25 August 2024

Ministry for the Environment

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Tēnā koe

Submission on New Zealand's second emissions reduction plan

The New Zealand Geothermal Association (NZGA) would like to submit our recommendations as part of the current consultation on the Second Emissions Reduction Plan. We strongly advocate for the government to make significant efforts to recognise and expand the role of geothermal direct use and cascade use, particularly in communities and regions where these technologies can provide sustainable, resilient, and secure energy solutions.

Geothermal direct use and cascade use applications are the cheapest energy option and ready to massively deploy in Aotearoa New Zealand now.

Geothermal[1] is an Aotearoa New Zealand icon and has been part of Māori culture for generations. Geothermal is an iconic kiwi symbol. Geothermal stories and geothermal energy have been part of Māori culture for generations, and geothermal is entrenched in our modern history. Over the past 70 years, geothermal has been a vibrant, proven, indigenous renewable resource, which enables other industries to thrive and our regions to grow. Through this period the significance of the kaitiaki role of Māori of this taonga has been progressively recognised.

New Zealand Geothermal Association (NZGA)

1. The NZGA, incorporated in 1992, is a non-political, non-governmental and not-for-profit organisation, with a focus on fostering a sustainable future for Aotearoa New Zealand through the use, development or protection of geothermal resources. The NZGA connects with global geothermal communities and is well positioned to positively influence geothermal initiatives on the international stage.

2. NZGA membership comprises ca. 520 individuals, as well as 38 corporate members, representing, research organisations, Māori trusts, geothermal electricity generators, engineering consultants, technology companies and planning consultants. This diverse and skilled network of people work and live with Aotearoa's geothermal resources.

[1] The reference to 'Geothermal' throughout this submission is a term that is used to describe both low enthalpy resources (potentially down to ambient conditions for geothermal heat pumps), and high enthalpy conventional geothermal resources (<3.5 km deep with reservoir temperatures <350°C).

Our recommendation#1: A Centralised Reliable geoheat database

Our recommendation#2: A significant support and leadership from local councils and central government. The development of a regional geoheat strategy and a commitment to geoheat project support initiatives like streamlined consenting, central government grants to allow a public and private co-investment model.

This submission is broken down into 5 parts:

Section 1: Geoheat Action Plan 2024-2025

Section 2: The role of geothermal in the Bay of Plenty RETA report, EECA

Section 3: The role of geothermal in Tauranga, Bay of Plenty Regional Council report

Section 4: The 2024 New Zealand Geothermal Week: "Geoheat: Every day, Everyone, Everywhere. Direct and Cascade Use of the Geothermal Resource"

Section 5: Geoheat example: Nature's Flame

Section 1: Geoheat: direct heat use and industrial process heat: always-on, off-grid, co-location, complementarity

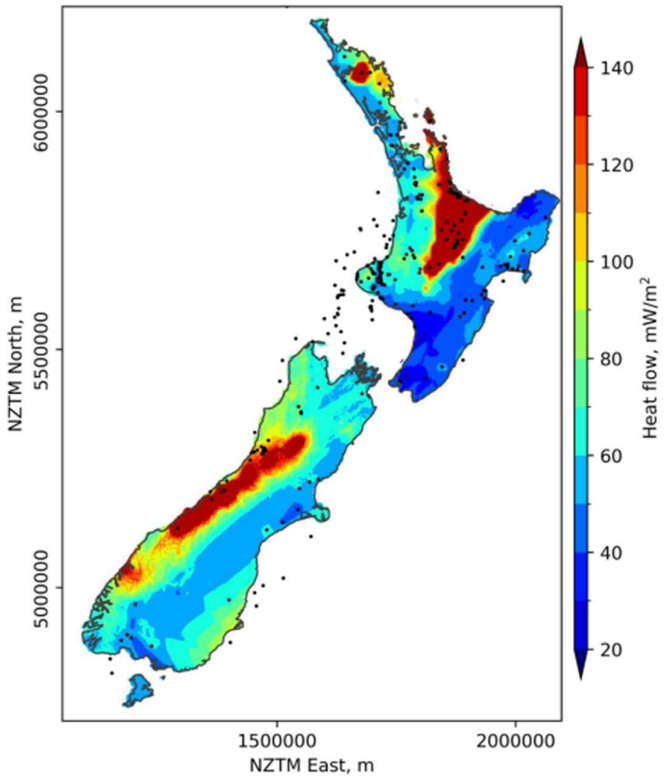
Geo-heat Strategy and Action Plan objectives

3. In 2017, the NZGA published the Geo-heat Strategy[2] which is the primary geothermal programme in Aotearoa New Zealand focussed on increasing the use of direct geothermal energy through industrial and commercial scale applications (e.g., glasshouses, timber processing, dairy processing).

