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Future Pathways Policy Team

Ministry of Business, Innovation and Employment

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Submission on Te Ara Paerangi Future Pathways Green Paper consultation

The New Zealand Geothermal Association (NZGA) would like to thank the Ministry for the opportunity to comment on the Te Ara Paerangi Future Pathways Green Paper.

We would be happy to discuss this submission further.

New Zealand Geothermal Association

The NZGA, incorporated in 1992, is a non-political, non-government and not-for-profit organisation, with a focus on fostering a sustainable future for Aotearoa New Zealand through use, development, and protection of geothermal resources. The NZGA is an affiliated member of the International Geothermal Association and the Royal Society of New Zealand. The NZGA connects with global geothermal communities and is well positioned to positively influence geothermal initiatives on the domestic and international stage.

NZGA membership comprises ca. 400 individuals, as well as corporate members, representing geothermal electricity generation, research organisations, regional economic development agencies, engineering consultants, service providers, technology companies, planning consultants and Māori trusts. This diverse and skilled association works, embraces and lives with geothermal resources in Aotearoa.

Firstly, we give background to the challenges experienced in the energy system in Aotearoa.

Energy and industry: Unparallel challenges experiencing in the energy system

Challenge 1: Decline in energy security score

Energy trilemma: NZ ranking 9th equal in World Energy Index[1].

1. We have slipped down the rankings, we have used too much coal in the last year, the MBIE Battery project will only supply stored electricity that will lose efficacy getting to the areas that demand it. Increasing geothermal baseload capacity reduces the demand on battery storage with key resources being closer to regions of highest demand. It also provides off-grid opportunities presented by process heat and eases baseload demand and mitigates against price fluctuation.

[1] https://trilemma.worldenergy.org/#!/country-profile?country=New%20Zealand&year=2021

2. Baseload geothermal electricity power stations can be built to supply baseload electricity demand (>95% capacity factors) rather than relying on variable hydropower schemes at around 45% load factor or wind at around 40%. This in turn will reduce capital needs of new renewable builds, and we will be less exposed to the variabilities of these types of generation. It should be noted that the intermittency of other renewable energies may be increased through the effects of climate change (geothermal is largely agnostic of climate variation).

   Geothermal is sustainable, secure, abundant, low carbon, and through strong joint venture partnerships ensures equitable outcomes for Aotearoa.

Challenge 2: Underinvestment in renewable energy and fragmented environment research fund unable to deliver national geothermal priorities

3. The Productivity Commission's report found that New Zealand's labour productivity is significantly lower than in other small advanced economies (SAEs)[2] and New Zealand is lagging behind on CleanTech. For example in the Global CleanTech Innovation Index 2017, New Zealand was ranked 22nd overall and was the lower scoring small advanced economy.

4. Independent research [3] commissioned by Callaghan Innovation suggests that New Zealand's CleanTech innovators are raising 95% less funding than those in other small advanced economies. In addition, the number of New Zealand CleanTech innovators raising funds is less than that in other small advanced economies.[4]

5. There is a widespread view that there is a disconnect between many government documents emphasising the strategic importance of environmental research and the actual research investments that are made. It is not that such investments are unable to be related to the various strategies at some level, they are simply too broad and open-ended. Rather, the way resources are allocated engenders little confidence in our ability to maintain a comprehensive portfolio of environmental research that addresses national priorities over time. Furthermore, these mechanisms do not appear to meet and reflect understanding of the nation's environmental research needs.

6. These concerns are in part a reflection of the fragmented funding machinery that is being used. Multiple models of investment have been developed over the years, which makes a joined-up view of the environmental research landscape almost impossible to achieve.[5] This disjointed nature and approach has left the research landscape behind in terms of energy solutions and the drive towards net-carbon zero.

