

Geothermal Down-Bore Heat Exchanger Project – New Zealand

SUMMARY

Project Description: Harnessing Geo-thermal energy at YHA Rotorua

Project Type: Energy Efficiency; geothermal & Education in sustainability

National Association: YHA New Zealand

Project Location: YHA Rotorua

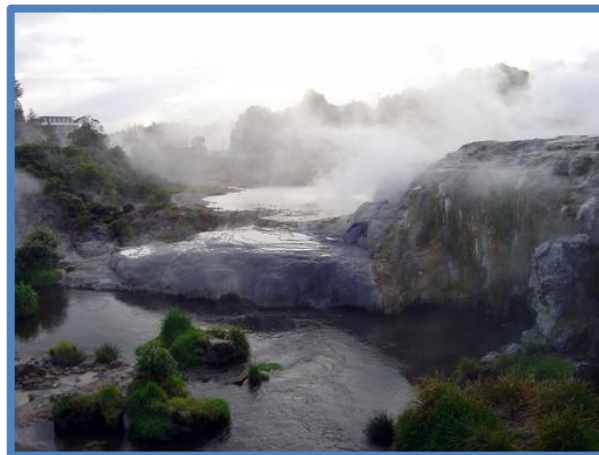
Estimation of number of reduced tonnes of CO2 per year: The project will save **31% or 18 tonnes of CO2-e per year.**

Total Funds Requested: £ 25,000

Total Project Cost: £ 29,500

Annual £ saves and ROI (return of investment): £4,456 per year

Extra Benefits: The savings realised from installation of the down-bore heat exchanger would be reinvested to support YHA's commitment to reduction of its carbon emissions. A prime candidate for re-investment is YHA Auckland International. This is because this hostel emits 9.45 tonnes CO2e per year as a result of natural gas consumption for production of potable hot water. We believe that with some investment this can be significantly reduced. A proposal to install hot water heat pumps in this hostel would therefore be instigated.



Why should this project be funded ahead of others?

YHA New Zealand proposes to install a geothermal down-bore heat exchanger in its YHA Rotorua hostel. This hostel produces a significant amount of YHA's total carbon emissions because it currently uses natural gas and electricity for its energy requirements. There is a unique opportunity to significantly reduce these emissions by using geothermal activity, of which there is plenty in the geothermally active city of Rotorua. Located right on the hostel site is a geothermal bore from which YHA has permission to remove heat. A heat exchanger would be installed down the bore to heat the potable hot water supply for the hostel.

The savings achieved from YHA Rotorua would then be invested in the YHA Auckland International hostel to install hot water heat pumps to replace the current and inefficient natural gas powered system for production of potable hot water.

YHA New Zealand has a long-standing commitment to environmental sustainability and acting as a catalyst for change for its members and guests. Funding a project such as this will support YHA's goal to be an exemplar for environmental sustainability both within New Zealand and in the HI community. Most importantly YHA's members and guests will learn more about the use of renewable geothermal energy when they stay at YHA Rotorua.



Help YHA New Zealand harness its boiling pools of geo-thermal energy that are currently underground below the YHA Rotorua hostel. Guests will learn more about geo-thermal power and environmental sustainability. It will cut greenhouse gas emissions at the hostel and the savings will help cut emissions at one of YHA New Zealand's largest city hostels.

DETAILED PROJECT INFORMATION

Background

YHA New Zealand was one of the first national member associations of HI to formally adopt its Environmental Charter and reported in its 1996 Annual Report that its progress was foremost amongst the then 64 member associations of HI.

For YHA New Zealand this long-standing concern for the environment has naturally progressed in the past decade into concern for the climate. YHA New Zealand is committed to combating climate change within all aspects of its business, as the hard reality is that every aspect of hostel accommodation operations has an impact on the environment, something that YHA believes it cannot ignore. To have continued success as a tourism business in New Zealand is to be inextricably tied to the country's clean green image in alignment with the New Zealand Government's 100% Pure New Zealand brand.

