

Ryman Healthcare – tapping into the earth’s energy

Did you know that heat can be harvested from the ground, right under your front lawn and flowerbeds – no matter how frosty winter gets? Ryman Healthcare did – and installed a system known as a ‘ground source heat pump’ to provide energy efficient hot water in its Invercargill retirement village.

About Ryman Healthcare Ltd

Established in Christchurch in 1984, Ryman Healthcare operates 21 retirement villages from Auckland to Invercargill, providing homes for over 4,000 residents and employing over 1,700 staff.

The villages provide a range of retirement living options, including independent townhouses, serviced apartments, and a care centre providing rest home and hospital-level care.

Going to ground

Ryman Healthcare was interested in trialling more efficient water heating technologies for its Invercargill facility, the Rowena Jackson Retirement Village, when adding 20 new serviced apartments to the complex in late 2008. After conducting feasibility studies for a range of heating options, the choice was narrowed down to either ‘air-to-water’ or ‘ground-to-water’ heat pump systems. Because it works equally well in winter as in summer, the latter won out due to Southland’s prolonged low winter temperatures.

Ground source heat pumps: an introduction

Although still fairly new to New Zealand, ground source heat pumps are increasingly common in North America and Europe. (They are sometimes also known as ‘geothermal heat pumps’, but this term can be confusing here in New Zealand, where geothermal energy is usually associated with power generated from steam or boiling water in volcanic zones.)

The ground source system, as the name suggests, extracts heat from the ground. Although air temperature fluctuates markedly between summer and winter, and even from one day to the next, a metre or more beneath the ground’s surface stays at a constant temperature all year round.

To capture this mild but consistent heat, a long loop of pipe (usually high density polyethylene) known as a ‘ground heat exchanger’ or ‘captors’, is buried in the earth. The captors can be laid flat or coiled in trenches; they can even be installed vertically in a bore hole, to a depth of up to 100 metres. Captors can also be put into underground water sources (e.g. if a water bore exists on the property), which is known as an open loop configuration.

The longer the captors, the more heat can be extracted from the ground. A mixture of water and glycol (anti-freeze) is circulated through the loop, absorbing heat from the ground. It then connects to a compressor which intensifies the heat before directing it into a heating system – typically a hot water cylinder and convective wet space heating system, such as radiators or underfloor heating.

The only external energy used by ground source heat pumps is electricity to power the compressor and the pumps which circulate the water.

Due to the relatively high cost of installing ground source heat pumps, the technology tends to make the most financial sense when used in large complexes with constant use. It can be a better option in colder climates, compared to other renewable technologies like solar or air source heat pumps.



Ryman Healthcare's Rowena Jackson Retirement Village.

✓ Key features

- Five 90-metre long ‘captor fields’ buried in the ground to capture heat
- Installation requires earthworks (and relevant council consents) making it more suitable for new builds. Check with your council about consenting the earthworks
- Provides hot water to 20 retirement home apartments

✓ Key benefits

- Savings of 50% on hot water heating costs. With smaller water cylinders and polyethylene pipes, these savings could have been higher still, up to 75%
- ‘Renewable’ form of heat which works efficiently year-round in all weather and temperatures – doesn’t need a boost on cold or cloudy days
- Systems tend to be highly reliable and require minimal maintenance, as they have few moving parts
- Components are hidden and unobtrusive, so don’t infringe on the ‘look’ of a new building
- Helps future-proof against the rising costs of retail power

✓ Sector relevance

- Hotel/accommodation industry
- Industrial/commercial hot water users
- Hospitals



Installing the ground source heat pump's captors.

Technology installed

In August 2008, a ground source heat pump system was installed at Rowena Jackson Retirement Village over a four-day period. For the 20 apartments, this comprised in total: five ground-sourced heat pump appliances, five 90-metre long 'captor fields' buried in the apartments' grounds, and five heat generator panels, external to the building, which each connect to a 310-litre hot water storage cylinder inside the building, via a heat exchanger coil.

The installation required the services of an electrician, plumber and excavation contractor, plus a ground source heat pump technician, whose services were provided by the supplier as part of the supply-and-installation price. The total project cost was \$60,000 (this included the relevant consents required).

Lessons learned

The system is working well, and saving around 50% on hot water heating costs when compared to a domestic electric-resistive storage system. However, anticipated cost savings of up to 75% have not been realised. The reason appears to lie with the over-design capacity of the five 310-litre hot water storage cylinders. "We're using less hot water than we expected to. In hindsight, we would definitely fit smaller cylinders," says construction manager Tom Brownrigg.

Another factor affecting the system's efficiency may have been the use of copper captors rather than polyethylene. As copper tends to lose heat more readily than polyethylene, it is suggested that copper captors be avoided.

Key personnel

Tom Brownrigg, Construction Manager – Ryman Healthcare Ltd
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Ryman Healthcare's perspective

Tom Brownrigg, Construction Manager:

"We saw, in ground source heat pump technology the potential for providing safe, reliable and cost-competitive hot water storage systems and the opportunity to monitor it alongside a traditional electric hot water system," says Tom Brownrigg.

"The comparison project has been a useful case study for us, because it incorporated 'off-the-shelf' technology well proven overseas and enabled us to determine the effectiveness in New Zealand environments."

"The Invercargill project was a bit unusual for us, as it was just for 20 apartments, meaning we could use an off-the-shelf domestic system. But most of our building projects are on a bigger scale, so if we were going to use this technology again, we'd probably have to use a larger, purpose-built heat pump system. We're currently exploring its feasibility for a property in Dunedin with 120 apartments."

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