CASE STUDY

RURAL FAMILY OPTS FOR SOLAR WATER HEATING

Vivien Edge and Ken Ross put a lot of thought and research into the design of their new home in rural Upper Moutere three years ago. They wanted a home that had minimal impact on the global environment, was comfortable to live in, and that also made sense financially.

They are a Kiwi family with two children, aged ten and thirteen. Vivien is a busy GP, and Ken teaches geography and social sciences at the local college. Their three hectare rural block keeps the family occupied in the weekends with landscaping and planting projects and looking after the deer, sheep, and other animals.

Vivien and Ken had been thinking about solar water heating and other energy efficient designs for quite a while before embarking on this project.

"The economics of investing in solar water heating made good sense" says Ken.

And now, after two years of living in their new home, Vivien says, "It feels great having a hot shower from our solar system and knowing that we're not wasting electricity".

This case study describes how Vivien and Ken:

- went about designing energy efficiency into their new home,
- assessed the solar water heating options and chose an installer,
- live comfortably with solar water heating throughout the year,
- maintain the system to maximise energy efficiency, and
- expect the system to perform for them over the coming decades.

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DESIGNING AN ENVIRONMENTALLY SOUND, AND ENERGY EFFICIENT HOME

Vivien and Ken engaged an architect to help them design an environmentally sound and energy efficient home. They already had a reasonable understanding of energy efficient design concepts (Ken has an interest in environmental science and has recently added it to his teaching portfolio), and so they looked at the work of three different architectural firms specialising in energy efficient designs before making their choice. Together they designed the house taking into consideration:

- The building site is on an exposed ridge, with the main views to the north-east, while optimal solar gain opportunities are to the north and north-west. This meant that orienting the house would require a compromise between views and solar efficiency.
- The family wanted a good indoor-outdoor flow, plenty of light and space, but also high thermal efficiency. This resulted in large windows and glass doors being designed into the house, all with double glazing to achieve the thermal efficiency.
- There's no town water supply available on the site, so household water would be from rain, collected on the roof, stored in 2 x 25,000 litre tanks, and pumped into the house. This constraint on water supply means the family is conscious of the need to use water efficiently, irrespective of the solar water heating considerations.
- The double storey house design, with multiple mono-pitch roofing areas, led to challenges in finding the ideal site for the solar collectors of the water heating system. The choice of a site needed to take into account the optimal pitch and angle to the sun, keeping the system close to the main hot water tank, sheltering the system from strong winds, and minimising its intrusion into the views from upstairs windows.
- Designing the house to be totally "off-grid" was considered, but the capital costs were estimated to be around $25,000, and couldn't be financially justified when mains power was available at the gate.
- A concrete floor and several internal concrete wall panels were designed into the house to soak up winter sun during the day and release it slowly in the evenings. With the compromise between views and solar gain, additional heating was included in the building, in the form of hot water reticulated through pipes in the concrete floor. Because the hot water for heating the floor was most likely to be needed during periods of low solar gain, the choice was between gas or electricity, a heat pump water heater was ultimately chosen.
- The floor coverings also had to be chosen carefully. They needed to transfer heat effectively, be durable, and look good. Ken and Vivien chose a compressed bamboo laminate because it not only had the key features described above, but the bamboo itself is produced on a sustainable, eight year, growing and harvesting cycle.

ASSESSING SOLAR WATER HEATING OPTIONS AND CHOOSING AN INSTALLER

While Vivien & Ken were pretty keen on solar water heating from the start, they still wanted to be sure they were making a sound, long term investment. This meant researching the products on offer, and doing the maths on the investment.

Participating suppliers and installers can be found at www.energywise.govt.nz/solar

They found the Home & Leisure Show a good place to do their research. There were several suppliers displaying their equipment. Vivien and Ken checked what standards the equipment was certified to, and the guarantees offered by the suppliers. They also used the internet to research some of the brands on offer.

In the end they chose a SolarPeak AP30 system in conjunction with a specialised 300 litre hot water tank. Their key reasons for choosing this system were:

- the warranties offered with the system
- the reputation of the supplier and their franchised installers
- the fact that the supplier was accredited by the Solar Industries Association, and was also able to offer a government subsidy scheme on solar water heating installations through the Energy Efficiency and Conservation Authority (EECA).

