2 November 2023

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Ministry of Business Innovation and Employment

Wellington, New Zealand

Attention: Advancing New Zealand's Energy Transition

To whom it may concern,

Response to public consultation on Advancing New Zealand Energy Transition

The Institute of Geological and Nuclear Sciences Te Pū Ao ("GNS") welcomes the opportunity to provide feedback on "Advancing New Zealand Energy Transition".

GNS Science, Te Pū Ao, is New Zealand's national institute of geological and nuclear sciences. As a Crown Research Institute, GNS Science is strongly mission led. Through world-class science, we are focused on delivering economic, environmental and social benefits for Aotearoa New Zealand.

GNS Science has led the energy exploration and research needs for the nation through-out its history. Traditionally this has been in the oil and gas sector. Through our Science Roadmap, we have now transitioned that effort to support the nation's zero carbon needs and focus our effort on the development and support of renewable energy resources.

Science-based decisions are essential

We would like to acknowledge that MBIE's public consultation document is based on evidence which adequately frames the critical crossroads we are at internationally, and we congratulate MBIE for using challenging facts as the foundation on which to negotiate.

The message we would like the New Zealand representation delegation to hear is that the global community must insist on continually making decisions based on sound scientific evidence.

There is little doubt that urgent action for both increasing renewable electricity share and alternate fuel to mitigate and adapt to climate change is required, but we must temper enthusiasm for low cost novel solutions by insisting that adequate scientific validation of the effectiveness of these actions is evident and provides insight that helps ensure we avoid unintended consequences.

Science and research underpin our current understanding of natural resources and future energy solutions and continue to be used to guide our decisions to advance and support the transition of New Zealand energy system to a cleaner renewable feet for purpose solution.

GNS Science collaborates with a wide range of international and local research and industries partners and we are committed to continuing work to enhance technologies uptake.

Implementing a ban on new fossil-fuel baseload electricity generation

GNS Science does not support any new fossil-fuel baseload plant. We recommend that no exception should be granted for fossil-fuel baseload should be granted however we acknowledge that a fair transition supporting the energy access security will likely require the use of gas and the development of potential storage for electricity peak needs. Gas or CCUS requires further geological and technological assessments to ensure environmental safety. We recommend throughout investigations on energy storage for peak performance.

The ban for new fossil-fuel baseload electricity generation will support investment in other baseload electricity generation such as geothermal. Recent technological development by the sector is transforming the industry into a carbon zero renewable source, and the potential growth of geothermal for New Zealand has been underestimated. GNS Science recommends to continued investigation to access low footprint supercritical geothermal solution, and to develop supporting regulations. GNS Science demonstrated that deep geothermal resource could potentially generate 30,000GWh of energy annually (Castalia, 2023), supressing the need for fossil-fuel baseload plant.

Interim Hydrogen Road Map

GNS Science supports the Interim Hydrogen Roadmap's positioning of green hydrogen's role in addressing the climate crisis, in enhancing energy security and resilience, and creating economic value for local communities and New Zealand industry. GNS Science agrees that research and development will play a key role in improving efficiencies in hydrogen production, compression, storage and conversion. These advances will ultimately provide cheaper hydrogen. Ensuring a research and development presence in the governance structure of the proposed coordination body will ensure better identification of research gaps for investment.

GNS Science recommends that an overt identification of principal risk factors to the viability of the Interim Hydrogen Roadmap, alongside an indicative approach to address these factors, should form part of the setting out of a strategic landscape for hydrogen in New Zealand. The government's assessment of the strategic landscape for hydrogen in New Zealand does not include an overt consideration of risk, particularly risk associated with climate change impacts. Water is a key input for green hydrogen production, and fresh water availability over the long term is vulnerable to climate change impacts. Given water's cultural importance for Iwi and Māori as well as the rights and interests in freshwater assets across the country, this would be an important to consider in assessing the overall strategic landscape for hydrogen in New Zealand. Given climate change's likely impacts on freshwater availability as noted earlier in this submission, it is important to support investigations that progress green hydrogen production from a range of other water sources.

Another key risk to the viability of the Interim Hydrogen Roadmap is the significant renewable electricity generation build-out required. The development of an hydrogen industry sector will need to be supported by electricity generation and we recommend investigation to support cascade use of electricity to limit energy depletion.

The government views the largest potential advantages for hydrogen in New Zealand to lie with its use in existing industrial processes to decarbonize large and hard-to-abate sources of emissions such as fertiliser, steel and chemical production, as well as in use across a range of transport applications. GNS Science agrees that green hydrogen use in the heavy transport sector as well as to decarbonise industrial process heat particularly for some high temperature options are areas of immediate viability.

Regulatory Framework for Offshore Renewable Energy

The marine regulatory space is already very complex and to help achieve offshore renewable energy development GNS Science recommends adoption of Marine Spatial Planning as a management framework for the marine environment. The proposed Spatial Planning Act already signals this tool. Spatial planning is a way to recognise that the demand for use of our seas and the resulting pressures on them will continue to increase, manage competing demands on the marine area, enable the co-existence of compatible activities wherever possible; and integrate with terrestrial planning.

