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To: [redacted]; Hydrogen
Subject: Hydrogen green paper - submission

Submission on Hydrogen green paper recevied:

Introduction
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Business name or organisation (if applicable):
Position title (if applicable):
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?

Government must have both strong policy and seed funding roles. A Green hydrogen economy is necessary to achieving net zero carbon emissions. New Zealand cannot afford to miss this opportunity. The introduction of hydrogen at the scale necessary is urgent, totally novel, requires bold vision and cross sector coordination, and involves substantial investment. It will not therefore be attempted by commercial enterprises responding to market forces alone. Government has a key role in developing a market framework to justify the storage and distribution of hydrogen, and facilitate the development of storage and transportation capacity. This could be through for example providing risk capital to build facilities in public-private partnerships (PPPs).

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

The main challenge is financial. Conventional hydrogen storage and distribution technologies have been in use for decades and new green applications have been researched and piloted for many years (eg the IEA Hydrogen Implementation - this submitter contributed distributed hydrogen research activities for over 10 years). Green hydrogen technologies are now largely proven for the range of applications relevant to New Zealand. The main strategic technical challenge in moving forward is to integrate supply, storage distribution and demand developments in such a way to ensure that a sustainable hydrogen economy optimally contributes to the net zero carbon outcomes.

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

Hydrogen storage and distribution opportunities will very much be determined by appropriate integration of supply/production with use/demand. For example a hydrogen vehicle project will require particular production, storage and dispensing capacity, and a merchant export project will define the local transport and storage needs for this opportunity. It is likely that at the smaller scale standardised 350 and 700 bar tanks as developed for HFCVs will play a role in smaller scale applications. So projects that develop experience and knowhow in the use of this storage and distribution means would be an important early step. for example tanks could be filled at a remote production site and trucked to distributed vehicle fueling projects in Auckland or elsewhere. Another distributed hydrogen storage concept appropriate to New Zealand could be to develop and implement low pressure storage and distribution technologies using polymers eg HDPE and other

materials for both pipelines and bladder storage. (While employed at IRL this submitter undertook substantial work in this field, including what became known as the HyLink remote area hydrogen distribution and storage project. Aspects of this technology are unique to New Zealand including the electrolyser and hydrogen califont water heater designs, currently being pursued by the original industry partners.) This niche application of low pressure pipeline/bladder storage and associated production and use technologies is of relevance to New Zealand distributed energy systems such as those in the Chathams and Stewart Island, and remote rural sites fed by lightly loaded spur distribution lines which are becoming ever more costly to maintain.

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

A strong leadership role in policy and road mapping is required due the cross-sectoral and integrating nature of green hydrogen. Industry needs to see a clear "big picture" national pathway with a high level vision and broad objectives which is supported by government strategy over a reasonable timeframe (up to 20 years?). This strategy needs to define outcomes which would not be readily achievable through a green electricity strategy alone, eg seasonal energy storage, green fertiliser production, land transport options with acceptable performance for all modes, etc.

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

The existing separately governed electricity and fossil fuel infrastructures are likely a substantial barrier to the development of a complementary role for hydrogen. Maybe it is time for consideration to be given to combining the energy jurisdictions of the various government agencies (eg MBIE, EA, NZTA) into one entity, ie a Ministry of Energy.

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

As identified above, New Zealand could lead the world in solving and implementing solutions which are not achievable through green electricity alone, eg seasonal energy storage, green fertiliser production, transport options with acceptable performance for all modes, etc. This could achieve the many positive outcomes as identified in the Green Hydrogen paper, all of which I strongly endorse.

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

The role of government is in development of strategies, and employing policy instruments to introduce HFCVs for replacement of diesel use in heavy trucks, buses, trains etc, and also (important in my view) providing an alternative to BEVs in light commercial and private transport. (It is now well established that pure battery EVs will always have range, payload and refueling limitations when compared with conventional liquid fuel vehicles, and even with first generation HFCVs). Because hydrogen vehicles offer capabilities not possible with EVs, it will be detrimental to New Zealand if, based on misguided advocacy, government policy results in their exclusion from the transport mix.