4. About 60% of process heat demand in Aotearoa New Zealand is supplied from fossil fuels, mainly coal or natural gas (MBIE 2024). Therefore, in order to meet the 50% economy-wide target for renewables by 2035, considerably more progress is needed in the industry sector. The importance of this Strategy therefore, is that it provides guidance and drive towards increasing uptake of geothermal direct use which can in turn displace heat sources that rely on fossil fuels and produce carbon emissions.

5. The Strategy's primary focus is to develop such resources in Northland, Waikato and Bay of Plenty regions with the goal of additional 7.5 PJ of geothermal utilisation. The secondary focus is to further push development of direct use of geothermal resources for residential scale use as well as the industrial use in other regions including South Island. Geothermal direct use applications including Christchurch Airport geothermal heating and cooling, pools and spas for bathing. For example, Maruia Hot Springs on the West Coast, and Hanmer Springs Canterbury.

[2] https://nzgeothermal.org.nz/app/uploads/2017/06/Geoheat_Strategy_2017-2030__Web_Res_.pdf



6. Every two years, we publish the bi-annual Action Plan where we celebrate our achievements and report on progress and details for the next two years. We have published the 2024-2025 Action Plan this June.[3] The Strategy and associated Action Plans are designed to be directive, yet flexible, incrementally evolving as efforts reveal the next best steps in the rapidly changing business and energy sectors in New Zealand.

7. There are many success stories of Geoheat use in Aotearoa New Zealand and, by increasing uptake, we envisage that Aotearoa New Zealand can continue to be a market-leader in geothermal innovation and sustainable utilisation of this native energy resource.

Diverse range of applications

8. Geoheat can deliver temperatures from chilled (4 ˚C) to around 220 ˚C and is on point with particularly relevant characteristics for energy requirements in today's energy sector environment, being: renewable, low carbon, cost-effective, always available, proven at scale and low risk (see Figure 1).

[3] https://www.nzgeothermal.org.nz/downloads/2024-2025-Geoheat-Action-Plan.pdf

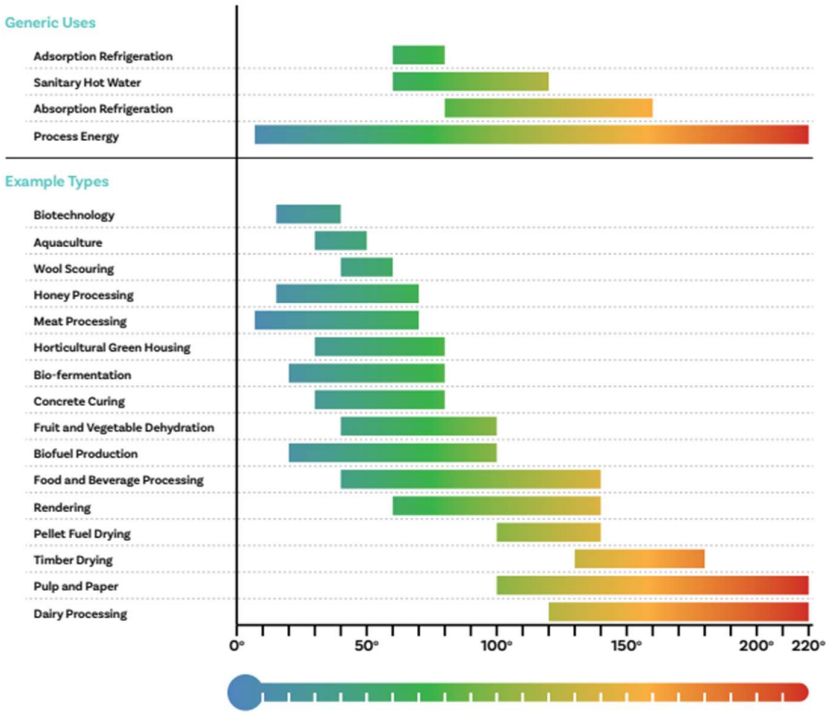


Figure 1 shows a schematic diagram of different applications from direct heat use.

