Lodge turns energy into revenue

CASE STUDY

Key features

- Highly energy efficient building design and heating/ hot water systems to reduce electricity needs.
- Good wind energy resource harnessed by two 2.4 kW wind turbines to generate electricity for lodge.
- Wind turbines grid-connected, to enable export of excess electricity back into network.

Key benefits

- Reduced electricity demand means lower running costs for business.
- Owners paid for excess electricity generated and exported into network – lower electricity demand means a greater proportion can be exported.
- Owners have control of both electricity supply and demand in their home and business.

By reducing their electricity needs and installing two small wind turbines, owners of this lodge have eliminated their power bill – and they're getting paid for the excess electricity they generate.

When they decided to build a modern and stylish getaway on their lush McQueens valley property, Taurikura Lodge owners Toni and Wayne Harris-Daw saw the opportunity to make investments that would pay off in the long run.

"Our motivation when designing and building the lodge was to reduce running costs for our business," says Toni.

By grasping both the supply and the demand sides of the energy equation, Wayne says they have created a stylish rural retreat for their guests that requires very little energy to run and generates more electricity than they can use – so they're now being paid for the electricity they export back into the network.

"Not many New Zealanders receive a cheque instead of a bill each month from the power company."

Technical specifications

The Taurikura Lodge has implemented a range of demand side and supply side measures.

- 2 x 2.4 kilowatt (kW) grid-connected Skystream wind turbines
- 2 x heat pump water heaters
- 1 x split heat pump with a single outdoor compressor unit powering 6 indoor wall units
- 122 x energy efficient 11 watt (W) down lights
- An efficient wood fire in the living room, with a heat transfer system for the family's three bedrooms – maximum draw from the heat transfer system is 180 W
- A 'high tech' efficient open fire in the guest lounge, with built-in draft control
- Double glazing on every window in the house
- Bottled gas is used for cooking
- All appliances are ENERGY STAR® rated
- Passive solar swimming pool heating

Heat pump water heaters provide hot water for the lodge.

A digital reading shows how much electricity the wind turbines are generating.

Energy efficiency first

The most obvious energy feature at the Taurikura Lodge is the two whirling wind turbines whizzing away in the paddock.

But the real key to the success of this tourism venture is in fact the range of energy efficiency measures implemented throughout the lodge, which result in even more benefit from the wind turbines.

"It's obvious. The more we can reduce our electricity demand on site, the more electricity from the wind turbines I can export and be paid for," comments Wayne.

To reduce on-site electricity consumption, Toni and Wayne chose a comprehensive package of demand side solutions.

The clay-brick exterior provides good thermal mass to store solar energy during the day and release it over time. All windows are double glazed, and there is thick insulation in all walls and the ceiling.

Heat pump water heaters in the main house and the guest accommodation use around half as much electricity as conventional water cylinders would have.

The lodge's heating comes from a free-standing firebox, an open fireplace in the guest living room, and heat pumps ensure that the bedrooms are always snug and warm.

Using efficient lighting also reduced electricity needs in the lodge – there are 122 highly efficient 11 W downlights throughout.

"If all of these were turned on at once the total draw would only be 1.35 kW," says Wayne. "However, to put this in perspective, if they were conventional bulbs, they would be drawing over 12 kW. That's a massive saving, right there."

The wind turbines

Toni and Wayne's property was well suited for wind generation – even when there is hardly any wind at ground level, the two turbines are quietly creating clean green electricity, thanks to careful siting.

"It's the lay of the land," says Wayne. "The wind funnels down the valley from the north and the south. It's perfect for wind generation."

They selected Right House Ltd to help them with system design and installation. Right House also worked with the local electricity lines company (Orion NZ Ltd) to ensure that connection to the electricity lines was safe, and helped obtain consent for the turbines.

The two Skystream wind turbines are rated at 2.4 kW each, which means they have a total capacity of 4.8 kW. However, the actual amount they generate at any one time depends on how windy it is – their rated capacity is based on winds of 12 metres per second, so when winds are lighter they will generate less.

