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Submission on Hydrogen green paper received:

Introduction

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Is this an individual submission or on behalf of a group or organisation?

Behalf of group or organisation

Please give the name of the group or organisation this submission is on behalf of.

New Zealand Hydrogen Association

What is the role of Government in developing hydrogen for storage and distribution?

The Government's role in developing hydrogen for storage and distribution includes:

- Providing policy direction such as a national strategic road map and delivery targets to support and underpin commercial and strategic investment decisions.
- Investing in, partnering and/or providing funding for comprehensive modelling and analysis, project feasibility, scoping and cost analysis and delivery of projects to establish more clearly the role that hydrogen can play across long and short term hydrogen storage and distribution applications, including electricity grid buffering for dry years, remote locations with seasonal and diurnal demand challenges, long-haul transport, industrial processing, decarbonising natural gas (NG) and export.
- Developing a clear, consistent and internationally recognised regulatory framework across the hydrogen supply chain, including consenting, licencing, technology importing and development, hydrogen production, storage, distribution, use and export.
- Addressing investment risk by financially supporting projects that advance the deployment of hydrogen technology and in particular across the four pillars identified by the IEA i.e. mobility (transport fleets and freight corridors), industrial ports, existing gas infrastructure and export.
- Funding, facilitating and supporting a coordinated approach to domestic hydrogen R&D and seeking opportunity to facilitate international cooperation in order to ensure NZ R&D is relevant in a global context and that we seek opportunity to benefit from the significant global investment that is occurring in hydrogen R&D.
- Adopting fiscal incentives to drive behavioural change through mechanisms such as targeted taxes that penalise GHG emissions producers with a portion of revenue generated used to fund new infrastructure and services that advance New Zealand's transition to low emission economy.

What are the challenges for using hydrogen for storage and distribution?

The challenges for using hydrogen for storage and distribution includes:

- New Zealand currently has no national hydrogen strategy or road map to support the investment decisions needed to deliver hydrogen storage and distribution infrastructure.
- A consistent and cohesive regulatory framework is required to support the deployment of hydrogen infrastructure for storage and distribution across the supply chain.
- The current cost and technology readiness of large scale hydrogen storage and distribution both domestically and for export.
- Current lack of technology readiness for heavy vehicle deployment and maritime and rail transport.
- General lack of public and institutional awareness and understanding of hydrogen opportunities across the energy system, the scale of existing domestic and global hydrogen production and use and the rate of international investment in R &D and advancements in technology developments.
- Lack of New Zealand specific analysis and research with respect to the implications and use of NG decarbonisation using green hydrogen.
- Cross sector collaboration required to deliver a cohesive approach to delivering infrastructure across the regions for hydrogen storage and distribution networks.

What are the opportunities for using hydrogen for storage and distribution?

The opportunities for utilising hydrogen for storage and distribution include:

- Integrated with increased electrification, green hydrogen can assist New Zealand transition to a low emissions economy and achieve its climate change obligations and targets.
- Green hydrogen can provide New Zealand with an opportunity to attract international investment centred around its renewable energy resources and expertise and to collaborate with much larger economies such as Japan, South Korea, Germany and Norway for example, to develop new hydrogen storage and distribution infrastructure, to transition and future proof existing infrastructure, be global leaders in hydrogen infrastructure and IP and technology developments, and to participate in a new global export commodity. This also offers the potential opportunity to unlock a significant domestic off take agreement, which would potentially reduce domestic costs of hydrogen production for use in grid and distributed energy storage solutions.
- Green hydrogen offers a decarbonised energy solution for remote locations, particularly for iconic tourism destinations such as Milford Sound, and also for locations where seasonal demand, population growth and/or consenting constraints pose generation and transmission hurdles.

What is the role of Government in developing the complementary role of electricity and hydrogen?

The role of Government in developing the complementary and integrated roles that electricity and hydrogen can play in advancing New Zealand's transition to a low emissions economy includes:

- Adopting regulations, policy and supportive mechanisms that apply equitably to all zero emission vehicles not just to BEV.
- Adopting Government procurement targets and processes for FCEV's that are aligned to the operational advantages that hydrogen vehicles offer and that support the uptake, integration and delivery of both BEV's and FCEV's.
- Develop educational tools and local case studies that illustrate the operational advantages and disadvantages and full life cycle costs associated with BEV's and FCEV's for light passenger vehicles and buses.
- Encouraging Government entities, such as EECA, to incorporate zero emission technologies that include hydrogen as part of their renewable energy solutions and zero emission contestable fund scope and assessment criteria.
- Provide funding for new infrastructure projects that stimulate the integration of renewable electricity generation with green hydrogen production, particularly for use in decarbonising existing fossil fuel derived industrially produced hydrogen, use of hydrogen in industrial process heat applications, zero emission mobility, dry year resilience, seasonal and diurnal demand peaks and population growth and transmission constraints and for export.
- Provide funding for feasibility assessments and analysis into the centralised and distributed use of

New Zealand's renewable electricity resources for the generation, storage and use of green hydrogen for grid resilience, domestic application to decarbonise process heat and transport sectors and for export.

