24 October 2019

A Vision for Hydrogen in New Zealand: Submission

Z Energy is committed to realising a meaningful contribution to a net zero-carbon future for New Zealand. We are a Kiwi company committed to New Zealand, but the products we sell make up 9% of New Zealand's total gross emissions.

Z is determined to move from being a significant part of the emissions problem to accelerating the solution. This is why we have a deliberate focus on future fuels and low-carbon mobility.

We believe that there will be a broader range of fuel/transport energy solutions in a decarbonised world, which will include battery electric, hydrogen fuel cells as well as renewable fuels including biofuels.

We do not intend to pick winners when it comes to pursuing lower carbon alternatives for transport use. But we are committed to helping our customers, and New Zealand, move away from the carbon intensity of fossil fuels. This will require a collaborative and joined-up effort with customers, government and other stakeholders, and we look forward to the challenge.

Z's submission is focused on the transport sector including storage and distribution for this use case, as this is our area of expertise and experience. We have also contributed the perspective of independent electricity retailer, Flick Electric – in which we have a 70.1% shareholding – on the challenges and opportunities of hydrogen in the electricity sector. There are others better qualified than us to respond to other sections of this Green Paper.

For your information, Z's complete "House View" on hydrogen can be found here: https://z.co.nz/assets/Uploads/Z-House-View-Hydrogen2.pdf

Thank you for the opportunity to submit. Z's responses to the questions posed in the Hydrogen Green Paper are below.

1a What is the role of Government in developing hydrogen for storage and distribution?

Hydrogen is used in a wide variety of industrial applications today, so production, storage and distribution are relatively mature technologies. That said, the solutions are designed for current demand use cases, and government will have a role to play in helping to ensure the right infrastructure exists to support domestic uptake of hydrogen in use cases such as transport, or export.

1b What are the challenges for using hydrogen for storage and distribution?

Hydrogen's flammability is well known. While Z and other companies have decades of experience in handling hazardous and flammable material safely, this risk should *never* be

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underestimated. We sometimes hear hydrogen referred to as less dangerous than petrol, or that the nature of the flame means there's less threat to surrounding environment and infrastructure, to allay people's fears. This makes Z somewhat uncomfortable as a risk such as this should never be minimised.

That said, Z believes that the health and safety risks for hydrogen *can* be safely managed, and there are companies such as BOC who are experienced at this. We just want to point out that there should always be a level of healthy discomfort when managing risk.

1c What are the opportunities for using hydrogen for storage and distribution?

Nothing to add.

2a What is the role of Government in developing the complementary role of electricity and hydrogen?

Z and Flick Electric support policy frameworks that encourage and incentivise low-carbon fuels for use in generating electricity, including but not limited to hydrogen.

2b What are the challenges for achieving this complementary role of electricity and hydrogen?

The economics of hydrogen in electricity production are challenging. If New Zealand develops an export market for our green hydrogen, domestic users will face that export price. It would be concerning if due to government intervention, green hydrogen becomes the marginal source of electricity, resulting in its export price being paid to all generation needed to meet demand as this could have the result of driving up the price for consumers.

2c What are the opportunities for this complementary role of electricity and hydrogen?

While hydrogen may offer some energy storage opportunities, green hydrogen should only be a source of electricity if it is the next least cost source after taking into account the full cost, including carbon costs, from thermal alternatives.

3a What is the role of Government in supporting hydrogen use for the transport sector?

We agree with the Minister of Energy and Resources' opening message in the Hydrogen Green Paper that states the government's focus on actions that can make the biggest difference, "identifying the incentives that may be needed, the roadblocks that need to be removed and how we can help new technologies come on stream."

Hydrogen for commercial transport use (heavy, long-haul transport) is technically feasible and hydrogen vehicle manufacturing is transitioning out of pilot phase on the promise of a decarbonised energy future. While these use cases can technically be met with hydrogen today, the economic signal to use hydrogen (or alternative decarbonisation options such as renewable biofuels for that matter) results in low or no uptake.

Z therefore supports policy frameworks that encourage and incentivise low-carbon fuels, including but not limited to hydrogen. As a business, policy certainty is crucial as without it we cannot give our shareholders enough confidence to justify investment.

Z's view of what would be needed to encourage hydrogen uptake in new use cases such as transport include:

- New regulations, particularly around ensuring safety requirements are met.
- A carbon price that would improve the affordability of hydrogen against fossil-fuels.
- Legislative and policy interventions that create a requirement for lower-carbon transport fuel.
- Technology adaptation, for example modification of equipment used for transport storage and distribution infrastructure
- Achieving economies of scale to drive down cost, for example government purchase of FCEV vehicles for public transport or assistance to organisations seeking to import hydrogen vehicles.

A potential policy framework that could be adapted to suit New Zealand is the Californian Low Carbon Fuel Standard, which promotes and incentivises low carbon energy – the lower the carbon intensity of the fuel or energy source, the higher the incentive.[1]

In addition, there could be a role for government to play, together with industry, in public education on hydrogen for transport, for example the way government and industry have worked in tandem on road safety campaigns and reducing single use plastic.