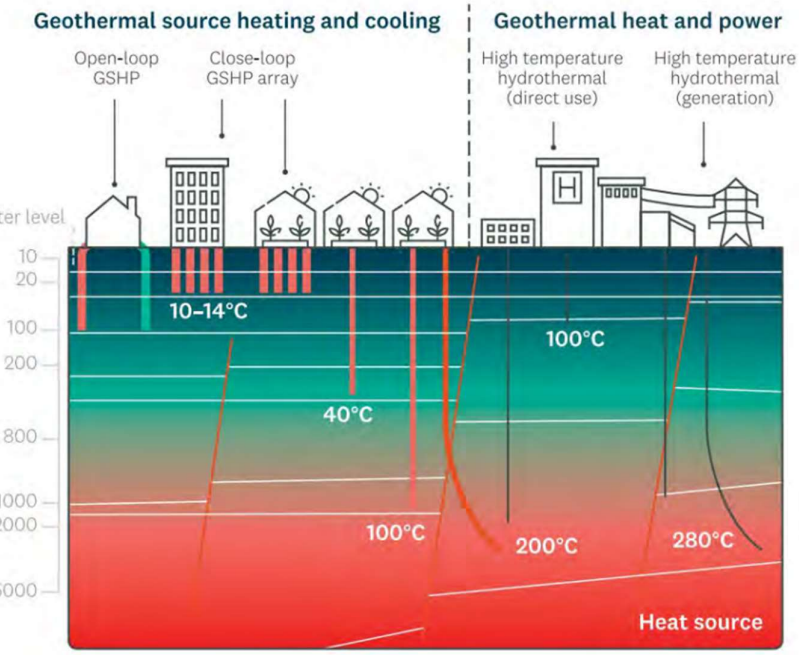
Cost-effective, sustainable solution

9. Geoheat is available now at many locations in Aotearoa New Zealand, and is a cost-effective, sustainable solution for industrial applications ranging from small (few megawatt) to large (100 megawatt) scale and should be considered as a viable alternative to traditional fuel sources whether for new ventures or decarbonising established operations. The Geoheat Strategy has been firmly embraced as an enabler by the economic development agencies in the Bay of Plenty Region (Bay of Connections) and the Taupō District (Amplify) which are actively involved, as are a range of Māori-owned entities, consultants, commercial businesses, research organisations and government.

A guide only as there is always an exception

Indirect Use
Needs a heat pump
<30C

Direct Use
NO heat pump
>30C



Source: GNS Science

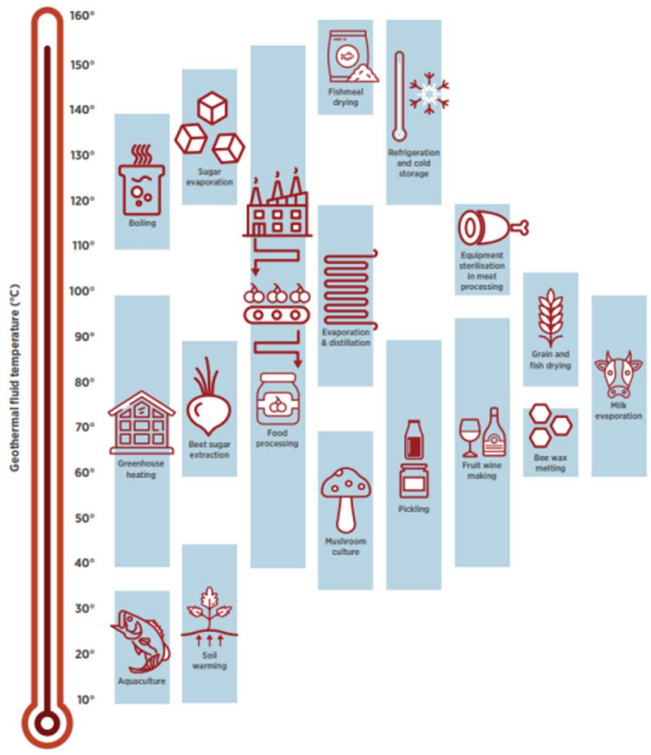


Figure 9: Potential uses of geothermal energy in the agriculture sector (IRENA, 2022)

10. Geoheat - the direct use geothermal energy - is the lowest cost of any fuel type in delivering energy to an industrial process in New Zealand, as highlighted in the table below.

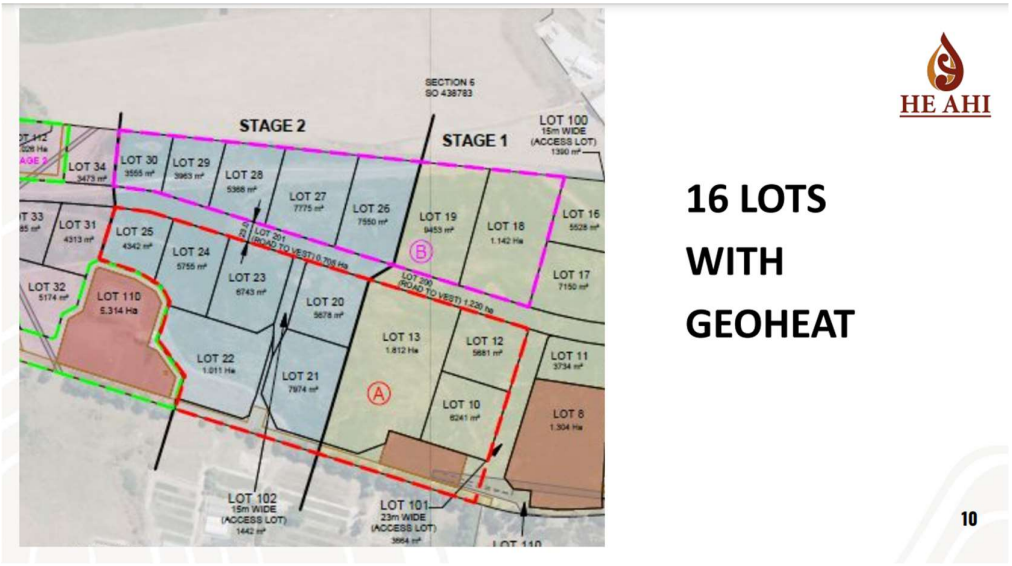
Table 1 Cost of fuel types in delivering energy in Aotearoa New Zealand