GNS Science has identified gaps and recommend inclusion of natural hazard information products in an Marine Spatial Planning. Some of this information is already available in the public space, while in other cases, specific hazards are understudied. GNS Science suggest that such that natural hazard information should be linked to a Marine Spatial Planning data repository and portal to provide an explicit picture of potential risk to future installations, to support risk mitigation. GNS Science recommends mandatory lodging of feasibility information and data by offshore renewable energy developers and public availability through a Marine Spatial Planning data repository and web based portal.

A Marine Spatial Planning commits government to make decisions on the best available scientific evidence. GNS Science recommends a panel or group be established to regularly review Marine Spatial Planning's for offshore renewable energy and determine where evidence gaps and uncertainties exist.

Measures for Transition to an Expanded and Highly Renewable Electricity System

GNS Science has conducted analysis exploring the social issues in relation to subsurface energy storage in New Zealand. There are several overarching policy drivers supporting action around large-scale energy storage options in the country (for example the New Zealand Battery Project) and policy action around addressing intermittency issues in relation to renewable energy sources that are intended to replace fossil fuel reliance. However, subsurface energy storage options are not clearly demarcated (or focused upon) within these policy drivers at the moment.

New Zealand should advocate for enhanced collaboration to develop new geothermal technologies for the identification and characterisation of resources, and for energy extraction and conversion. This would accelerate the viability for geothermal energy to become a key component of the energy systems. Many countries are looking to use geothermal energy in the transition from fossil fuels as it is an established technology and abundant renewable resource. For example, GNS Science has an established partnership with Japan and the US Department of Energy to share our expertise in geothermal exploration and energy generation.

GNS Science recommends facilitating the development of distributed decentralised energy solution via thermal network systems and utilisation of ground source geothermal heat pump. In response to global demands towards electrification, high-temperature heat pump technology, tailored for industrial applications, is progressing at an accelerated pace. Although the initial capital outlay remains relatively high, ongoing technological innovations indicate a trajectory towards greater cost competitiveness, alongside advancements that are poised to enable even higher industrial process temperatures in the near future. The feasibility assessment showed a lot of promise for this type of technology, and GNS Science recommends that conducting feasibility assessments in the future would be useful, especially with anticipated technological advancements. The potential for lower temperature technologies extends nationwide. Therefore, it is recommended that national guidance on the opportunity and potential consenting process that include best practices for subsurface and groundwater management be established to facilitate and standardize the development of these technologies.

Future of the Gas Industry

A full transition to zero carbon energy sources may require time to be completed, due to the need for maturation of new technologies. During this time, the gas sector may fail to remain operational due to the lack of economic feasibility and investment.

An unmanaged transition poses challenges for the sector and could contribute to unintended adverse consequences: The potential loss of industries which mostly rely on gas in their manufacturing process, a decrease in the energy sector resilience due the loss of gas operated power plants (in emergency scenarios), the risk of a loss of gas pipelines and infrastructure, leaving various small users without mature solutions to replace gas (earlier than planned).

Summary of recommendations

1. *The global community must insist on continually making decisions based on sound scientific evidence.*
2. *New Zealand should advocate for improved scientific understanding of hydrogen future environmental impact.*
3. *New Zealand should advocate for the development of guidelines and methodologies for evaluating and verifying to improve efficiencies in hydrogen production, compression, storage and conversion.*
4. *New Zealand should advocate for the establishment of a hydrogen government and sector coordination body that has oversight over actions under a range of policy objectives, and that will be responsible for monitoring outcomes.*
5. *New Zealand should advocate for reconsidering the role of geothermal as baseload electricity generation and district energy solution.*
6. *New Zealand should advocate internationally for indigenous-led/co-designed approaches to local energy needs.*
7. *New Zealand should advocate for enhanced collaboration to develop new geothermal technologies for the identification and characterisation of resources, and for energy extraction and conversion.*

8. *New Zealand should advocate for a panel be established to regularly review Marine Spatial Planning's for offshore renewable energy and determine where evidence gaps and uncertainties exist.*
9. *New Zealand should advocate for clear assessment of environmental guideline for offshore wind developments supported by scientific evidences.*
10. *New Zealand should advocate for the development of technologies that are affordable and have clear international standards to ensure interoperability.*

Concluding remarks

Reducing the growing impact of climate change requires the fast tracking development of renewable, baseload, regional and national mixed energetic solutions. Our comments are intended to support an the development of a New Zealand Energy Strategy, we have brought together knowledge and expertise from many areas across our organisation and hope that our feedback is carefully considered and useful. GNS Science would welcome the opportunity to engage to further develop any of these ideas.

Should you wish to discuss any of the content of this submission please do not hesitate to contact Isabelle Chambefort i.chambefort@gns.cri.nz or myself.

Yours sincerely