Heritage hotel goes solar

CASE STUDY

Key features

- Hotel overcomes challenge of heritage building status to install solar water heating
- Solar water heating suited to tourist accommodation facilities

Key benefits

- Energy savings of $1,255 p.a to be achieved
- Additional savings achieved through avoided heat loss
- 3.25 tonnes of carbon emissions off-set each year

Heritage buildings are appealing because of their character and the history that comes with age. Their age can also contribute to high maintenance and energy costs for space and water heating. Old electric hot water cylinders can have low energy efficiency, slow performance, and ongoing plumbing and electrical maintenance problems.

This case study looks at how the operator of the Mangonui Hotel, built in 1905, retrofitted the building with a modern solar water heating system with gas back-up.

About Mangonui Hotel

Mangonui Hotel has been described as New Zealand's most beautiful hotel. It has an Historic Places Trust classification as a heritage building.

The hotel has been the social centre of the town for most of its history. Today many local groups use the facilities for their gatherings, and it is a popular summer tourist destination. It is also near the Doubtless Bay wharf that services Auckland trawlers, whose crews use the accommodation and dining facilities of the hotel all year round.

Services at the hotel include accommodation for 25 people across 14 rooms and substantial dining and bar services. Their combined hot water requirements are up to 800 litres per day.

Retrofit considerations

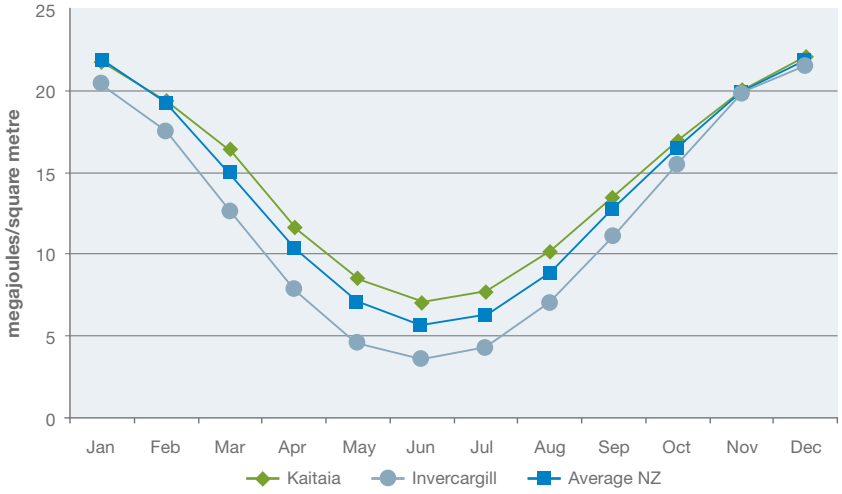
The sole source of hot water for the hotel for several decades had been a single 360 litre low pressure electric cylinder. Due to the high volume of water being drawn from it, the cylinder's electric elements were running constantly. Heat losses were also high due to the combination of an old poorly insulated cylinder, and a pumped recirculation system that lost large amounts of heat through the unlagged network of pipes in the hotel.

Added to the high electricity bill was the cost of several visits a year from the electrician to replace failed electric elements in the cylinder. The elements were failing due to the high lime (alkaline) content of the local water rapidly corroding the elements. To replace an element the cylinder must be drained each time causing disruption and cost to hotel operations.

A replacement hot water system was needed for the hotel to resolve the problems described above.

The use of solar energy was factored into the decision to invest in a new system on the basis that the energy contribution from solar has been proven many times to provide a very good return on investment. Solar water heating is also particularly suited to tourist accommodation facilities as hot water is always available when the guests arrive, yet costs nothing to keep hot when guests are not in residence.

Daily average of solar radiation



However, as is the case with most solar installations, an additional heat source would be required for periods of high demand on the hot water, and for periods of low solar radiation. Both gas and electricity options were considered.

Gas was chosen as the preferred heat source to supplement the solar water heating system. One of the advantages of gas was that the components would not be as susceptible to corrosion.

