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Subject: Hydrogen green paper - submission

Submission on Hydrogen green paper recevied:

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.

Venture Taranaki Trust and New Plymouth District Council

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

There are three key roles for Government:
(1) Setting policy
(2) Setting regulations
(3) Supporting investment

Government sets the policy framework for the storage and distribution of hydrogen. MBIE, MoT, MfE all play key roles as do other agencies such as EECA, the Productivity Commission and the Interim Climate Change Committee/Independent Climate Change Commission.

These agencies should ensure they integrate and align their workstreams and remove barriers while creating the regulatory framework to facilitate hydrogen's creation, flow and use within New Zealand's energy system.

Government also plays a key regulatory role with respect to the storage and distribution of hydrogen. It sets the relevant laws and regulations and their monitoring framework. While this is likely to be focused on the storage and distribution of hydrogen in various forms of tanks or pipelines we suggest there should also be consideration of the possibility for hydrogen to be stored geologically. We suggest there should also be consideration of the storage of hydrogen in various formats – as gaseous or liquid hydrogen, as synthetic natural gas, as ammonia or combined with other substances such as liquid organic hydrogen carriers.

The Resource Management Act (RMA) is yet to be fully tested in terms of assessing the effects of hydrogen infrastructure projects. Whether the RMA will be an enabler or barrier to hydrogen

projects is yet to be seen, however Government needs to be cognisant of the interrelationship between the RMA and the aspirations of the Zero Carbon Bill and Emissions Trading Scheme.

In order for local government to issue Land Use and/or Building Consents for hydrogen related infrastructure, Councils will need a level of certainty and trust in the safety of such infrastructure through the application of standards and regulation adopted at a national level. Councils will need to understand the issues, the potential effects on the environment/communities and how best to mitigate those effects, before issuing consents. This may require some support for Councils to achieve.

Government can and should also be a key funder of projects related to the storage and distribution of hydrogen. We suggest that the New Zealand Government should provide financial support for new energy technologies. This could be via Crown Infrastructure Partners in a similar way to how it has supported the role out of fibre and rural broadband.

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

There are several challenges.

There is a technical challenge around the significant loss of energy that occurs when converting electricity to hydrogen and back to electricity again. While this is a genuine challenge it is only one of several factors that influence the business case for hydrogen.

There is another technical challenge around competing technologies. There are various ways of storing and distributing hydrogen (or related products such as synthetic natural gas and ammonia). It is not yet clear which method or methods will ultimately be preferred.

Hydrogen embrittlement of steel pipelines is another technical challenge when using steel pipelines to distribute hydrogen. FirstGas is about to commence a project exploring this issue with the goal of determining what percentage of hydrogen can be safely mixed with natural gas.

There are health and safety issues which need to be addressed and appropriate standards agreed for the storage and distribution of hydrogen including in public environments such as refuelling sites. These issues have been addressed internationally and are already addressed in industrial environments in New Zealand where there is large-scale use of hydrogen. While there should be little issue developing appropriate standards for the storage and distribution of hydrogen there is a public perception issue around the safety of hydrogen which needs careful management. Based on the experience of other countries, once hydrogen is being used safely in a public manner e.g. public buses with “hydrogen powered” on the side of them (as in Aberdeen and other cities), then hydrogen becomes quickly accepted.

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

A key opportunity is for the effective and efficient storage of the energy generated from increased volumes of renewable electricity.

Many forecasts suggest New Zealand will attempt to decarbonise its energy system by significantly increasing its volume of renewable electricity to help replace fossil fuels where appropriate (such as replacing coal for process heat or as vehicle fuel). For example Transpower in its Te Mauri Hiko Report (2018) has suggested the country will need twice the current volume of renewable electricity to decarbonise the energy system by 2050. Such doubling of renewable electricity supply poses challenges.

