

12 September 2025

RE: Consultation feedback on “From the Ground Up: A draft strategy to unlock New Zealand’s geothermal potential.”

Dear Sir / Madam,

GeoExchange NZ Limited is a multidisciplinary team of scientists, engineers and social scientists that have over 70 years combined local and international experience. We provide independent design and advisory services to the public and private sector on geothermal heating and cooling (aka geoheat) systems.

We would like to thank the Ministry of Business, Innovation and Employment (MBIE) for the direct consultation they have already included GeoExchange NZ in with the drafting of this strategy and initial stages of consultation. This includes our attendance at the draft strategy workshop at Geothermal Week, and ongoing conversations with key staff.

As our area of expertise lies in geothermal heating and cooling with low temperature geothermal resources (including ambient temperature systems), with or without ground source heat pumps, the focus of our response is on geoheat rather than electricity generation. We have multiple case studies and papers we have authored that we can provide as evidence where required, along with several international sources that may be of use to MBIE.

Please do not hesitate to engage directly with us on any of the points raised in our submission.

Our key recommendations are as summarised:

- The goal to ‘Double geothermal energy use by 2040’ is not ambitious enough and there should be separate heat and electricity targets. We recommend that geothermal heating and cooling use could readily increase ten-fold by 2040;
- Include a sixth goal that explores risk mitigation. We especially believe that New Zealand would benefit from a public well insurance scheme to address resource risk barriers early on in project stages;
- Quantify total geothermal heating and cooling potential in New Zealand based on resource assessments of ambient groundwater, low temperature and high temperature geothermal systems; and
- Create detailed heat maps of existing heat users for the purpose of identifying district heating / geothermal cluster zones.

The following responses are focused on the set questions as outlined on Page 22. of the strategy.

1. Are the three strategic outcomes of the strategy, centred around world-leading geothermal innovation, accelerating energy resilience and strengthening regional economies and te Ōhanga Māori, suitable, or is there more we need to consider?

We support the strategic outcomes and believe they capture the opportunities for Aotearoa New Zealand. However, within these strategic outcomes, the goal to “double geothermal energy use by 2040” could be clarified and, importantly, made more ambitious.

Suggestion: ‘Strategic Outcome 2.’ already splits the two opportunities of electricity generation and geothermal heat, we believe the associated goal should also be split with separate targets. Clearer differentiation would better reflect the distinct opportunities and potential of each technology, their current uptake in the nation’s energy mix and their respective positions on the supply (electricity) and demand (geoheat) sides of the energy system. We suggest:

GOAL: Double geothermal electricity generation by 2040 and achieve a 10-fold increase in geothermal heating and cooling use by 2040.

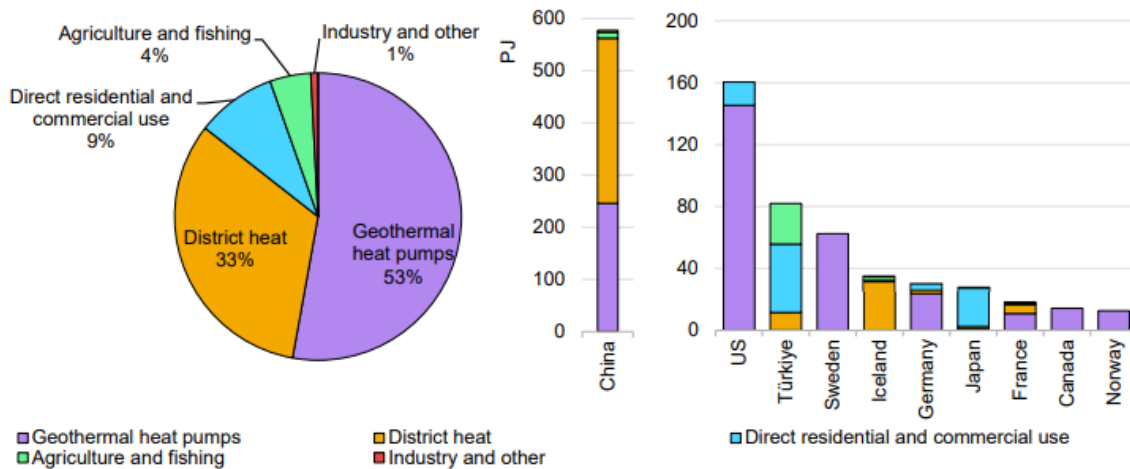
Our peers at Earth Sciences NZ and the Geothermal Institute are best placed to comment on the ambition of the electricity generation goal. We understand that one supercritical power generation connection alone would approximately double existing electricity generation from geothermal. The timeframe of achieving this by 2040 is ambitious, due to the construction of such projects, but it is appropriately aspirational.