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

There are no challenges to commercialisation of private and light commercial HCFVs, as these are now in production. Investment for production facilities and fueling stations is obviously an issue and countries that have committed to HFCV fleets all provide substantial government support in this area.

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

An important capability that a FCV fleet can provide is both transport and stationary energy infrastructure resilience. Distributed storage of hydrogen (both stationary and on board) provides an inherent and enhanced disaster and crisis ride-through capability greater than that currently available through the fossil fuel infrastructures. Most of the existing resilience capacity will be lost if as predicted in some quarters (eg the electricity industry) that New Zealand can and should gallop towards full electrification of the majority of its energy infrastructure. This would be a disaster. Electrification will obviously increase over the coming decades, but should not be allowed at the expense of resilience, transport flexibility, and consumer choice. To increase existing energy resilience rather than diminish it with excessive electrification, New Zealand could start with light

duty HFC mobility pilots, to gain experience in a full hydrogen energy chain. For example, the "ideal" future light vehicle for New Zealand conditions would be a hybrid BEV with FC range extender to circumvent BEV range and highway charging inadequacies. There may be opportunities for local development of FC range extender conversion kits since while this type of vehicle is in demand here it is being discontinued by the major manufacturers (eg while very popular in NZ, BMW have now dropped the REx version of the i3).
Specific projects to pilot and commercialise heavy transport could also be encouraged, to ramp up demand for hydrogen production. Opportunities include coaches and buses, particularly in high profile tourist locations, and specific train routes.

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

Govt needs to lead production of a road map for industrial process uptake of green hydrogen. Transition pathways could be included, but would need to show an ultimate net carbon zero contribution.
I am not convinced of the validity of using hydrogen for process heat, except in niche applications where the unique qualities of green hydrogen make this convincing. Generally other renewable resources should be considered first, ie electricity, biomass, biogas etc. Since most or all green hydrogen will come from electricity at a considerable efficiency and production cost penalty, there would have to be a strong reason why one of the other resources would not be more appropriate.

What are the challenges for using hydrogen in industrial processes?

Very few challenges, other than the common issue of cost. Hydrogen is used globally in many industrial processes, but due to the cost generally only used for heating if it comes from a waste stream (eg in methanol production) .

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

The major opportunity I see for New Zealand is the use of green hydrogen to offset ammonia imports and NG usage in fertiliser production. Apart from methanol production, New Zealand's current industrial use of NG sourced hydrogen is relatively small. I do not know enough about methanol production to comment.

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

Government could undertake studies to determine the value to net carbon zero of the limited amount of hydrogen which can be injection into gas pipelines. Would it be cost effective to extract conveyed hydrogen and compress it for transport fueling purposes at a usage centre, say Auckland? While many trials have been carried out overseas, Government could facilitate injection trials and monitoring and dissemination of the results, as local experimentation is essential to gain confidence in operation and safety.

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

Issues with pipeline embrittlement and leakage at high transmission pressures are noted. This may make injection into the ageing NG network impractical or ineffective.

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

There are many new local polymer pipe based low pressure LPG distribution networks in the South Island and elsewhere which might be more amenable to hydrogen injection. It may be worthwhile undertaking a study and if feasible support pilot trials on LPG distribution networks in association with suitable green hydrogen production projects.

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

Involvement in negotiations and incentivisation pricing. Addressing planning issues. possibly PPP investment.

What are the challenges for hydrogen if produced for export?

Volumes are large and capital costs huge. Form of transportation will be dictated by the purchaser. High risk commodity market with no opportunity for differentiation. It remains to be seen if New Zealand could profitably be a competitive producer.

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.

No knowledge to offer.

What are the opportunities for hydrogen if produced for export?

A side benefit is that production at export scale would drive investment in renewable generation, and reduce the overall cost of hydrogen production in New Zealand. It could also create a production and storage scale necessary for use of hydrogen for seasonal and dry year electricity re-generation. Supply tracking electrolysis production could optimise electricity utilisation and eliminate "overbuild" resource spill (wind, PV, geothermal). It is worth noting that present day electrolyser plant is manufactured to one-off requirements and priced accordingly. As large scale demand for green hydrogen ramps up, electrolyser prices will fall substantially and it will become more viable to operate electrolyser plant at variable output in a supply follower mode.

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