A considerable proportion of an increased supply of renewables could be supplied from the variable sources of generation such as onshore and offshore wind, solar and possibly wave or tidal. This would complement the more consistently available forms of electricity supply from hydro and geothermal generation. However, an expected outcome from an increase in variable renewable

generation will be a significant increase in the "dry year" issue. To address this imbalance between when electricity is generated and when energy is needed, a significant increase in energy storage will be required. While batteries will be part of the solution (and noting these are not without environmental impact), particularly when energy storage is required for short periods of time, other solutions are required where energy is required to be stored for longer periods of time.

There is a significant opportunity for hydrogen and/or compounds produced using hydrogen to be the media for storing renewable energy. While the challenge of the efficiency of converting electricity to hydrogen and back to electricity remains, once stored there are no significant energy losses over time. This means hydrogen and related compounds can effectively store energy for long periods of time.

The technology for producing hydrogen and related compounds is also well established and cost effective. Andrew Renton from Transpower has analysed various energy storage pathways (presented in a paper to the 2019 Electrical Engineers Association conference) and found that various hydrogen-related pathways appear likely to be the best options for New Zealand. For example if hydrogen is converted to synthetic natural gas then New Zealand already has storage facilities for natural gas, pipelines for distributing it and power stations in place to re-generate electricity and distribute it when needed. Such a pathway will still require considerable investment and there are interesting issues to address around how such storage is paid for, and how the energy produced from such stored energy is priced. These challenges are shared with other forms of potential energy storage such as pumped hydro.

The various pathways using hydrogen also provide opportunity for New Zealand to both export and import energy. There is ongoing interest from Japan in importing green hydrogen from New Zealand. If this export pathway is developed New Zealand would have the opportunity to gain an economic return from its potential ability to produce more renewable electricity than the country directly needs. Such international trade in green hydrogen also provides opportunity for New Zealand to import energy in times of local electricity shortage.

The ability to store hydrogen also provides opportunity for it to be utilised at the time and for the purposes for which the highest returns can be generated. As a country with the potential ability to over-produce low-emissions energy this is an important economic opportunity.

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

There is a policy setting role which has been addressed in a range of papers prepared over the past two years – including the Hydrogen Green Paper.

There is a regulatory role surrounding the efficient and effective management of the energy sector. This includes addressing any regulatory barriers.

The Resource Management Act is yet to be fully tested in terms of assessing the effects of integrated electricity/hydrogen infrastructure projects. Whether the RMA will be an enabler or barrier to hydrogen projects is yet to be seen, however Government needs to be cognisant of the interrelationship between the RMA, and the aspirations of the Zero Carbon Bill and Emissions Trading Scheme reform.

There is also a key role for the Government to play in underwriting the investment in infrastructure required to enable the hydrogen sector to get established and enable the decarbonisation of the energy sector.

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

While there are ongoing technical issues e.g. improving the efficiency of electrolysers to produce hydrogen from electricity, the investment to enable these technology issues is occurring

internationally. We suggest the key challenge surrounds encouraging investment in the required infrastructure.

There will likely be parties who subscribe to the view that "the market" will sort out whether investing in hydrogen infrastructure is a good investment or not. This approach does not take into account several important factors:

(1) the energy system is of key national strategic importance. Providing investment that enables ongoing stability and efficiency for the electricity system and affordability for consumers is a matter that the government should and already does support (eg via Transpower's provision of the national transmission network).

(2) Private investors usually have shorter investment horizons than governments. Private investors will struggle to make some decisions that require long term investment horizons.

(3) The local parties with the capacity to make the significant investments required tend to be relatively low risk investors. They will struggle to make investment decisions that have uncertainty over just when returns will be generated.

(4) There is no single party which can lead the development of the hydrogen sector. It requires coordination amongst multiple parties. Lead investment by government complementing appropriate policy and regulatory support will provide confidence to other investors.

The imperative for government investment support is very similar to that which occurred with the roll out of fibre and rural broadband in New Zealand (or the initial establishment of electricity infrastructure in NZ). Crown Infrastructure Partners is already established and could be directed to support key infrastructural investments that will facilitate the use of hydrogen.

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

Developing infrastructure for hydrogen storage and distribution will enable ongoing investment in renewable electricity generation.