We strongly encourage a similar approach to innovation and aspiration when it comes to geoheat. This is especially so given its potential to be of immediate value to the national economy and its potential to resolve energy security implications for many businesses at a time of electricity and gas supply issues.

The draft strategy highlights that 7.45 PJ of geothermal heat is used in direct use applications in New Zealand (the benchmark for the goal), this existing use is predominantly associated with high temperature geothermal fields in the Taupō Volcanic Zone.

By comparing this figure to other countries that are investing significantly in deep (> 2km), but low temperature geothermal resources (< 130 °C), reveals that this current figure is an underutilisation for a country which is blessed with relatively abundant and shallow resources. Furthermore, it undervalues the opportunity that exists from shallow, ambient resources with geothermal heat pump use. Figure 1 demonstrates potential consumption totals that are possible from mass deployment of this technology (coloured in purple).

Direct and indirect geothermal energy consumed for heating and cooling by application, world (left) and top 10 consumers (right), 2023



IEA. CC BY 4.0.

Note: "Direct residential and commercial use" includes space and water heating, bathing and swimming, and snow-melting.

Figure 1. Sourced from International Energy Agency’s (IEA) The Future of Geothermal, 2024. Note that this includes significant ground source/geothermal heat pump use (indirect use) across mentioned markets (in purple).

In summary, doubling direct and indirect geoheat use by 2040 lacks ambition when considering the available resource and even more so in an era of gas supply issues and high electricity prices. We recommend increasing the target ten-fold, to 75 PJ by 2040. MBIE (2025) indicates that annual energy use in 2024 was 525 PJ, which has been down on previous years. Process heat is variously approximated as one third of annual energy usage, equating to ~175 PJ of 2024 usage. A ten fold increase to 75 PJ represents around 40% of process heat requirements and does not include the potential cooling applications of geoheat. For example, process heat by definition includes heating of a hospital but not its cooling.

To further illustrate that the heat target lacks ambition, we have chosen two country case studies. While New Zealand has a lower GDP per capita in 2024 (USD 41,416) than the Netherlands (USD 51,471) and Germany (USD 44,109) (Trading Economics, 2025), it possesses a far greater geothermal resource base. Yet both European countries, with fewer natural advantages, are investing heavily to expand geothermal heating. This contrast highlights a strategic gap: if higher income nations see geothermal as essential to their secure energy future, New Zealand, with more abundant resources, has even stronger grounds to prioritise investment and policy support.

In the Netherlands, total heat extraction from deep geothermal was estimated to reach 7.9 PJ in 2024 (TNO, 2025). The majority of end users are covered crop growers which target temperatures of 70-90 °C from deep aquifers. This figure already exceeds New Zealand’s direct use total. On top of this, a further ~6.85 PJ is supplied from shallow geothermal heat (Central Bureau of Statistics, 2024).

In addition, their 2050 industry ambition for geothermal heat uses across greenhouses, urban developments and industry far outstrips New Zealand’s ambition as they target a combined total use of 200 PJ (McKinsey & Company, 2018). According to the WARM study, the total potential of

geothermal energy in the Netherlands is 290 PJ, where one PJ equals the heating of 30,000 homes (EBN, 2020).

