To: **Ministry for the Environment (climate.contribution@mfe.govt.nz)**

Regarding **Climate Change Contribution Consultation**

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This is the submission of GNS Science (Institute of Geological and Nuclear Sciences Limited) to the Ministry for the Environment's (MfE) consultation on setting New Zealand's post-2020 climate change target.

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GNS Science is a Crown Research Institute established in 1992. Through our predecessor organisations, we have a heritage of 150 years of earth science research in New Zealand. We operate as a stand-alone company with shares held by the New Zealand Government on behalf of the Crown. GNS Science's purpose is to undertake research that drives innovation and economic growth in New Zealand's geologically-based energy and minerals industries, that develops industrial and environmental applications of nuclear science, that increases New Zealand's resilience to natural hazards and that enhances understanding of geological and earth-system processes. This submission covers areas related to our Statement of Core Purpose.

GNS Science's role is to provide scientific information and advice to Government to support the development of New Zealand's 2030 Climate Change Targets, known specifically as New Zealand's Intended Nationally Determined Contribution (INDC) for negotiations at the United Nations Framework Convention on Climate Change (UNFCCC) Conference of the Parties (COP21) in Paris in December 2015.

Key Points

- Scientific research should continue with efforts to reduce uncertainty in relation to climate change and its impacts. This would enable both costs and benefits to be considered more accurately in the policy process to set targets.

- The INDC process may benefit from different targets for sectors with different emissions profiles and uncertainties.

- Options such as further development of geothermal baseload, solar or wind opportunities, or carbon capture and storage or may assist with meeting future climate change targets.

- Development of methodologies to independently verify sources and quantities of biofuels, bioproducts and fossil fuel emissions may enhance international trust and underpin participation in global markets for verifiable emissions reductions.

Considering Uncertainty in Relation to Climate Change Impacts

Civilization has developed over the past 10,000 years, a period in which climate has been more stable than any other period that is readily identifiable in the geologic record. The geological record of our region, based on ice core and sedimentary archives, tells us that past climate changes have had serious impacts, including abrupt changes in terrestrial and marine ecosystems. If climate change causes the state of the earth system to exit its current envelope of stability, potential impacts include increased occurrence of droughts, floods and storms, sea level rise, altered erosion and sedimentation, biodiversity loss, biosecurity threats and health risks. The best internationally agreed boundary of stability is a limit of 2° C of warming from preindustrial climate, noting that approximately 1° C of warming has already occurred.

Projections of New Zealand's future temperatures under climate change scenarios are more moderate than some other areas of the globe, but our exposure to impacts such as storms, droughts and sea level rise remains uncertain. By quantifying the large but uncertain costs associated with potential impacts of climate change, it is possible to consider the benefits of mitigating climate change alongside the costs in the process of setting New Zealand's climate change targets. In addition to improving the use of cost-benefit analysis to support policy development related to New Zealand's INDC, quantifying impact risks for unmitigated and mitigated climate change scenarios is beneficial to the operation of efficient insurance and reinsurance industries, and supports planning for business and government investment in infrastructure.

All significant expert assessments of the costs versus benefits of addressing climate change (such as Stern 2006) have concluded, with little or no uncertainty, that the costs of impacts and adaptation associated with unmitigated climate change scenarios are far greater than the costs of reducing emissions.

Pathways for Defining Emission Reduction Targets

New Zealand faces a unique challenge in defining emission reduction targets due to the most unique aspect of its emission profile: nearly half of emissions are derived from agriculture, producing food which is mainly consumed by other nations. Uncertainty in our potential to reduce agricultural emissions differs markedly from uncertainty in the potential to reduce emissions from other sectors of our economy, such as transport or electricity production.

The bottom-up processes leading to COP21 in Paris may allow New Zealand to address the challenge posed by our unique emissions profile in very different ways than was possible under the top-down rules of the Kyoto Protocol. For example, the bottom-up INDC process may be enabled by defining separate sectoral targets that allow the markedly different emission profiles and uncertainties in different sectors, such as agriculture and energy, to be quantified and understood separately. Reducing New Zealand's large agricultural emission profile is a unique challenge, due to the issues of ethics and equity involved in global food supply, and uncertainty in the economic viability and social acceptability of emission-reduction technologies. In contrast, areas within the energy sector, such as transport and electricity production, could more easily benefit from an environment where emission pricing maximises efficiency and certainty. A key reason for this is the ability to take advantage of mitigation technologies and strategies

adopted by other nations, such as vehicles with enhanced fuel efficiency or electric vehicles.

To affirm that there are potential opportunities for emissions reductions that will help New Zealand develop and achieve “ambitious and fair” targets for greenhouse gas emission reductions, we give the following pathways as examples.

New Zealand’s electricity generation already has one of the lowest emission profiles in the world. This has resulted from our extensive hydroelectric capacity, which is well matched to geothermal base load and ephemeral wind-based generation. Our gas resources have enabled coal-based generation to be minimised, but these fossil energy sources could be further reduced through ongoing development of geothermal potential. Over the last 5 years, geothermal has increased from 10% to 16% of electricity production and could be further increased. *Further development of geothermal baseload and solar or wind opportunities would be well matched to demand growth from a transformational shift of transport toward of electric personal and fleet vehicles, with charging infrastructure.* Combined, these developments could reduce emissions by replacing petrol and diesel powered vehicles.

There is a long-recognised gap between potential and achievable emissions reduction pathways. Social and political acceptance of mitigation pathways can be seen as important in explaining this gap (Socolow and Pacala 2004; Geden 2015). These pathways for emissions reductions require lead time for research and development, implementation of the technology, and consenting. Where INDCs allow country-specific targets and rules to exist, verification procedures for transformational technology pathways (such as biofuels, CCS and BECCS) may become an important component of societal acceptance. Verification of sources and quantities of biofuels, bioproducts and fossil fuel emissions may also have an important role to play in achieving international acceptance of products or trading in emissions units. As a result, *there may be reasons to consider the potential for technologies to independently verify sources and quantities of biofuels, bioproducts and fossil fuel emissions, designed to enhance international trust and underpin participation in global markets for verifiable emissions reductions.*

New Zealand also has potential to benefit from emissions reductions from carbon capture and storage (CCS) technology, which was identified by the Intergovernmental Panel on Climate Change’s 5th Assessment Report (AR5) as an important ingredient in cost-effective achievement of global emission reductions. Further, application of CCS to biomass energy (BECCS) has been identified by AR5 as a strong prospect for generating negative emissions – i.e. removal of carbon dioxide from the atmosphere. New Zealand’s high rates of forest growth and large areas of hill country could be particularly well-matched to BECCS. There are opportunities for New Zealand to benefit from CCS and BECCS in electricity generation, and there may be considerable potential to apply these technologies at dairy factories, which are major consumers of coal and gas. GNS Science has been a partner in the Australian CO2CRC on the topic of CCS, and is capable of providing leading expertise on this topic to enable development and acceptance of this technology within New Zealand.

References:

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