Geoheat Delivers Cost-Effective Energy

Fuel Type	$/GJ	Emissions Factor tCO_{2e}/GJ	Carbon costs[1]	Conversion Factor[2]	Total Cost $ / GJ Delivered
Geothermal - Steam	8[3]	0.0073[4]	$0.51	0.83[5]	$10.25
Electricity - Heat Pump COP 3.5	43.34[6]	0.0206[7]	$1.44[8]	3.5[9]	$12.38
Biomass	13[10]	0	$0.00	0.8[9]	$16.25
Gas	11.57[6]	0.0557[11]	$3.90	0.85[9]	$18.20
Coal	9[10]	0.0944[12]	$6.61	0.78[9]	$20.01
Wood Pellets	18[10]	0	$0.00	0.9	$20.00
Electricity - Resistance	43.34[6]	0.0206[7]	$1.44[8]	0.99[9]	$43.78

Co-location

11. A new industrial estate is being developed in Taupō, called He Ahi, the Tauhara Clean Energy Park. Users will have the opportunity to tap into geothermal energy to power their activities. The 45-hectare site is located in the existing industrial area on the northern edge of Taupō town. The land is co-owned by several local iwi groups and is subdivided into numerous sections. Each site will be specifically designed and built to meet the requirements of the tenant. Contact Energy Ltd. will supply geothermal energy to the tenants from the existing infrastructure associated with the nearby Te Huka geothermal power station.



Our recommendation: A Centralised Reliable geoheat database

12. Low awareness is a substantial barrier to increasing the diversification of geothermal resource use in New Zealand[4]. Showcasing existing applications is one way to raise awareness, promoting potential business uses and opportunities. Successful implementation of direct use development also requires financial data on economic viability, market drivers and sound business cases to be developed by the potential user. Moreover, reliable data is necessary on both energy use and employment for projects established to track progress of the geoheat strategy. More detail on the Geoheat Strategy and the implementation approach can be found in Climo et al., (2020)[5].

13. Furthermore, the quantification of geothermal resources economic value[6] provides policy makers with a framework for considering the impact of resource management decisions and assists economic development agencies and investors to better understand the opportunities. Direct use data can be used to support economic studies, as well as the creation of multipliers for industries where quantitative information is less readily available, for example, horticulture, fish farming and honey processing.

14. Historically, geothermal research and data collection in New Zealand has focused on high temperature resources and electricity generation, while direct use and lower temperature geothermal research has been more ad-hoc[7].

15. A fundamental limitation to reporting, past reviews and geothermal energy use assessments in New Zealand, has been that the direct use data sets are incomplete, much is estimated, and the data is of variable quality. The most accurate data is associated with the larger use industrial installations, where flow (and energy) metering are often linked to industrial/commercial supply contracts and/or resource consent monitoring. Commercial, domestic, and small mineral bathing uses are the least well defined, less monitored, with estimates often based on consented take, coupled with known resource and use characteristics. Smaller users are often unaware of the thermal capacity or the daily to annual energy delivery from their heat producing facilities. Also, for 'Permitted' uses (or any other uses that are unconsented), there is usually no requirement to submit monitoring data[21].

16. Geothermal resource consent applications require the developer to pay the costs of exploration to acquire data required for the resource consent application. A thorough investigation must be undertaken but with no right of priority or access. Since geothermal exploration carries no rights of priority, there is a strong incentive for the data collected to remain confidential. In these cases, data is commercially sensitive and can be treated as such under New Zealand law, and therefore will not be readily available. However, if consent data could be integrated directly with the database, it would provide the most accurate and timely measure of direct use nationally. This would require