Using hydrogen (or related products) as a storage medium will enable the energy from renewable electricity to be cost-effectively stored and then distributed to where it can generate optimal returns. The optimal use may be conversion back to electricity, it may be for use as a vehicle fuel, it may be for use as an industrial chemical feedstock (e.g. for ammonia, urea or methanol) or it may be for export to international markets.

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

The Ministry of Transport's recent Green Freight Project report (2019) suggests there are three likely energy pathways for decarbonisation of the heavy transport sector: batteries, biofuels and hydrogen.

The same technologies have potential to decarbonise the wider transport sector including light vehicles. There are challenges and opportunities with each technology.

Battery technology is now widely seen as having applicability for light vehicles, particularly where daily usage and distance is low to moderate. Concerns over range, recharge time and cost as well as potential environmental impact related to mining key minerals and battery disposal are hindering quicker uptake of battery powered electric vehicles. While the technology for recharging modest numbers of electric vehicles is available in New Zealand, there are concerns over the infrastructural demands if there is widespread uptake of battery powered vehicles.

Hydrogen is widely seen as having particular advantages for heavy vehicles and/or for vehicles with

high utilisation including long distance travel. However, the use of hydrogen fuel cell electric vehicles in New Zealand is currently minimal. The key issue is the lack of refuelling infrastructure although cost and suitability of vehicles for New Zealand is also an issue.

The use of hydrogen fuel cell vehicles faces a "chicken or egg" situation of a scale much deeper than that faced by battery powered vehicles.

The private sector won't invest in fuel cell vehicles because there is currently no refuelling infrastructure. There is no investment in refuelling infrastructure because there are no customers with fuel cell vehicles. Addressing this issue is the key role that government can play to support hydrogen use in the transport sector. In this case we suggest the refuelling infrastructure needs to come first but in conjunction with a plan for introducing vehicles to use the infrastructure.

The Provincial Growth Fund has provided some initial support for Taranaki-based Hiringa Energy to plan for the rollout of hydrogen refuelling infrastructure. While this is encouraging there is a need for further ongoing support. Once refuelling infrastructure is in place then transport companies can implement vehicle options for New Zealand.

As with our previous comments we suggest that this infrastructural support could be provided via Crown Infrastructure Partners or a similarly structured entity. It could underwrite the rollout of suitable infrastructure until commercial returns are generated.

There are four other key areas where government support will be helpful.

(1) Support for the development of vehicles suitable for the New Zealand market – such as trucks, coaches or buses. At present this could occur via the Provincial Growth Fund but other mechanisms may be required in future, possibly via extension of EECA's low emissions vehicles contestable fund.

(2) The implementation of hydrogen fuel cell trains by Kiwirail. Hydrogen-powered trains are already running internationally. The set routes run by trains require relatively modest refuelling infrastructure to service. This infrastructure could also be of benefit to trucking companies which have regular visits to many rail sites.

(3) Encouragement for the use of hydrogen by the marine industry. Again a relatively modest level of infrastructure at ports would be required and would have potential for use by both the rail and trucking industries.

(4) Use hydrogen fuel cell vehicles within the government fleet (15,473 in total) as appropriate based on type and function. This demonstrates leadership and absorption of early adopter risk, while assisting with the 'supply vs demand' conundrum noted above by giving certainty to local hydrogen providers, widening the channel for the importation of hydrogen fuel cell vehicles and identifying issues within the regulatory framework when trying to get them legally on the road.

In order for local government to issue Land Use and/or Building Consents for hydrogen related infrastructure, Councils will need a level of certainty and trust in the safety of such infrastructure through the application of standards and regulation adopted at a national level. Councils will need to understand the issues, the potential effects on the environment/communities and how best to mitigate those effects, before issuing consents. This may require some support for Councils to achieve.

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

The availability of refuelling infrastructure and suitable vehicles are the key challenges. Based on developments in international markets it is likely that once the refuelling infrastructure is committed the vehicles will become available in New Zealand.

The H2 Taranaki Roadmap identified hydrogen fuel cell buses as an early catalyst project that would assist with the 'supply vs demand' conundrum early on. As significantly sized vehicle fleets that "return to base" and use a shared refuelling site, public bus networks are driving hydrogen development in many parts of the world.

