[redacted]

From: no-reply@mbie.govt.nz
Sent: Monday, 30 September 2019 4:47 p.m.
To: [redacted]; Hydrogen
Subject: Hydrogen green paper - submission

Submission on Hydrogen green paper recevied:

Introduction
Name

John Hill

Email

hilltration@yahoo.com

Business name or organisation (if applicable):

Hilltration Limited

Position title (if applicable):

owner/director

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

Individual

Please give the name of the group or organisation this submission is on behalf of.
What is the role of Government in developing hydrogen for storage and distribution?

To conduct a study to determine the most suitable regions in NZ for large scale production of green hydrogen. For example the high sunshine hours for renewable PV Solar and the extreme high level of quality rainwater on the west coast of the south island represent ideal conditions (NASA circa. 2010). To conduct a study to determine suitable hydrogen supply chain and refill stations for a heavy transport national HFC truck fleet. The Government support for geothermal blue hydrogen production in Taupo and Steam Methane Reformation to blue hydrogen in Taranaki, following the "no more gas and oil permits" environmental initiative should be followed by support for large scale green electrolysis on the west coast following the "no more mining on Conservation Land" environmental initiative.
The role of government is to support "green" hydrogen initiatives based around renewable energy and rainwater rather than "Blue" hydrogen initiatives based around Steam Methane Reformation and geothermal

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

Conversion of gaseous hydrogen into a form that is easy and safe to freight, handle and dispense. This requires compression into high pressure gaseous, liquid forms, or manufacture as ammonia for freight/export and reversion to hydrogen by membrane technology at point of delivery
Establishing a NZ supply chain suitable for refuelling HFC heavy trucks, within the ranges appropriate to these trucks.

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

Hydrogen may be stored and distributed for use in hydrogen fuel cell (HFC) technology, industrial process heating, or industrial processes such as catalytic hydrogenation of foods such as edible oils and fuels such as fungible diesel from timber (Shell CRI-IH2) or conversion of Carbon Dioxide to

fungible diesel, by Fischer Tropsch Synthesis (FTS). The main opportunity is in the heavy transport sector. Provision of power by HFC to small remote towns is another option.

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

In order for commercial viability of green hydrogen production, it should be manufactured from low cost renewable energy such as PV solar, wind or geothermal, and an abundance of low cost, high purity water must be available for electrolysis. Again the government should provide expert feasibility analysis to establish the most suitable regions and provide support to regional councils and district councils to incentivise projects in these regions. Government must collaborate with large electricity gentailers, in particular Meridian Energy in the south island, with a view to supporting avoided cost of transmission (ACOT). Establishing popup microgrids for renewable energy adjacent to high volume rainfall collection, large scale tunnel house horticulture/food production and electrolysis to hydrogen (and oxygen). Establishment of such microgrids will place significant downward demand on electricity from the Manapouri Hydro Scheme to allow the necessary availability of 6300MW of additional grid electricity needed by 2050 for uptake of electric vehicles. (ref:MBIE August 2019)

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

Regions such as the west coast are remote so in order to avoid freighting of hydrogen over long distances will involve establishing regional pop up micro grids in several regions within HFC refilling range and hydrogen supply chain limits. 75% of the cost of hydrogen production by electrolysis is the cost of wholesale renewable electricity and associated line charges (Concept Consulting 2019). In 2016 the government removed ACOT subsidies from small electricity generation schemes. ACOT may need to be reintroduced. There is no hydrogen supply chain infrastructure in place, no pipelines in the south island and specialist gas companies such as Linde/BOC and L'Aire Liquide do not have significant gas trailer hydrogen fleets. It is more appropriate to generate the renewable energy and hydrogen in the region of the HFC refilling station, thereby reducing transmission of electricity via the national grid