YHA New Zealand has formalised its commitment to environmental sustainability within its Mission Statement and its Sustainable Development policy. YHA New Zealand's Mission is:

'To deliver services to members which enrich their understanding of others and the environment by providing quality accommodation and travel experiences'

YHA New Zealand is committed to sustainable development, which is defined as development that meets the needs of the present without compromising the ability of future generations to meet their own needs. This commitment is expressed through triple bottom line reporting, considering not just its economic performance but also its social and environmental performance. It is the responsibility of Y

YHA's Senior Leadership Team to ensure that the triple bottom line principles are communicated and understood across YHA, and that appropriate measures are established, recorded, maintained and reported. YHA New Zealand has an assigned Sustainability Co-ordinator, Kate Ufton.

From the senior management and Board to front-line Hostel staff, the commitment to sustainability is an integral part of YHA's organizational culture and forms a vital part of recruitment, induction, position descriptions and performance appraisals. Sustainability is all pervasive in YHA New Zealand's policy, procedures, operational systems and long-term strategy.



Rotorua History

New Zealand is where the Pacific and Australian tectonic plates collide, and nowhere is this more evident than in the city of Rotorua and the lake it surrounds.

Bubbling mud pools and spectacular geysers are proof of Rotorua's volcanic background. This thermal activity makes itself known in every corner of the city, and is the reason for the area's famed sulphur scent. Clouds of steam drift across towards YHA Rotorua Hostel from Kuirau Park, home to boiling mud pools, crater lakes and sulphur vents.

Rotorua's geysers and mud pools are now among the city's biggest draw cards. Fumaroles, geysers and silica terraces displaying amazing colours can also be found within minutes of the city centre.

The renowned Pohutu geysers, and geysers elsewhere in the region, are also attractions. Pohutu geyser, in the Whakarewarewa Thermal Valley, erupts several times a day.

YHA Rotorua

YHA Rotorua is a 5 star and Enviro Silver Qualmark rated and HI-Q Level 2 hostel. It is staffed 24 hours a day and offers excellent amenities. <https://www.yha.co.nz/hostels/north-island-hostels/yha-rotorua/>

The hostel accommodation includes multi-share rooms, twin and double ensuite rooms and standard double rooms. It is located in Rotorua's central business district only a short stroll from geothermal attractions.

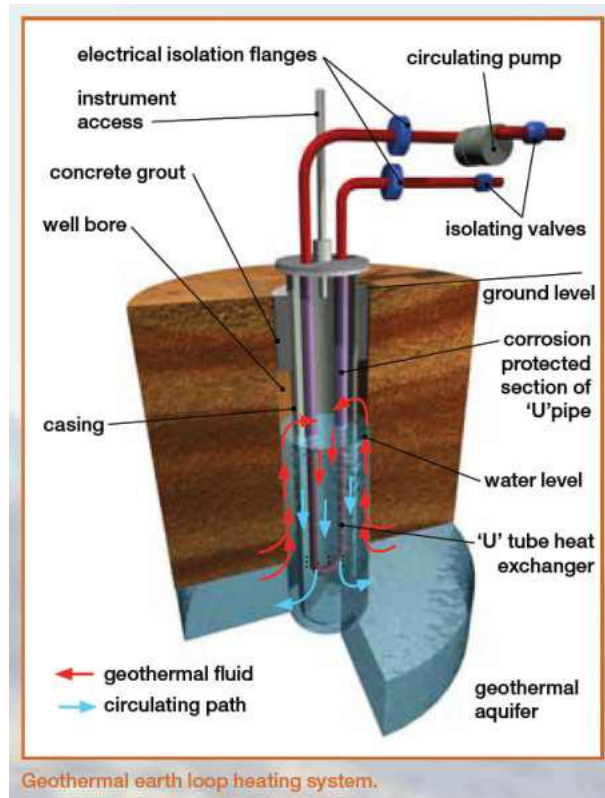
The clean, modern and secure hostel is also an active member of the **Rotorua Sustainable Tourism Charter** - recycling, energy efficiency and biodegradable laundry powders and cleaning products are just some of the measures taken at YHA Rotorua.