As in many New Zealand regions, Taranaki's public transport is managed by the Regional Council but supported by government funding. There needs to be a shift in procurement focus to enable hydrogen fuel cell buses to be considered at the tendering stage, the parameters of which are currently dictated by government.

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

Hydrogen has three key advantages over battery technology.

(1) Refuelling times are much shorter than recharging times for battery vehicles – and comparable to refuelling times for petrol or diesel vehicles. This is of key importance for high use commercial vehicles while also important to many private drivers.

(2) Hydrogen is a denser energy medium than batteries. This energy density provides greater range and much less weight for vehicles. These are particular advantages for heavy vehicles though will also be of benefit to drivers of light vehicles.

(3) The cost of the infrastructure required to enable fleet-wide implementation of fuel-cell vehicles is likely less than the cost of the infrastructure for fleet-wide implementation of battery-powered vehicles. While there is a high initial cost to get a base hydrogen-refuelling network established, the ultimate cost of a suitable network of service stations with hydrogen refuelling capability is likely less than providing the considerably larger network of recharging sites needed for electric vehicles.

Hydrogen fuel cell vehicles are likely to have two other advantage in New Zealand compared to many other countries:

(1) New Zealand is an island nation meaning our vehicles can't go anywhere else. There is no need to coordinate network development with neighbouring countries.

(2) New Zealand has long established used vehicle importation arrangements with Japan. Japan has a commitment to developing a "hydrogen economy" including using hydrogen as a vehicle fuel. It is likely Japan will be a ready source of reasonably priced right-hand drive fuel cell vehicles (including light vehicles).

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

The roles of the government are similar to those suggested above for other sectors and need to align with aspirations in other workstreams such as the Zero Carbon Bill and Emissions Trading Scheme:
(1) Setting policy
(2) Regulating
(3) Supporting investment

In order for local government to issue Land Use and/or Building Consents for hydrogen related infrastructure, Councils will need a level of certainty and trust in the safety of such infrastructure through the application of standards and regulation adopted at a national level. Councils will need to understand the issues, the potential effects on the environment/communities and how best to mitigate those effects, before issuing consents. This may require some support for Councils to achieve.

What are the challenges for using hydrogen in industrial processes?

Hydrogen is already used in New Zealand as an industrial feedstock – large quantities of hydrogen sourced from natural gas are used in the manufacture of products including methanol and urea.

The pathway of instead using green hydrogen produced by using renewable electricity to electrolyse water is well recognised and already feasible. It is the focus of the proposed project involving Hiringa Energy and Ballance Agri-Nutrients. The challenge of using green hydrogen is primarily economic not technical. The production of low or no emissions products manufactured using green hydrogen will require significant investment in new plant and equipment. The low emissions products manufactured using green hydrogen are also competing against similar high emissions and potentially cheaper products made using natural gas or coal. This cost differential is closing and is influenced by carbon pricing.

Hydrogen (or related products such as synthetic natural gas produced from green hydrogen) can also be used to replace fossil fuels to produce process heat. MBIE and EECA suggested in their Technical Paper on Process in New Zealand released in January 2019 that green hydrogen was unlikely to be cost effective as a process heat fuel source compared to other available sources including using electricity directly. There is a clear cost challenge if green hydrogen is to play a role as a fuel for process heat applications.

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

The key opportunity in New Zealand appears to be using green hydrogen as an industrial feedstock to replace hydrogen currently produced from natural gas.

This is perhaps the most important and core opportunity for the development of the green hydrogen sector in New Zealand as it provides a market for large quantities of green hydrogen at the lowest cost of production. Once large industrial markets are in place then initially smaller markets such as for vehicle fuel can be provided with cost-effective green hydrogen as they get established.

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

The roles of the government are similar to those suggested above for other sectors and need to align with aspirations in other workstreams such as the Zero Carbon Bill and Emissions Trading Scheme:

(1) Setting policy
(2) Setting regulations
(3) Supporting investment

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

There are two ways for hydrogen to decarbonise current uses of natural gas.