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

large scale PV solar may be established as pop up microgrids (off the National Grid) that may initially focus upon self sufficiency in renewable electricity for regional NZ This will be essential for generation of the three fold increase in electricity required for the 47% uptake of EV's by 2050. This will also place less strain on Transpower's national grid by reducing the need for transmission infrastructure that is vulnerable in high impact low probability (HILP) events and is a threat to resilience for remote regions. This is particularly important on the west coast which is already 12 MW or 100GWh deficient in electricity. Electricity transmitted from Benmore exchange to Orawaiti exchange incurs up to 30% transmission loss (ASEC Consulting 2012). If adjacent to large scale rainwater catchment (established as part of large scale tunnel house horticulture/food production up to 100 hectare), the hydrogen may be manufactured from low cost PV Solar (6-7c/KWh), zero transmission loss and zero line charges. This represents the lowest renewable electricity cost in NZ outside of the Manapouri scheme. High purity rainwater ensures no additional cost for water purification. Deploying a NEL or Ballard electrolyser would result in the lowest cost hydrogen in NZ as well as reduced cost of wholesale electricity in the regions that need it.
Hydrogen may be dispensed on site of manufacture into "back to base" coal trucks (Bathurst resources) and Kiwirail Locomotives, from an on site rail siding at the vacated Holcim cement manufacturing site), as well as back to base farm vehicles.

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

To support the establishment of hydrogen supply chain outside of the region of manufacture. To support and incentivise logistics companies to convert fossil based diesel truck fleets to HFC or green diesel truck fleets.
In all examples of HFC technology previously mentioned, rather than deploy HFC technology, green diesel may be substituted as the preferred fuel (ref Kiwirail), and hydrogen is still the pivotal part of

the technology. The government may review Scion Research "biofuel Roadmap" study in which energy crops from the Billion tree planting in central north island are used to manufacture Crude Pyrolysis Oil (CPO) for freight to the regions for hydrogenated upgrade to green diesel. Alternatively energy forests grown in the regions as short rotation crops (eg Ngai Tahu Forestry) may be converted to green diesel by the hydrogen based Shell CRI-IH2 process. The government role is to influence organisations such as Kiwirail, Bathurst Resources and Federated Farmers and lobby these organisations into converting from fossil based fuels to hydrogen based green fuels.

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

It is unlikely that HFC technology will be suitable for the light vehicle fleet short term due to EV's emerging as a more suitable option for the light vehicle sector. Alternatives to lithium battery technology using carbon is likely to increase competition from EV's in the light vehicle fleet. Hydrogen will remain more suited to heavy transport rather than light transport

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

It is well acknowledged that hydrogen and HFC technology will be more suited to the heavy transport sector, initially with return to base fleets, followed by larger truck fleets requiring a hydrogen supply chain and rail, coastal shipping and jet aircraft. In all cases the 2 options for hydrogen is in HFC technology or green diesel paraffinic kerosene biodiesel fractions.

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

Hydrogen may replace other forms of industrial heating such as electricity, gas, coal. Government may need to fund and incentivise regions to manufacture hydrogen from electricity (electrolysis), gas (SMR) and coal (gasification) to allow regional microgrods and industrial hydrogen based heating processes to be established and place lower demand for energy from the existing national grid. Such government support may be from reintroducing ACOT. Such government support for regional microgrids will make more grid electricity available for increased demand from uptake of EV's.

What are the challenges for using hydrogen in industrial processes?

Hydrogen may replace other industrial heating processes such as electricity, gas and coal however because these forms of energy are often the basis of hydrogen manufacture the EROEI of hydrogen heating compared to these forms of industrial heating is significantly lower.
On the west where grid power transmission losses may be as high as 30% (ref:ASEC 2012), hydrogen manufactured at an EROEI of greater than 70% will be competitive with existing wholesale power prices.

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

Hydrogen may be deployed wherever other industrial heating is presently used provided the EROEI is competitive. The west coast does not have natural gas, and is disadvantaged by being in an electricity transmission constrained region. This lack of process heat sources is a disincentive for manufacturing companies to establish on the coast.
Such disadvantaged regions present an opportunity for pop up microgrids and hydrogen production and storage to provide process heating at competitive prices and support regional economic development.
In addition large scale rainfall catchment, for electrolysis, from large tunnel house infrastructure encourages large scale food production in the regions and strengthens NZ national food security and spreads the pressure on Pukekohe for food production. The west coast may supply food at scale (5 shipping containers per day per 100 hectares of tunnel house) distributed by rail locomotives operating on HFC or green diesel refuelled on the same site.