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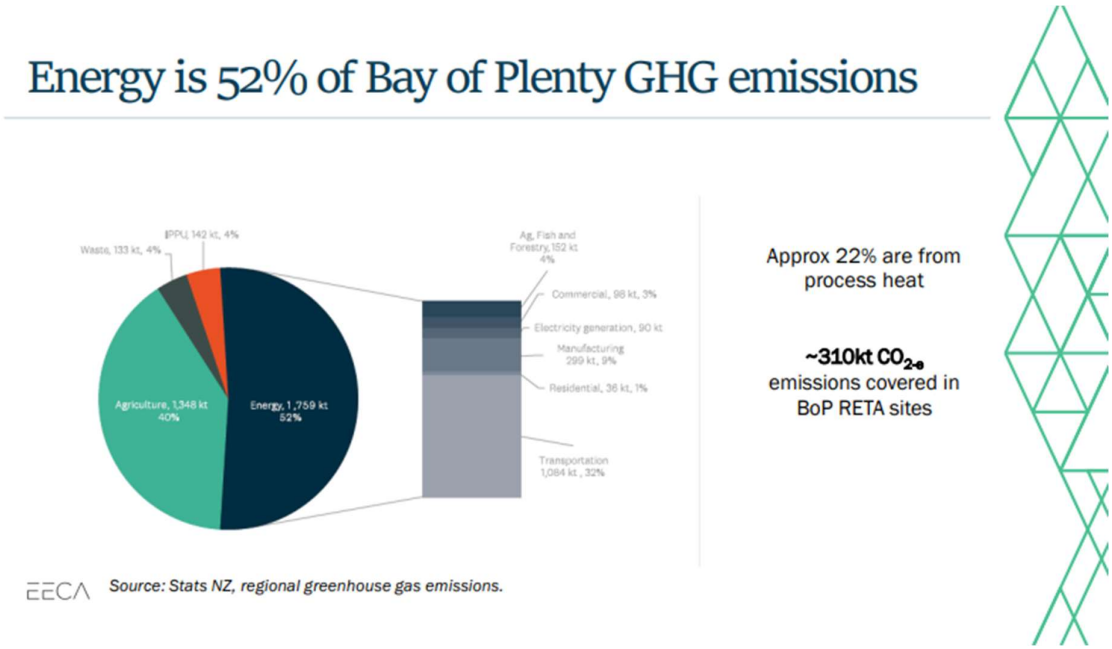
[4] Carey, B., Climo, M., *Watt? A Geoheat Strategy For New Zealand*. Proceedings of the NZ Geothermal 34th Workshop, 19-21 November 2012, Auckland (2012)
[5] Climo, M., Blair, A., Carey, B., Bendall, S. Daysh, S. *Driving the Uptake of Geothermal Direct Use in New Zealand: Successful Strategies, Empowered Champions, and Lessons Learnt Along the Way.* Proceedings World Geothermal Congress 2020, Reykjavik, Iceland, April 26 – May 2, 2020. (2020)
[6] Barns and Luketina, 2011; Conroy and Donald, 2013; Luketina et al., 2016
[7] M. Climo, S.D. Milicich, P. Doorman, S.A. Alcaraz, A. Seward and B. Carey, 2021 *New Zealand Direct Geothermal Use Inventory Update Data, Visualisation and Information (geothermal-energy.org)*

agreed protocols with regional councils around data reporting and aggregation, and subsequent processes put in place to feed data into a centralised database.

Section 2: The role of geothermal in Renewable Energy Transition Accelerator: Bay of Plenty Region, EECA (2024)[8]



[8] https://www.nzgeothermal.org.nz/downloads/eeca_NZGA-Conference----RETABoPGeothermal-vFINAL-010724.pdf

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Key opportunities

Kawarau

- Already key contributor to low carbon process heat in BoP
- Still plenty available: 6PJ p.a. @ ~170°C

Reporoa

- Geothermal potential exists circa 260°C
- Exploratory activity required for development (est $18.5m)
- Plan change to facilitate extraction would be required

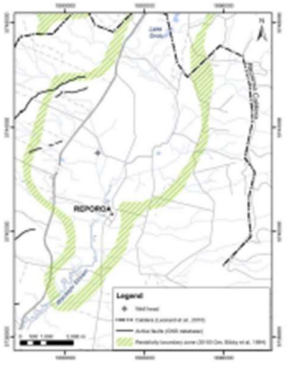
Mount Maunganui

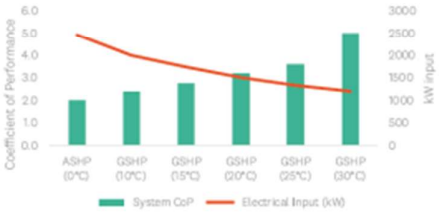
- Geothermally enhanced aquifer
- Concentration of process heat demands – DES opportunity

Low temp Aquifers and GSHP's

- Increased efficiency over airsource, though increased capital
- 'Geothermally enhanced' enhances performance and options
- Significant number of examples in Christchurch

EECA





Four 'case study' sites

Whakatane Growers (heating)

- Low temp Matahina aquifers with GSHP
- Replace coal/gas boilers, abate ~3,700 t CO_2 p.a.
- 35.2 TJ/yr

Whakatane Hospital (Heatng and cooling)

