# High country home generates its own power

When Maree Handy built on a remote property near Fairlie in South Canterbury, she had the choice of connecting to the nearby electricity lines or building her own stand alone power system. Being independent from the grid and never receiving another power bill was appealing – so she opted for her own 'little power station'.

Although she had always been interested in renewable energy, it was independence and energy security that really convinced Maree to investigate the possibility of generating her own electricity.

When she was quoted between $24,000 and $30,000 to connect her new house to the electricity network one kilometre away, she looked at alternatives seriously.

She found out that renewable energy technologies could also be expensive, but by avoiding ever-increasing power bills and avoiding the connection cost, a stand alone system seemed to definitely be the way to go on her 3.9 acre bush block.

## The stand alone power system

Maree's stand alone system has a modest 800 W peak solar photovoltaic (PV) array which generates most of her electricity needs. Electricity is stored in a battery bank until it is needed, when it is converted from DC electricity into AC electricity in an inverter. A system controller and other management devices all ensure that the system works efficiently and automatically, meaning Maree doesn't have to worry too much about the system or maintaining its components. A back-up diesel generator provides power if the batteries get too low, or if the electricity demand is above a certain level.

The reason why Maree's system can be relatively small (and therefore more affordable) is that she has ensured her home is energy efficient and uses alternatives to electricity where possible, thereby reducing her electricity demand. A gas-cooker is used in the kitchen, and a large solid fuel woodburner provides heating through radiators, and can act as a back-up for her solar water heater. She also uses energy efficient lighting, and top-of-the range energy efficient appliances. The home is well insulated and all the windows have double glazing, which is essential in the snowy winter months.

## The technical stuff

The stand alone power system installed on Maree's home has the following components:

- 4 x 200 Watt peak (Wp) Kyocera photovoltaic modules, giving a total array size of 800 Wp
- 1 x 3 kW Outback 48 V DC inverter/charger
- 1 x Outback MX60 60 amp Maximum Power Point Tracking (MPPT) controller
- 1 x Outback MATE systems manager
- 1 x Outback HUB4 communications manager
- 16 x 6 V 375 amp/hour batteries
- 1 x HATZ 3000 rpm 5 kVa diesel generator

## Energy demand

A common misconception is that people who generate their own electricity do not get to enjoy all the mod-cons or conveniences that those connected to the electricity network do. However, Maree's household is a great example that having your own power station does not have to compromise your standard of living. Maree is able to use multiple appliances such as the television, stereo, microwave or vacuum cleaner at once, and the system also provides for her laptop computer, bread-maker, hairdryer, and the pumps for the radiator and sewage system. If the amount of electricity required ever exceeds a certain level, the diesel generator will kick in automatically. Despite this convenience and security, however, the generator is only used sparingly; she estimates about 400 hours in the last two years.

Generating her own electricity also makes Maree more aware about how she uses energy in the home. "When the children are here, I am always going around after them turning things off at the wall. You have to be even more conscious of these sorts of things when you are generating your own electricity," she says. "Unlike most people, I have the control of both how I use energy in my home and how it is generated!"

Maree's system has four 200 W photovoltic modules.

## The solar panels

Maree's system has four 200 Wp Kyocera photovoltaic modules, meaning the array is 800 Wp.

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## How much electricity could I generate?

Here's an easy calculation to find out how much electricity you could generate each day a PV array.

Take the rated capacity of the array (eg. 0.8 kW), multiply by 24 (for the hours in the day) and then multiply by the expected resource available (estimate 12-15%)

0.8 kW (capacity of generator) x 24 hours x between 12%-15% (0.12-0.15) (resource availability) = 2.3-2.9 kWh generated per day

The batteries, controller and inverter are separated from the diesel generator.

## The inverter/charger

The inverter installed on this system converts the DC electricity from the PV modules to AC electricity which is able to be used by the appliances in Maree's home. It also controls the charging of the batteries.

## The battery bank

Maree opted for 16 6 V battery cells, rated at 375 amp/hours. These store the electricity generated by the photovoltaic array or generator until it is required for use.

## Controllers and system management

The system also has an Outback MPPT controller which enables the photovoltaic array to achieve the high possible performance. The Outback MATE system manager is a display unit which provides information about the operation of the system and allows the set points of the inverter to the adjusted.

## The diesel back-up

The diesel generator used in this system is a 5 kVa generator. Because the photovoltaic panels produce more than was expected, the diesel generator has played a relatively minor role. When designing a system, by increasing the size of the renewable energy generators and battery storage, it may be possible to greatly reduce the use of the diesel generator. This is important to reduce environmental impact of the system.

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## Maintenance

Most modern stand alone power systems do not require much maintenance when designed and installed correctly, although there will always be some things which require attention and the occasional fixing. In Maree's case, all she has had to do in the last two years was top up the battery fluid a few times, and change the generator oil every few months. "It's no hassle; it's easy," Maree says.

The only problem she has had with the system was once when, after a long period of fine sunny weather when the generator wasn't required, the small battery used to start the generator went flat. The solution was to have a small photovoltaic panel installed on the generator, which keeps its starter battery topped up. Since this was corrected, the generator is always ready and able to start when required.

## Costs

- Photovoltaic array: $10,800
- Inverter/charger: $5,200
- Maximum Power Point Tracking controller: $1,300
- System manager: $650
- Communications manager: $420
- Battery bank: $10,200
- Mounting and wiring: $3,000
- Installation: $2,000
- Diesel generator: $8,000

## Next steps for going off grid

If you are considering a stand alone power system, there are some important steps to take.

Gather information. Get a number of different system quotes and use an experienced and qualified company. Ask your installer for references and visit the Sustainable Electricity Association of New Zealand's website – www.seanz.org.nz

Get a quote for connecting your property to the electricity network. This will help you decide whether an off-grid system is viable option. www.electricity.org.nz has a map of which electricity distribution company covers your area.

Get your system designed by an expert. To be effective, the system needs to meet the specific characteristics of your property – an expert can maximise productivity and minimise environmental impacts.

**For more information, visit www.energywise.govt.nz**

## For more information contact The Energy Efficiency and Conservation Authority:

**EECA HEAD OFFICE:**
PO Box 388, Wellington, (04) 470 2200

**EECA AUCKLAND:**
PO Box 37444, Parnell, Auckland, (09) 377 5328

**EECA CHRISTCHURCH:**
PO Box 8562, Christchurch, (03) 353 9280

or visit **www.energywise.govt.nz**

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