A Vision for Hydrogen in New Zealand – Green Paper, Ministry for Business, Innovation and Employment

Submission by Climate Justice Taranaki, 25 October 2019

Introduction

1. Climate Justice Taranaki Inc. is a community group committed to justice, action and true solutions to our climate crisis. Our core members include scientists, anthropologists, health professionals, home and market gardeners, farmers, musicians, artists, community organisers and researchers. Most of us are parents or grandparents. Several of our members and supporters are tangata whenua. We raise awareness on social justice issues around climate change which impact disproportionately heavily on the under-privileged and on future generations. We advocate for policies and decisions that alleviate the impacts and empower communities. We support communities in building climate resilience.
2. We welcome the opportunity to comment on the Green Paper – A Vision for Hydrogen in New Zealand (hereafter referred to as 'the paper').

Our key concerns

3. We are extremely concerned about the apparent overarching push for hydrogen by the Government. The paper itself acknowledged that "*Direct use of electricity is currently a more logical and efficient choice in many situations…"* and that "*hydrogen may prove to be more suitable*" only in the future (p.33 of the paper). With our climate crisis, we need urgent action to reduce greenhouse gas emissions, lighten our pressure on natural resources to pull back from exceeding planetary boundaries, and build societal resilience and adaptation to crises. We do not have the time or luxury to play with unproven technology.

4. A lot of the comparisons presented in the paper are between hydrogen and fossil fuels, e.g. "*In the medium term, if production costs fall and carbon prices rise, then hydrogen will become more cost-competitive with natural gas and liquid fuels*" (p.25 of the paper). Given the urgency of our climate crisis, fossil fuels are out of the question. Lifecycle analysis of any potential new or emerging technology such as green hydrogen should be compared with other renewable options such as pumped storage[1], bioenergy[2], wind, tidal and wave[3] energy. Yet they are not being considered while hydrogen is being pushed along openly by central government as well as locally in Taranaki[4, 5]. Why?

5. Although the paper says that "*the Government considers there is greater opportunity for New Zealand in exploring the use of our renewable energy to produce green hydrogen*", it also says that "*hydrogen produced from fossil fuels and industrial process (brown, blue and grey) may play a role in the transition of New Zealand's regions and existing industries",* as illustrated graphically (p.36-37 of the paper). The paper therefore presents no clear Government position on the different types of hydrogen in question. We find this ambiguity unhelpful.

6. The urgency for climate action means that there should be no development of brown, grey and blue hydrogen as a transition pathway, in Taranaki or elsewhere in Aotearoa, because of its reliance on fossil fuels and unproven carbon capture, use and storage (CCUS).

7. Therefore, we ask that MBIE put forward a clear position and instigate or amend legislation, such as the Gas Act, to prohibit any new brown, grey and blue hydrogen development. If this is not done, it

is fairly easy to see what the outcome will be - a door wide open to fossil gas based hydrogen production and more poisoning of our environment with synthetic urea. The green hydrogen will be too expensive in comparison and never get off the ground despite initial tax-payer funding and good but naive intentions.

Fossil fuel derived hydrogen – brown, grey and blue

8. Some of the information and graphics (e.g. graph on p. 21) are not specific to green hydrogen but reflect the current situation which is hugely dominated by brown and grey hydrogen. When presented without clarification, they can be misleading and are not really relevant to what is supposedly the Government's preference – green hydrogen. We do however commend MBIE for turning down 8 Rivers Capital's Provincial Growth Fund application for a feasibility study associated with blue hydrogen and urea production in Taranaki[6].

9. Crucially, hydrogen is only as clean as the energy source and methods used to produce it. It would indeed be 'clean' if electrolysis[7] is used to split water into hydrogen and oxygen, with renewable energy powering the process. However, currently the hydrogen produced globally and in the US is largely derived from fossil fuels by steam-methane reforming and gasification techniques. The Aberdeen Renewable Energy Group also points out that producing hydrogen currently uses a lot of non-renewable energy[8]. In steam-methane reforming[9], methane reacts with high-temperature steam to produce hydrogen, CO and CO_2, so it is not without emissions. Even methane cracking[10], which produces hydrogen from methane in the absence of oxygen, and therefore does not emit CO or CO_2, is still reliant on fossil fuels, and the technology is far less developed.

