fencing in a remote location, or you can attempt to supply all or most of your electricity with a large system.

The first thing to do is find out how much electricity (in kilowatt-hours, kWh) you use in a year (check your bills), and think about ways to reduce your usage: switch lights off when you leave the room; don't leave appliances on standby; use a laptop (c. 18 watts) instead of a desktop (c. 180 watts); use Savaplugs and low-energy light bulbs and appliances; don't overfill kettles; think about solar hot water and a wood-burning stove, and whether you need so much electrical gear at all. A typical UK family will use about 3000-4000kWh per year, but if you are single, have no children and / or reduce your electricity use, we can work with a figure of 2000kWh / year. Taking the annual amount of sunshine into consideration, this will require a 2.4kW system, covering 20m², and costing around £16,000 installed. There is now a 50% government grant in the UK for professionally-installed, grid-connected systems (see resources), which will reduce this to £8,000. With electricity at 7.9p per kWh this will save £158 per year, giving a payback time of 50 years, which will come down as fossil fuel prices rise. This system will save 1-2 tonnes of carbon per year. It has to be said though, that pv is only cost-effective for remote locations where the cost of grid connection is prohibitive, or when the satisfaction of obtaining clean energy from the sun is taken into consideration.

The cost can't be reduced by self-build (like solar hot water), because the manufacturing process is too high-tech, but you could self-install if you have the know-how. Of course you could use pv in conjunction with a wind turbine to take advantage of all weather conditions.

Other factors to consider are: is your roof south-facing? is it big enough? (if not, panels could be located on a frame in the garden or on a flat roof) is it shaded? (panels can be damaged if parts of them are shaded) if you are using batteries they need to be deep-cycle (able to be continuously drained and re-charged) with a charge regulator to prevent overcharging.

resources

- The DTI is providing 50% grants to householders for grid-connected, professionally-installed pv systems. The scheme is administered by the Energy Savings Trust. Call 0800 298 3978 or visit www.solarpvgrants.co.uk for more info
- Simon Roberts, 1991, *Solar Electricity*, Prentice Hall; bit pricey at £25, but the best book on the subject we found
- a list of pv suppliers and installers is available from the National Energy Foundation on 0800 138 0889 or online at www.greenenergy.org.uk
- LILI run residential weekend courses on wind & solar electricity (see below)
- Centre for Alternative Technology: (01654) 702400 www.cat.org.uk and Green Dragon Energy www.greendragonenergy.co.uk (01974) 821564 also run courses
- see the links page of LILI's website for many more renewable energy sites

Contact us to find out more about **LILI**. We run a range of residential weekend courses on practical environmental topics, and install facilities directly. For an annual subscription of £10 you can become a 'Friend of **LILI'**, and receive our biannual newsletter, discounts on our literature and courses, and help us to make a difference.

LILI*, Redfield Community, Buckingham Road, Winslow, Bucks, MK18 3LZ*
tel / fax: *(01296) 714184* ***email:*** *lili@lowimpact.org* ***web:*** *www.lowimpact.org*
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