(1) Reducing the volume of natural gas used by mixing in a portion of hydrogen

(2) Producing synthetic natural gas from green hydrogen

The key challenges from mixing hydrogen with natural gas relate to:

(1) Embrittlement of steel pipelines – there is an upper level that can be safely mixed and distributed in steel pipes. This safe level needs to be determined in New Zealand conditions and is being investigated by FirstGas.

(2) The ability of existing equipment that burns natural gas to cope with a portion of hydrogen. Again this needs to be determined in New Zealand conditions.

The key challenge related to the production of synthetic natural gas is the requirement for cost

effectively securing CO2 that does not add to emissions. This would either require direct capture of CO2 from the air or capture of natural emissions that are already being released e.g. from a geothermal field.

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

As natural gas is widely seen as an important transition fuel over coming decades, controlling emissions from natural gas will be an important factor in controlling overall emissions.

Mixing green hydrogen with natural gas will reduce emissions roughly by the proportion of hydrogen mixed (it won't be a strict proportional relationship as the energy density of the two gases is different).

Synthetic natural gas may also play an important role. As suggested earlier it is a medium that may play a useful role in the process of storing and then using the energy produced by renewable electricity. It may also play a role as an industrial feedstock.

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

The roles of the government are similar to those suggested above for other sectors and need to align with aspirations in other workstreams such as the Zero Carbon Bill and Emissions Trading Scheme:
(1) Setting policy
(2) Setting regulations
(3) Supporting investment

In the case of developing export markets, the New Zealand Government also has an international relationships role. It has already signed a Memorandum of Cooperation with the Japanese Government re production of green hydrogen in New Zealand for export to Japan. The New Zealand Government could develop similar agreements with other countries.

We note that while this question is specifically focused on export, the opportunity for New Zealand to import hydrogen to supplement local production should also be recognised.

What are the challenges for hydrogen if produced for export?

There are a range of challenges to be addressed.

There is uncertainty around which technology will be used for storage and distribution. There are risks around choosing technologies.

Once green hydrogen is produced for export it becomes an international commodity. This will have flow-on effects on the local price of hydrogen. In turn this will impact on the potential local uses of hydrogen and on the local price of renewable electricity.

There is also a social licence challenge. There is the opportunity for international demand to drive significant investment in renewable energy generation. There may be local concern about the impacts of some forms of renewable generation e.g. the landscape impacts of additional wind generation. These concerns may be heightened if the electricity produced is being used for producing green hydrogen for export rather than for local supply.

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 development of green hydrogen production in New Zealand provides a range of opportunities which Māori may choose to take advantage of. The opportunity to invest in and benefit from development of sustainable, low emissions energy resources is likely to be of interest. This has already been demonstrated by the agreement between Tuaropaki Trust and Japan's Obayashi Corporation to produce hydrogen at the Mokai Geothermal Plant.

The location of opportunities is also important and it is likely that most of the opportunities for the production and utilisation of green hydrogen will take place in regional New Zealand.

The New Zealand Hydrogen Association is currently considering how best it can support its members when they engage with tangata whenua in the location of proposed projects. While localised conversations with iwi/hapu are the most appropriate, it would be helpful if government could assist with this conversation with Māori on a national level.

What are the opportunities for hydrogen if produced for export?

New Zealand has the potential opportunity to produce more renewable electricity than it needs. Currently it is difficult for New Zealand to export electricity other than taking advantage of local electricity to produce energy intensive products such as aluminium.

The production of green hydrogen offers potential for New Zealand to become a net exporter of energy. This is a significant multi-billion dollar opportunity. The export of related products that utilise green hydrogen, such as ammonia, urea and methanol, is also an important opportunity.

There is an associated opportunity for New Zealand companies to apply their skills and experiences on international hydrogen projects.

These development opportunities are of particular importance for the Taranaki region as the development of green hydrogen production and export provides opportunity for the region's oil and gas sector – for both the region's workforce and also for some of the region's existing infrastructure.

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

H2-Taranaki-Roadmap.pdf - Download File

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