The key point is that New Zealand has a more advantageous resource base and comparable agricultural and food processing industries, meaning we too can afford to be more ambitious.

Germany currently operates forty-two deep geothermal plants (mostly for heat), with an astounding 171 new geothermal plants in planning or construction right now (McBride et al, 2025). Studies have forecast that their geothermal reserves could cover more than a quarter of the country's annual heating demand, accelerating investment and uptake (Reuters, 2024). In response, the government introduced a bill to parliament this June to fast-track geothermal projects planning consents (Reuters, 2024).

We are of the view that geothermal heating and cooling is the 'low hanging fruit' opportunity in this strategy, and as such, separating it out in the goal with a more ambitious target is appropriate. Establishing a clear methodology to set this target may be required, and GeoExchange NZ are available to provide expertise to support its development if of interest.

2. Do the five overarching action plan goals capture the areas that are most important for achieving the vision, strategic outcomes and energy goal?

We suggest that a sixth goal 'Risk Mitigation' should be added. While aspects of risk are included under other goals, such as improving geothermal data access, making it distinct with horizon action plans would acknowledge that risk is one of the principal barriers to achieving the strategy's outcomes and vision. Successfully addressing risk has been a proven strategy to unlocking finance, investment and uptake.

At the end of 2024, the International Energy Agency (IEA) released The Future of Geothermal report which promotes the vast untapped potential of geothermal globally and recommends key initiatives to accelerate uptake. Risk mitigation measures are recommended throughout the IEA special report. In fact, to "Design risk mitigation schemes for early-stage project development, including in collaboration with regional, national and international finance institutions" is the second of ten policy recommendations from the introduction (IEA, 2024).

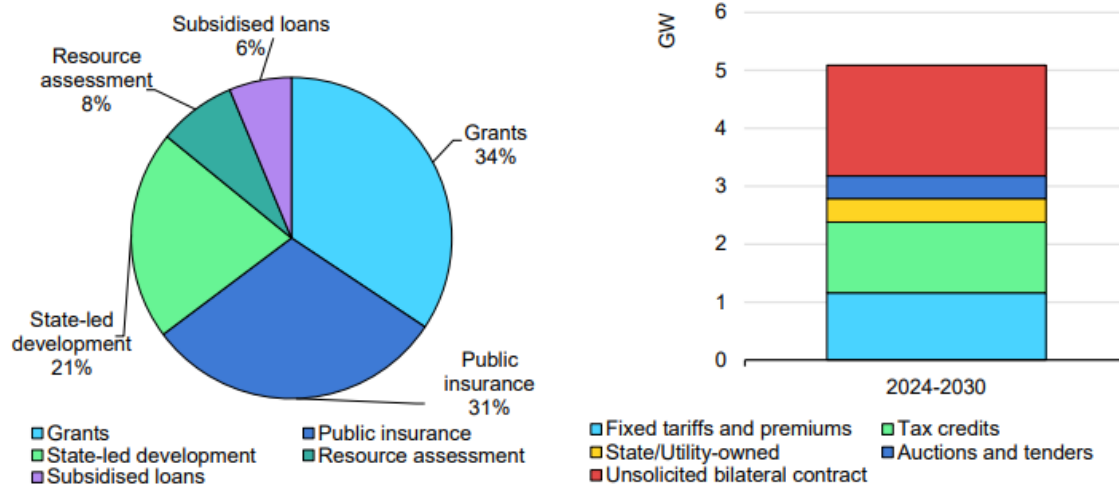
"Risk mitigation schemes targeting early-stage project development can be effective in accelerating geothermal deployment. Depending on market maturity, grants, subsidised loans and public insurance schemes could help reduce predevelopment risks. Alternatively, governments can carry the resource risks by undertaking exploration activities through state-owned enterprises. In co-operation with national governments, international/regional financing institutions and development banks also provide risk mitigation mechanisms" (IEA, 2024).