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

Natural gas supplies are limited to the North Island and Taranaki specifically. Government has already provided PGF support for Hiringa Energy to develop a hydrogen production and supply chain. Also support for hydrogen R&D has been provided to Taranaki. Natural gas has a finite life and no more gas and oil permits further limits the future of gas.
Support for green hydrogen production by electrolysis will lower carbon emissions from gas use when green hydrogen is fed into the gas pipeline. This will also extend the life of the gas fields.

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

Natural gas is fossil based and in order to decarbonise the SMR production of hydrogen (8 Rivers proposal in Taranaki), carbon capture storage and utilisation (CCSU) must be deployed. In Taranaki this would involve the Hallam Cycle (Which is not yet proven), using captured carbon dioxide compressed into it's supercritical form and injected into low yield oil wells to achieve enhanced oil recovery (EOR). Without available oil wells, captured carbon dioxide would need to be stored underground, which is not ideal.
Natural gas applications must deploy CCSU to decarbonise this sector but this will only at best produce blue hydrogen not the green hydrogen produced from electrolysis.

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

Green Hydrogen may be manufactured by electrolysis and supplied into the Maui pipeline to reduce the natural gas component in the reticulated gas supply and reduce carbon emission from gas consumers.

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

To link up with overseas markets for hydrogen, such as the MOU signed with Japan, the Taupo geothermal hydrogen export project maintaining close liason with Ministry of Foreign Affairs and Trade (MFAT) in such hydrogen consuming nations such as South Korea. Providing funding support for feasibility studies and innovation grants to ensure a continuous "pipeline" of export hydrogen projects.

What are the challenges for hydrogen if produced for export?

Long Haul export distribution requires compression of hydrogen to high pressure gas, liquid or liquid ammonia that must be reverted to hydrogen at point of delivery. These processes are energy intensive and reduce the overall Energy Returned on Energy Invested (EROEI) These processes have safety challenges emphasised by the recent fatal hydrogen explosion in South Korea at an HFC plant that has delayed progress of a hydrogen economy in South Korea. Only large scale production of hydrogen by gasification of Southland lignite (Ref: CRL Transitioning to a hydrogen Economy 2007) West Coast low grade coal gasification (New Zealand Institute of Minerals to Materials Research, 2019), Low grade coal to ammonia and nitrogen based fertilisers via Thyssen Krupp Electrolysis or basic Haber Bosch technology, are at a scale large enough for the export market as in the case of the Latrobe Valley lignite gasification project in Victoria Australia.
All of these technologies are available and may be developed with government support and incentivisation of potential stakeholders, as well as government support in establishing Japanese/NZ JV's. The conversion of low grade coal may provide large scale hydrogen production for export and also mitigate the importation of 1milliom tpa of urea into NZ. With 1billion tree planting NZ import demand for urea will rise exponentially with such plantings.

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.

My personal mission statement for the west coast is that "The west coast will lead NZ into the fourth Industrial Revolution (4IR) based upon the principles of kaitiakitanga and Matauranga Maori." My view is that the more DoC stewardship land must be made available for forestry, based around short rotation energy crops for conversion by catalytic hydrogenation to green diesel via the Shell CRI-IH2 process (Ref: Nxt Fuel Limited Nick Gerritsen, Anake Goodall). Such large scale forestry would allow the west coast to re-establish forestry as a pivotal industrial sector with Ngai Tahu as

the main driver and Akina Foundation (Nick Gerritsen and Anake Goodall Directors.) to develop a social enterprise forestry sector and hydrogen as part of the catalytic process to convert timber biomass or Crude Pyrolysis Oil into fungible green diesel. There is an opportunity for iwi (te rununga o ngati Wai Wai and te rununga o ngai tahu) to drive and expand forestry and social enterprise as part of government wellbeing strategy.

What are the opportunities for hydrogen if produced for export?

The predominant opportunities for hydrogen for export is with Japan. Since the Fukishima catastrophe Japan is committed to developing a hydrogen based economy and Australia and NZ are well placed to supply hydrogen at scale to Japan. Other countries in the SE Asia block may represent export potential for hydrogen.

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

West-Coast-Hydrogen-Economy-Report.docx - Download File

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Yes

Can we include your position title?

Yes

Can we include the group or organisation your submission represents (if submitting on behalf of a group or organisation)?
If there are any other parts to your submission that you do not want public on the website please note them below:
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If there is information in your submission that you wish to remain confidential, please note them below:

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