



SOLAR ENERGY SYSTEMS – resource paper

A photovoltaic (PV) solar system generates electricity from sunlight and reduces the amount and therefore the cost of electricity drawn from the grid. A solar system also reduces the need for electricity from power stations burning non-renewable fuels, that emit greenhouse gases.

Grid-interactive systems export power to the ETSA system when the power is not being used in the house. Electricity retailers are required to pay for this exported power. Stand-alone (RAPS) systems use batteries to store electricity independent of the grid, and are most often used in rural locations remote from power-lines

Size

1 and 1.5 kilowatt output systems are most common, although many households would need more to cover their full electricity use. Size selection depends on household electricity use, cost and government rebates available.

Cost

The approximate full price of a 1 kW system is about \$14 000 and a 1.5 kW system \$16 000. The price may be reduced by sale of Renewable Energy Certificates (RECs) attributable to the system (1) or Solar Credits (2). Solar Credits apply from 9 June 2009 and will be phased out by 2015-16, because the government states that technology costs are going down, and the Carbon Pollution Reduction Scheme (CPRS) will also be providing incentives for renewable technologies.

Group purchase schemes are offered by some suppliers at reduced prices, but be sure to carefully read the contract, as they may ask you to sign over RECS/Credits that you would prefer to keep (ie do your research).

Feed in tariff

Feed-in tariffs are provided by various state governments and utility providers and serve as an additional benefit in switching to green energy. When you generate energy via solar power and your electricity generation exceeds your usage, excess power is fed back into the main electricity grid and you are paid a premium for this excess – this premium is called a feed-in tariff.

www.solarshop.com.au/incentives-and-offers/feed-in-tariff

A majority of current feed-in tariffs, including South Australia's, are 'net', which means you are paid only for excess electricity fed back into the grid from your grid-connect solar system. In comparison, under a gross feed-in tariff scheme, consumers are paid for all electricity generated by their system.

The SA tariff is set at 44cents/kWh.

Some energy retailers provide a 'top-up', paying customers an additional credit (on top of the state-legislated feed-in tariff) for surplus energy. For example, Origin pays another 6cents on top of the 44cents.

Components

The major components are the solar panels and an inverter. Solar panels contain thin pieces of silicon, which are connected together electrically and supported in rigid frames under glass (3). When light energy falls on a thin sheet of silicon some electrons in the silicon absorb sufficient energy to break away from their atoms and establish a current flow.

There are three types of panels. Monocrystalline (12-17% efficiency; most expensive, highest embodied energy), polycrystalline (12% efficiency) and amorphous (thin film) (10% efficiency). Lower efficiency requires a larger surface area for the same output, and the selection partly depends on the area of roof available.

Power output of all panels falls at high temperatures. Amorphous (thin film) panels take less energy to manufacture, use less silicon, and have better tolerance than crystalline for heat and partial shade.

The inverter converts direct current at about 12 volts from the plates into 240V alternating current for household use and for export to the grid. It may be worth installing an inverter capable of serving a larger system than you are currently installing, so you can add more panels later on.

Meters

The rotating disc in an old-style ETSA household meter runs in reverse when current is being exported to the grid. It can never show an excess of exported power over imported power. In order to get the feed-in tariff you need to upgrade to a digital input/output meter that ETSA will charge you about \$430 for them to install. This type of meter is now installed in new houses at no extra cost.

Input/Output meters give 2 main readings: the total amount of electricity drawn from the grid, and the total generated power returned to the grid (nett, after any daytime use has been subtracted). Many inverters show the total output of the plates; if yours does not, it is worth considering purchasing an additional meter costing about \$100, so you can see how much electricity your panels are making.

Power from a grid-connected photovoltaic system is disabled temporarily if mains electricity is out for any reason, for the safety of ETSA staff. Stand-alone (RAPS) systems with batteries continue to provide power from the panels even during mains power outages.

Mounting

The panels are usually attached to the roof with a 25 mm air space between the roof and the panels. Shading of the panels by trees or buildings must be avoided. Solar tiles are modified PV panels which can be built in to the roof of

new houses but installation is complex and few have been built in SA (4). The optimum inclination for panels is latitude plus 12° (ie. 47° for Adelaide) but in practice panels are often inclined at 30°, and an inclination down to only 10° loses little in efficiency.

Orientation should be due north however up to 45° off due north gives acceptable efficiency. The inverter must be under cover protected from the weather and kept as cool as possible.

For more tips on how your system can be positioned to catch the most sun, maintenance and a range of other things to consider, visit livinggreener.gov.au/take-action/save-energy/install-solar-power

Embodied energy

Energy used in construction of the plates and inverter is called embodied energy. The electricity generated by the system is said to 'pay back' its embodied energy. The estimated payback periods are about 6 years for monocrystalline plates and 3 years for polycrystalline and amorphous plates, but as plates become more efficient payback periods will reduce.

Environmental cost of manufacture

One overseas manufacturer is using solar panels to generate power for its factory. It also aims to reduce lead in soldered electrical connections, and to eliminate cardboard for packaging. There may in the future be recycling options when the plates reach the end of their estimated 20 or 25 year useful life.

Capital cost payback period

It requires many years to generate enough power to repay the initial cost. The time will be shortened as the tariff charged by the retailer increases and if you maximize the feed-in tariff you receive on exported power by minimizing power use during the day. Alternatively, the saving on electricity from the grid can be seen as a return on investment of the initial cost. For example the return on a 1.5 kW system has been estimated at 2.5% pa.

Selection of supplier

Reputation, after-sales service, and warranties are all important, and the installer and all components should carry Australian Standard certification.

You can check the accreditation of your installer and system through the Clean Energy Council's lists of approved photovoltaic (PV) inverters and modules, and accredited installers at cleanenergycouncil.org.au

It is usual to obtain competitive quotes.

BP Solar plates and some inverters are Australian made and others are imported.

Operation and maintenance

The system needs no attention other than occasional careful cleaning of the plates to remove dirt. Avoid cold water on a hot day, which may crack the glass.

You will enjoy recording the meter readings and seeing how much power you are generating.

References

1. Office of the Renewable Energy Regulator, GPO Box 621 Canberra 2601
Tel. (02) 6159 7700

www.orer.gov.au/recs

2. Department of Climate Change, 2 Constitution Ave, Canberra ACT 2600
Tel. 1800 057 590 within Australia

www.climatechange.gov.au/government/initiatives/renewable-target/need-ret/solar-ret.aspx

3. Energy Division, SA Department for Transport, Energy and Infrastructure, Level 8, 11 Waymouth Street, Adelaide 5000

Tel. 8226 5500

Energy Information Service 8204 1888

www.dtei.sa.gov.au/energy/renewable_energy/solar

4. PV Solar Energy Pty Ltd, 28 Florence St, St Peters NSW 2044

Tel. (02) 9557 6657

www.pvsolar.com.au