10. While some argue that methane cracking could be a bridge technology to a hydrogen economy, its effectiveness in reducing global CO_2 equivalent emissions varies hugely depending on the process. A recent study indicates that "*the hydrogen economy has the potential to reduce global carbon dioxide equivalent emissions between 0 and 27%, when methane leakage from natural gas is relatively low, methane cracking is employed to produce hydrogen, and a hydrogen fuel cell is applied. On the other hand, when methane leakage from natural gas is relatively high, methane steam reforming is employed to produce hydrogen and an internal combustion engine is applied, the hydrogen economy leads to a net* ***increase*** *in global carbon dioxide equivalent emissions between 19 and 27%*." Weger et al., 2018[11].

11. In relation to carbon capture, use and storage (CCUS) on which blue hydrogen relies for its justification, evidence overseas shows that it fails to effectively remove GHG and is largely a dissembling tactic used by fossil fuel companies to prolong their operations[12]. For example, "*An estimated 6.2% of the Petra Nova power station's emissions are captured, compressed and then piped 130km to help extract stubborn oil out of a depleted oil field. In the process, an estimated 30% of the carbon dioxide leaks back into the atmosphere, not to mention the emissions that will ultimately be released when the extracted oil is consumed*" (Simon Holmes a' Court, 2018)[13]. "*The No. 1 outcome we wanted to make clear is there is no substitute for mitigation and adaptation*," Waleed Abdalati, a professor at the University of Colorado[14].

12. As energy advisor and former oil and gas chemical engineer Tim Forcey[15] pointed out, marketing 'blue hydrogen' may be the gas industry's way to claim social license, just like "*the same fabled technologies promised back in the 'clean coal' days: capturing emissions and storing them away underground… forever.*" The Centre for International Environment Law (2019) [16] explained that carbon capture, use and storage, "*CCUS is valuable to the fossil fuel industry in three key ways: it expands oil production, provides a life-line to a declining coal industry, and further entrenches the overall fossil fuel economy*".

13. Research overseas[17] and within our GNS[18] indicates that CCUS is a risky, immature and as yet unreliable technology, "*we specialise in assessing how much CO_2 can be stored in a particular region or reservoir, what chemical reactions might occur with the rocks, what risks there are and their magnitudes, monitoring for potential leakage, and community concerns and perceptions associated with CCS*".

14. Energy projects involving brown, grey and/or blue hydrogen, either at national or Taranaki level, will do little but prolong fossil fuel reliance and mining, with known environmental and social harm[19, 20], and when IPCC is calling for unprecedented, drastic action to avoid the worst climate impacts[21, 22]. Any follow-up implementation would require hugely expensive and risky investments, when resources are desperately needed for genuine and effective emission reduction and climate mitigation efforts.

Hydrogen for a Resilient Energy System

15. Given the amount of energy required to produce, compress and store hydrogen, using it to buffer the difference between electricity supply and demand would be more wasteful than prudent. This is especially the case when mature technologies notably pumped hydro already exist[23, 24]. A recent study has found that pumped hydro storage along with wind and solar photovoltaic, would eliminate Australia's need for coal and gas-fired power, "*Australia needs only a tiny fraction of these sites for pumped hydro storage – about 450 GWh of storage – to support a 100 per cent renewable electricity system*," Prof. Andrew Blakers[25]. Like all technologies and development, comprehensive environmental and social impact assessments are necessary, such as the impacts on freshwater ecosystems and cultural values, when identifying potential pumped storage sites.

16. If the "*retention and expansion of existing skills and experience derived from the process-oriented hydrocarbon industry…"* is important as suggested in the paper, the emerging 'liquid air' storage technology may be considered. In the UK, Highview Power uses equipment developed for the conventional power and oil and gas industries to liquefy gas, store it in tanks and release it to spin turbines and produce electricity on demand[26]. Again, comprehensive impact assessment and life cycle analyses are needed before justifying any new technology.