Which combination of these initiatives are best suited to the New Zealand context is something that we recommend is explored over the coming years. A report on this could be initiated in Horizon 1 or 2.

The IEA report lists 27 countries that have introduced geothermal risk mitigation schemes. Depending on a market's maturity, instruments can include grants for drilling, subsidised loans and public and/or

private insurance schemes to cover resource risks (IEA, 2024). We believe that a publicly led well insurance scheme to cover resource risk will significantly increase geothermal direct use uptake, currently, the strategy does not have scope to explore the impact such a scheme could have in New Zealand.

Conventional geothermal capacity additions by risk mitigation scheme (left) and by remuneration (right), 2024-2030



IEA. CC BY 4.0.

Figure 2. IEA, 2024. We understand that state-led development and various grants / loans are being explored by the current government. Public insurance schemes for drilling have a significant impact (31%) and should also be considered.

The insurance model was first established in France in the early 1970s when it became apparent that geological risk was a critical concern for French investors. To mitigate these challenges, the French government implemented an insurance scheme and as a result it led to significant uptake in the Paris Geothermal Basin (Wells, et al., 2024).

The core principle is that, for a sign-up fee, projects are reimbursed for a large share of drilling costs if the resource does not perform within agreed pre-drilling parameters (Wells, et al, 2024). This reduces fear of proceeding with a project, but just as importantly, successful wells create a snowball effect as each success builds confidence in the resource and attracts further investment in that location. The fact that insurance for the risk of a possible failed well does exist, in turn, instills confidence in investors and makes projects more attractive to finance. Elements of that successful scheme have been replicated in Turkey, Mexico, Indonesia, the Netherlands and Japan (IEA, 2024).

3. Does the proposed action plan correctly capture the necessary government interventions and priorities?

We endorse the action plan as it is presented. In the following we include specific feedback on some elements of detail and timing. Please note our comprehensive answer in Question 2, which outlines an additional action plan goal addressing risk mitigation is recommended, should also be considered as part of the answer to this question.

Improving access to geothermal data and insights.

Horizon 2 – “Consider the need for Crown involvement in further exploration or modelling”

We recommend changing the wording from ‘consider the need’ to ‘investigate the opportunity’. We suggest this as government investment in exploration should have multiple socio-economic benefits and even opportunities for financial return on investment for government. Full central government economic assessment, where they realise potential co-investment scenarios, could catalyse this entire strategy. There are a number of international models where governments monetise the exploration by auctioning off publicly funded wells, for instance in Greece and Kenya.

Horizon 2 – “Investigate need for low heat mapping” currently sits within in the 2027/28 timeframe and recommend bringing this forward to 2025/26 (Horizon 1). Given current gas supply issues and the ambitious targets outlined by other countries in our Question 2 response, unlocking this potential is a critical step and should be treated with far greater urgency.

Advancing knowledge and uptake of geothermal technologies

We note there is an absence of the term ‘next-generation’ geothermal technologies within this strategy. It may be implied under this heading ‘Uptake of geothermal technologies’, however, we believe that categorising that there are conventional geothermal and next-generation geothermal technologies is a useful distinction, as they require different focus. We recommend that a specific action plan should be added in Horizon 1 or 2 that explores the applicability and impact of next-generation geothermal technologies in New Zealand. This may benefit through collaboration with international research partners.

Horizon 1 – New Zealand does not yet have a definitive report calculating the heat potential of its geothermal resources comparable to the 290 PJ potential that was established for the Netherlands or Germany’s estimate that geothermal could supply a quarter of total heat demand. Understanding this potential is essential to giving the strategy clear direction. We therefore recommend commissioning a study within Horizon 1 to quantify both the direct and indirect heating potential across New Zealand from our ambient, low temperature and high temperature geothermal resources.