The economic assessment of the system was straight forward. The cost over and above a standard hot water installation was around $4,000. At current and forecast electricity prices that provides a payback of approximately five years (the equivalent of putting your money in the bank and earning around 20% interest).

SOLAR WATER HEATING MANAGEMENT AND LIFESTYLE

Vivien and Ken rely almost entirely on the sun to heat their hot water for eight months of the year i.e. from late August through to mid-May. During the mid-winter months they switch on an electrical boost element in the hot water tank. The electrical boost is on a timer, and will only come on between the hours of 7pm and 10pm and, then, only if the temperature of the water in the tank is below 60°C. They will also occasionally turn on the boost at other times of the year if there are extended periods of bad weather. Vivien also keeps an eye on the temperature during summer to ensure it hits at least 60°C once a week (see the **Safety Tip**).

Safety Tip: The Building Code requires that water in the storage tank must be protected from liegionella bacteria growth.

One way to achieve this is to heat all the water so it reaches 60ºC for at least one hour each week.

While solar water heating systems normally heat the water to over 60ºC, it pays to check the temperature shown on the controller to ensure this temperature is being reached. If it's not, then the electrical boost should be used.

If using the electrical boost, it is best to use it in conjunction with a time-switch or controller to maximise the use of free solar energy, and minimise the use of electricity.

The system incorporates its own pump that circulates water between the collector panel on the roof and a heat exchanger in the hot water tank. The pump runs when the temperature in the solar collector is 10°C higher than in the hot water tank, thus heating the water in the hot water tank.

The family uses hot water for four showers a day, plus whatever is needed for the kitchen sink and hand basins. Their washing machine and dishwasher each heat their own water electrically and so don't draw on the solar hot water supply. The family never goes without hot water.

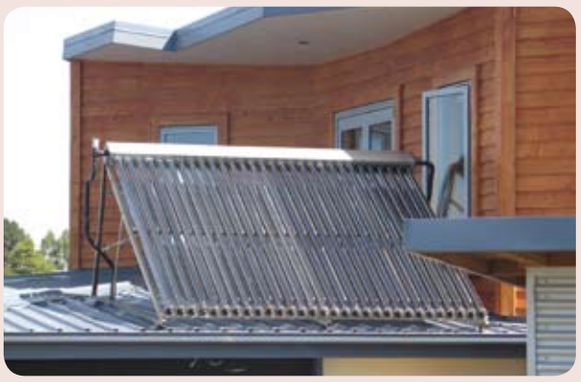
MAXIMISING ENERGY EFFICIENCY AND MAINTAINING THE SYSTEM

When the solar collector system was first installed on the roof, the decision was made to angle it to the north-west, and to keep its pitch at about 25 degrees (relative to horizontal) so it didn't intrude on the views from upstairs windows.

After their first winter they were a little disappointed with the amount of electricity that was being used to keep topping up the heat in the hot water, and so Ken increased the angle of the collector to around 38 degrees so it would be more 'square-on' to the low winter sun.

By increasing the angle of the solar collector Vivien and Ken have achieved a significant improvement in winter performance of the system, and are very pleased with the result. The compromise has been that the top of the collector intrudes into the view of one of the upstairs windows, but Vivien says "we're more than happy to live with that compromise to get the gains we've had from the system".

Ken has also been up on the roof once in the last two years to wipe-down the tubes of the solar collector with a damp cloth to remove dust and pollen.



The solar collector raised to be more square-on with the low winter sun

FUTURE EXPECTATIONS OF THE SYSTEM

Based on the research they've done and the warranties of the manufacturer, Vivien and Ken expect the solar equipment to keep performing for many years.

When asked for advice to give to other families considering investing in a solar water system, Ken says;

"It's a no brainer. In comparison with the overall cost of the building, solar water heating provides a great buzz for your buck."

"When choosing your system make sure you get what you pay for. It's not worth saving a few hundred dollars for an inferior product."

"Also, making sure you get the placement and angle of the solar collector right is vital if you're going to get the most from the system."

For more information visit
www.energywise.govt.nz/solar or
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