Challenge 3: No technology-enabled carbon sequestration is recognised in Emissions Trading Scheme

7. Carbon sequestration is not a new technology and its contributions being unrecognised in the ETS misses a significant opportunity for Aotearoa. Unlocking our domestic knowledge and capabilities to capture and sequester carbon will help shift us closer to our net-zero goals. By leveraging our expertise in geothermal and petroleum industries, using the subsurface of Aotearoa to put carbon back underground makes sense not only for our economy but for the benefit of the global community.

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[2] *New Zealand firms: Reaching for the frontier*, Productivity Commission, 2021
[3] *New Zealand Climate Tech for the World*, Cleantech Group, 2021.
https://www.callaghaninnovation.govt.nz/sites/all/files/CleanTech-Making_it_happen_for_NZ.docx.pdf
[4] Ibis
[5] https://www.pce.parliament.nz/media/197111/report-environmental-research-funding-review-pdf-32mb.pdf

Q1: What principles could be used to determine the scope and focus of research priorities?

8. We support the priorities of Research, Science and Innovation (R,S &I) sector to enable a **climate-resilient Aotearoa, enabled economy and giving effect to our Tiriti o Waitangi**.

A climate-resilient Aotearoa

9. There have been many consultations over the past few years, recommendations that result in small actions. Our domestic emissions are still on the upward trajectory. We stepped up our Nationally Determined Contribution (NDC) before COP26 but tax-payers will pay a hefty price to meet our NDC target by relying on international carbon credits. By 2030, New Zealand needs to reduce 150 million tonnes of CO_2e and Minister Shaw announced that 2/3 of the emissions reduction (100 million tonnes) will be from purchasing international carbon units that will cost in excess of $7.0 billion of tax-payer's money ($70 per unit) and only 50 million tonnes come from domestic actions. By investing in our R,S&I sector, we can approach our net-zero targets.

Working with our Tiriti partners

10. As guardians of the gifted geothermal resources, engaging with tangata whenua is central to NZGA's work. Tangata whenua have a special relationship with the natural resources that we rely on. To have deep and meaningful partnerships, the government and NZGA need to interact with various iwi, hapu, and ahu whenua trusts around operational sites where geothermal resources present. For example, in Taupō, Contact Energy has continued to work constructively and transparently with Tauhara hapū, to understand hapū interests in relation to their development plans for Tauhara. Their commercial partnership with local Māori Lands Trust Tauhara Moana has been constructive in relation to geothermal access rights.

Geothermal resources need protection

11. New Zealand's geothermal policy and regulatory regime is internationally recognised as global best practice. Currently, environmental protection occurs *alongside* geothermal development, through a thoroughly consulted, clearly spatially based allocation that ensures geothermal systems with important intrinsic or cultural values are protected and development of other systems is enabled under the Resource Management Act.

12. Understanding the health of the geothermal resource and impacts on hau kāinga can provide insight into desired outcomes. These include, for example, protection of the rights of hau kāinga to restore and maintain access to the geothermal resources and to protect the traditionally held geothermal resources which includes the ability to ensure their sustainable use in Rotorua.[6]

[6] Nga Wai Ariki o Rotorua: He Kohikohinga: Hau Kāinga perspectives on the health and wellbeing of geothermal taonga within Rotorua, p.47.

Q2. What principles should guide a national research priority-setting process and how can the process best give effect to Te Tiriti?

Costly and underproductive Research, Science and Innovation system

13. Our R,S &I funding system is purely based on the weightings spread across economic (70%), environmental(25%) and societal (5%) benefits and impact[7]. The argument is that science funding systems embody a knowledge of deficit theory of change, where science is assumed to be both the keyhole and the key to 'fix a problem'. The persistence of this approach means that the R,S & I sector carries an expectation that the problem is fixable without creating an enabling, innovative, and thriving ecosystem.

14. The current system is also backing Crown Research Institutes, universities, private industry, and research organisations one-by-one (due to their size and ability to dedicate staff to the preparation of funding applications). This promotes an ecosystem that lacks a vision of long-term growth for a full industry, across multiple links of the supply chain results in picking winners and lack of co-ordination, while collaboration is encouraged but not in a co-ordinated way.