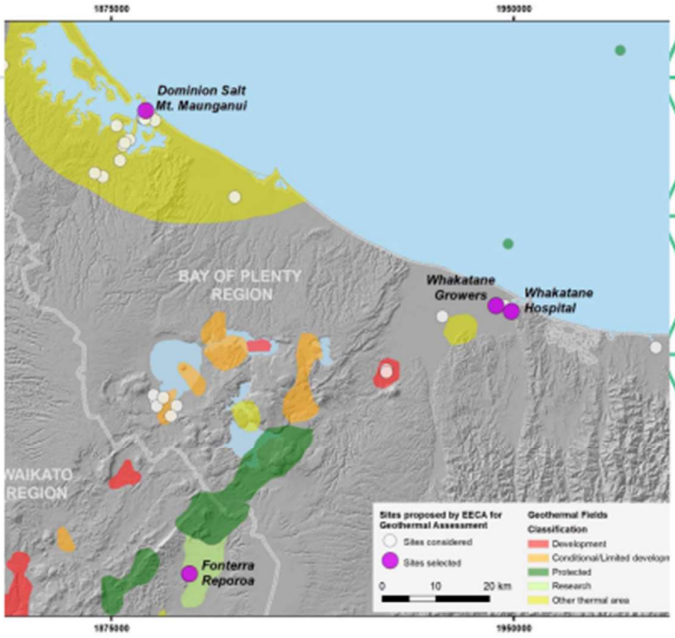
- Low temp Matahina aquifers with sync H&C GSHP
- Replace coal/gas boilers, abate ~210 t CO2 p.a.
- 17.1 TJ/yr

Dominion Salt (Mt Maunganui)

- Low temp Matahina aquifers with GSHP
- Replace coal/gas boilers, abate ~3,700 t CO2 p.a.
- 20.7 TJ/yr

Fonterra Reporoa

- Geothermal generated steam 14 barg (198°C)
- Replace Significant portion of gas boiler demand
- 266.9 TJ/yr



Section 3: Geoheat Potential of the Tauranga Geothermal System, Bay of Plenty Council

17. A study for the Bay of Plenty Regional Council, evaluating the geoheat potential of the Tauranga Geothermal System was conducted in August 2024.[9] The report establishes that there are plenty of opportunities for geoheat development while the Tauranga Geothermal System with lower temperature geothermal fluid accessible at relatively shallow depths.

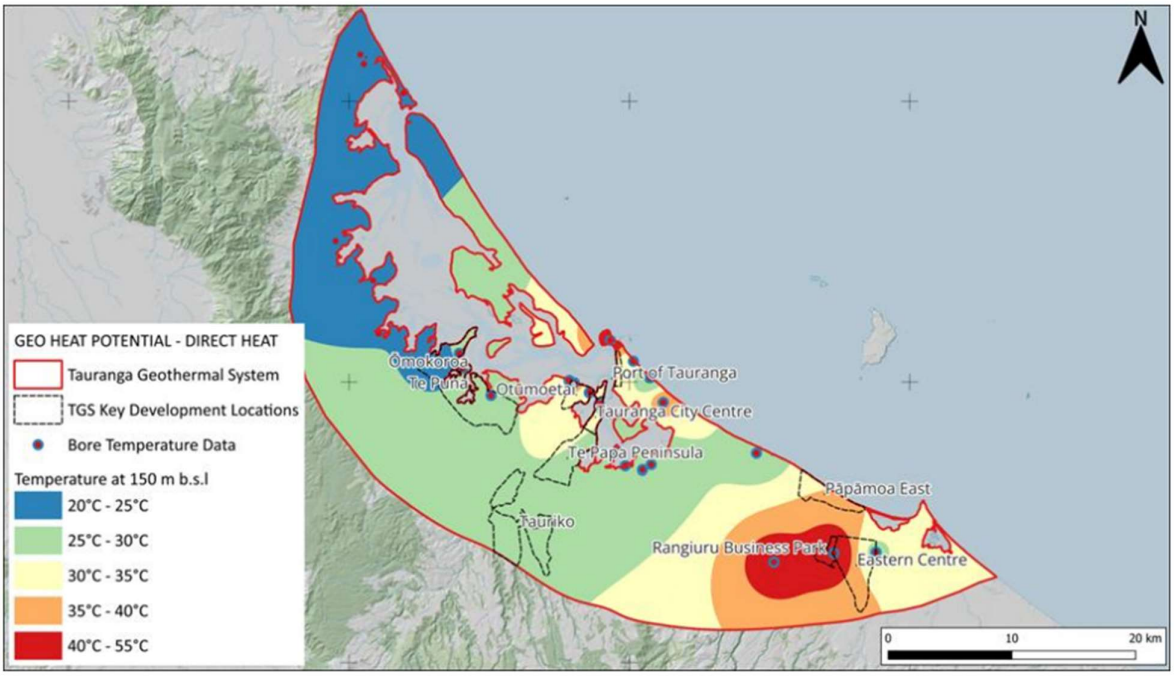


Figure X: Interpolated temperature at 150 m below sea level across Tauranga Geothermal System

