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RE: GNS SCIENCE SUBMISSION ON POTENTIAL SOLUTIONS FOR PEAK ELECTRICITY CAPACITY ISSUES CONSULTATION PAPER

1.0 SUBMITTER DETAILS

Name of Organisation:	Institute of Geological and Nuclear Sciences Limited (GNS Science)
Email	s.thomas@gns.cri.nz
Capacity of response:	Public sector
Confidentiality and Disclosure:	Not commercially sensitive
Publication of response:	Consent provided to publish the content of this submission

2.0 INTRODUCTION

GNS Science welcomes the opportunity to submit on Potential Solutions for Peak Electricity Capacity Issues Consultation paper.

Context

GNS Science, Te Pū Ao, is New Zealand's national institute of geological and nuclear sciences. Through world-class science, we are focused on delivering economic, environmental, and social benefits for New Zealand. As a science and research-based organisation, GNS has an important role to provide expert scientific input into policy, regulation, standards, and guidance. It is from these strategic directives that this submission has been developed.

GNS' strategic research is divided into four science themes, of most relevance to this feedback is our work in Energy Futures. GNS has undertaken decades of research into our subsurface resources, including the discovery, exploration, and development of geothermal energy; Carbon Capture and Storage; mapping critical minerals and more recent research into materials for hydrogen production.

Geothermal is not considered in the paradigm of the consultation, and this is concerning to us. Geothermal energy provides high-capacity factor baseload power, is renewable, and has the

potential to be completely carbon neutral through proven CO_2 re-injection. The purpose of this letter is to highlight matters that GNS believe could enable New Zealand's efforts to make a meaningful impact on issues surrounding peak winter demand in the long-term, rather than answer specific questions posed in the document.

3.0 GNS COMMENTS TO CONSULTATION DOCUMENT

GNS Science is leading a comprehensive, multi-year research programme entitled 'Geothermal: The Next Generation'. We are investigating New Zealand's 'supercritical' (high temperature/superhot) geothermal conditions and evaluating the economic opportunity for supercritical geothermal (SCGT) heat and electricity generation in New Zealand.

SCGT represents an exciting new frontier for renewable energy generation and utilisation. It has unique characteristics that differ from current geothermal energy resources, as it has the potential to meet a significant component of New Zealand's renewable energy demand beyond 2037. New Zealand's existing geothermal generation resources will contribute to additional electricity generation.

SCGT is a potential constant, zero-emissions abundant source of energy that can leverage hydro generation capacity for peaking.

SCGT could meet all elements of the energy trilemma and provide abundant low-cost, zero emissions, and reliable electricity for New Zealand. According to GNS' Next Generation experts, SCGT resources could potentially generate 30,000[1] GWh of energy annually. For context, New Zealand's energy system is approximately 43,500 GWh per year[2]. This abundant underground energy source remains untapped.

Over the last two years, geothermal operators have reduced the relatively minor emissions from conventional geothermal to near-zero by reinjecting greenhouse gases extracted from wells back underground from whence they came. When SCGT is developed, we expect CO_2 reinjection to be part of the design of the plant. SCGT should be treated essentially as a zero-emissions energy source.

With the baseload potential of SCGT electricity generation, this could be used in conjunction with New Zealand's existing hydroelectric infrastructure to manage peak demand issues. Hydroelectricity already provides 57% of our electricity needs and is still anticipated to provide 46-50% in 2035[3].

SCGT generation could be commissioned as early as 2037

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[1] Castalia Ltd, 2023. "Supercritical Geothermal in New Zealand: Economic opportunity in renewable electricity generation and for off-grid energy" (page 3) Available at: https://www.geothermalnextgeneration.com/knowledge/supercritical-nz-economic-opportunity

[2] MBIE, 2023. "Energy in New Zealand 2023" Available at: https://www.mbie.govt.nz/building-and-energy/energy-and-natural-resources/energy-statistics-and-modelling/energy-publications-and-technical-papers/energy-in-new-zealand/energy-in-new-zealand-2023/

[3] EECA. "Hydroelectricity in New Zealand" Available at: https://www.eeca.govt.nz/insights/energys-role-in-climate-change/renewable-energy/hydroelectricity/

The science of exploring SCGT resources and gaining an understanding of its potential is being examined. There is a critical challenge in the environmental consenting regime, where Government support will be essential to avoid delays not directly related to resolving genuine environmental issues.

Based on analysis, GNS estimates that the earliest timeframe for SCGT commercialisation is 2037. This is according to estimates of the engineering advancements that will be required to reach commercial stages. However, a streamlined and fast consenting regime and investment into the technology will be critical to bringing SCGT into the electricity mix in 2037.

The costs to build SCGT generation plants are currently conservative estimates. The wells are required to be approximately twice as deep as current conventional geothermal wells, with hotter fluids and varying chemical properties. However, even if costs are double current geothermal costs, very significant SCGT plant could be built economically as part of a low carbon, or 100 per cent renewable energy scenario. At 1.5x the cost of current geothermal, the demand for SCGT electricity generation will be robust in a renewable or gas-peaker electricity system scenario.[4]

Next steps

Despite the potential benefits of SCGT, government agencies have yet to include it in their analysis. GNS intends to proactively engage with relevant stakeholders to explore how SCGT can contribute to addressing the energy trilemma. The objective of engagement is to highlight the potential advantages of SCGT and encourage investments to enhance its technology readiness. If the ambitious timeline of 2037 is to be reached, significant investment and policy alignment is needed. Institutions such as the Electricity Authority, through public consultations such as this one, can also consider the impact of SCGT in their future long-term plans and how hydroelectricity or other energy storage assets can be leveraged to find solutions to New Zealand's current and future peak electricity issues.

Concluding remarks

It is our position that changes to our electricity generation mix is important and timely. Our comments are intended to improve the future planning and bolster the chances of success. **GNS Science would welcome the opportunity to engage** to further develop these ideas if required.

Should you wish to discuss any of the content of this submission please contact Sheena Thomas (s.thomas@gns.cri.nz).

Yours sincerely

Sheena Thomas
Commercial and Business Partnerships Manager

[4] Castalia Ltd, 2023. "Supercritical Geothermal in New Zealand: Economic opportunity in renewable electricity generation and for off-grid energy" (page 5) Available at: https://www.geothermalnextgeneration.com/knowledge/supercritical-nz-economic-opportunity