Hydrogen for transport and mobility

17. There is no rational argument for the promotion of hydrogen fuel cell light vehicles over light battery electric vehicles (BEV). In terms of energy, producing and storing green hydrogen are extremely energy intensive and will require development of more new renewable energy sources than what BEVs need. The efficiency of a hydrogen fuel cell vehicle is less than half of that of a BEV like Tesla[27]. A study in Victoria showed that a full transition to hydrogen vehicles in 2046 would require three times more electricity than transition to BEVs[28].

18. In terms of economics, the uptake of BEVs has been enabled largely by government subsidies and incentives as well as substantive investment in public charging networks. Any development and large-scale uptake of hydrogen vehicles will require similar, and likely greater, government and private investments, and therefore compete with what's still needed for growing further EV up-take[29]. A study in California has also concluded that battery EVs would offer a more affordable way to reduce emissions than hydrogen vehicles[30, 31].

19. Moreover, the unfamiliarity and lack of health and safety protocol for hydrogen use in the public and domestic environments make hydrogen riskier than petroleum. Safety handling protocols and experience are limited to industries in New Zealand. Critically hydrogen can ignite more easily than petrol or natural gas and it burns with a nearly invisible flame[32]. Explosion and fires have happened at hydrogen fuelling stations causing injuries, such as in Norway this year[33].

20. The ability to charge BEVs at home, and indeed to incorporate these into domestic energy system[34, 35], offers a more decentralised model, another advantage over hydrogen vehicles which must be refuelled at designated stations most likely owned and controlled by corporations.

21. There may be a role for hydrogen fuel cell for heavy, long-haul freight, maritime transport or port and warehousing facilities. However, other options such as biofuels from farm and animal wastes or municipal wastewater, are either already available or could be implemented rapidly. Second generation biofuels do not need to be blended with fossil fuels and can reduce GHG emissions by 85-90%[36]. A better approach from climate and safety perspectives is to take most freight off the road, using electric rail for long-haul freight and passenger transport, with biofueled, BEV or biofuel-electric hybrid trucks[37] for rail to destination connections. Why are there no comparative analyses presented in the paper?

22. Ultimately, to substantially reduce the climate impact from transport or mobility, we need far greater efforts to expand and improve existing public transport systems, to reduce private car ownership and use, and to promote active modes of transport[38], in part through redesigning our cities and towns and work patterns. On freight transport, ports and warehousing facilities, we need to reduce the amount of goods that we move around domestically, that we import and export, if we are serious about climate action and energy and resource conservation. Government policies and incentives "*to avoid locking-in higher emissions for decades from newly imported diesel and petrol vehicles*" must indeed be considered and implemented, as suggested in the paper (p.55).

Decarbonising industrial processes – 'green' urea, 'low-carbon' oil refining…

23. The narrative on 'decarbonising' industrial processes and push for 'green industrial chemical feedstocks', notably urea (p.13 of the paper) or 'green urea' as promoted in the Taranaki Hydrogen Roadmap[39, 40], is flawed. It is misleading and ignores the fact that when applied to land, urea, whether it is made from natural gas or hydrogen, releases nitrous oxide, a long-lived greenhouse gas 280 or 310 times more potent than CO_2 over 20 or 100 years respectively[41]. Continuing production and application of urea to support industrial animal agriculture, notably dairy, creates the major climate impact from livestock methane, and contributes to the degradation of our soil, waterways and ecosystems[42]. The paper points out the importance of 'lifecycle analysis from cradle to grave' when considering the costs and benefits of hydrogen. The same level of analysis is required concerning urea.

24. In terms of process heat for industries, the suggestion of expanding our renewable energy capacity to produce green hydrogen for 'low-carbon oil refining' or drying milk (without coal) for export borders on the farcical. On the latter, burning waste wood or producing biogas from farm wastes for heating and electricity are proven and much more economical than hydrogen. However, industrial animal agriculture really needs to be replaced by regenerative agriculture, incorporating greater product diversity, carbon-sequestering tree crops, biodiversity and ecosystem enhancement.