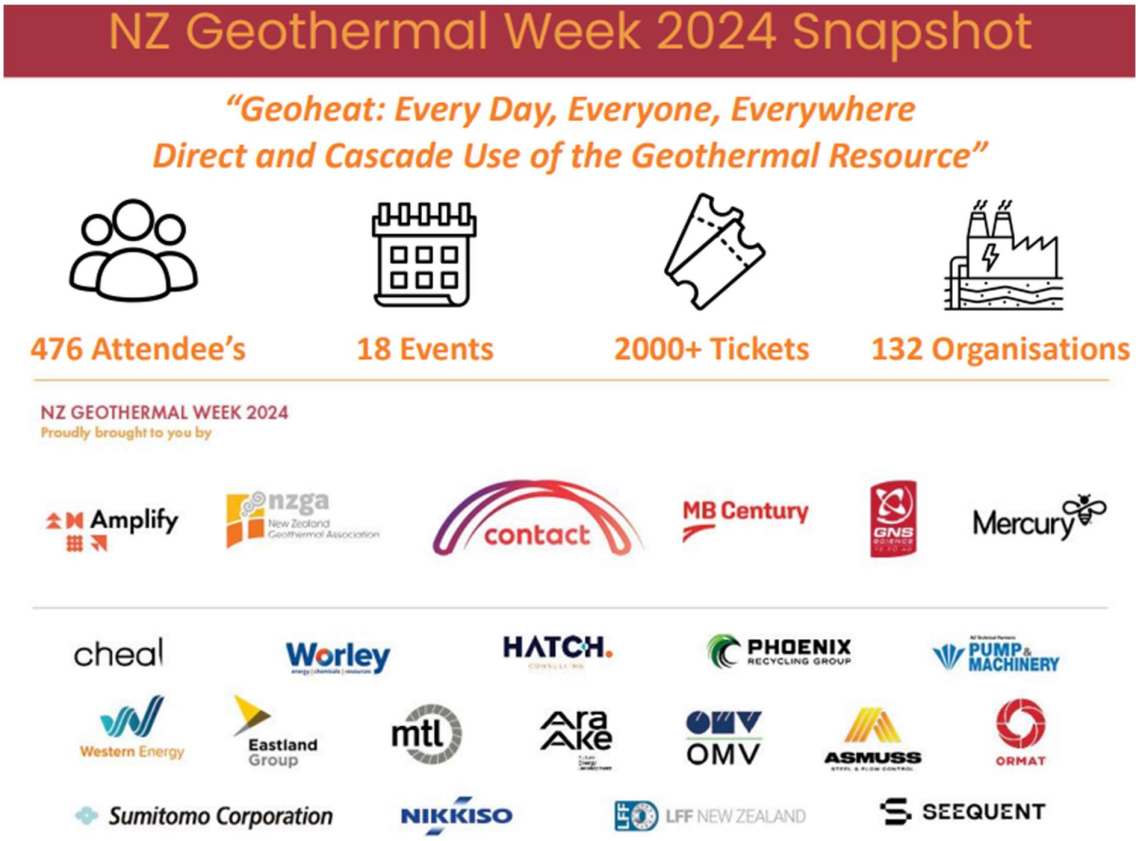
Our recommendation: A significant support and leadership from local councils and central government. The development of a regional geoheat strategy and a commitment to geoheat project support initiatives like streamlined consenting, central government grants to allow a public and private co-investment model.

Section 4: The 2024 New Zealand Geothermal Week: "Geoheat: Every day, Everyone, Everywhere. Direct and Cascade Use of the Geothermal Resource"