- Develop a regulatory framework that supports and speeds¹ up the supply and demand side transition of the internal combustion engine transport fleet to zero emission vehicles. This would include multi-faceted fiscal incentives and mechanisms targeted at OEM's, (such as targets for gCO₂/km emission limit on vehicle sales), carbon tax and fuel excise relief for zero emission fuels, (such as certified green hydrogen), support to incentivise new technology uptake, ongoing operational cost reduction. ¹The current annual new vehicle replacement per year in New Zealand is circa 160,000 new entries per year, which is a 4% replacement rate per year of our 4 million car fleet. At this current new entry level it will take 25 years to turnover our existing internal combustion engine car fleet.
- Facilitating and investing in nationally coordinated and compatible infrastructure for EV's and hydrogen refuelling networks.

What are the challenges for achieving this complementary role of electricity and hydrogen?

The challenges for achieving this complimentary role of electricity and hydrogen include the following:

- Access to and procurement of FCEV's.
- Lack of technology readiness and infrastructure to transition New Zealand's transport fleet to zero emission vehicles and in particular to FCEV's for heavy vehicles, marine transport and rail.
- No recognised policy framework for importing new or used FCEV's.
- Lack of significant supply and demand side fiscal incentives for purchase and use of zero emission vehicles that will enable New Zealand to transition the existing internal combustion engine fleet at a rate that keeps step with a transport emissions trajectory that would enable us to meet our climate change targets and obligations.
- Lack of comprehensive economic analysis of dry year storage options using hydrogen integrated into the electricity grid.
- Lack of policy and regulatory framework to support the investment, delivery and use of hydrogen infrastructure.
- General lack of public and institutional awareness and understanding of hydrogen opportunities across the energy system, the scale of existing domestic and global hydrogen production and use and the rate of international investment in R &D and technology development.

What are the opportunities for this complementary role of electricity and hydrogen?

The opportunities for New Zealand in developing a complementary role of electricity and hydrogen includes:

- Participating in global market development for green hydrogen deployment.
- Taking advantage of international investment and global collaboration opportunities for the benefit of the New Zealand economy.
- Expand our global reputation as an innovative test bed for new and emerging technologies.
- Develop opportunities to expand our energy resilience, reduce New Zealand's reliance on fossil fuel imports and consumption, reduce GHG emissions, support the private sector to decarbonise their product offerings and exports, develop zero emission transport corridors and globally iconic tourism offerings, partner with global leaders in hydrogen deployment, develop and participate in the emerging global export of green hydrogen.
- Develop the opportunity over time to export New Zealand's renewable energy resources to displace over time the export of our existing fossil fuel resources.

What is the role of Government in supporting hydrogen use for the transport sector?

The role of Government in supporting hydrogen use for the transport sector includes:

- Adopting regulations, policy frameworks and supportive mechanisms that apply equitably to all zero emission vehicles not just to BEV.

- Adopting Government procurement targets and processes for FCEV's that are aligned to the operational advantages that hydrogen vehicles offer and that support the uptake, integration and delivery of both BEV's and FCEV's.
- Develop educational tools and local case studies that illustrate the operational advantages and disadvantages and full life cycle costs associated with BEV's and FCEV's for light passenger vehicles and buses.
- Encouraging Government entities, such as EECA, to incorporate zero emission technologies that include hydrogen as part of their renewable energy solutions and zero emission contestable fund scope and assessment criteria.
- Provide transparent funding initiatives for demonstration and infrastructure projects that focus on zero emission mobility, including FCEV's and refuelling infrastructure, marine deployment and rail.
- Develop a regulatory framework that supports and speeds up the supply and demand side transition of the internal combustion engine transport fleet to zero emission vehicles. This would include multi-faceted fiscal incentives and mechanisms targeted at OEM's, (such as targets for gCO₂/km emission limit on vehicle sales), carbon tax and fuel excise relief for zero emission fuels, (such as certified green hydrogen), support to incentivise new technology uptake, ongoing operational cost reduction. As noted above, the current fleet turnover rate is too low to transition to a low emissions fleet before 2050.
- Developing a domestic regulatory and compliance framework based on international best practice and globally recognised standards from established and sophisticated markets such as Germany, Japan and Australia.
- Development of WorkSafe guidelines (in-line with the Hazardous Substances & Gas Act) for refuelling infrastructure, particularly to ease delivery of early adopter infrastructure and pilot projects. The interim guidelines will assist early adopters such as OEM's with the safe installation of refuelling equipment, site layout, certification, hydrogen gas thresholds and operator qualifications with gas handling.
- Facilitating and investing in nationally coordinated and compatible infrastructure for hydrogen refuelling networks. Globally, governments have played an essential role in funding or part funding early stage infrastructure deployment.
- Stakeholder engagement across the hydrogen supply chain to remove barriers and future proof industry developments, particularly with respect to new and used imports of FCEV's, domestic design and build of heavy vehicles, hydrogen technology and componentry imports, technology demonstration development and testing.
- Develop planning guidelines for the consenting of hydrogen refuelling infrastructure to achieve a consistent coordinated approach across New Zealand and to prevent delays infrastructure delivery.