15. The linear relationship in our contestable science funding system where we assume high science scores + high impact scores = excellence research contributing to a trend towards conservatism rather than breakthrough or high-risk research.

16. With the success rate of 10%-20% in the contestable funding process, it is comparatively costly, both to awarding agencies (usually funded by taxpayers) and researchers' time spent on preparing applications (usually funded by publicly funded institutes). There are also administrative costs to MBIE staff, research community in providing peer reviews (funded by taxpayers).

17. Achieving the optimal balance of high-quality decision making and cost (given that resources expended on assessment or preparation of applications could be redirected to the conduct of research) is of critical importance in the design of research funding systems.[8]

Q3. How should the strategy for each research priority be set and how do we operationalise them?

18. Our current modular, fragmented R, S & I system is not fit for purpose to tackle these challenges.

19. The need to cope with current and future challenges faced by societies by major transformations such as digitalisation and sustainable development require us to establish and operationalise new concepts and methods of science and research.

Transdisciplinary as a unifying approach to problem-oriented, transcending research

20. R, S & I system should facilitate the desired transformations towards a sustainable future and to help resolving complex problems that accompany societies in transition. The concepts such as transformative, transdisciplinary or co-creative approaches combine co-create new knowledge between academia and

[7] https://www.mbie.govt.nz/dmsdocument/15272-endeavour-fund-investment-plan-2022-2024
[8] https://www.oecd-ilibrary.org/docserver/2ae8c0dc-en.pdf?expires=1647127091&id=id&accname=guest&checksum=148ED3E63778E43118E4BC795E5413C5

practitioners. The goal is to develop a collaborative space from which concrete actions can be prepared supported by stable research & industry funding.

Q4. How would you like to be engaged throughout the Future Pathways programme?

21. NZGA is happy to continue our engagement in the process and open to discussions, presentations and further contribution to the programme.

Q5. What are your thoughts on how to enable and protect Mātauranga Māori in the research system?

Geothermal enables Māori socio-economic development

22. The principles of Te Tiriti o Waitangi, including self-governance, kaitiakitanga and resource ownership, are demonstrated by Māori land-owners, Māori-owned enterprises (e.g. ahu whenua trusts) and other partners in geothermal developments and enterprises. There is scope to enhance this relationship by further embedding tikanga and mātauranga Māori in geothermal management.

23. Geothermal is Aotearoa's indigenous renewable energy solution, and it creates genuine, active, and enduring partnerships with iwi/Māori. Māori are driven by principles of investing in projects that provide intergenerational prosperity and sustainability of natural resources. This philosophical view (combining kaitiaki and Māori economic development) aligns with geothermal resource developments, with the long-term project life of geothermal power plants or heat plants i.e., 30+ years and the intended longer term operational life of the fields.

24. Most geothermal fields that have operating power stations, have some form of commercial or other beneficial arrangement (i.e., ownership, fluid supply, royalties, land lease etc.), with a Māori-owned enterprise. Geothermal energy developments have enabled true partnership and participation for Māori in the energy industry, as owners, developers, or co-owners and co-developers of geothermal fields (e.g., the energy ecosystem owned by Tuaropaki Trust at Mokai; Ngāti Tūwharetoa Geothermal Assets at Kawerau; Tauhara North No. 2 Trust at Rotokawa). At Ngāwhā, a community geothermal energy solution addresses a lack of regional renewable power generation and high energy transmission costs while protecting the geothermal pools.

25. Māori groups have led and grown successful businesses by leveraging their geothermal assets, people, and resources in other sectors. Māori innovation is driving new approaches to geothermal developments: collectives such as Waiū Dairy (a group of eleven Māori groups processing dairy products using geothermal heat) and whole ecosystem approaches, like Tuaropaki Trust (building a business cluster that combines electricity, horticulture, green hydrogen, dairy processing, composting, farming and more).

26. Significant revenues/profits from geothermal enterprises create opportunities for Māori shareholders to further development aspirations, and funds are reinvested in their people through financial, health, wellbeing, educational, cultural, and sporting endowments.

