Renewable Energy

There are many options for using clean renewable energy sources in the home. Systems based on solar and wind are becoming increasingly accessible. This fact sheet outlines key considerations.

Electricity accounts for about 53 per cent of the energy used in Australian households, but creates around 87 per cent of the greenhouse gas emissions because most electricity is generated by burning fossil fuels. Coal, oil and gas are non-renewable energy sources.

Renewable power systems use renewable energy sources to produce electricity with very low greenhouse gas emissions.

Renewable energy sources such as the sun, wind and water are continuously replenished from natural sources.

When fossil-fuelled generators are used as back up, some greenhouse gases will be produced.

Renewable energy systems usually operate at low cost but can be expensive to install. The cost per kWh for the system life includes the installation and maintenance costs and remains unaffected by future energy price rises.

The design and installation of a these systems is a complex task requiring specialist knowledge. The former Australian Business Council for Sustainable Energy (BCSE) now the Clean Energy Council has a register of accredited designers and installers who can ensure systems comply with the appropriate Australian Standards. The register can be accessed on the website at www.bcse.org.au.

Rebates may be available to offset the initial cost of installing renewable energy power systems (REPS).

RENEWABLE SOURCES

The most common systems used in Australian homes are photovoltaics and wind turbines. These can be used individually or in combination.

Photovoltaic panels

Photovoltaic (PV) modules convert sunlight into electricity PV modules also commonly referred to as PV panels, are made up of a connected group of PV cells to form a usable size and electricity output. They have no moving parts and are therefore reliable and require little maintenance. PV panels can be expected to last 20 years or more. PVs are suitable for use in urban areas as they take up little space and make no noise.

Solar cells are usually monocrystalline, multicrystalline, or amorphous type.
[See: 6.7 Photovoltaic Systems]

The different module types are suited to different applications. Always seek expert advice before deciding which to use.

Solar modules come in different sizes ranging from two Watts peak (Wp) output up to 300Wp output. The most common modules sold in Australia are in the 60Wp to 80Wp range.

Solar modules can be mounted on a frame (either free standing or on the roof) or incorporated in the building fabric. Building Integrated PVs are more commonly installed in grid-connected systems than stand-alone systems.

Wind generators

Wind generators or turbines use the wind to turn a propeller that drives a generator. They come in many shapes and sizes. The most common is the horizontal axis turbine with blades like an aircraft propeller and a tail or vane to direct it into the wind. Larger wind generators are more suited to non-urban areas as the turbine needs to be mounted on a tower and makes some noise in operation.

A number of vertical axis and more aerodynamic wind generators are being developed and show promise in overcoming wind turbulence and noise problems in urban use.

Domestic wind generators are usually used in stand alone power systems and designed to charge a battery bank. [See: 6.9 Batteries and Inverters]

A wind turbine produces an alternating voltage and current, and these are rectified to provide DC at the correct voltage to charge batteries, similar to the system in a motor vehicle.

Domestic sized wind generators range from 300 Watts to 5kW, but in some instances a 10kW or 20kW turbine could be used.
A typical installation will use a 1kW turbine.

The wind generator must be installed on the highest tower that is practical and cost effective for the site. The typical tower used in domestic wind generator systems is between 10-20m tall.
[See: 6.8 Wind Systems]

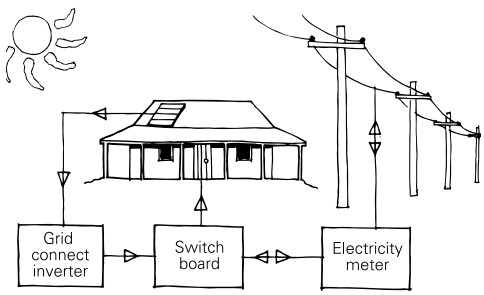
Note: Micro Hydro generators are a less common renewable energy power system. The unit operates by converting the energy from flowing water to electrical energy.

