#16

INCOMPLETE

Page 4: Privacy Information

Q1

Privacy information

Respondent skipped this question

Page 5: Submitter information

Q2

Name

Q3

Organisation and role (if submitting on behalf of a company or organisation)

Respondent skipped this question

Q4

Email Address

Q5

Are you happy for MBIE to contact you, if we have questions about your submission?

No

Q6

Please clearly indicate if you are making this submission as an individual, or on behalf of a company or organisation.

Individual

Page 6: Strategic context

Q7

If there are other issues we should be considering in our assessment of the strategic landscape for hydrogen in New Zealand?

1. Safety: There is no mention of program support for the safe transport of hydrogen. It is presumed that the network of hydrogen fuelling stations around the country will be serviced by tanker trucks carrying compressed hydrogen. As with any form of road transport, there will be accidents and local fire & emergency personnel will be needed to respond to these accidents. Compressed hydrogen presents serious safety risks to these personnel. For example:

- Hydrogen has no smell and when prepared for fuel cells, cannot be perfumed. Local firefighters will need special sensors to detect leaking hydrogen at an accident site.
- Hydrogen burns with a flame that is invisible in daylight. Firefighters will need special equipment to detect burning hydrogen at an accident site.
- Hydrogen has very low ignition energy and can spontaneously explode when decompressed. Compressed hydrogen presents a serious explosion hazard to rescue personnel.

If hydrogen is to be transported around the country in tanker trucks, the skills and equipment of local emergency personnel nationwide will need to be upgraded. This should also be part of the hydrogen roadmap.

2. Leakage: One of the unavoidable realities of hydrogen is that it leaks through most materials, including the carbon composite fuel tanks of fuel cell vehicles. It is estimated that 2.7% of hydrogen produced leaked to the atmosphere in 2020. The International Energy Agency estimates that with increasing hydrogen demand could lead to as much as 5.6% leakage by 2050. Leakage from transportation applications (trucking & storage) is considerably larger than that from fixed industrial applications. Transportation leakage has been calculated to be 2.3% while that for industrial processes is assumed to be around 0.5%.

3. Global Warming: While the main focus on leakage has been to prevent hydrogen from reaching explosive concentrations in air (above 3-4%), there has been little attention given, until recently, to low level leakage which will have a climate impact. Recent studies have shown that hydrogen has a global warming potential of 11.6 times that of CO2 over 100 years (GWP100), but an estimated GWP of over 100 times that of CO2 over ten years due to its short lifetime (~2.4 years). It is not itself a greenhouse gas; its warming effect is due to its rapid reaction with atmospheric hydroxyl ions, which results in prolonging the life of the intense greenhouse gas methane and contributing to the production of the other greenhouse gases, such as tropospheric ozone and stratospheric water vapour.

4. Water Demand: Simple chemistry suggests that it takes 9 kilograms of water to make 1 kilogram of hydrogen by electrolysis. This will put additional pressure on freshwater resources. Seawater can be used, but traditional methods of electrolysis produce toxic and corrosive chlorine ions (i.e., Cl- and ClO-) which should not be released to the environment. Many electrolysis processes use water treated with alkali or acid, which would similarly need to be disposed of safely and kept out of the environment. There is no mention in the assessment of the environmental risks presented by water demand and waste water disposal related to green hydrogen production.

Page 7: Use cases for hydrogen

Q8

Do you agree with our assessment of the most viable use cases of hydrogen in New Zealand's energy transition?

No,

Please provide further explanation to your response:

The assessment given in the consultation document is highly favourable toward green hydrogen while missing or only briefly mentioning some of the many downsides to hydrogen as an energy fuel. A more balanced assessment would include the factors outlined in the next answer (to question #9).

Q9

What other factors should we be considering?

1. Efficiency: Green hydrogen used for combustion or fuel cell energy in transport is very inefficient compared to the direct use of electricity through batteries or overhead electrification, as with electric trains. Battery electric vehicles are approximately 3 times more efficient in the use of electricity than fuel cells or internal combustion engines fuelled by hydrogen.

New Zealand is depending upon an ample supply of renewable electricity to replace fossil fuels, yet renewable energy supply will only grow at a pace that the wholesale price of electricity allows. In our current electricity market, increasing electricity prices are needed to promote growth in renewable generation. With an expectation of a long term increase in electricity prices, it makes no sense to invest in low efficiency uses of electrical energy.

2.Impact on Electricity Prices: Electrical energy used to make green hydrogen will be energy not available to other consumers. Although hydrogen consumers are expected to help with generation, they can also simply purchase electricity from third party generators. It is wishful thinking that an over-build of intermittent renewable electricity will be sufficient to supply the power needed for the high capacity factor (80-90%) that electrolysers will require to be economic.

Growth in hydrogen users, then, will create further demand for electricity. The laws of supply and demand dictate that greater demand will result in increasing price, as more “marginally economic” renewable energy projects will be needed to fulfil added demand due to green hydrogen production. In New Zealand’s deregulated electricity generation market, we would expect to see average electricity prices rise due to the added demand from hydrogen producers.

This does not meet with the expectation of a “just transition”. Residents and businesses in New Zealand should not have to pay more for their electricity due to the electricity demand created by a hydrogen fuel production industry.

3.Practicality: There are a number of hydrogen fuel uses proposed in the consultation document which show very marginal practicality. Examples include:

- Aircraft: compressed hydrogen, at the 350 bar pressure NZ standard, has the density of expanded polystyrene. The space requirement for hydrogen fuel tanks on even medium range aircraft is impractical. Liquefied hydrogen fuel is even more impractical because it takes roughly 40% of the energy embedded in the hydrogen fuel just to liquefy it. In addition, even in the most well-insulated storage vessels, liquefied hydrogen loses about 1% of its mass each day due to boil-off. In NASA space rockets, typically 45% of liquefied hydrogen fuel is lost before launch.

- Energy Storage: Storage of hydrogen for peak or back-up generating capacity is one of the least efficient forms of energy storage. Battery storage returns more than 80% of stored energy. Pumped hydro returns about 75% of stored energy. Green hydrogen storage, in compressed gas tanks or underground, will return, at most, 30% of stored energy. The Parliamentary Commissioner for the Environment, Simon Upton, recently emphasised this point when commenting on the early NZ Battery project option to store hydrogen for “dry year” back-up power. The option for green hydrogen storage has since been dropped from the NZ Battery project list of options.

Page 8: The pathway to 2050

Q10

Do you agree with this assessment of the potential for hydrogen supply and demand in New Zealand?

Respondent skipped this question

Q11

Do you agree with the key factors we have set out that are likely to determine how hydrogen deployment could play out?

Respondent skipped this question

Page 9: How hydrogen could contribute to our objectives

Q12

Do you agree with our findings on the potential for hydrogen to contribute to New Zealand's emissions reduction, energy security and resilience and economic outcomes?

Respondent skipped this question

Q13

Do you have any insights we should consider on what is needed to make hydrogen commercially viable?

Respondent skipped this question

Page 10: Government position and actions

Q14

Do you agree with our policy objectives?

Respondent skipped this question

Q15

Do you agree with our positioning on hydrogen's renewable electricity impacts and export sector?

Respondent skipped this question

Q16

Do you agree with the proposed actions and considerations we have made under each focus area?

Respondent skipped this question

Page 11: Other Feedback

Q17

If there is anything else you'd like to tell us, please comment below.

Respondent skipped this question