Q6. What are your thoughts on regionally based Māori knowledge hubs?

Establishing Geothermal Clusters in Aotearoa

27. Successful New Zealand innovators that the government has backed have mostly received support at an individual level, rather than the more intentional approach to lift an entire industry, comprised of multiple technology verticals and not necessarily individual companies, into export markets observed in comparable economies such as Israel (e.g. the Israel Innovation Authority), Europe (e.g. Cleantech for Europe) and Sweden (e.g. Swedish Cleantech). SAEs that have successfully launched innovative climate tech industries have done so through a process of investing in ecosystems of innovation, not through backing companies one-by-one. Investing in a full ecosystem requires a vision of long-term growth for a full industry, across multiple links of the supply chain, with a firm connection to demand that allows innovators to collaborate among each other to solve practical industry challenges.[9]

28. Clusters are groups of specialised enterprises, and other related supporting actors in the same location that cooperate closely. Together, clusters can be more innovative, create more jobs and business expertise to promote sector value chains and development of emerging industries. Geothermal enables clusters to thrive, industrial power generation installations can provide 'cascade' uses of high-temperature fluids useful in industrial processing, heating, and tourism opportunities.

29. Aotearoa's geothermal resources are close to high concentrations of Māori populations (e.g., Taupō, Rotoura, Kawerau). Enabling knowledge hubs that integrate principles of mātauranga and kaitiakitanga of geothermal resources is critical to ensuring that regional growth through R,S&I integration provides training, education and research in these regions. Through knowledge hubs focused on sustainable geothermal practices, where research and development spill-over may also increase the incentive for firms to invest in research and development activities if other firm's technology spill over or knowledge spill over is complementary.

30. NZGA has previously engaged with NZTE to investigate initiatives focus on geothermal hubs for Aotearoa, inspired by geothermal clusters in Iceland that continue to thrive, and recently we have also begun our discussions with Amplify (Taupō regional economic development unit). We welcome the opportunity to discuss with the submission team how these clusters operate and what socio-economic and regional benefits they have had and how we see they will benefit our future here.

Q8. Do you think a base grant funding model will improve stability and resilience for organisations? How should we go about designing and implementing such a funding model?

31. The IEA estimates that commercially available low-emission innovations (mature or at early adoption stages, respectively in the blue and green on the following graph) have the greatest potential to reduce emissions by 2035 (end of Budget period 3). The clear implication of this is that New Zealand's emissions reductions commitments in 2030 and 2050 will mostly have to be met by proven technologies which are in-use today.[10]

[9] *New Zealand Climate Tech for the World*, Cleantech Group, 2021. https://www.callaghaninnovation.govt.nz/sites/all/files/CleanTech-Making_it_happen_for_NZ.docx.pdf

[10] https://www.eeca.govt.nz/assets/EECA-Resources/Research-papers-guides/Innovation-and-the-transition-to-a-low-carbon-future.pdf#page=12