What are the challenges when using hydrogen for mobility and transport?

The challenges when using hydrogen for mobility and transport in New Zealand includes:

- New Zealand currently has no national hydrogen strategy or road map to support the investment decisions needed to deliver hydrogen storage and distribution infrastructure.
- A consistent and cohesive regulatory framework is required to support the deployment of infrastructure across the hydrogen mobility supply chain.
- Current lack of technology readiness for heavy vehicle deployment and maritime and rail transport.
- General lack of public and institutional awareness and understanding of hydrogen opportunities across the energy system and in particular for transport and level of international investment and collaboration and technology development for the use of hydrogen for zero emission transport solutions.
- Cross sector collaboration is required to achieve a cohesive approach to delivering infrastructure across the regions for hydrogen storage and distribution networks.
- Cost of delivery of new and expensive hydrogen infrastructure and vehicles when compared to the existing and well established fossil fuel distribution network and internal combustion engine.
- There is currently no transparent allocated Government funding initiatives for new infrastructure projects that focus on zero emission mobility, including FCEV's and refuelling infrastructure, marine deployment and rail.

- Access to and procurement of FCEV's, including fuel cell fork lift trucks.
- Lack of technology readiness and infrastructure to transition New Zealand's transport fleet to zero emission vehicles and in particular to FCEV's for heavy vehicles, marine transport and rail.
- No recognised policy framework existing for importing new or used FCEV's. New vehicle compliance requirements are needed for FCEV's as currently Alternative Fuel Compliance Certificate requirements for NZTA are not aligned for hydrogen powered mobility. Due to the nature of the technology, currently only OEM's would have the expertise to complete the annual safety inspections required.
- Lack of significant supply and demand side fiscal incentives for purchase and use of zero emission vehicles that will enable New Zealand to transition the existing internal combustion engine fleet at a rate that keeps step with a transport emissions trajectory that would enable us to meet our climate change targets and obligations.

What are the opportunities for using hydrogen for mobility and transport?

The opportunities for using hydrogen for mobility and transport includes:

- Integrated with increased renewable electrification, green hydrogen can assist New Zealand transition to a low emissions economy and achieve its climate change obligations and targets.
- Deployment of green hydrogen mobility solutions can provide New Zealand with an opportunity to collaborate internationally and attract offshore investment centred around development of additional renewable energy resources. It also provides R & D opportunities and infrastructure development opportunities with some of the world's largest economies, such as Japan, South Korea, Germany and Norway, for example. In particular opportunities exist to collaborate internationally on marine fuel cell propulsion, hydrogen production storage and distribution infrastructure, aviation innovations, IP development, hydrogen cryogenics, decarbonised steel production and distributed and centralised large scale storage, distribution and refuelling.
- Green hydrogen offers a decarbonised transport solution for remote locations and for long distance iconic branded tourism routes such as Queenstown to Milford Sound and also for long distance heavy vehicle commercial fleet routes and transport hubs.
- Appropriate government support can unlock private sector investment in infrastructure to maximise returns on sunk capital e.g. decarbonise existing brown hydrogen generating industries which will lead to large industrial scale green hydrogen production and zero emission mobility off-take agreements.
- Green hydrogen fuel cell materials handling technology offers zero emission solutions for confined space operations with no temperature dependent performance limitations and battery replacement, storage, charging and discharge management issues.
- Widespread deployment of FCEV's reduces New Zealand's reliance on importing and managing the disposal infrastructure, costs and obligations associated with hazardous end of life batteries (e.g. lithium ion).
- FCEV and public refuelling infrastructure availability will broaden consumer choice options for zero emission vehicles in New Zealand.