Horizon 2 – As mentioned extensively in our Question 2. response, we recommend that risk mitigation should be the 6th strategic outcome. In the event that a 6th strategic outcome is not possible, specific risk mitigation actions in relation to technology uptake could be explored in this 2026/28 period.

Enabling place-based geothermal clusters

Horizon 1 – We recommend adding work to instigate and develop detailed heat maps and potential district heating zones is added to this horizon. The development of heat maps – where there are concentrations of demand side energy use – has been a successful United Kingdom policy initiative to encourage district schemes / clusters. Further explanation of this idea is covered in Question 6. response that follows.

4. Is the role for the sector clear? How can the wider geothermal sector play a role (e.g. are there specific actions that the sector could own?)

No answer. Left blank intentionally.

5. Does the strategy and proposed action plan create the right settings to enable tāngata whenua to realise their aspirations for geothermal resources in their rohe?

The Strategy acknowledges that tāngata whenua face additional barriers to accessing capital. By strengthening the focus on effective risk mitigation mechanisms – as recommended in this response by adding a 6th risk mitigation goal, the Strategy can help reduce these barriers, enabling tāngata whenua to participate more fully and, in turn, to benefit proportionately more from such measures.

Iwi are well-positioned to lead the ownership and operation of these systems, particularly in regions with hot geothermal resources. The Tuwharetoa Geothermal energy park in Kawerau is a strong example of how government, the private sector, and iwi can collaborate over time to deliver a functioning district energy system.

The first geothermal wells at Kawerau were drilled by the New Zealand government in the 1950s to support industrial development, such as the Tasman Pulp & Paper mill and early electricity generation. These initial wells were later deepened by the Ministry of Works in the 1960s to sustain production, and while the assets were originally Crown-owned, they were transferred to Mighty River Power in 2005 as part of a Treaty settlement before being sold to Ngāti Tūwharetoa Geothermal Assets (NZGA, 2025).

6. Are there opportunities for our geothermal sector that we haven't considered?

Our responses to Questions 1 and 2 address the opportunity to separate the goal into distinct electricity generation and heating and cooling targets, as well as the consideration of risk mitigation strategies, such as bespoke geothermal drilling insurance schemes. Rather than repeating these points here, we direct the reader to those sections for part of our answer for additional opportunities that may not yet have been considered for the geothermal sector.