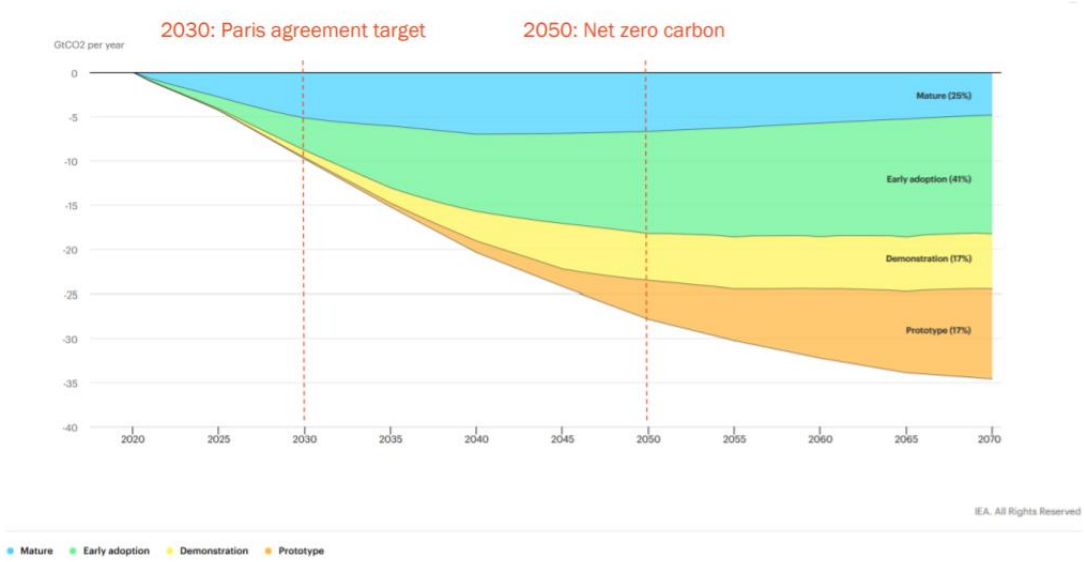

Figure 1: Global energy sector CO_2 emissions reductions by current technology readiness category in the Sustainable Development Scenario relative to the Stated Policies Scenario, 2019-2070[11]

Rec (1): R&D to remove barriers and massive deployment of proven geothermal technologies for massive rollout (the blue section Figure 1):

- $10 million for tangata whenua to identify barriers to development coincident to protection of their geothermal resources.
- $20 million Exploration fund to accelerate 'shovel-ready' geothermal development fields classified as suitable for development.
- $10 million to explore the potential of smaller resources and allow small 0.5-10 MWe installations to have national significance.
- $10 million over 5 years Information and awareness campaign to promote the use of geothermal resources and the myriad opportunities for innovation and knowledge generation they possess.

Rec (2): R&D to remove barriers to basic research, development, demonstration, commercialisation for emerging geothermal technologies to expand market opportunities (the green section in the Figure 2 graph):

- $10 million over 2 years for industrial geothermal direct use transition and innovation pilots
- $30 million over 5 years to unlock supercritical geothermal by drilling a test well in an active field
- $100 million over 10 years to establish new industries and uses of geothermal
  - Geothermal minerals: such as lithium and silica
  - Geothermal hydrogen
  - Geothermal CO2 capture and storage
  - Geothermal CO2 capture and production of alternate fuels using geothermal as a catalyst
  - Other innovative industries that may emerge through further geothermal research

[11] https://www.iea.org/data-and-statistics/charts/global-energy-sector-co2-emissions-reductions-by-current-technology-readiness-category-in-the-sustainable-development-scenario-relative-to-the-stated-policies-scenario-2019-2070

32. There may be some debate around whether these initiatives are best-funded through R,S&T budgets or say through EECA grants.

Rec (3): Congruence of government policies to ensure no perverse outcomes

33. An effective legislative framework for Aotearoa New Zealand requires a holistic overview and interconnectivity to guide decision-making and policy choices. There is a real risk that siloed thinking will place unnecessary obstacles in implementation of climate actions.

34. While the purpose of the Climate Change Response (Zero Carbon) Amendment Act provides a framework to implement clear and stable climate policies, achieve carbon emission reductions and allow Aotearoa New Zealand to meet its international obligations, other reforms such as Resource Management Reform, Water Reform, Research, Science and Innovation Reform and Health Reform could have the perverse outcome of preventing projects that could significantly benefit New Zealand's effort to achieving low carbon emissions objectives.

Conclusion

Meeting our net carbon zero is an enormous task that requires deep systemic change with authentic purposes.

Geothermal is a domestic energy source that will unlock net zero solutions, improve wellbeing, and improve economic standing throughout the regions.

No stone unturned, no one left behind, every carbon molecule counts!

We would be happy to answer any further queries.

Nāku noa, nā

Dr Paul Siratovich

President, New Zealand Geothermal Association

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