3b What are the challenges when using hydrogen for mobility and transport?

Hydrogen is a real option to meet the needs of transport operators for certain use-cases, but it will take some time for cost-effective hydrogen fuelled vehicles to grow to material volume.

While Z believes that hydrogen (or a derivative fuel such as ammonia) could help meet the need for low-carbon solutions in certain use cases including long distance transport, materials handling equipment such as forklifts and long distance marine applications, the expected lead time until cost effective hydrogen fuelled vehicles are available is significant.

The lead times we have already seen for BEV's give some insight into the challenge for fuel cell electric vehicles making it to market in significant volumes.

In addition, the cost to manufacture green hydrogen is still high (albeit reducing), and there will be substantial infrastructure required to achieve scale. A large-scale hydrogen economy would need to be stimulated by establishing an industrial scale facility that can produce large volumes of hydrogen at low cost, and "blue" hydrogen (manufactured using natural gas with between 80-98% carbon capture) could play a complementary role in achieving this.

[1] California Air Resources Board: https://ww3.arb.ca.gov/fuels/lcfs/lcfs.htm

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The service sector for hydrogen vehicles needs to also be considered, particularly around training and safety regulations. For example, training and apprenticeship programme, retrofitting or developing specialist hydrogen workshops, on-site fuelling procedures and HSNO regulations.

3c What are the opportunities for using hydrogen for mobility and transport?

Electrification is still the dominant theme of decarbonising many use cases, but it is uncertain whether cost and weight improvements in battery technology will be sufficient to enable electric vehicles to meet the needs of marine, aviation, heavy transport and some materials handling use cases.

Heavy transport vehicles use more energy, and coupled with longer range requirements, would result in a battery that would have a significant weight and space penalty impact on the transport operator.

Hydrogen is one alternative option for these applications. (Others include biofuels and synthetic fuels produced to similar specifications to existing liquid-based hydrocarbon fuel). Overseas pilots show that hydrogen can be a viable technology for these segments especially where they have back-to base or back-to-port routes, resulting in a centralised refuelling facility.

Large-scale transport related asset replacement decisions (ferries, trains and buses) present opportunities to transition away from fossil fuels.

As these vehicles and vessels reach full replacement or half-life replacement, Z expects that consideration of hydrogen and fuel cells will be considered and may be retrofit options.

6a What is the role of Government in producing hydrogen in sufficient volume for export?

Z supports a strong economy and the correct incentivisation for the energy transition, so we comment on this point from that perspective (as opposed to a position of upstream or export expertise).

Z notes that New Zealand's high proportion of renewable electricity has generated international interest in our potential as a producer of green hydrogen, while many other countries must necessarily focus on 'blue'. That said, an industrial size blue hydrogen facility with proven carbon capture and safe storage would help provide scale.

It should be noted that fuel is a lifeline utility, and should hydrogen prove to be a cornerstone 'future fuel' it will therefore be critical that the security of domestic energy supply is prioritised.

Also important is the point that if New Zealand develops an export market for our green hydrogen, domestic users will face that export price (as noted by both Flick Electric and Z).

6b What are the challenges for hydrogen if produced for export?

Given New Zealand's location, establishing an international supply chain for hydrogen export, whilst not insurmountable, will be challenging. There would need to be sufficient scale to stimulate the establishment of an international supply chain as it would otherwise be uneconomic. It's difficult to see this eventuating without an industrial scale facility that can produce large volumes of hydrogen at low cost.

The other main challenge is New Zealand's cost competitiveness with other countries with green hydrogen supply strategies. The utilisation of solar power is currently the cheapest way to produce green hydrogen, and countries like Australia, Chile and the UAE have a natural advantage which means NZ could struggle to compete on cost. More on this below.

6c What are the opportunities for hydrogen if produced for export?

Decarbonisation efforts are gaining momentum internationally and hydrogen is becoming a component of several countries' energy strategies.

Energy importers such as Japan, South Korea and China have limited local low-carbon energy sources and there is reliance on importing energy – resulting in demand led strategies.

Hydrogen becomes a candidate where electrical interconnection (such as through undersea cables) is not viable. In response, a number of energy exporters (Australia, Middle East, South America) have supply led strategies, and are establishing hydrogen-based supply chains to meet the potential demand of energy poor nations.

New Zealand would need to compete with countries with lower land costs, larger project sizes and superior natural resources (such as all-year-round solar production) – all of which result in lower production costs.

Large scale onshore and potentially offshore wind development will require public acceptance which may be challenging, especially if these resources were developed only for energy export.

All that said, while other countries with more sunlight would likely be able to produce green hydrogen at a cheaper cost, if hydrogen becomes a traded commodity, there is real opportunity for New Zealand to also become a profitable exporter of hydrogen.

There are also opportunities for the export of blue hydrogen. While we would ultimately seek to reduce reliance on hydrocarbon resources, New Zealand still has significant gas resources. Should carbon capture and storage be utilised effectively, blue hydrogen could be produced at competitive prices as an export fuel.

This may then also enable more domestic use for hydrogen as it would likely be produced at substantially lower cost than green hydrogen, but with a very low carbon emission footprint.

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