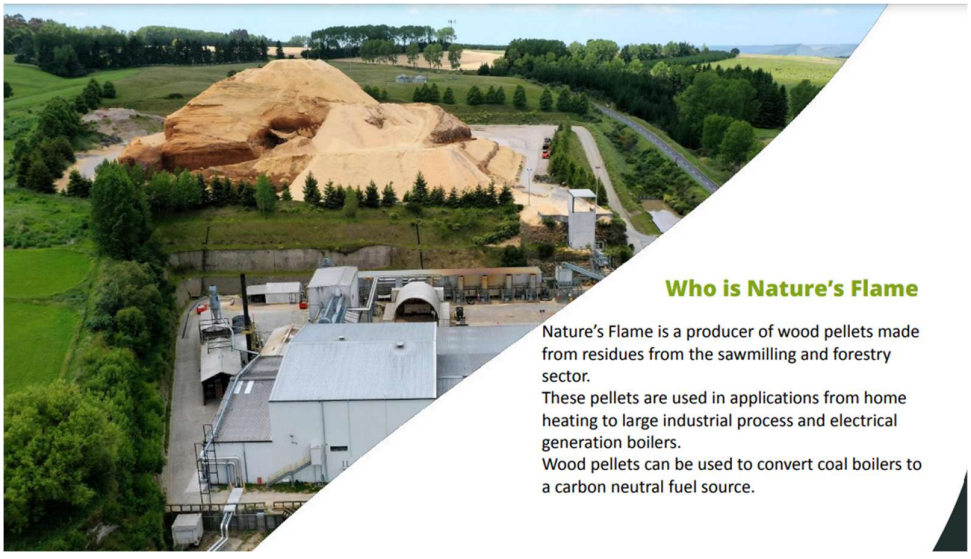
18. The 2024 New Zealand Geothermal Week has highlighted the immense potential of geothermal energy as a clean and reliable source of power that can be harnessed directly for heating, industrial processes, and other applications. Through cascade use, the energy from geothermal sources can be utilized multiple times in different stages,

[9] https://atlas.boprc.govt.nz/api/v1/edms/document/A4731812/content

maximizing efficiency and minimizing waste. This approach not only supports emissions reduction but also strengthens energy security by reducing dependence on fossil fuels and diversifying the energy mix.



Section 5: Geoheat example: Nature's Flame at Taupō



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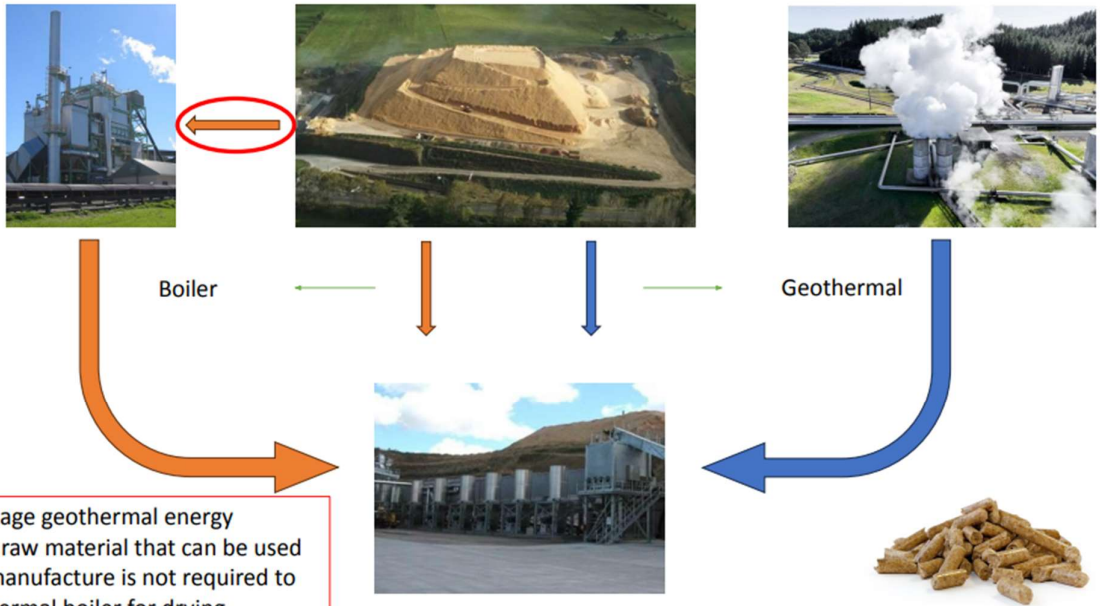
How We Use Geothermal Energy

Heat is reduced through three heat exchanging loops (two heat exchangers) to supply 125°C clean hot water to the drier with 22MW of thermal energy available.

Why We Use Geothermal Energy



The advantage geothermal energy provides is raw material that can be used for pellet manufacture is not required to supply a thermal boiler for drying

Conclusion:

By accelerating the deployment of geothermal direct use and cascade use, we can drive regional economic growth, create jobs, and support the development of local communities. Moreover, these technologies offer a unique opportunity to transition to a low-emission economy while ensuring the stability and resilience of our energy infrastructure.

We urge the government to incorporate these considerations into the Second Emissions Reduction Plan and to provide the necessary policy support and investment to scale up geothermal energy use across New Zealand. Doing so will position New Zealand as a leader in sustainable energy innovation and help us achieve our climate goals. Thank you for considering our submission. We look forward to the opportunity to further discuss these recommendations with you.

Yours sincerely | Nāku noa, nā,

Kennie Tsui
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Acknowledgements

The New Zealand Geothermal Association wish to express our gratitude to all those who guided us in preparing for this submission. We would like to thank those who provided information, data, knowledge during meetings, discussions, and reviews. The insight and expertise have been invaluable to us.