The Project

YHA Rotorua has access to a geothermal heat source via a geothermal bore that is currently located on the hostel site. YHA New Zealand has resource consent from the Bay of Plenty Regional Council to remove heat from this bore site via a down-bore heat exchanger. To date this has not been implemented and instead YHA Rotorua has relied on natural gas and electricity to provide its energy requirements.

Installation of a down-bore heat exchanger would result in the heat energy from the geothermal bore being used instead of natural gas to heat the potable hot water supply for the hostel.

The geothermal bore is rated at 70oC at its 45 metre depth. The potable water will be piped from the bore into the hostel mechanical plant room where hot water storage tanks will be installed to hold the hot water until it is required by the hostel guests.



The capacity of the existing bore will unfortunately not be able to supply the entire requirements of the hostel. Natural gas will still have to be used in times of high demand and as a backup during maintenance periods however the geothermal energy will provide 70% of the current natural gas potable hot water heat load thereby reducing the CO₂e (carbon dioxide equivalent greenhouse gas emissions) by 18 tonnes per year. Natural gas heating is used for space (room) heating during the winter months and this project will not affect the gas consumption for space heating.

Comparisons of previous gas accounts will enable monitoring of the effectiveness of the geothermal heat source. This monitoring occurs already as part of YHA New Zealand's commitment to reducing its carbon emissions.

Project Investment costs

The project costs include the supply and installation of the down-bore heat exchanger, connection and installation of above ground pipework and high grade thermal insulation, supply and installation of hot water storage tanks and associated pumps and controls.

The project budget is NZD \$57,400 + GST (Goods and Services Tax) which at today's exchange rate equates to approximately GBP £29,500. YHA New Zealand will fund the difference from its energy efficiency repairs and maintenance fund.

Why YHA Rotorua?

This hostel emits more than its expected share of carbon emissions for its size and annual overnights. The hostel has 189 beds representing 9.5% of the 1,972 beds in the YHA New Zealand hostel network yet emits 22% of YHA New Zealand's total carbon emission from electricity and gas.

The table below totals YHA emissions from electricity and gas, which based on historical data represent 80% of its total carbon emissions. A total of 47%, equating to 57.84 tonnes CO₂e, of the total YHA natural gas emissions is generated at YHA Rotorua

YHA emissions from electricity and gas 2012/13

| GHG emission sources –tonnes CO ₂ e | YHA New Zealand | YHA Rotorua hostel | YHA Rotorua as a % of YHA New Zealand |
|---|--------------------|-----------------------|--|
| Electricity (kWh) | 219.57 | 34.15 | 15% |
| Natural Gas (kWh) | 123.42 | 57.84 | 47% |
| LPG (kg) | 99.40 | 0 | 0% |
| Total emissions from electricity and gas | 442.39 | 91.99 | 22% |

Clearly there is opportunity to reduce this significantly and in Rotorua the opportunity is unique – being the combination of Rotorua city's geothermal activity and the existing bore located right on the hostel site.

Our calculations are that installation of a geothermal down-bore heat exchanger would result in a 31% or 18 tonnes reduction in total YHA Rotorua greenhouse gas emissions. This would reduce the hostel's natural gas emissions to approximately 40 tonnes per year

Reinvestment of Savings Project

The financial impact of installing the geothermal down-bore heat exchanger is significant for YHA New Zealand. Once installed, the projected savings are NZD \$8,667 per annum or approximately £4,456, which represents an excellent return on the investment.

The savings realised from installation of the down-bore heat exchanger would be reinvested to support YHA's commitment to reduction of its carbon emissions. A prime candidate for re-investment is YHA Auckland International. This is because this hostel emits 9.45 tonnes CO₂e per year as a result of natural gas consumption for production of potable hot water. We believe that with some investment this can be significantly reduced. A proposal to install hot water heat pumps in this hostel would therefore be instigated. This would assess the feasibility and cost of heating the potable hot water via heat pumps technology so that the natural gas boilers could be decommissioned. Indicative high level costings are approximately NZD \$55,000 (£28,280) for this project and the savings from YHA Rotorua would provide a strong contribution to this cost.