SYSTEM TYPES

Most renewable systems are unable to provide energy at all times as there may be insufficient sunlight, wind or water available. To fill the gaps, electricity can be supplied from storage batteries or generators in stand alone systems or from the electricity grid in grid connected systems.

Grid connected systems

Grid connected systems interact with the electricity supply grid. Grid connected systems are generally located in urban areas and PVs are the usual energy source. The main components of the system are the renewable energy source and a grid interactive inverter.



Grid connected system.

The inverter converts the low DC voltage generated by the system to the normal 240V AC household supply. It also monitors the operation of the system to control how much electricity is drawn from or fed to the grid.

If the household uses more energy than the renewable sources can supply, the shortfall is provided by the grid so power is always available.

If the system is supplying more energy than is needed, the excess is fed into the grid. Often the meter just runs backwards when electricity is going into the grid, so the household only pays for the difference between what is imported and what is exported. Different suppliers have different buy-back rates and metering arrangements. Check with your energy supplier for precise details.

System sizing is not critical as the grid is used for backup when the system output is insufficient for household needs.

As a rule of thumb, a one kWp monocrystalline array will produce about 1,500kWh of electrical energy per year and will require 9m^2 of space. An amorphous system will require more space. The system designer will specify and size it accurately for your particular location and load.

As the peak output of the system is determined by the size of the inverter, it can be useful to install a larger inverter than initially required. The excess capacity will allow additional modules to be added later. The size of the inverter will depend on your budget.

Most grid connected systems do not have storage batteries and do not provide a guaranteed continuous power supply. If the grid goes down the inverter will cut out for safety reasons and there will be no energy available.

Where continuity of supply is critical for part of the load a special type of inverter and batteries may be used to give unprecedented supply, but this adds to the cost of the system.

Stand alone power systems

Sometimes known as Remote Area Power Supplies, these systems are also used in less remote rural areas where the cost of connection to the electricity. They are more complex and expensive than grid connected systems because they need to be self-sufficient.

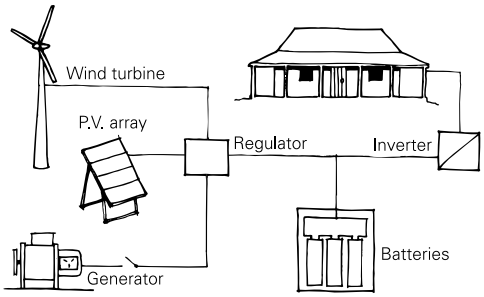
The main components of a stand-alone system include:

> A renewable energy source.

> Control equipment for battery charging and backup power source operation.

> Storage batteries.

> An inverter.



Stand alone power system.

Note: an inverter is not required if the home runs 12 and 24V DC appliances. Although DC appliances are usually more energy efficient than their AC counterparts, they are more expensive and the range is limited. DC systems also need larger capacity and more expensive wiring. Some stand alone power systems use a combination of AC and DC appliances.

A generator set is commonly required for emergency backup. These are generally installed in PV and wind systems, but not micro-hydro where an adequate water supply is continuously available. They are used for:

> Charging the batteries.

> Supplying specific high power loads.

> Emergency back-up in periods of unfavourable weather or when loads are larger than the original design.

It is generally recommended that the system includes a generator for battery charge equalisation. [See: 6.9 Batteries and Inverters]

Your stand alone power system should be designed to meet the required household load. Excess energy generated is stored in batteries for use when the renewable source is not available. The battery bank should be sufficient to provide power for several days.

Stand alone systems are usually installed where electricity supply is not available or connection costs are high. However, some people install these systems to be independent from the mains supply or to have reliable power in areas where blackouts are common.

In some cases it may be appropriate to use more than one type of renewable energy source, such as a photovoltaic system with a wind system.

REDUCING ENERGY CONSUMPTION

Investing in energy efficiency will avoid unnecessary expenditure on system capacity.