What is the role of Government in encouraging the use of hydrogen for industrial processes including process heat supply?

Decarbonising GHG emissions generated from industrial processes, including process heat, is widely acknowledged as being a critical pathway to New Zealand's transition to a low emissions economy. Process heat requires combustion temperatures that can be supplied through fuel switching to green hydrogen to eliminate fossil fuel consumption. Green hydrogen could also reduce emissions substantially from chemical synthesis operations (especially ammonia but potentially also methanol) and even provide an emissions free pathway to produce iron. This transition is unlikely to happen without the Government playing an important strategic role in facilitating this change.

The role of Government in encouraging the use of hydrogen for industrial processes, including process heat supply, includes:

- Providing policy direction such as a national strategic road map and delivery targets to support and

underpin commercial and strategic investment decisions for the use of hydrogen for industrial processes, including process heat.

- Developing a clear, consistent and internationally recognised regulatory framework across the hydrogen supply chain, including resource consent processes, technology importing and development, hydrogen production, storage, distribution and use in industrial processes including process heat.
- Addressing investment risk by financially supporting projects that advance the deployment of hydrogen technology for industrial processes and in particular process heat.
- Encouraging Government entities, such as EECA, to incorporate zero emission technologies that include green hydrogen as part of their renewable energy solutions, with a focus on industrial applications, including decarbonising process heat.
- Providing funding for new infrastructure projects that stimulate the integration of renewable electricity generation with green hydrogen production, particularly for use in decarbonising existing fossil fuel derived industrially produced hydrogen and use of zero emission hydrogen in industrial process heat applications.
- Providing funding for feasibility assessments and analysis into the centralised and distributed use of New Zealand's renewable electricity resources for the generation, storage and use of green hydrogen to decarbonise industrial processes, including process heat.

What are the challenges for using hydrogen in industrial processes?

The challenges for using hydrogen in industrial processes in New Zealand include:

- New Zealand currently has no national hydrogen strategy or road map to support the investment decisions needed to deliver green hydrogen infrastructure for use in industrial processes.
- A consistent and cohesive regulatory framework is required to support the deployment of new green hydrogen infrastructure for use in industrial processes, particularly for industries not currently familiar with hydrogen production, storage and use etc.
- The cost of procurement and production of new green hydrogen infrastructure is expensive when compared to the existing and well established fossil fuel derived hydrogen production systems.
- There is currently no transparent allocated Government funding initiatives for new infrastructure projects that focus on industrial process applications.
- Currently there is a general lack of public and institutional awareness and understanding of hydrogen opportunities across the energy system, including the use of hydrogen to decarbonise industrial processes and process heat.
- Further investigation, modelling and economic analysis of the implications, opportunities and use and continuity of supply of green hydrogen to decarbonise industrial processes and process heat is needed across a range of industries and sectors in New Zealand and particular in the dairy manufacturing sector and for low carbon feedstock substitution.

What are the opportunities for the use of hydrogen in industrial processes?

The opportunities for the use of hydrogen in industrial processes includes:

- Large scale production and use opportunities which may provide improved economies of scale for infrastructure investment compared with other hydrogen applications such as distributed mobility scenarios.
- Participating in and taking advantage of global market developments (e.g. price premium) for green hydrogen derived ammonia exports and low carbon aviation fuels, for example.
- Expand our global reputation as an innovative test bed for new and emerging technologies for the use of green hydrogen in industrial processes for low carbon steel manufacture.
- Develop opportunities to expand our energy resilience, reduce New Zealand's reliance on fossil fuel imports and consumption and in particular coal, reduce GHG emissions, support the private sector to decarbonise their product offerings and exports, partner with global leaders in hydrogen deployment for industrial processes and process heat applications.
- Develop globally leading capability and demonstration projects for transitioning industrial processes and process heat to green hydrogen solutions at the planned National New Energy Development Centre in Taranaki.

- Develop and promote public and private sector partnerships to increase the range of industrial processes and scale of the generation and use of green hydrogen demonstration projects across the regions of New Zealand.

What is the role of Government in encouraging hydrogen uptake for decarbonisation of our natural gas uses?