An additional challenge was to design the retrofit in a way that was sympathetic to the heritage status of the hotel, and to apply to the New Zealand Historic Places Trust (the Trust) for approval to proceed. The Trust takes into consideration a number of factors when considering such applications, including:

- adverse impact on the appearance of the building
- adverse effect on the heritage precinct.

The conclusion of the Trust was that the proposed design with solar panels facing away from the most public view of the hotel (which is also fortunately to the north), would have little adverse impact on the heritage values of the building or the surrounding precinct. The Trust approved the retrofit project.

The solar solution for motor camps through to exclusive retreats

The opportunity for solar water heating in New Zealand is particularly good due to our high solar radiation levels. While there is some variation in the energy levels available between the top of the North Island and the bottom of the South Island, all parts of the country can use solar energy to produce hot water cost effectively.

The amount of solar energy available to be captured between summer and winter varies significantly. This has implications for tourist accommodation operators. If seasonal occupancy peaks coincide with the solar radiation peaks between October and March, then hot water energy bills can be cut by up to 75% through the use of solar water heating. For those operators catering to a winter tourist trade, solar water heating can also make a significant difference to power bills, but a high capacity electrical or gas back-up system will be required to maintain the flow of hot water in those dark winter months.

The solution

At the heart of the solution is a 1000 litre GreenGlo cylinder that contains two separate heating coils.

The lower coil is connected to a 10m^2 array of Solahart solar heating panels discretely positioned on the roof of the hotel. A smart controller measures the temperature difference between the water in the cylinder and the fluid in the solar panels. The controller activates a pump to circulate the heating fluid from the solar panels through the heating coil in the cylinder when there is a temperature differential of 10°C or more between the two, thus heating the water in the cylinder.

The upper coil is connected to a Rheem 26 gas water heating unit. Its job is to maintain the temperature in the upper half of the cylinder at 60°C. A temperature sensor in the cylinder triggers a pump, and thus the gas heating unit, whenever the temperature falls below the target.

The energy savings arise through a combination of the improved insulation of the modern GreenGlo cylinder, and the free energy from the solar water heating unit that pre-heats the water in the cylinder, greatly reducing the need for the gas unit to operate.

The energy value delivered by the solar water heating unit has been calculated as 6.5MWh per annum. At 19.3 cents per kWh that equates to an energy saving of $1,255 p.a. It also off-sets 3.25 tonnes[1] of carbon emissions each year. Additional savings are also being achieved through avoided heat loss as a result of the significantly improved insulation rating of the cylinder, and through avoided maintenance costs.

The total project cost was $33,000. A simple return on investment calculation shows it will take at least 25 years to recover the investment from the savings. However, much of the cost of the project, for example the installation of new cylinders and conversion to gas, would have been incurred by the hotel even if the solar component had not been added in. While it's difficult to precisely isolate the component of the cost solely related to the solar units and associated plumbing, in other similar sized projects these costs are around $8,000 - 10,000, providing a 5 - 6 year return on investment (See the LandCare Research case study on this website).

[1] Based on NZ Energy Greenhouse Gas Emissions from MED:
– Electricity 0.5t/MWh
– Diesel 0.248t/MWh
– LPG 0.215t/MWh

Special permission was granted by the Historic Places Trust for the alterations to the hotel. The solar panels were positioned away from the view of the public and patrons. The gas heating unit was placed on the back of the utility shed.

Lessons for other tourist accommodation operators

In this project the return on investment from the solar component of the solution is not obvious due to it being just one component of a major retrofit of the hot water system. However, when taken in isolation, the addition of solar water heating typically:

- provides a direct 5 - 6 year return on investment, and
- means that hot water is always available when guests arrive without the worry of turning hot water systems on and off as guests come and go (See the EECA Solscape Retreat case study for more information).

A remaining issue for the Mangonui Hotel is the heat losses occurring in the uninsulated hot water pipes throughout the hotel. The hotel runs a hot water recirculation system, ensuring hot water is immediately available to all rooms, and this is responsible for ongoing heat losses. According to the installer, Kerry Robertson of Apex Plumbers Ltd, a better solution may have been obtained through a larger scale project that also included updating the piping network and recirculation system, and adding lagging to all the hot water pipes in the hotel.

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SEPTEMBER 2009 / EEC1070