Decarbonising gas

25. The paper uses the existing industrial production and use of hydrogen and the existing gas and industrial infrastructure as arguments in support of hydrogen development (e.g. p.29 of the paper). This argument is flawed and reads more like PR spin of lobbyists from the fossil fuel and petrochemical industries. The tendency for hydrogen to embrittle metals is a major barrier against using existing high-pressure gas network for hydrogen storage and distribution. We can only hope that the quarter of a million dollar government funding for First Gas provides robust assessment of the feasibility and risks of using the North Island's natural gas pipelines for hydrogen distribution[43].

26. In relation to domestic gas consumption, studies in Australia have shown that it is more economical to run all-electric homes by tapping in to renewable heat and disconnecting from the gas-supply grid[44, 45]. The increasingly popular electric heat pumps and induction cook-tops are energy efficient and climate friendly when the electricity is generated from renewable sources[46]. Hence, there is no reason or advantage to switch domestic heating or cooking from electric to hydrogen (20% concentration) supplied through existing gas network.

27. The transition to a carbon neutral economy needs to happen now and be achieved well before 2050. We do not support further exploration and reliance on natural gas as a transition fuel, nor unproven emissions offsets by way of CCUS. These are flawed proposals promulgated repeatedly by the petroleum sector for decades to perpetuate 'business as usual'. Please also refer to our submissions on the Zero Carbon Bill and the MBIE Resource Strategy Consultation[47, 48].

Export green hydrogen - our sunshine and wind!

28. It is ludicrous to think that we can or should develop a hydrogen export commodity market with Japan or anywhere else. It makes no energy or economic sense, when we realise that we must ensure our own energy, water and food security, reduce our emissions to zero, stop overshooting the known planetary boundaries and have capacity to sustain not only our own populations but climate refugees also. All these do not take into account the energy and resources required at the receiver's end, to re-convert the stored-form of hydrogen back into electricity or the required feedstock. In terms of economics, the pertinent question is how would we possibly compete with Japan's much closer neighbour, Australia, which has an immense amount of sunshine?

29. The current economic growth model ignores all social and environmental costs of resource extraction, consigned as 'externalities'. A lot of mining operations globally, including so-called clean-tech minerals both on land and on the seabed, have been socially and environmentally damaging[49]. We believe true values may be derived from innovations in the area of resource conservation, efficiency, recovery, reuse and recycling, rather than extracting virgin materials to generate excess energy to support a failing economic model. Such innovations, both technological and social, should enable the realisation of a circular or doughnut economy[50, 51] which takes into account the full life-cycle of materials and respect all known planetary boundaries[52].

Te Ao Māori, Te Tiriti o Waitangi

30. This section in the paper (p. 30-31) is disappointing and disingenuous.

31. In reality the Crown has never honoured Te Tiriti o Waitangi properly and Māori has not had the ability to outright refuse oil and gas well drilling on their whenua. We do not see how hydrogen development would be different. How would it "*assist whānau, hapū and iwi to thrive*" rather than negatively impact them, as the oil and gas industry has done for generations, ploughing through waahi tapu, disrupting land operations, polluting the environment and causing harm to workers.

32. Hydrogen technology is not a natural technology. It is the splitting of water molecules to take hydrogen for energy use. What is given back? What are the real 'side effects'? How does this affect the mauri of wai and taiao? Māori tikanga certainly does not define the taonga of our atua as 'resources' to be used and exploited for capital gain. Kaitiakitanga is not to take and use. Our tikanga is to nurture taiao, take some of what is created and give back to further nurture taiao for the days to come.

33. The infographics used are offensive as they try to incorporate capitalist ideas into our traditions and tikanga that do not sit within the exploitative ideology of capitalism. It is possible that green hydrogen may have no side effects but this is still not well proven technology and frankly too good

to believe. It is an energy source that seems unnecessary to explore given we already have taken so much from this planet and really just need to stop taking more and learn to live with what we have so that future generations might merely live.

34. Hydrogen technology, whatever colour we want to term it, is just another form of taking, that aims to prop up the capitalist system that has led us to the brink of killing this planet. We have to put aside irresponsible dreams of business as usual, feeding the soil poisonous synthetic urea and exporting commodity products across the globe. The only real path forward is to live within the economic, social and ecological means of this island we are lucky enough to live on. No more fossil fuel extraction. No more taking without giving back. No more tax-payer money on big business ventures that do not benefit the planet and ALL of community.

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