This is particularly important for systems that must be self-sufficient. They do not have access to the electricity supply grid for back-up and you may have to resort to using expensive fuels such as diesel. For grid connected systems, using less energy reduces the amount purchased from the grid or increases the amount that can be sold back to the grid. This saves you money.

Before installing a renewable energy system, your electricity usage needs to be calculated and minimised through energy efficiency or use of alternate fuels to reduce the size and cost of the system.

General rules

Use energy sources other than fossil-fuel electricity where possible, eg solar for hot water. If solar is not suitable consider an efficient heat pump system. [See: 6.5 Hot Water Service]

Limit the use of high power demand electrical appliances such as cookers, microwave ovens, water heaters, room heaters, clothes dryers, air conditioners, vacuum cleaners and hair dryers.

Buy energy efficient appliances, especially fridges and freezers. [See: 6.4 Appliances]

Use externally heated water from solar systems for clothes and dishwashers – do not let them heat their own water.

Use passive design building principles to reduce the need for heating and cooling. [See: 4.5 Passive Cooling; 4.6 Passive Heating]

Use natural lighting and energy efficient fluorescent lighting. [See: 6.3 Lighting]

Be aware that many appliances use stand-by energy when not actually being used. Televisions, videos, clocks, computers, faxes, battery chargers, power packs, etc. still use power when they are 'switched off'. These small loads may be enough to switch on the inverter, and inverters are often very inefficient at low load. Turn appliances off at the wall switch when not in use and buy Energy Star approved models. [See: 6.1 Energy Use Introduction]

GREENPOWER

GreenPower enables householders to buy accredited renewable energy from the electricity grid.

GreenPower™ Accredited Renewable Energy

GreenPower is a national accreditation program that sets stringent environmental and reporting standards for renewable electricity products offered by energy suppliers across Australia. GreenPower aims to increase Australia's capacity to produce environmentally friendly renewable electricity by driving demand for alternative energy generation.

Accreditation is essentially an endorsement from an independent authority. In GreenPower's case this means the renewable energy product is endorsed by a collection of state governments that manage the GreenPower program. For a renewable energy product to gain endorsement from the GreenPower program it must be generated from:

> Eligible renewable energy sources that meet strict environmental standards.

> A new renewable energy facility that was built since January 1997 (Other renewable energy exists, but it may not be accredited because it was built before 1997, and was already contributing energy to the electricity grid).

Accreditation ensures that energy companies are producing renewable energy of the same standard, making it easier for customers to choose between different renewable energy products. From a customer's perspective, the GreenPower label demonstrates at a glance that they are supporting renewable energy that is best for the environment and the renewable energy purchased will decrease greenhouse pollution.

Since 1997, more than 645,000 residential and commercial customers Australia wide have contributed to reducing greenhouse gas emissions by buying GreenPower, resulting in savings of nearly 4.5 million tonnes of greenhouse gas emissions.

You can get more information on GreenPower from www.greenpower.gov.au and you can check with electricity retailers to see the options for buying accredited GreenPower offered under various names.

ADDITIONAL READING

Contact your State / Territory government or local council for further information on renewable energy, including what rebates are available.
www.gov.au

Australian Business Council for Sustainable Energy (2006), *Australia's Renewable Energy Use: Technologies and Services.*

Clean Energy Council
www.cleanenergycouncil.org.au

Department of the Environment, Water, Heritage and the Arts (2008), *Australian Residential Sector Baseline Energy Estimates 1990 – 2020.*

Gilchrist G (1995), *The Big Switch – Clean Energy for the 21st Century*, Allen and Unwin, Sydney.

Green Electricity Watch
www.greenelectricitywatch.org

GreenPower
www.greenpower.gov.au

Renewable Energy, Australian Government
www.greenhouse.gov.au/renewable

Renew: technology for a sustainable future, Alternative Technology Association
www.ata.org.au

The Australia and New Zealand Solar Energy Society
www.anzes.org

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