Analysis on total potential

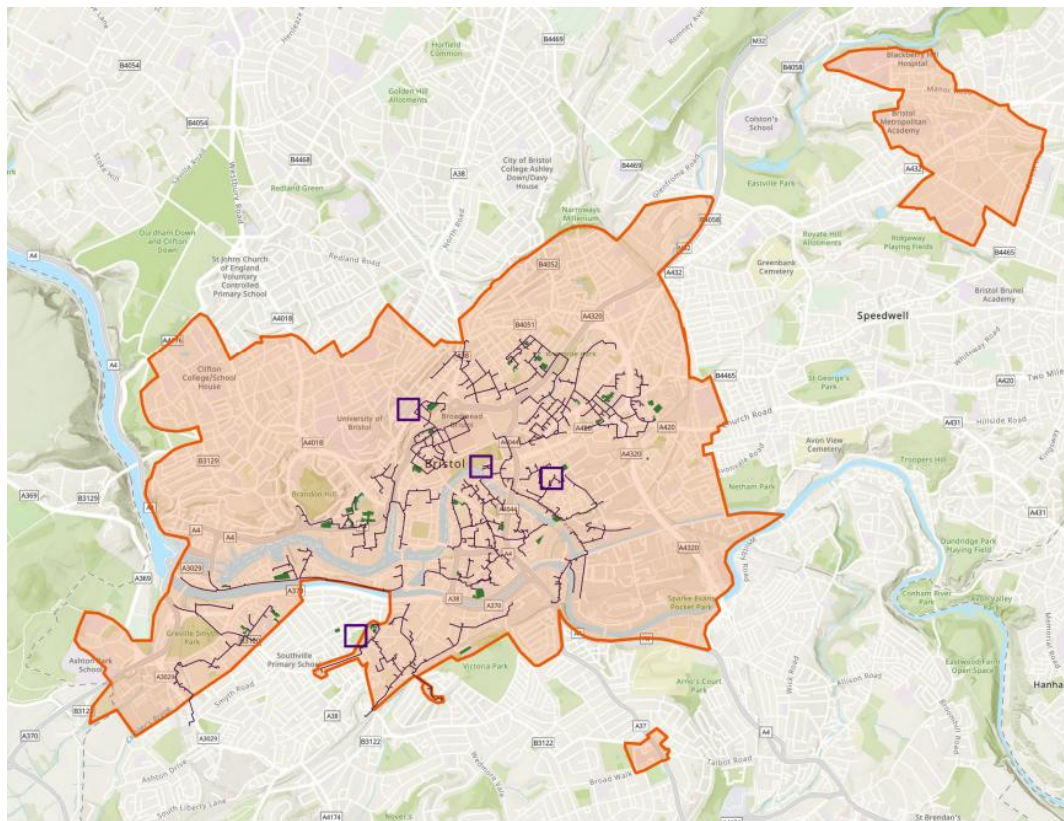
To the best of our knowledge, there has been no specific analysis of total potential of geothermal energy in New Zealand for direct and indirect heating and cooling. This requires analysis that combines resource assessment with current and forecast energy demand, something our research partners are well placed to undertake.

It is important that these calculations include resource assessments from ambient groundwater systems (ground source heat pump opportunities), low-temperature geothermal systems, as well as high-temperature resources. Together, the utilisation of these resources is how we scale the opportunity across New Zealand and build awareness that geothermal is not limited to the Taupō Volcanic Zone.

The outcome of such analysis would not only provide critical evidence but also catalyse greater strategic direction, allowing us to make claims similar to Germany's - that geothermal could meet a quarter of the country's heat demand. We could replicate the WARM study completed in the Netherlands and gain access to projections of comparable clarity and ambition.

According to the WARM report, the total potential of geothermal energy in the Netherlands is 290 PJ (EBN, 2020). This is broken down as:

- Heating for buildings: 88 PJ or 26% of the demand



Bristol Pilot Project Outputs Local Authority Boundaries (white outline) Other Local Authority Boundary (dotted outline) Potential Heat Network Zone (red fill) Energy Centre (purple square) Initial Zone Opportunity (grey outline) Connected buildings/ high potential connection opportunity (green fill)			Developer Details Developer Name: Natural Developer Contact Name: Jon Soley Developer Contact Email: jon.soley@natural.com	Local Authority Details LA Name: Bristol City Council LA Contact Name: Jon Bick LA Contact Email: jon.bick@bristol.gov.uk
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Figure 4. Bristol Pilot Heat Map: Red areas indicate potential heat network zones, with the squares considered locations for energy / heat supply centres. This zoning is more granular than in detail than what currently exists in New Zealand.

Working closer with Transpower

Direct use of geothermal energy (where the geothermal temperature meets or exceeds the requirements of a facility) can almost eliminate the need for additional energy for heating systems. Indirect use of geoheat, involving systems that use heat pumps, is typically 40 to 60% more efficient than air source heat pumps, and even more efficient when compared to electric boilers (see Table 1. below). Both types of geothermal applications are an investment in reducing the electricity used for heating as well as peak demand.

Therefore, utilising geoheat in future developments has the potential to increase the resilience of the electrical grid by reducing peak demand and potentially reducing the required investment in supply infrastructure. A 2023 report funded by the US Department of Energy calculated that mass deployment of geothermal heat pumps (using ambient groundwater as a source) for building heating and cooling electrification in the US would reduce national transmission expansion requirements by 33-38% (Liu, et al. 2023).