The Skystream turbines have the inverter and controller built into the 'nacelle', on the top of the pole. The inverter converts DC electricity from the generator into AC electricity to be used in the lodge, which means a separate inverter is not needed in the house. A 16 mm single-phase cable runs from the turbines over 100 m to the switchboard in the house, where a 30 amp breaker ensures safety.

The turbines are mounted on 10 m high poles, which are embedded in a concrete foundation. The diameter of the blades is about 3.7 m. The Skystream turbines are 'downwind' turbines, which means the blades rotate behind the pole.

"Some people think that small wind turbines are noisy", says Wayne. "But, even standing right below ours, the noise is minimal. They do make more noise on really windy days, but the wind itself makes noise too, so the turbines are masked. Overall it isn't a problem."

How much electricity will a wind turbine generate?

The amount of electricity a turbine generates depends on the available wind and the rated capacity of the turbine.

To make a rough estimate:
Take the rated capacity of the turbine (e.g. 2.4 kW), multiply by 24 (hours in the day) and then multiply by the expected resource available (usually between 15% and 40% – it depends on the site).

For example: 2.4 kW x 24 hours x between 15% and 40% (0.15-0.40) = between 8.6 and 23 kWh per day.

The turbines are on 10 m high poles.

Exporting back to the electricity network

The turbines are grid-connected, so whenever they generate more electricity than is needed, the excess electricity is fed back into the local electricity network. Since the lodge's opening in December 2008, the wind turbines have provided all its electricity needs, so a large proportion of what is generated has gone back into the network.

Though this could change in winter when electricity demand in the house increases, or when there are many guests staying, Wayne says "we're really thrilled with the results so far".

A special meter on the house, installed by Meridian Energy, accurately records electricity flows in both directions. At the end of each month, the power bill shows how much was imported and exported, and the net amount.

Their arrangement with Meridian means they are paid the same amount for the electricity they export as they pay for any electricity they import.

"It's a great feeling to see the bill at the end of the month. It vindicates all our hard work we put into the energy efficient design of the lodge, and choosing to generate our own electricity," says Wayne.

The two-way electricity meter, which measures how much is imported and exported.

Getting connected to the electricity network

Connecting a wind turbine to the electricity network should be relatively straightforward.

Regulations introduced in 2007 mean that your local lines company will accept connections up to 10 kW, provided it meets their safety and technical requirements. A fee of $200+GST is usually charged.

Check out www.electricity.org.nz to find out which lines company works in your area, and look at their websites for their 'distributed generation' policies.

Different electricity retailers offer different rates for the electricity they purchase, so it is important to shop around for the best 'buy-back' rate. All retailers will require that a metering system is installed which measures both electricity imported and electricity exported.

Results

Since Taurikura Lodge was opened in December 2008, the wind turbines' performance has been impressive.

In one month over summer the lodge exported over 2100 kWh, which gave them a credit on their power bill of over $450. During the same month, they had to import just 230 kWh – so the net amount they received for that month was a credit of $380.

The total 'turnkey' cost of the two turbines was approximately $31,000. The first turbine cost $18,000 because it included the cabling cost (usually a major cost component), and the new metering setup. The second turbine only cost $13,000 because it only required an additional 10 m of cable.

Through smart design and generating their own electricity, Wayne and Toni may never receive another power bill at the Taurikura Lodge. The success of this installation is due to both the high quality wind available, and the impressive energy efficiency improvements in the home.

Key steps for getting a small wind turbine

If you are interested in a small wind system, the first thing to do is to work out whether your site is windy enough. Not all sites will be as successful as the Taurikura Lodge.

It is best to leave the design and installation to an expert. Ask your installer for references and even talk to other homeowners about their experience. The website of the Sustainable Electricity Association of New Zealand (www.seanz.org.nz) has useful information on Standards, the New Zealand installer accreditation scheme, and even draft contracts to use when you engage a supplier and installer.

The lodge has two grid-connected Skystream wind turbines.

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