The role of Government in encouraging the use of hydrogen uptake for decarbonising our natural gas uses includes:

- Providing policy direction such as a national strategic road map and delivery targets to support and underpin commercial and strategic investment decisions for the use of hydrogen in natural gas networks.
- Developing a clear, consistent and internationally recognised regulatory framework across the hydrogen supply chain, including resource consent processes, technology importing and development, hydrogen production, storage, distribution and use in reticulated gas networks.
- Financially supporting trials and demonstration projects to better understand and address embrittlement issues across the network and to establish end use application impacts.
- Working in collaboration with the private sector to identify the localised risk factors of advancing decarbonisation of our natural gas networks through hydrogen injection and to establish risk mitigation strategies in the New Zealand context.

What are the challenges for hydrogen to decarbonise the applications using natural gas?

The challenges for hydrogen to decarbonise the applications using natural gas include:

- New Zealand currently has no national hydrogen strategy, policy framework or road map to support the use of hydrogen to decarbonise the applications using natural gas.
- A consistent and cohesive regulatory framework is required to support the use of hydrogen to decarbonise natural gas networks across the transmission, distribution and end use applications.
- Further investigative analysis and modelling is required in New Zealand to identify the localised risk factors of advancing decarbonisation of our natural gas networks through hydrogen injection.
- Comprehensive trials and demonstration projects are required in New Zealand to understand and address embrittlement issues across the network, end use application impacts and risk identification and mitigation in the New Zealand context.

What are the opportunities for hydrogen to decarbonise our gas demand?

The opportunities for hydrogen to decarbonise our gas demand include:

- Developing globally leading capability and demonstration projects for transitioning natural gas infrastructure to lower carbon options.
- Establishing the planned National New Energy Development Centre in Taranaki as a centre of excellence for technology developments and research projects to decarbonise our natural gas infrastructure and systems.
- Expand New Zealand's hydrogen capability, knowledge and skill base through a just transition of existing gas engineers and specialists.
- Reduce New Zealand's GHG emissions and support the private sector to decarbonise their product offerings and partner with global leaders in hydrogen deployment for natural gas injection projects.
- Involving existing industry in the transition to new technologies enables access to substantial skill and knowledge bases as well as large balance sheets to repurpose existing assets and fund new developments and infrastructure.

What is the role of Government in producing hydrogen in sufficient volume for export?

The role of government in producing hydrogen in sufficient volume to enable export includes:

- Providing targeted resources and financial support to establish and advance international collaboration opportunities that will lead to the development of hydrogen export opportunities, as well as an understanding of the timeframe and necessary staged development of critical infrastructure and resources.
- Support and facilitate government to government cooperation with potential hydrogen importing

countries to advance hydrogen export opportunities and also with countries that are advancing hydrogen export technologies.

- Adopt a regulatory framework that incorporates the provisions for the development of an export scale hydrogen industry.
- Provide clear export policy provisions in a national hydrogen strategy and road map that would signify to potential hydrogen importers that the Government is committed to establishing export trade opportunities.

What are the challenges for hydrogen if produced for export?

The challenges for hydrogen in New Zealand, if produced for export include:

- Comparatively expensive electricity and transmission costs. New Zealand will be competing with other renewable energy rich countries such as Australia, Chile and Saudi Arabia on an international competitive market.
- Reluctance of private sector companies to invest in hydrogen export infrastructure without significant investment from the Government.
- Uncertainty over the scale and timing of export market opportunities. For example, Japan's strategic vision suggests a large scale import market would only become reality once thermal power generation is converted to hydrogen in circa 2030.

In addition, we welcome your feedback about the opportunities of hydrogen to Māori and how this will support their aspirations for social and economic development.

The opportunities from hydrogen for Māori in developing their aspirations for social and economic development may include:

- Opportunities to utilise Māori geothermal resources to produce green hydrogen for use in Iwi owned business enterprises and for potential export.
- Opportunities for Māori focussed skills and development programmes to engage and participate in future renewable energy growth areas and to develop and foster skills and expertise and career and business opportunities that are leveraged from and by the kaitiaki or stewards of our natural resources.

What are the opportunities for hydrogen if produced for export?

Producing hydrogen for export in New Zealand offers the following opportunities:

- Significant opportunity to collaborate with international export technology developers.
- Provides an opportunity to generate a significant revenue stream to the New Zealand economy.
- Presents opportunities to develop significant new renewable energy generation and infrastructure as well as utilising existing assets and infrastructure and skill and expertise.
- The international hydrogen export market is potentially huge, with significant energy imports required for key Asian economies e.g. Japan, Taiwan and Korea.
- Importing countries will seek to secure a diversity of supply from different partners to reduce their exposure.
- Economies of scale would allow efficient production for domestic consumption as well as export.
- Flexible contracts could enable diversion of product to meet dry shortfalls in hydro generation.

If you wish to, you can attach a document to this submission.

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