A summary table below shows the typical energy savings by using geoheat directly or with a geothermal or ground source heat pump (GSHP) to deliver specific temperatures.

Table 1: Typical Energy Savings Using Geoheat Directly or with a Ground Source Heat Pump		
Heating Type	Coefficient of Performance (CoP)	kWe for 500 kW Heating
Electric Boiler	1.0	500
Air Source Heat Pump (60°C)	3.0	167
Air Source Heat Pump (80°C)	2.0	250
Direct Geoheat	60	8
Geothermal Heat Pump (60°C)	4.0 to 8.0	125 to 63
Geothermal Heat Pump (80°C)	3.0 to 7.0	167 to 71
Geothermal Heat Pump (150°C)	2.0 to 4.0	250 to 125
Note: The temperatures provided in brackets are the intended delivery temperature.		

The supporting role that geoheat can play in the continued electrification of New Zealand is not obvious in this strategy, nor is the invitation for industry to collaborate with the likes of Transpower to identify opportunities to reduce public investment in transmission and supply electrical infrastructure.

7. Are there challenges for our geothermal sector that we haven’t considered?

No answer. Left blank intentionally.

8. Are there any other things that the strategy should include or exclude?

The following are editorial suggestions and/or comments that were not relevant to the other questions but we feel are worthy of consideration in our overall submission on the draft strategy.

Page 6. Under the heading ‘Beyond Electricity Generation’

The definition of indirect use in footnote 8 is misleading. It states that indirect use is ‘outside of the technical definition’ in the Resource Management Act (RMA). Indirect use isn’t outside of RMA for two reasons, the first is if the source temperature is ambient, it is treated as a consented groundwater take in most instances. The second point is that ground source heat pump technology can be used with water above 30°C (meeting the RMA classification of geothermal). We are unsure exactly what this point is trying to make and it detracts from an opportunity to clearly define what indirect use is.

We recommend clarifying that indirect use is ‘ground source heat pump assisted’ within the body of the text and then work to improve the wording of footnote 8.

Under the same heading, the figure of 7.45 PJ of existing direct use in New Zealand is quoted and we believe it could be contextualised to demonstrate that it is an underutilisation of resource.

Underutilisation is alluded to in other parts of the strategy but lacks detail, our response in Question 1. includes referenceable case study comparisons which could be used for context.

Page 10. Location 4 Tauranga:

Focus here is on the RETA work only. We believe a follow up sentence could be added that based on the BOP RETA findings, the Bay of Plenty Regional Council commissioned the 'Geoheat Potential of the Tauranga Geothermal System' (GeoExchange NZ, 2024). While this may appear self-referential, we believe it is valuable to highlight local council initiatives that are actively supporting sustainable geothermal uptake.

Page 12. Under the heading 'What's holding us back'

Missing from the text and we recommend consideration for adding:

- Until now, a strategy with government targets.
- A lack of awareness of applications beyond electricity generation and thermal spas. E.g. the public education piece
- States that field knowledge is unconsolidated, the term fields is associated with high temperature systems specifically. I think adding that subsurface data is not available in a fit for purpose manner is a useful additional clarification of the problem here. This addresses the opportunity of our ambient and low temperature systems, alongside the high temperature ones mentioned.
- Risk and a lack of initiatives to address the unique risk profile of geothermal projects.

P14 – 15. Under the heading 'We are building momentum...'

There is inconsistency in recognising the project participants. UpFlow and Tauhara No 2 are named as project leads twice, however, Earth Science NZ, Vegetables NZ, Tomatoes NZ and GeoExchange NZ are not acknowledged for the 'Decarbonising the covered crop sector' industry project.

Should you require any further details or clarification, we would welcome the opportunity to discuss this further with you.

Ngā mihi



Yale Carden
Director

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